



Flood Risk Assessment

Land South of Echo Hill, Royston, Herts

Client

Gladman Developments Ltd

Ref: 13378

Date: May 2025

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Executive Summary

- The planning application is submitted on behalf of Gladman Developments Ltd to North Hertfordshire District Council for the development of Land South of Echo Hill, Royston, Herts. The Application Proposal is described in Section 1.
- This Flood Risk Assessment ("FRA") addresses the requirements of relevant Local Plan Policies and demonstrates compliance with the National Planning Policy Framework ("NPPF") and relevant planning practice guidance, in particular "Flood risk and coastal change" (PPG).
- The Site lies entirely within Flood zone 1 – Low probability, remote from any fluvial risk area. There are no areas of surface water flood risk mapped within the site.
- There is a raised covered reservoir adjacent to the south-west corner of the site. The risk of breach is low, but potential flow pathways have been kept free of buildings within the Development Framework Plan.
- In-situ soakaway tests have demonstrated suitable soil permeability for soakaways at sufficient depth below the Head deposits and weathered bedrock at the top of the chalk horizon. Development runoff will be managed by means of infiltration. Further ground investigations are needed at the next stage to inform the detailed design of the infiltration systems, but sufficient information is available at this outline stage to demonstrate the viability of the proposed SuDS strategy.
- The site overlies a principal aquifer classed as Source Protection Zone I – Inner. Treatment of runoff water is vital prior to discharge to ground. This will be achieved by means of a multi-stage SuDS treatment train including permeable paving, bioretention features (rain gardens and tree pits), swales and wetland ponds in sequence. The suitability of the treatment train has been demonstrated using the Simple Index Approach set out within The SuDS Manual (CIRIA C753).
- The SuDS ponds and final infiltration features have been sized to serve the surface water catchments with sufficient volume provided to cater for the 1 in 100 (1%) annual exceedance probability ("AEP") plus 40% climate change rainfall events.
- The proposed SuDS strategy to manage runoff via infiltration will ensure that existing surface water flood risk downstream in Royston will not be exacerbated.
- Foul drainage from the development will be directed to the existing sewer network in Echo Hill.

1 Introduction

- 1.1 The outline planning application is submitted on behalf of Gladman Developments Ltd to North Hertfordshire District Council for the development of Land South of Echo Hill at Royston, Herts.
- 1.2 The Proposed Development comprises c.84 dwellings along with associated roads, parking and landscaping.
- 1.3 GTA Civils & Transport Ltd was appointed by Gladman Developments Ltd to provide an FRA to support the planning application to North Hertfordshire District Council as described above. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.4 This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) (2025) and relevant planning practice guidance, in particular "Flood risk and coastal change" (PPG ID7, updated August 2022).

2 Policy Context

Local Plan

2.1 The North Hertfordshire Local Plan 2011-2031 was adopted in November 2022. The policies relevant to this FRA are summarised or quoted in the following paragraphs.

2.2 Policy SP11: Natural resources and sustainability. This policy sets out that NHDC will: *"Take a risk based approach to development and flood risk, directing development to areas at lowest risk in accordance with the NPPF and ensuring the provision of Sustainable Drainage Systems (SuDS) and other appropriate measures;"* and *"Support the principles of the Water Environment (Water Framework Directive) Regulations 2017 and seek to protect, enhance and manage the water environment"*.

2.3 Policy NE7: Reducing flood risk. This policy states:

"Planning permission for development proposals will be granted provided that (as applicable):

- a) Development is located outside of medium and high-risk flood areas (flood zone 2 and 3) and other areas affected by other sources of flooding where possible;*
- b) Where (a) is not possible, application of the sequential and exception tests is demonstrated where development is proposed in areas of flood risk using the Strategic Flood Risk Assessment (SFRA) and Environment Agency flood maps;*
- c) A FRA has been prepared in accordance with national guidance that considers the lifetime of the development, climate change impacts and safe access and egress;*
- d) It will be located, designed and laid out to ensure the risk of flooding is reduced whilst not increasing flood risk elsewhere;*
- e) The impact of any residual flood risk will be minimised through flood resistant, resilient design and construction;*
- f) Any flood protection and mitigation measures necessary will not cause harm to nature conservation, heritage assets, and/or landscape and recreation and, where possible, will have a positive impact in these respects; and*
- g) Overland flow routes and functional floodplain areas are protected from all development other than that which is "water compatible" and this must be designed and constructed to remain operational and safe for users during flood*

events, resulting in no net loss of flood plain storage and not impeding water flows or increasing flood risk elsewhere."

2.4 Policy NE8: Sustainable drainage systems. This policy states:

"Planning permission for development will be granted provided that:

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

2.5 The Local Plan is supported by evidence base documents and studies including those relevant to this FRA as discussed in the following paragraphs.

2.6 The Strategic Flood Risk Assessment (SFRA) was updated in September 2016. The SFRA gives a district-wide overview of flood risk from various sources along with policy recommendations. The findings of the SFRA relevant to this FRA are discussed in the following section.

2.7 The Infrastructure Delivery Plan (IDP) was also published in September 2016. The IDP mentions that Royston Sewage Treatment Works (STW) had capacity issues at the time of writing and that investment would be needed with growth. Funding for STW upgrades where required to provide for additional growth are wholly funded by water companies through their Asset Management Plans. Apart from this comment, no specific infrastructure projects related to flood risk are identified which are needed to service the proposed development site.

2.8 The North Hertfordshire Surface Water Management Plan (SWMP) prepared by Hertfordshire County Council (HCC) was published in 2017. The SWMP identifies Hotspots with recommended actions to manage existing flood risk areas.

2.9 The application site is at the upstream boundary of "Hotspot 14 – Royston" which encompasses the whole of the town. This Hotspot selection is explained in the SWMP as a "Desk-Based Identified Hotspot" identified by mapping analysis rather than a "Stakeholder Identified Hotspot" identified based upon local knowledge and evidence. The designation is based on the mapped surface water flood risk through Royston as

well as railway and highway culvert constraints. However, some locally known flooding incidents east of the A10 and to the east of the town centre are mentioned.

- 2.10 Hotspot 14 was not taken forward for modelling. The SWMP recommended action is as follows:

"Significant investigation into the status and performance of the many soakaways and their associated infrastructure would be required. This would not meet the timescales or budget constraints associated with the SWMP. This is not to be progressed for further assessment at this stage, but to be considered for an individual study at a later date."

- 2.11 There is no information available on any subsequent individual surface water management study for Royston.

Legislative Context

- 2.12 The Flood and Water Management Act 2010 (FWMA) updated legislation to ensure better protection from flooding, manage water more sustainably, improve public services and secure water resources during periods of drought. The FWMA helps reduce flood risk by:

- clarifying who is responsible for managing all sources of flood risk;
- encouraging more sustainable forms of drainage in new developments; and
- making it easier to resolve misconnections to sewers.

- 2.13 The FWMA established the creation of the Lead Local Flood Authority (LLFA) at county or unitary level to manage local flood risk. Each LLFA is required to prepare a Local Flood Risk Management Strategy which considers all sources of flood risk and identifies objectives to manage local flood risk to local communities.

- 2.14 The LLFA relevant to the Development is Hertfordshire County Council.

- 2.15 The FWMA also laid the groundwork for national Sustainable Drainage Systems (SuDS) standards to be created. No legislation has yet been passed for this, but Defra has published non-statutory technical standards for SuDS which are frequently referred to by LLFAs in establishing suitable standards for development.

- 2.16 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 tie the UK into the EU Water Framework Directive (WFD) which sets environmental objectives for water bodies. The Regulations set out how the Environment Agency (EA)

monitors the ecological and chemical status of surface water bodies and the chemical and quantitative status of groundwater. The EA has published River Basin Management Plans (RBMP) to coordinate the WFD objectives in each river basin district.

3 Existing Site & Current Flood Risk

Site Location

- 3.1 The site comprises open fields located on the south-west extremity of Royston, around 0.5km from the town centre. The site is bound by Echo Hill (north), Briary Lane (west), and Royse Grove (east).
- 3.2 A location plan is in Appendix A.

Topography

- 3.3 The site straddles a ridge which is descending steadily from south-west to north-east. From a high point of 120m AOD in the south-west corner, the northern slope descends to 94m AOD at the north-west corner. The eastern slope descends to the boundary where levels are between 102m and 107m AOD.
- 3.4 Survey data is in Appendix B.

Hydrology

- 3.5 There are no watercourses in the vicinity of the site. The nearest mapped watercourses are on the northern edge of Royston.

Geology

- 3.6 The published bedrock geology for the site comprises New Pit Chalk Formation, classified as a principal aquifer. Superficial deposits of Head - Clay, Silt, Sand and Gravel are mapped at the low points in the south-east and north-west corners. Till – Diamicton deposits are mapped at the crown of the site in the south-west corner.
- 3.7 Defra's Groundwater Vulnerability Map shows the solid geology as High risk and the deposits as Medium-High. This indicates the high permeability of the chalk strata and the potential pathway for pollutants to reach the aquifer beneath the site.
- 3.8 The site lies within a groundwater Source Protection Zone I – Inner, but lies outside of any Drinking Water Safeguard Zones. The Source Protection Zone (SPZ) designation is due to two public water supply abstraction points being situated to the northwest and east within 500m of the proposed development.

- 3.9 In situ ground investigations were conducted at the site in April 2017 in support of a previous planning application. The investigations included BRE 365 soakaway tests in trial pits 2m deep in the lower parts of the site. The results ranged between 3.74×10^{-6} m/s (0.013 m/hr) and 2.04×10^{-4} m/s (0.734 m/hr). The better rates were recorded on slightly higher ground and where the chalk horizon was shallower.
- 3.10 Further testing at the north-west of the site was carried out in November 2024. The two test pits were excavated at lower ground levels than the 2017 tests and the pit depths were shallower at 1.6 and 1.7m. Insufficient soakage occurred to record an infiltration rate. The geotechnical consultant concluded as follows:

"In general chalk deposits and anticipated deep groundwater level would be expected to provide a reasonable infiltration rate. The chalk bedrock encountered within the trial pits is therefore likely to be essentially highly weathered with the chalk degrading to a silt/clay matrix essentially filling in the naturally occurring fracturing of the bedrock blocking the ability of the water to infiltrate. Given the data from the test, it is considered that the use of shallow soakaways is not suitable for this site.

Consideration would need to be given to either repeat testing but in deeper trial pits (recommend 3m deep to try and excavate into less weathered bedrock) or test to greater depth utilising a drilled borehole."

- 3.11 Groundwater was not encountered during any of the excavations. Borehole records located 250m from the site suggest the groundwater level is likely to be more than 50m deep beneath the site.
- 3.12 Relevant extracts from the soakaway test reports are included in Appendix C.

Flood Zone

- 3.13 In its elevated position, the site is remote from any fluvial flood risk area. The EA's Flood Map for Planning shows the Site lies within Zone 1 – Low Probability, having less than a 1 in 1,000 (0.1%) annual exceedance probability (AEP) of river flooding.

Surface Water Flood Risk

- 3.14 The EA's Risk of Flooding from Surface Water mapping shows the site is not affected by any risk area. This reflects the site's position at the top of a chalk catchment.

Reservoir Flood Risk

- 3.15 The site is not close to any reservoir flood risk area shown on the EA's mapping.
- 3.16 There is a covered reservoir for water supply located immediately to the south-west of the site. From LiDAR terrain data, the covered reservoirs are raised above ground level.
- 3.17 The likelihood of a breach occurring is remote due to the solid construction, including surrounding earth embankments, and the maintenance regime that such facilities are subject to in the UK. However, in the unlikely scenario where a breach occurred, volumes of water could be released rapidly and move downhill as directed by the topography. Depending on which side of the reservoir a breach occurred, the onward flow path would be northwards via the western margin of the site, or eastwards via the southern margin of the site. Figure 3-1 below illustrates the topography.



Figure 3-1: LiDAR terrain map (from SCALGO Live software)

Groundwater Flood Risk

- 3.18 The GeoSmart GW5 groundwater flood risk profile for the site is Negligible. As mentioned above, available geological data indicates that local groundwater levels are significantly deep below the site.

Climate Change

- 3.19 The site lies within the Cam and Ely Ouse Management Catchment. Applicable peak rainfall allowances are 35% for the 1 in 30 annual exceedance probability (AEP) events and 40% for the 1 in 100 AEP events.

Historical Flooding

- 3.20 A review of the available data and documents has not identified any records of flooding incidents at or close to the site. The SWMP information (see Section 2) indicates that flooding has occurred at lower levels through the town. Management of surface water runoff in the top of the catchment will therefore be important.

Existing Drainage Characteristics

- 3.21 There are no existing watercourses or surface water sewers identified in the vicinity of the site. The existing development in the upper parts of Royston is understood to be served by soakaway drainage.
- 3.22 The Soilscape classification of the surface soils at the site comprises shallow lime-rich soils, loamy, freely draining. Together with the chalk bedrock, and the absence of any watercourses, it is evident that majority of rainfall currently dissipates via infiltration.
- 3.23 There are existing public foul sewers in the residential estates to the north and east. The foul sewers in Echo Hill are not mapped on Anglian Water's records; however, the Echo Hill development pre-dates the sewer transfers of 2011 and it is assumed that the sewers are in fact public.
- 3.24 Anglian Water's sewer records are included in Appendix D.

4 Proposed Flood Risk Mitigation

- 4.1 The Site lies entirely within Flood Zone 1. All types of development are appropriate within this Zone in terms of flood risk according to the NPPF and planning practice guidance.
- 4.2 There are no risks from surface water or groundwater that need to be mitigated. The residual risk from a breach at the covered reservoir to the south-west of the site will be managed by preserving the likely flow paths as green open space. This is reflected on the Development Framework Plan which is included in Appendix E.
- 4.3 The proposed development follows the sequential approach outlined in the NPPF as it will be located on land with least flood risk. No further specific flood risk mitigation measures are required beyond the management of development runoff. This is discussed in the next section.

5 Proposed Surface Water Strategy

- 5.1 Potential options for rainwater re-use will be explored at detailed stage. For the purposes of this outline FRA, it has been assumed that any such systems are full during a design storm event and the need to manage runoff remains.
- 5.2 The preference for disposing of surface water runoff is at source by means of infiltration techniques. The site geology will permit infiltration drainage as is evidenced by the permeable soils and bedrock geology as well as the historical reliance on soakaway drainage in the upper parts of Royston.
- 5.3 Two prior outline applications for residential development at the site have been made to NHDC under reference 18/00747/OP in 2018 and reference 20/00744/OP in 2020. Each was refused for reasons other than flood risk. The submitted drainage strategy for both applications relied on infiltration techniques and the LLFA and the EA each accepted this as a viable outline strategy subject to detailed design.
- 5.4 To develop a sound strategy for infiltration drainage, this assessment and the site investigations have identified a number of constraints which must be carefully considered. These constraints are as follows:
- Poor soakage rates were recorded at shallow depth in the Head deposits and the weathered Chalk horizon at the lowest parts of the site. For better soakaway rates a slightly deeper construction is needed into the more structured chalk.
 - The SPZ I – Inner designation requires runoff to be thoroughly treated prior to any discharge to ground.
 - The need to locate infiltration drainage features sufficiently above the saturated soil layers to further mitigate the risk of any pollutants migrating into the aquifer.
- 5.5 GTA consulted the EA in December 2024 regarding the use of infiltration SuDS within the SPZ I – Inner. The response, included in Appendix H, states that this will be acceptable subject to compliance with the following principles:
1. *Infiltration sustainable drainage systems (SuDS) such as soakaways, unsealed porous pavement systems or infiltration basins shall only be used where it can be demonstrated that they will not pose a risk to the water environment.*
 2. *Infiltration SuDS have the potential to provide mobilise pollutants and must not be constructed in contaminated ground. They would only be acceptable if a site investigation showed the presence of no significant contamination.*

3. *Only clean water from roofs can be directly discharged to any soakaway or watercourse. Systems for the discharge of surface water from associated hard-standing, roads and impermeable vehicle parking areas shall incorporate appropriate pollution prevention measures and a suitable number of SuDS treatment train components appropriate to the environmental sensitivity of the receiving waters.*
 4. *The maximum acceptable depth for infiltration SuDS is 2.0 m below ground level, with a minimum of 1.2 m clearance between the base of infiltration SuDS and peak seasonal groundwater levels.*
 5. *Deep bore and other deep soakaway systems are not appropriate in areas where groundwater constitutes a significant resource (that is where aquifer yield may support or already supports abstraction). This would include the principal chalk aquifer comprising this area.*
 6. *SuDS should be constructed in line with good practice and guidance documents which include the SuDS Manual (CIRIA C753, 2015) and the Susdrain website.*
- 5.6 The in-situ ground investigations and soakaway test results indicate that, in the lower parts of the site, it may be necessary to relax the acceptable depth of the base of the infiltration features slightly, perhaps to 3m deep in order to sit below the clay deposits and weathered chalk. On the basis that groundwater levels are anticipated to be significantly deep below the site, this relaxation is considered reasonable.
- 5.7 At the next stage, ground investigations will need to include assessment of existing contamination, groundwater monitoring and further targeted soakaway testing to inform the detailed design of the infiltration systems. Meanwhile, to support the outline planning application, this FRA identifies the viable means of providing a compliant SuDS strategy within the parameters outlined above.
- 5.8 The proposed SuDS strategy is as follows:
- The existing two topographic catchments will be preserved – north and south.
 - Roof runoff from each dwelling will be directed to an individual cellular soakaway located in each back garden. These will not accept runoff from any paved surfaces.
 - Runoff from all paved surfaces will be managed within a multi-stage SuDS treatment train comprising the following sequence:

- Lined permeable paving or bioretention features (rain gardens and tree pits).
 - Lined conveyance swales with micropools.
 - Lined wetland ponds.
 - The ponds will discharge the treated runoff at controlled rates into the final infiltration cell located at the lower end of each catchment.
- 5.9 Due to the steep topography and the depth limit for the soakaways below ground level, the only way to provide a feature with sufficient storage volume is to install long, linear infiltration trenches which wrap around the existing contour lines. However, this configuration will be an advantage in offsetting any local variations in soil permeability and dissipating inflows to reduce the risk of formation of solution features in the chalk below the soakaway.
- 5.10 A 10m minimum offset has been assumed from the final infiltration features to boundaries and all structures. For domestic soakaways it should be possible to locate individual features adjacently in clusters at the ends of the gardens (sized with design calculations taking into account the influence of nearby soakaways).
- 5.11 The proposed SuDS strategy is illustrated in Appendix E.
- 5.12 Based on a conservative assumed infiltration rate of 1×10^{-5} m/s (0.036 m/hr), the ponds and infiltration features have been sized with sufficient volume to cater for the 1 in 100 AEP +40% storm events. Calculations are included in Appendix F.
- 5.13 Flow controls will be fitted on the pond outfalls to reduce the inflow to the infiltration cells and provide storage volume. An additional 'dry' basin is provided in the north catchment to supplement the trench volume via an overflow. The basin can be unlined as it will lie downstream of the treatment train.
- 5.14 The access from Echo Hill may prove too low to drain back to the on-site SuDS network. A separate roadside bioretention infiltration feature will be required at detailed stage.
- 5.15 Exceedance: A plan showing exceedance routes will be required at detailed stage. The existing margins at the west and south boundaries will be the most likely flow routes, and these have been preserved as green open space in the layout. Additional measures may need to be considered in the detailed layout design to divert any overland flow

routing away from buildings.

- 5.16 **Water quality:** The proposed SuDS strategy includes appropriate runoff treatment measures in the form of permeable paving, bioretention features, swales and wetland ponds to capture pollutants before they enter the receiving aquifer.
- 5.17 Based on the Simple Index Approach described in CIRIA C753 (The SuDS Manual) the development's pollution hazard indices are outlined in Table 5-1 below along with the relevant SuDS mitigation indices for the proposed SuDS components. The components will be lined with an outfall and so the indices for discharges to surface water are more applicable for use in this case. Subsequent stage mitigation indices are halved and added to the previous total.

Pollutant type	TSS	Metals	Hydrocarbons
Pollution hazard indices			
Vehicular areas – Low	0.5	0.4	0.4
Spine road – Medium	0.7	0.6	0.7
SuDS mitigation indices			
Permeable pavement	0.7	0.6	0.7
Bioretention system	0.8	0.8	0.8
Min Stage 1	0.7	0.6	0.7
Swale	0.5	0.6	0.6
Min Stage 2	0.95	0.9	1.0
Wetland pond	0.8	0.8	0.8
Min Stage 3	1.35	1.3	1.4

Table 5-1: Runoff Treatment – Simple Index Approach

- 5.18 From Table 5-1, it is evident that the proposed 3-stage treatment train will provide a robust level of runoff treatment for paved surfaces prior to onward infiltration into the ground. This will protect the groundwater aquifer in the SPZ I - Inner. It is also anticipated that the water table is at significant depth which allows the unsaturated soil beneath the site to continue to filter water as it migrates down.
- 5.19 The access road from Echo Hill will be directed to a bioretention system which will provide sufficient treatment as shown in Table 5-1.

5.20 Ownership and maintenance: A draft Drainage Maintenance Plan (DMP) outlining ownership and maintenance responsibilities is included in Appendix G. This is a draft version based on the information currently available at this stage; the DMP will be updated as the design of each phase is developed and will remain a live document over the duration of the project. A summary of the various ownership responsibilities is as follows:

- Individual property drainage will be cared for by the property owner.
- Highway drainage and SuDS will be the responsibility of HCC as the Highway Authority. The final extent of adopted roads will be confirmed at the next stage.
- Adopted sewers and qualifying SuDS components will be the responsibility of Anglian Water, or will be vested in a sewerage company under a NAV agreement. The final arrangements will be confirmed at the next stage.
- The remaining drainage features along with the site-wide infrastructure will be cared for by the Estate Management Company set up by the developer.
- The developer will be responsible for maintaining completed SuDS components in advance of transfer to / adoption by the relevant party.

5.21 Foul drainage: The proposed foul drainage network will connect into the existing sewers in Echo Hill. These are believed to be public, but this will be confirmed with Anglian Water. If connection to the Echo Hill sewers cannot be agreed for any reason, a separate parallel sewer would need to be provided to connect to the mapped public foul sewer in Sun Hill.

5.22 The nature of any off-site upgrades will be determined by Anglian Water following modelling work which will take place following outline consent being granted. Any upgrades will be funded by Anglian Water from Infrastructure Charges and will be delivered by them in a suitable timeframe to accommodate the occupation programme.

5.23 Anglian Water was consulted on the capacity of Royston STW (also known as Water Recycling Centre or WRC). The response is included in Appendix H and confirms that there is currently some available headroom capacity.

6 Conclusions

- 6.1 The site lies entirely within Flood zone 1 remote from any fluvial risk area. There are no areas of surface water flood risk mapped within the site. The development is appropriate in terms of flood risk.
- 6.2 The residual risk of the unlikely scenario of a breach occurring at the covered reservoir to the south-west will be managed by preserving potential flow pathways free of buildings.
- 6.3 In common with the historical drainage methods within the chalk catchment locally, the proposed surface water strategy relies fully on infiltration measures to manage runoff. This will ensure no detrimental impact on surface water flood risk downhill from the site including within SWMP Hotspot 14.
- 6.4 The proposed SuDS components will capture pollutants to protect water quality in the receiving groundwater aquifer. The multi-stage treatment train provides more than sufficient protection based on the Simple Index Approach set out within CIRIA C753.
- 6.5 Further ground investigations are required at detailed stage to inform the detailed design of the infiltration drainage systems.
- 6.6 The development complies with the NPPF and relevant planning practice guidance in terms of flood risk.
- 6.7 The proposed SuDS and foul drainage strategies comply with Local Plan Policies SP11, NE7 and NE8 in terms of flood risk.

Appendix A

Location Plan



Aerial Photo



Appendix B

Site Survey



**JLP Surveys
Limited**

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PROJECT
Briary Lane, Royston, Hertfordshire

DRAWING TITLE	

Topographical Land Survey

SCALE 1:500	SHEET SIZE A0	No. of SHEETS 2	DATE 31.03.16	REVISION
DRAWING NUMBER				

S16-132-2

Appendix C

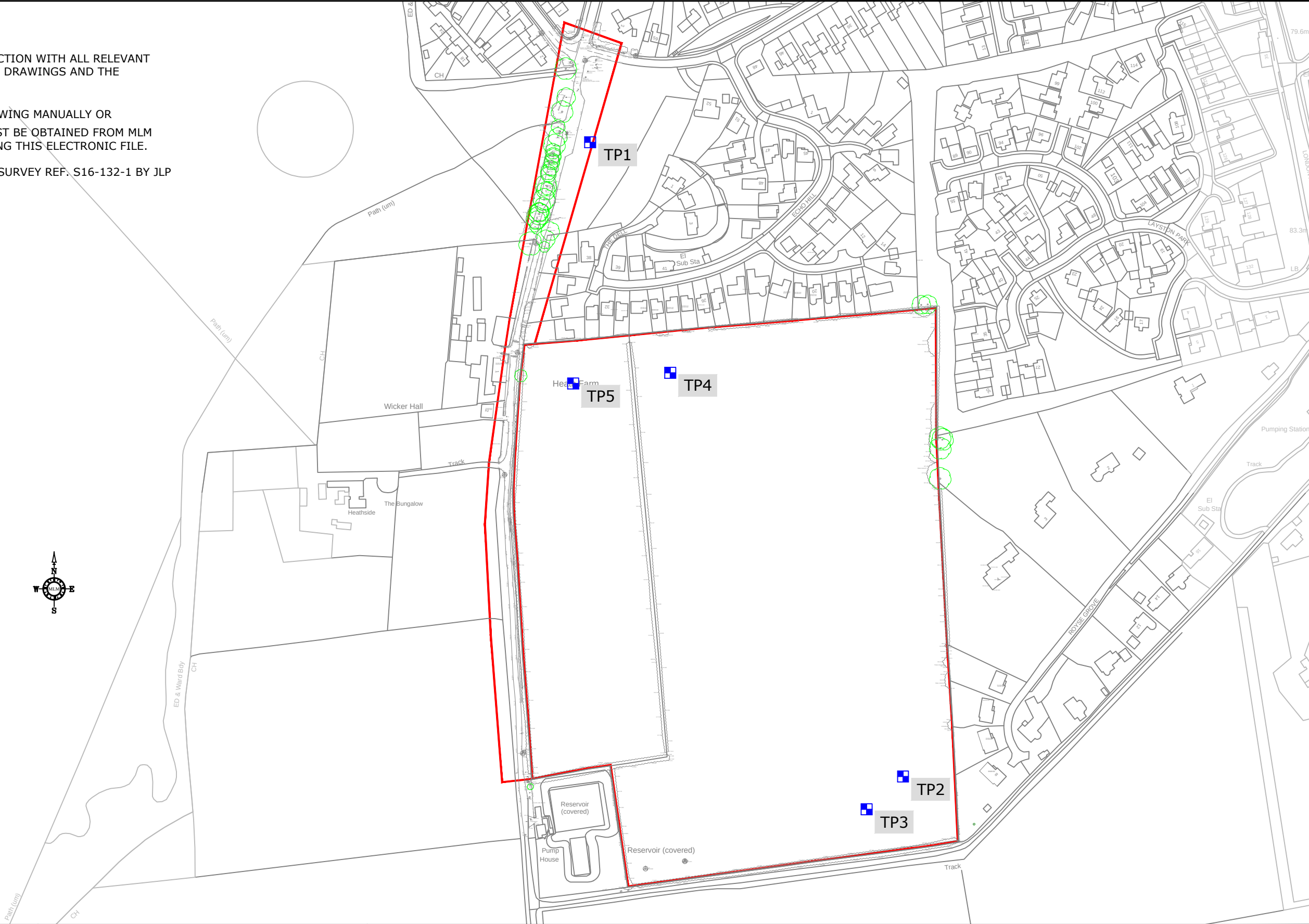
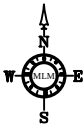
SI Data

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEER'S, ARCHITECT'S AND SPECIALIST'S DRAWINGS AND THE SPECIFICATION.
2. **DO NOT SCALE** FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.
3. BASE PLAN TAKEN FROM TOPOGRAPHICAL SURVEY REF. S16-132-1 BY JLP SURVEYS LTD DATED 31 MARCH 2016.

LEGEND

TP1 TRIAL PIT LOCATION



MLM

Multidisciplinary Consulting

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Drawing Status

FINAL ISSUE

Client

GLADMAN DEVELOPMENTS

Project

LAND OFF ECHO HILL, ROYSTON

Drawing Title

EXPLORATORY HOLE LOCATION PLAN

Drawn/Design

AT

Date

APR 2017

Scales

1:2500 @ A3

Checked

JG

Approved

WF

MLM Ref

775069

Drawing No.

775069-DWG-ENV-001

Rev

1

Rev	Date	Description	Made	Ckd
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SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP2 - Test 1

Readings:

Time (mins)	Water Level (m bgl)
0	1.03
1	1.06
2	1.09
3	1.10
4	1.13
5	1.14
10	1.20
15	1.25
20	1.30
30	1.36
45	1.46
60	1.51
120	1.68
180	1.76
240	1.80

Trial Pit Dimensions (m)

Length	1.35
Width	0.30
Depth	2.00

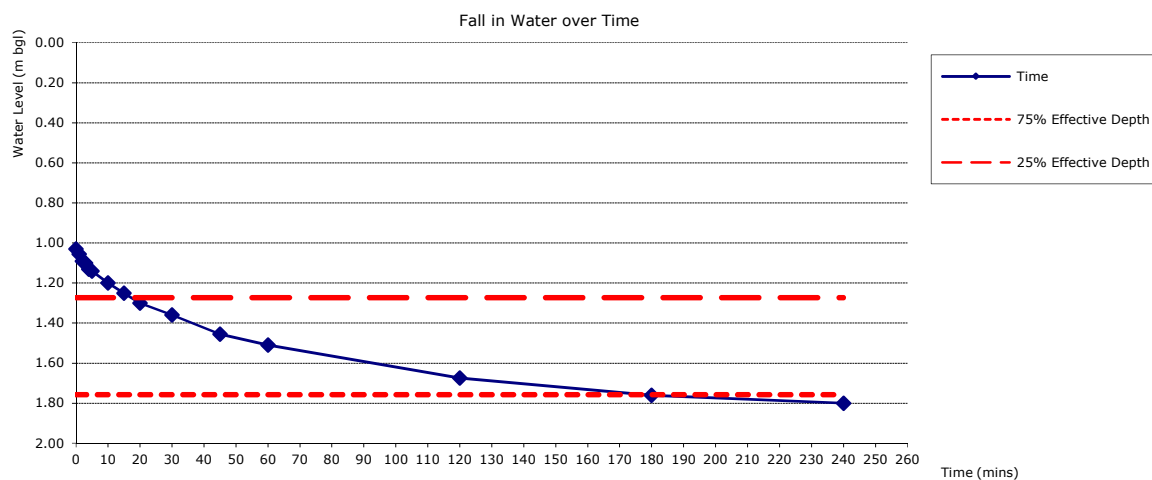
Assumed Invert Level (m bgl) 1.03

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 1.04E-05$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP2 - Test 2

Readings:

Time (mins)	Water Level (m bgl)
0	0.97
1	0.99
2	1.00
3	1.01
4	1.02
5	1.03
10	1.07
15	1.10
20	1.14
30	1.18
45	1.27
60	1.32
120	1.52
180	1.62
260	1.75

Trial Pit Dimensions (m)

Length	1.35
Width	0.30
Depth	2.00

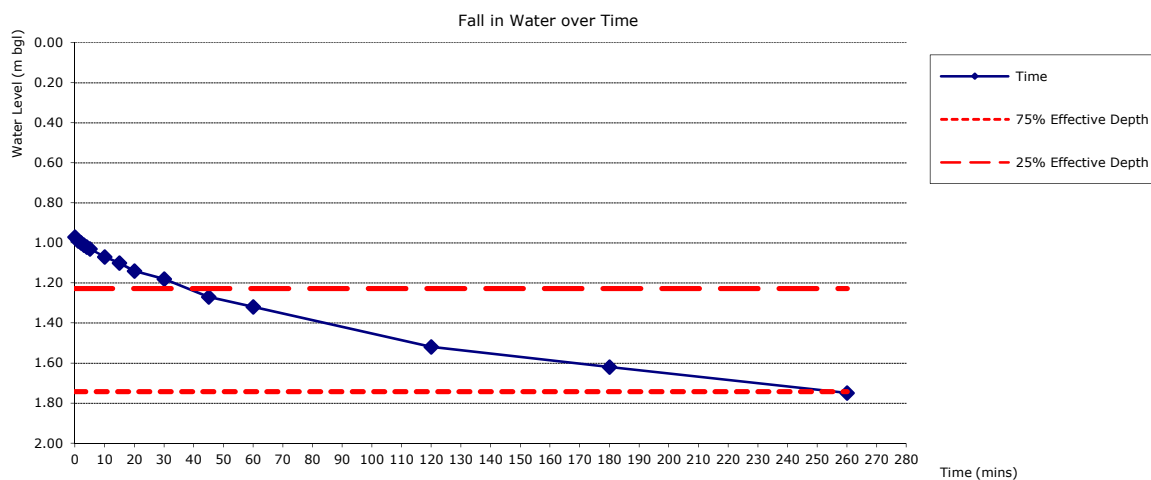
Assumed Invert Level (m bgl) 0.97

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs
	Data extrapolated using graph



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 7.52E-06$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)



Project Name: Echo Hill, Royston
 Location: SG8 9DP
 Project Ref: 775069
 Test Location: TP3 - Test 1

Readings:

Time (mins)	Water Level (m bgl)
0	1.15
1	1.27
2	1.35
3	1.41
4	1.46
5	1.52
10	1.61
15	1.77
20	1.85
30	1.97
45	2.00

Trial Pit Dimensions (m)

Length	1.40
Width	0.30
Depth	2.00

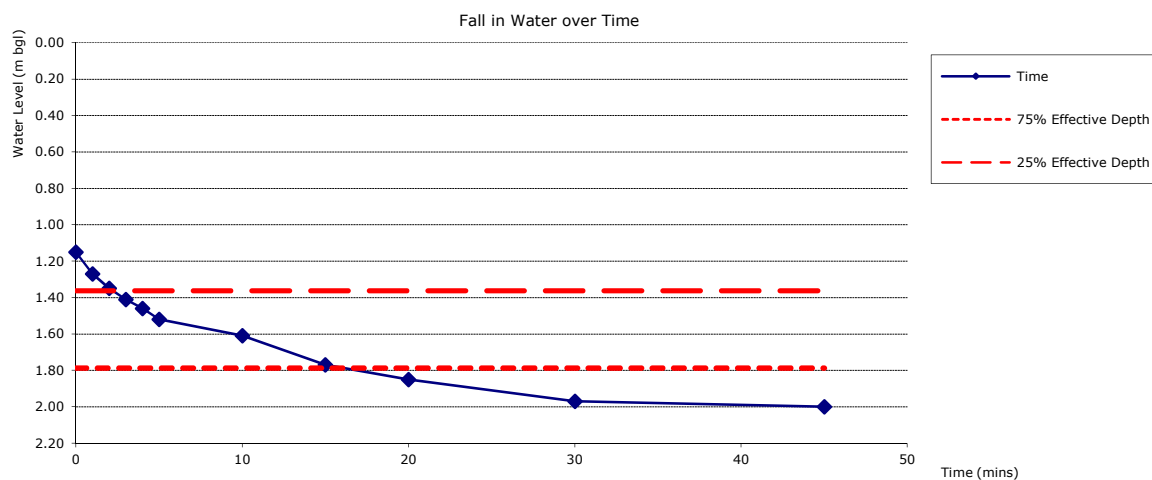
Assumed Invert Level (m bgl) 1.15

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 1.22E-04$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP3 - Test 2

Readings:

Time (mins)	Water Level (m bgl)
0	1.02
1	1.11
2	1.17
3	1.21
4	1.25
5	1.29
10	1.46
15	1.57
20	1.65
30	1.75
45	1.88
60	2.00

Trial Pit Dimensions (m)

Length	1.40
Width	0.30
Depth	2.00

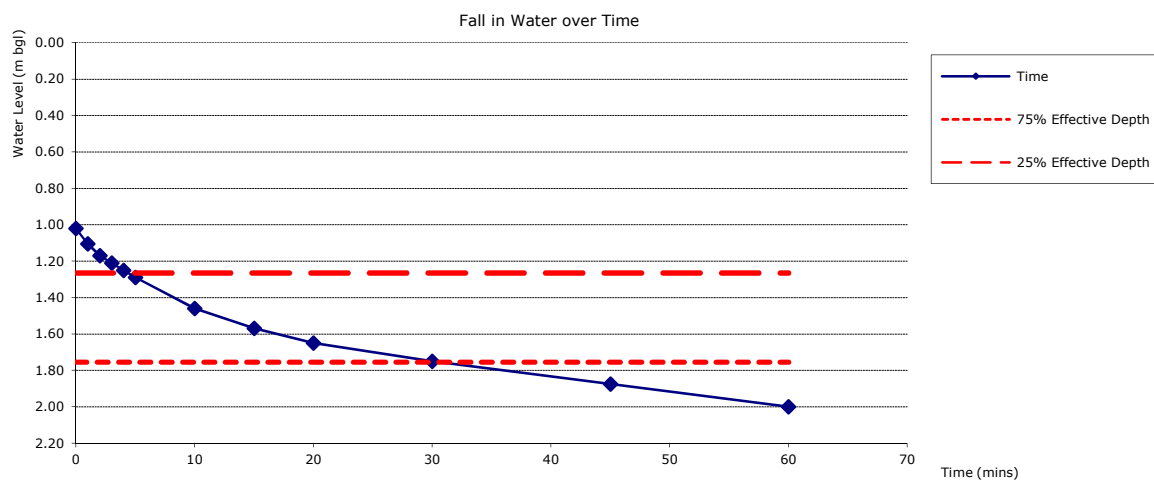
Assumed Invert Level (m bgl) 1.02

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 6.35E-05$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP3 - Test 3

Readings:

Time (mins)	Water Level (m bgl)
0	1.05
1	1.13
2	1.17
3	1.21
4	1.25
5	1.29
10	1.42
15	1.52
20	1.63
30	1.73
45	1.85
60	1.99

Trial Pit Dimensions (m)

Length	1.40
Width	0.30
Depth	2.00

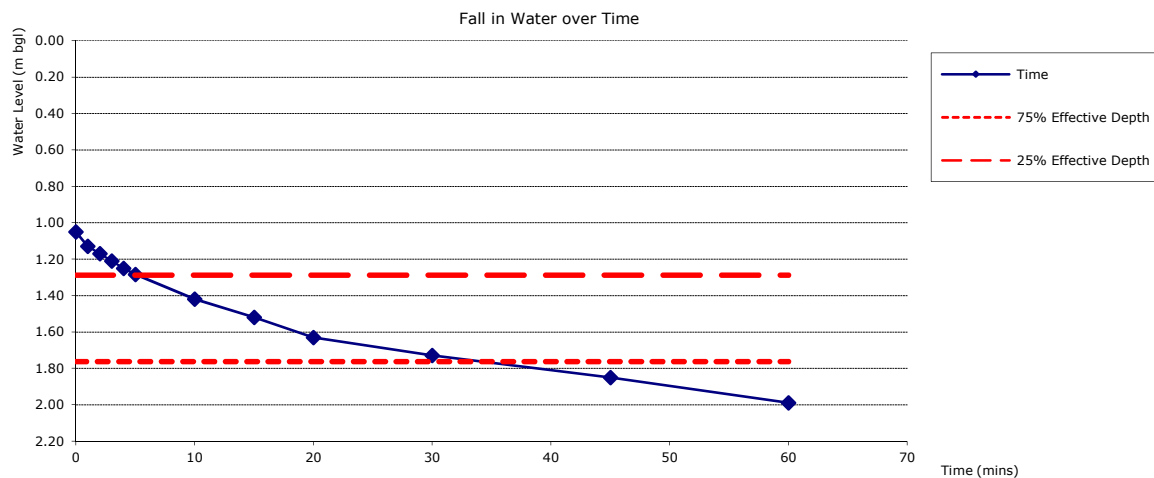
Assumed Invert Level (m bgl) 1.05

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs



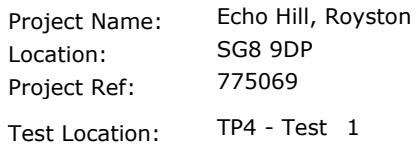
Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 5.79E-05$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

Based on BRE Digest 365: Soakaway Design (2007)

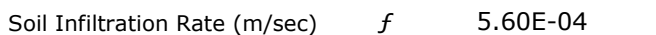


Trial Pit Dimensions (m)

Length	1.50
Width	0.30
Depth	2.00

Assumed fill porosity (CIRIA 156)	N/A
-----------------------------------	-----

	Refer to engineers logs



1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP4 - Test 2

Readings:

Time (mins)	Water Level (m bgl)
0	1.35
0.5	1.46
1	1.54
2	1.61
3	1.66
4	1.72
5	1.74
10	1.84
15	1.89
20	1.93
30	2.00

Trial Pit Dimensions (m)

Length	1.50
Width	0.30
Depth	2.00

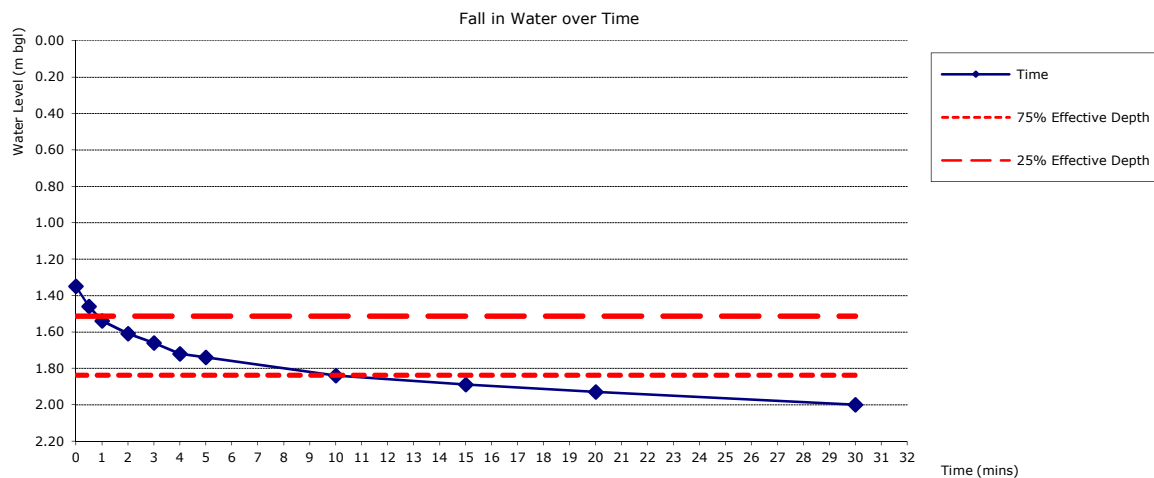
Assumed Invert Level (m bgl) 1.35

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs



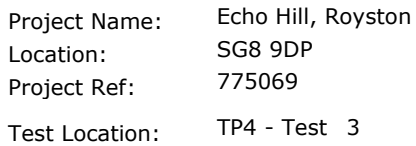
Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 2.04E-04$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

Based on BRE Digest 365: Soakaway Design (2007)

[illegible]

	Refer to engineers logs



SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP5 - Test 1

Readings:

Time (mins)	Water Level (m bgl)
0	1.07
1	1.11
2	1.14
3	1.15
4	1.17
5	1.19
10	1.23
15	1.30
20	1.34
30	1.39
45	1.46
60	1.53
120	1.62
240	1.71
320	1.78

Trial Pit Dimensions (m)

Length	1.40
Width	0.30
Depth	2.00

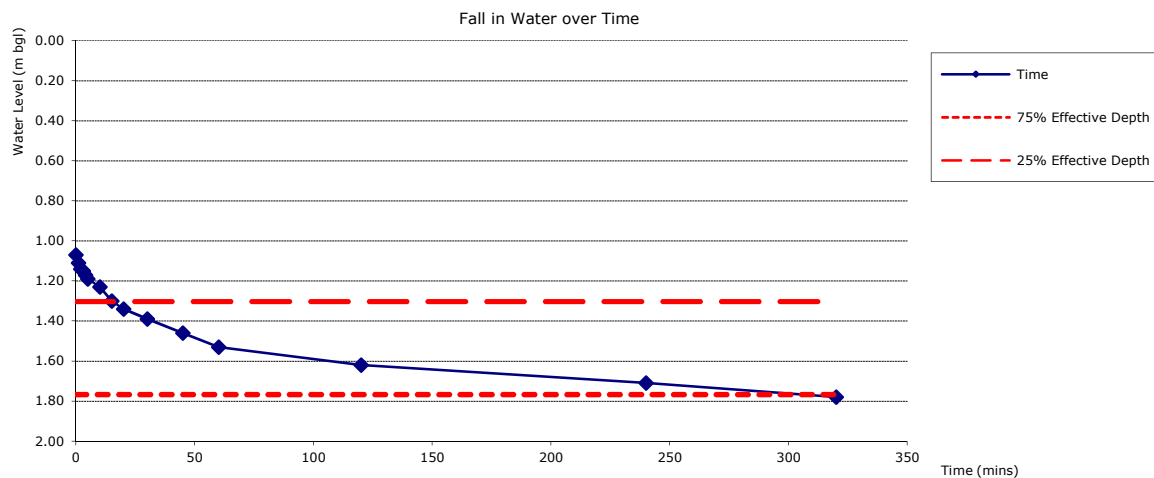
Assumed Invert Level (m bgl) 1.07

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs
	Data extrapolated from graph



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 6.02E-06$

Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

Project Name: Echo Hill, Royston
Location: SG8 9DP
Project Ref: 775069
Test Location: TP5 - Test 2

Readings:

Time (mins)	Water Level (m bgl)
0	1.00
1	1.01
2	1.02
3	1.03
4	1.04
5	1.07
10	1.09
15	1.11
20	1.16
30	1.21
45	1.25
60	1.40
120	1.54
240	1.59
300	1.63
360	1.67
420	1.70
500	1.76

Trial Pit Dimensions (m)

Length	1.40
Width	0.30
Depth	2.00

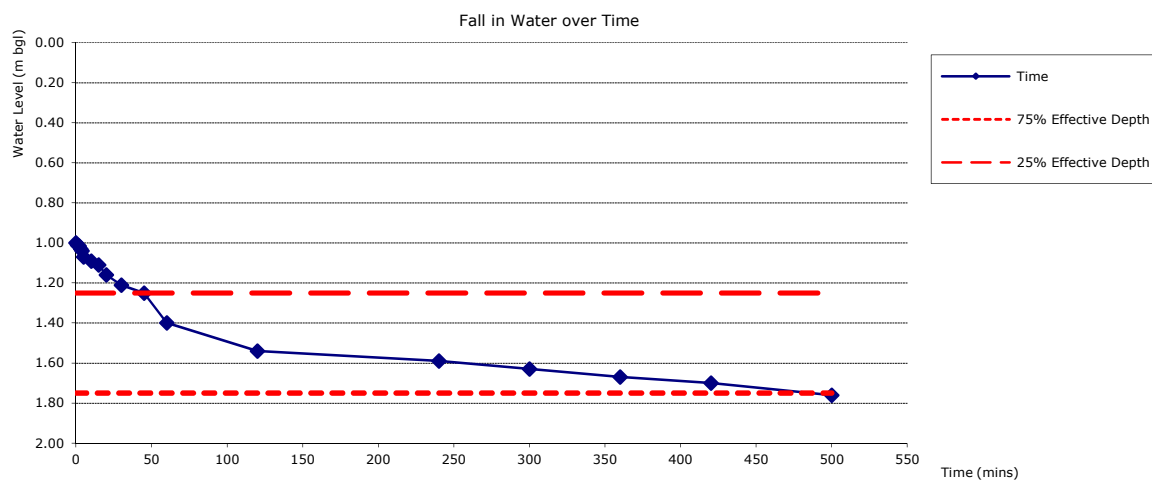
Assumed Invert Level (m bgl) 1.00

Was trial pit filled with gravel (Yes/No): No

Assumed fill porosity (CIRIA 156) N/A

Ground Conditions:

	Refer to engineers logs
	Data extrapolated from graph



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

Soil Infiltration Rate (m/sec) $f = 3.74E-06$

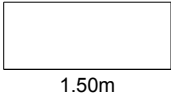
Remarks

1. The soil infiltration rate has been calculated using the BRESOAK Program version 1.0.4

MLM www.mlm.uk.com			Project: Land off Echo Hill, Royston Project ID: 775069 Location: Royston, Hertfordshire, SG8 9DP			Method: TP Start: 04/04/2017 Finish: 04/04/2017		TP1		
			Client: Gladman Developments Project Engineer: J. Gooch			Level (mOD): 87.32 Co-ordinates: 535284.51E - 240223.00N		1:25 Sheet 1 of 1 Logged by: J. Gooch		
INSITU TEST/SAMPLING			STRATA							
Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata			Thickness (m)	Water (m)
			86.92	0.40		Dark brown slightly gravelly clayey SILT containing active roots. Gravel is fine to medium sub angular to rounded chalk and flint. TOPSOIL			0.40	
				1		Structureless CHALK composed of slightly sandy silty angular to sub rounded fine to coarse GRAVEL. Gravel is medium density, white with occasional black specks. Contains rare coarse angular to sub rounded flint. (Grade Dc) NEW PIT CHALK FORMATION			1.60	
			85.32	± 2.00		End of trial pit at 2.00 m				
				3						
				4						
Notes: Shear strengths recorded using Pilicon Hand Shear Vane Remarks 1. No groundwater encountered						Dimensions: Stability: Stable Plant Used: Mechanical Excavator				

MLM www.mlm.uk.com			Project: Land off Echo Hill, Royston Project ID: 775069 Location: Royston, Hertfordshire, SG8 9DP			Method: TP Start: 04/04/2017 Finish: 05/04/2017		TP2		
			Client: Gladman Developments Project Engineer: J. Gooch			Level (mOD): 105.93 Co-ordinates: 535483.32E - 239819.93N		1:25 Sheet 1 of 1 Logged by: J. Gooch		
INSITU TEST/SAMPLING			STRATA							
Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata			Thickness (m)	Water (m)
			105.53	0.40		Dark brown and grey slightly gravelly clayey SILT. Gravel is fine to coarse angular to sub rounded chalk and flint. TOPSOIL			0.40	
			105.33	0.60		Medium brown silty gravelly CLAY. Gravel is fine to medium angular to sub rounded chalk and flint. SUBSOIL			0.20	
				1		Structureless CHALK composed of slightly sandy silty angular to sub rounded fine to coarse GRAVEL. Gravel is medium density, white with occasional black specks. Contains rare coarse angular to sub rounded flint. (Grade Dc) NEW PIT CHALK FORMATION			1.40	
			103.93	± 2.00	End of trial pit at 2.00 m					
				3						
				4						
Notes: Shear strengths recorded using Pilicon Hand Shear Vane Remarks 1. No groundwater encountered						Dimensions: Stability: Stable Plant Used: Mechanical Excavator				

MLM www.mlm.uk.com			Project: Land off Echo Hill, Royston Project ID: 775069 Location: Royston, Hertfordshire, SG8 9DP			Method: TP Start: 04/04/2017 Finish: 05/04/2017		TP3		
			Client: Gladman Developments Project Engineer: J. Gooch			Level (mOD): 107.63 Co-ordinates: 535460.17E - 239799.14N		1:25 Sheet 1 of 1 Logged by: J. Gooch		
INSITU TEST/SAMPLING			STRATA							
Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata			Thickness (m)	Water (m)
			107.23	0.40		Dark brown and grey slightly gravelly clayey SILT. Gravel is fine to coarse angular to sub rounded chalk and flint. TOPSOIL			0.40	
				1		Structureless CHALK composed of slightly sandy silty angular to sub rounded fine to coarse GRAVEL. Gravel is medium density, white with occasional black specks. Contains rare coarse angular to sub rounded flint. (Grade Dc) NEW PIT CHALK FORMATION			1.60	
			105.63	± 2.00		End of trial pit at 2.00 m				
				3						
				4						
Notes: Shear strengths recorded using Pilicon Hand Shear Vane Remarks 1. No groundwater encountered						Dimensions: 1.40m 0.30m Stability: Stable Plant Used: Mechanical Excavator				

MLM www.mlm.uk.com			Project: Land off Echo Hill, Royston Project ID: 775069 Location: Royston, Hertfordshire, SG8 9DP			Method: TP Start: 04/04/2017 Finish: 05/04/2017		TP4		
			Client: Gladman Developments Project Engineer: J. Gooch			Level (mOD): 101.93 Co-ordinates: 535335.39E - 240076.46N		1:25 Sheet 1 of 1 Logged by: J. Gooch		
INSITU TEST/SAMPLING			STRATA							
Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata			Thickness (m)	Water (m)
			101.63	0.30		Dark brown and grey slightly gravelly clayey SILT. Gravel is fine to coarse angular to sub rounded chalk and flint. TOPSOIL			0.30	
				1		Structureless CHALK composed of slightly sandy silty angular to sub rounded fine to coarse GRAVEL. Gravel is medium density, white with occasional black specks. Contains rare coarse angular to sub rounded flint. (Grade Dc) NEW PIT CHALK FORMATION			1.70	
			99.93	± 2.00		End of trial pit at 2.00 m				
				3						
				4						
Notes: Shear strengths recorded using Pilicon Hand Shear Vane Remarks 1. No groundwater encountered						Dimensions:  Stability: Stable Plant Used: Mechanical Excavator				

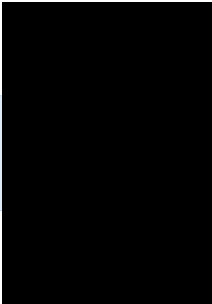
MLM www.mlm.uk.com			Project: Land off Echo Hill, Royston Project ID: 775069 Location: Royston, Hertfordshire, SG8 9DP			Method: TP Start: 04/04/2017 Finish: 05/04/2017		TP5		
			Client: Gladman Developments Project Engineer: J. Gooch			Level (mOD): 96.01 Co-ordinates: 535273.68E - 240069.69N		1:25 Sheet 1 of 1 Logged by: J. Gooch		
INSITU TEST/SAMPLING			STRATA							
Depth (m)	Sample Ref.	Strength Shear (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata			Thickness (m)	Water (m)
			95.76	0.25		Dark brown slightly gravelly clayey SILT containing active roots. Gravel is fine to medium sub angular to rounded chalk and flint. TOPSOIL			0.25	
				1		Medium to dark brown gravelly very sandy CLAY. Gravel is fine to medium sub angular to sub rounded chalk and rare angular medium flint. HEAD DEPOSITS			1.35	
			94.41	1.60		Structureless CHALK composed of weathered light grey and white sandy SILT. (Grade Dm) NEW PIT CHALK FORMATION			0.40	
			94.01	± 2.00	End of trial pit at 2.00 m					
				3						
				4						
Notes: Shear strengths recorded using Pilicon Hand Shear Vane Remarks 1. No groundwater encountered						Dimensions: 1.40m 0.30m Stability: Stable Plant Used: Mechanical Excavator				

IPX1026

Soil Infiltration Testing Report

Land off Echo Hill, Royston, SG8 9BB

November 24

	Name	Position	Signature	Date
Prepared	Jacob Roby	Geologist/Geotechnical Engineer		14 November 2024
Reviewed	Graham Dowlen	Principal Engineering Geologist		14 November 2024
Authorised	Richard Addison	Managing Director		14 November 2024

Issue	Date	Description	Prepared	Reviewed	Authorised
01	14 November 2024	Final Report	JR	GD	RA

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Physical Setting	4
Geology	4
Radon.....	4
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Unexploded Ordnance (UXO)	4
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Ground Conditions	6
Groundwater	6
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Notes and Limitations	8
Limitations and Uncertainties	8

Appendix A	Trial Pit Plan
Appendix B	Trial Pit Logs
Appendix C	Trial Pit Photographs
Appendix D	Soil Infiltration Test Results

Introduction

iPlant have been instructed by Gladman to undertake soil infiltration testing at a site in Royston.

Grid Reference	535378, 239965
Size of Study Site	9.27 Ha
Topography	100m AOD at lowest point.

The scope of works included two (2no.) trial pits (TP01 and TP02). The infiltration test locations were selected by the client and undertaken in accordance with Building Research Establishment (BRE) Digest 365, Soakaway Design, September 1991.

The proposed development is currently unknown.

Physical Setting

The site is currently unoccupied fields to the south of the town of Royston. The site is surrounded by residential properties to the north and east, and fields to the south and west.

Geology

The relevant British Geological Survey (BGS) GeoIndex Onshore online mapping information indicates the site is underlain by the superficial Head deposits (clay, silt, sand and gravel) encroaching in the northwest of the site and Glacial Till deposits (diamicton) encroaching in the southwest.

With respect to the underlying bedrock geology, the site is identified to be underlain by the New Pit Chalk Formation of the Cretaceous Period.

There are no British Geological Survey (BGS) borehole records within 250m of the site.

Radon

The radon potential at the site is indicated to be <1%.

Mining

The site is outside the coal mining reporting area as outlined by the Coal Authority (CA).

Unexploded Ordnance (UXO)

The UXO risk at the site is moderate. However, due to the small scale of the ground investigation, UXO supervision was not present on site. A watching brief was undertaken while excavating the trial pits.

Fieldworks

The works were completed on the 1st November 2024 under the supervision of a Geo-Environmental Engineer from iPlant and was carried out in general accordance with BS5930:2015+A1:2020 and BRE Digest 365.

In summary, the investigation undertaken included:

- Excavation of 2no. trial pits (TP01 and TP02).
- Subsequent infiltration testing.

The locations of exploratory positions were selected relative to the proposed development and being free of buried services.

The trial pits were logged in accordance with BS EN ISO 14688 and 14689 with any groundwater conditions noted.

Upon completion, the trial pits were backfilled, compacted and made good to existing levels and finishes, with any surplus spoil bagged up and removed from site.

The positions of the trial pits can be reviewed within Appendix A and the trial pit logs are available in Appendix B.

Geology and Groundwater Conditions

Reference to the British Geological Survey databases indicates that the site and surrounding areas are underlain by the New Pit Chalk Formation bedrock across the majority of the site. Superficial Head deposits (clay, silt, sand and gravel) are shown to be encroaching in the northwest of the site and Glacial Till deposits (diamicton) encroaching in the southwest.

Ground Conditions

The following ground conditions were encountered during the works:

Topsoil

Brown gravelly sandy TOPSOIL with occasional rootlets and constituents of sandstone, chert and chalk was encountered in both trial pits to a depth of 0.30m bgl.

Head Deposits

Head deposits were encountered in TP01 from a depth of 0.30m bgl to a depth of 1.30m bgl.

The superficial population comprised brown gravelly very clayey fine to coarse SAND with constituents of chalk and flint.

New Pit Chalk Formation

Bedrock deposits were encountered in both trial pits and comprised structureless Grade Dc CHALK composed of sandy subangular to rounded gravel from depths between 0.30m and 1.30m bgl to depths between 1.60m and 1.70m bgl.

Groundwater

Groundwater was not encountered during the investigation. Borehole records in excess of 250m from the site suggest the groundwater level is likely to be greater than 50m depth beneath the site.

It should be noted that groundwater levels are dependent upon seasonal variations and can change after periods of prolonged rainfall or drought.

Photographs can be reviewed in Appendix C.

Infiltration Testing

During the soakaway tests the water failed to achieve a fall from 75% to 25% of the effective depth of the storage volume in both pits and therefore no infiltration rate could be calculated. The results obtained from the soakaway tests are summarised below:

TP and Test Number	Dimensions (m)	Depth (m)	Infiltration Rate (m/sec)	Drainage Characteristics
TP01 Test 1	1.0 x 0.3	1.6	N/A	Poor
TP01 Test 2	1.0 x 0.3	1.6	N/A	Poor
TP01 Test 3	1.0 x 0.3	1.6	N/A	Poor
TP02 Test 1	1.0 x 0.3	1.7	N/A	Poor
TP02 Test 2	1.0 x 0.3	1.7	N/A	Poor
TP02 Test 3	1.0 x 0.3	1.7	N/A	Poor

Conclusion

The soils encountered beneath the site were found to be Chalk bedrock, with gravelly clayey Sand encountered locally in TP01. The soakage rates obtained during the investigation were found to be poor. In general chalk deposits and anticipated deep groundwater level would be expected to provide a reasonable infiltration rate. The chalk bedrock encountered within the trial pits is therefore likely to be essentially highly weathered with the chalk degrading to a silt/clay matrix essentially filling in the naturally occurring fracturing of the bedrock blocking the ability of the water to infiltrate. Given the data from the test, it is considered that the use of shallow soakaways is not suitable for this site.

Consideration would need to be given to either repeat testing but in deeper trial pits (recommend 3m deep to try and excavate into less weathered bedrock) or test to greater depth utilising a drilled borehole.

It is recommended that options for drainage solutions are discussed/considered with iPlant Geotechnical.

The detailed soil infiltration test results can be reviewed within Appendix D.

Notes and Limitations

iPlant take no responsibility for conditions which have not been revealed by the trial pits, or which occur between trial pits. Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative, and liability cannot be accepted for its accuracy.

The information contained in this report is intended for the use of the named client (or their approved contractors). Should a third party rely on any part of this report, that party does so wholly at its own risk and iPlant disclaim any liability to such parties. Should the purposes for which the report is used, or the proposed use of the site change, this report may no longer be valid and further use of reliance upon the report in those circumstances shall be at the client's sole and own risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. iPlant should in all such altered circumstances be commissioned to review and update this report accordingly.

iPlant take no responsibility for any construction design, foundation design, final design and structural plans that the customer chooses to carry out or implement. iPlant provide a factual report based on the information we find and our opinions/interpretation of the data.

iPlant have not been instructed to carry out a Euro Code (7) design or global slope stability assessment.

The site works carried out are a snapshot in time and environmental/other factors can alter ground conditions in which iPlant take no responsibility for. It is down to the customer to ascertain if further investigations are required if a long period of time passes between report and implementation.

Limitations and Uncertainties

iPlant have prepared this report with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

Information reviewed should not be considered exhaustive and has accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, iPlant reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed.

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices at this time and as such are not a guarantee that the study site is free of hazardous conditions.

IPX1026

Land off Echo Hill, Royston, SG8 9BB

November 24

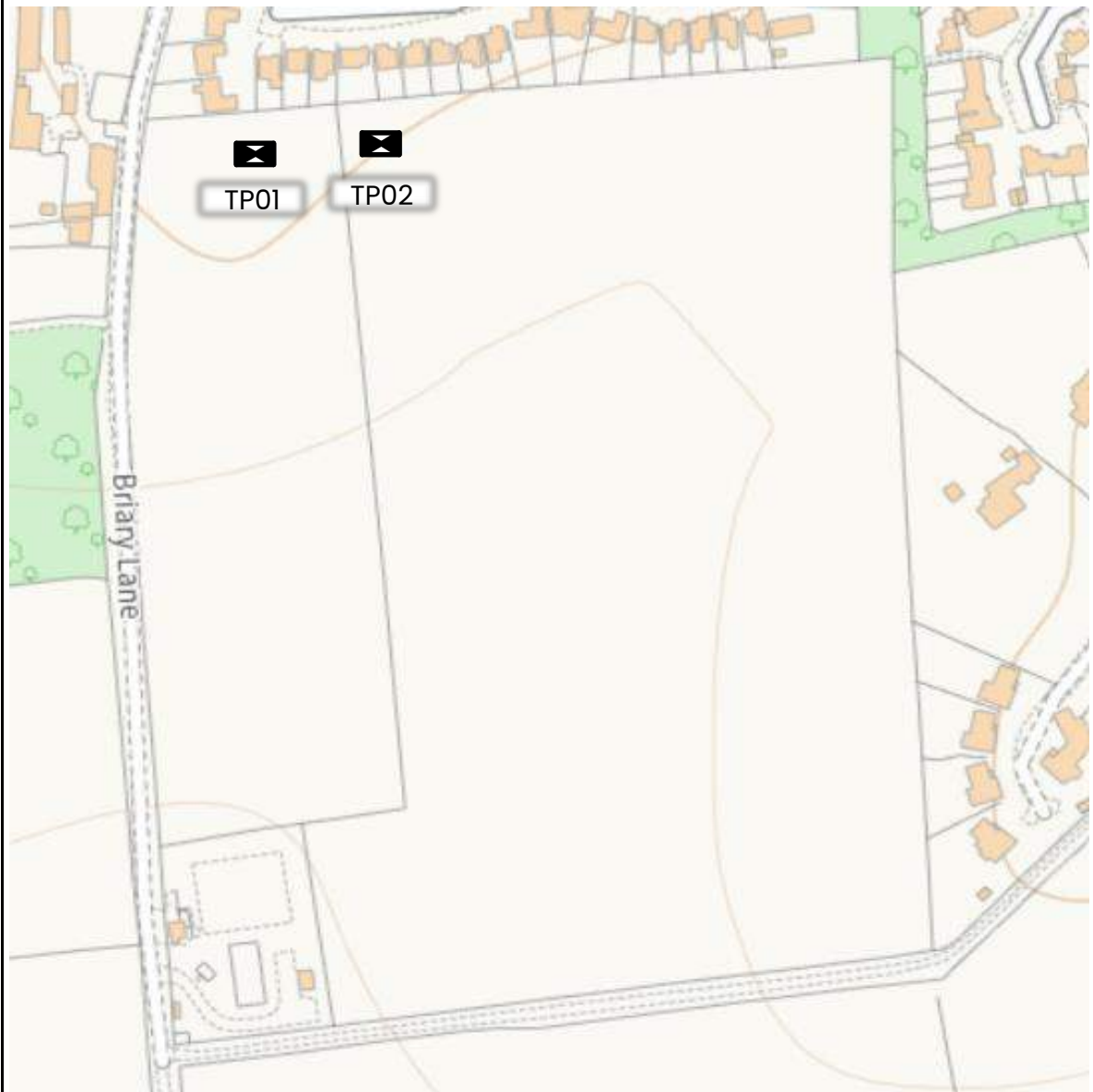


This report has been prepared solely for the use of the named client and may not be relied upon by other parties without written consent from iPlant. iPlant disclaim any responsibility to the client and others in respect of any matters outside the agreed scope of the work.



Appendix A – Trial Pit Plan





Site Investigation Plan



Land off Echo Hill, Royston
IPX1026
14/11/2024

IPX1026
Land off Echo Hill, Royston, SG8 9BB
November 24



Appendix B – Trial Pit Logs



IPX1026
Walkover Photos

TP01



Superficial arisings in TP01



TP02



Chalk bedrock in TP02



IPX1026

Walkover Photos

TP01 during the tests



TP01 backfilled



TP02 backfilled





Appendix C – Trial Pit Photographs





Trial Pit Log

TrialPit No
TP01
Sheet 1 of 1

Project Name: Land off Echo Hill

Project No.
IPX1026

Co-ords: -
Level:

Date
01/11/2024

Location: Royston

Dimensions (m): 1.00

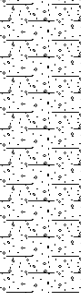
Depth
1.60

0.30

Scale
1:25

Logged
JR

Client: Gladman

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Brown gravelly sandy TOPSOIL with occasional rootlets. Gravel is angular to subangular fine to medium of sandstone, chert and chalk. Sand is fine to coarse.	
							Brown gravelly very clayey fine to coarse SAND. Gravel is angular to subrounded fine to coarse of chalk and flint.	1
				1.30			Structureless CHALK composed of sandy subangular to rounded GRAVEL. Clasts are weak, medium density, white. Matrix is creamish white and very clayey (Grade Dc).	
				1.60			End of Pit at 1.60m	2
								3
								4
								5

Remarks: No groundwater encountered. Soil infiltration test carried out.

Stability: Stable





Trial Pit Log

TrialPit No
TP02
Sheet 1 of 1

Project Name: Land off Echo Hill

Project No.
IPX1026

Co-ords: -
Level:

Date
01/11/2024

Location: Royston

Dimensions (m): 1.00

Depth
1.70

0.30

Scale
1:25

Logged
JR

Client: Gladman

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Brown gravelly sandy TOPSOIL with occasional rootlets. Gravel is angular to subangular fine to medium of sandstone, chert and chalk. Sand is fine to coarse.	
				1.70			Structureless CHALK composed of sandy subangular to rounded GRAVEL. Clasts are weak, medium density, white. Matrix is creamish white and very clayey (Grade Dc).	
							End of Pit at 1.70m	

Remarks: No groundwater encountered. Soil infiltration test carried out.

Stability: Stable





Appendix D – Soil Infiltration Test Results

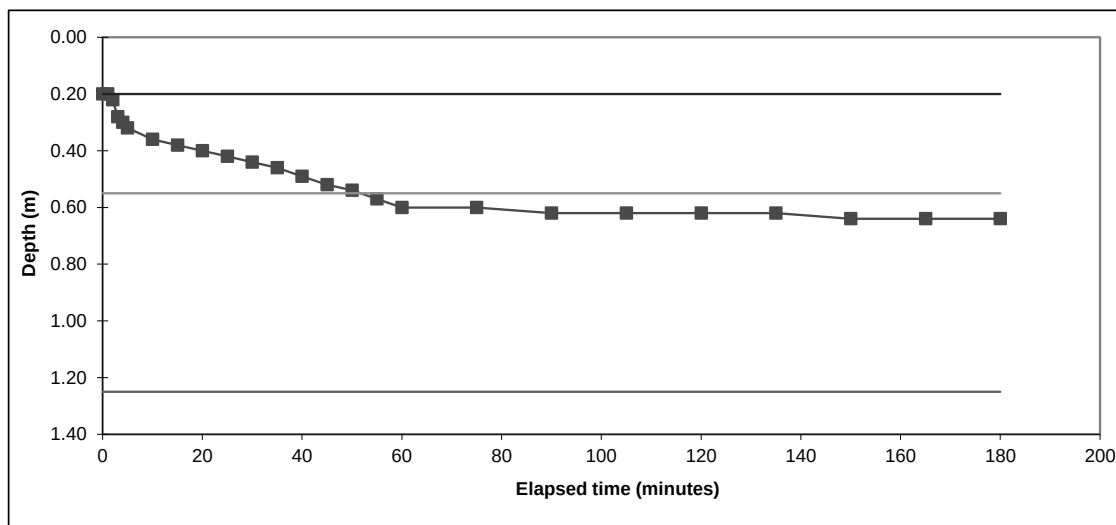


iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP01	Test No:	1	Date:	01/11/2024
Length (m):	1.000	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.60	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.200	50	0.540
1	0.200	55	0.570
2	0.220	60	0.600
3	0.280	75	0.600
4	0.300	90	0.620
5	0.320	105	0.620
10	0.360	120	0.620
15	0.380	135	0.620
20	0.400	150	0.640
25	0.420	165	0.640
30	0.440	180	0.640
35	0.460		
40	0.490		
45	0.520		



Start water depth for analysis (mbgl):	0.20		
75% effective depth (mbgl):	0.55	Elapsed time (mins):	51.7
50% effective depth (mbgl):	0.90		
25% effective depth (mbgl):	1.25	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.60		
Volume outflow between 75% and 25% effective depth (m³):			
Mean surface area of outflow (m²):		2.12	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			
Soil infiltration rate (m/s):		Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.	
Remarks Results processed following BRE 365 (2007).			

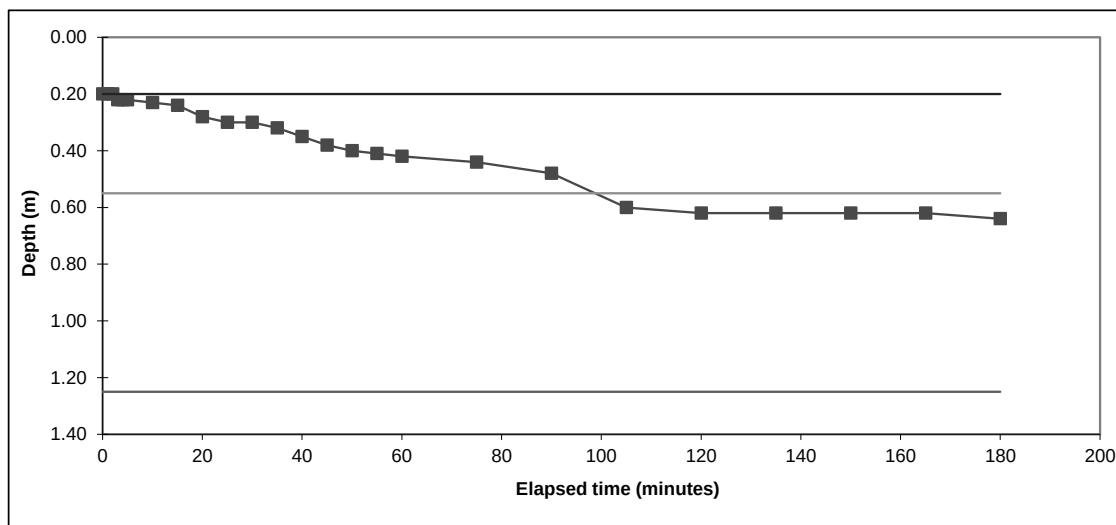
Client:	Gladman	TP01
Site:	Land off Echo Hill, Royston	

iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP01	Test No:	2	Date:	01/11/2024
Length (m):	1.000	Datum Height:	0.00 m agl		
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.60	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.200	50	0.400
1	0.200	55	0.410
2	0.200	60	0.420
3	0.220	75	0.440
4	0.220	90	0.480
5	0.220	105	0.600
10	0.230	120	0.620
15	0.240	135	0.620
20	0.280	150	0.620
25	0.300	165	0.620
30	0.300	180	0.640
35	0.320		
40	0.350		
45	0.380		



Start water depth for analysis (mbgl):	0.20		
75% effective depth (mbgl):	0.55	Elapsed time (mins):	98.8
50% effective depth (mbgl):	0.90		
25% effective depth (mbgl):	1.25	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.60		
Volume outflow between 75% and 25% effective depth (m³):			
Mean surface area of outflow (m²):		2.12	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
-------------------------------	---

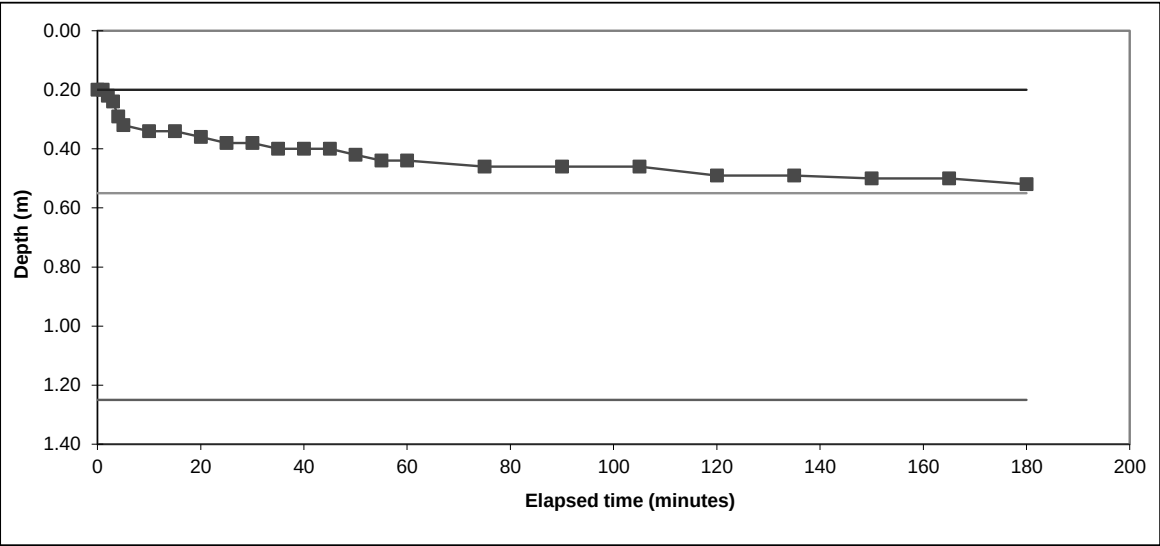
Remarks	Results processed following BRE 365 (2007).
---------	---

Client:	Gladman	TP01
Site:	Land off Echo Hill, Royston	

iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP01	Test No:	3	Date:	01/11/2024
Length (m):	1.000	Datum Height:		0.00 m agl	
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.60	Porosity of infill:	1	(assumed)	
	Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)	
	0	0.200	50	0.420	
	1	0.200	55	0.440	
	2	0.220	60	0.440	
	3	0.240	75	0.460	
	4	0.290	90	0.460	
	5	0.320	105	0.460	
	10	0.340	120	0.490	
	15	0.340	135	0.490	
	20	0.360	150	0.500	
	25	0.380	165	0.500	
	30	0.380	180	0.520	
	35	0.400			
	40	0.400			
	45	0.400			



Start water depth for analysis (mbgl)	0.20	Elapsed time (mins):	#N/A
75% effective depth (mbgl):	0.55		
50% effective depth (mbgl):	0.90	Elapsed time (mins):	#N/A
25% effective depth (mbgl):	1.25		
Base of soakage zone (mbgl):	1.60		
Volume outflow between 75% and 25% effective depth (m ³):			
Mean surface area of outflow (m ²):			2.12
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
Remarks	Results processed following BRE 365 (2007).

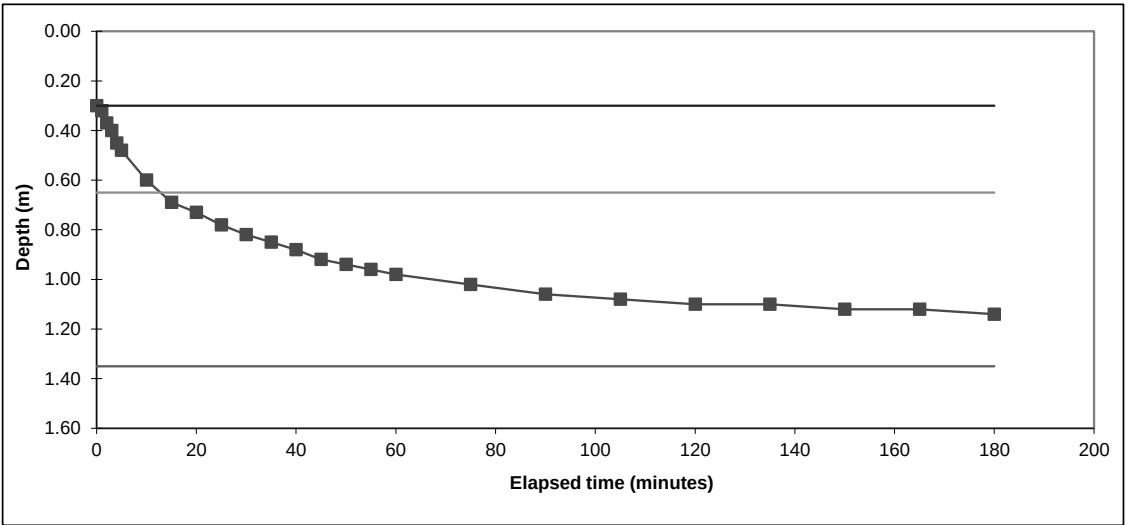
Client:	Gladman	TP01
Site:	Land off Echo Hill, Royston	

iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP02	Test No:	1	Date:	01/11/2024
Length (m):	1.000	Datum Height:			0.00 m agl
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.70	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.300	50	0.940
1	0.320	55	0.960
2	0.370	60	0.980
3	0.400	75	1.020
4	0.450	90	1.060
5	0.480	105	1.080
10	0.600	120	1.100
15	0.690	135	1.100
20	0.730	150	1.120
25	0.780	165	1.120
30	0.820	180	1.140
35	0.850		
40	0.880		
45	0.920		



Start water depth for analysis (mbgl):	0.30		
75% effective depth (mbgl):	0.65	Elapsed time (mins):	12.8
50% effective depth (mbgl):	1.00		
25% effective depth (mbgl):	1.35	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.70		

Volume outflow between 75% and 25% effective depth (m³):

Mean surface area of outflow (m²): 2.12
(side area at 50% effective depth + base area)

Time for outflow between 75% and 25% effective depth (mins):

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
-------------------------------	---

Remarks	Results processed following BRE 365 (2007).
---------	---

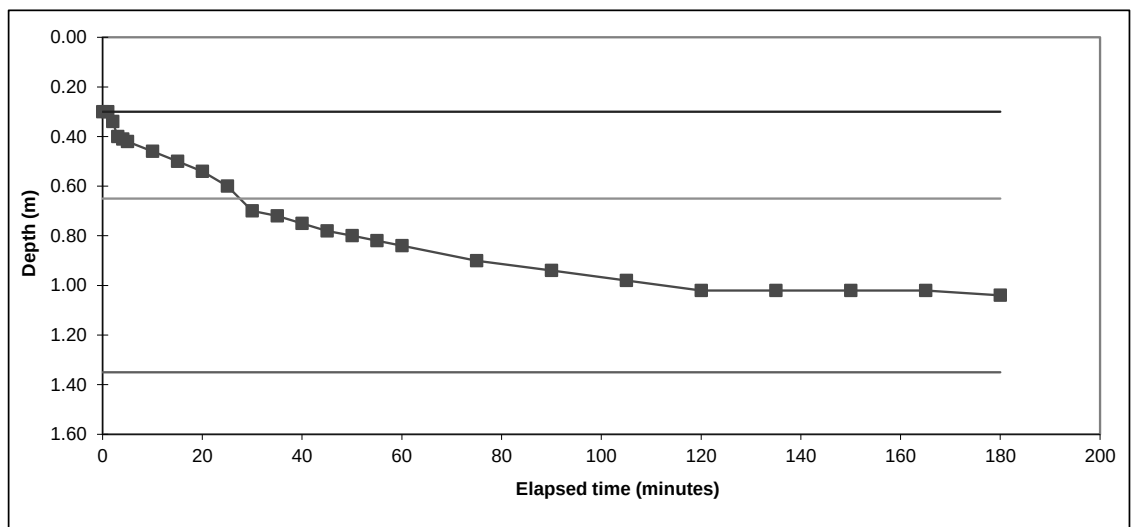
Client:	Gladman	TP02
Site:	Land off Echo Hill, Royston	

iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP02	Test No:	2	Date:	01/11/2024
Length (m):	1.000	Datum Height:	0.00 m agl		
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.70	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.300	50	0.800
1	0.300	55	0.820
2	0.340	60	0.840
3	0.400	75	0.900
4	0.410	90	0.940
5	0.420	105	0.980
10	0.460	120	1.020
15	0.500	135	1.020
20	0.540	150	1.020
25	0.600	165	1.020
30	0.700	180	1.040
35	0.720		
40	0.750		
45	0.780		



Start water depth for analysis (mbgl):	0.30		
75% effective depth (mbgl):	0.65	Elapsed time (mins):	27.5
50% effective depth (mbgl):	1.00		
25% effective depth (mbgl):	1.35	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.70		

Volume outflow between 75% and 25% effective depth (m ³):	
Mean surface area of outflow (m ²):	2.12
(side area at 50% effective depth + base area)	
Time for outflow between 75% and 25% effective depth (mins):	

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
-------------------------------	---

Remarks	Results processed following BRE 365 (2007).
---------	---

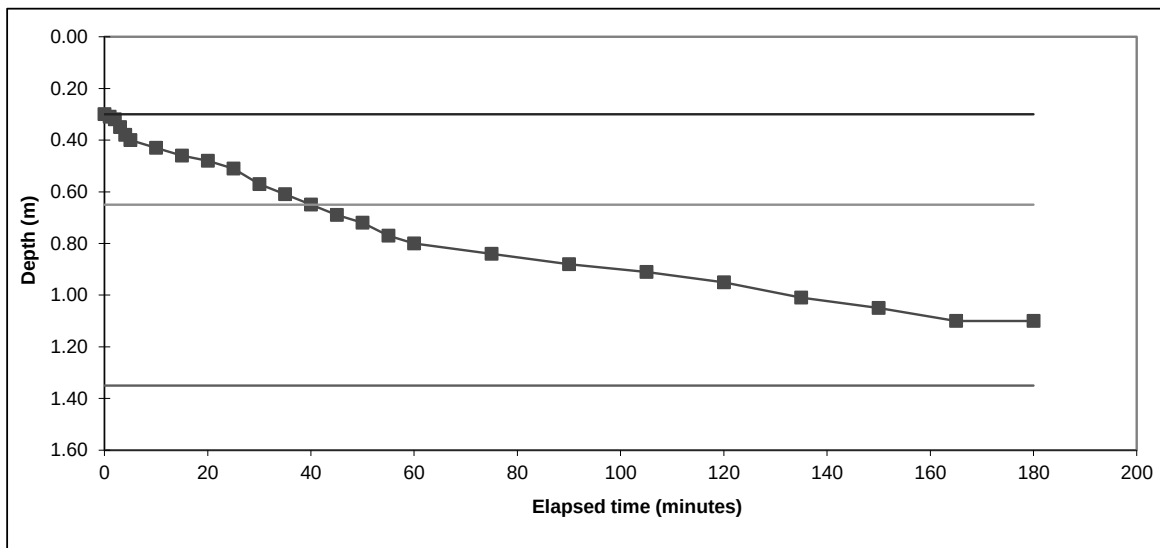
Client:	Gladman	TP02
Site:	Land off Echo Hill, Royston	

iPlant Geotechnical

Soakaway Test

Trial Pit No:	TP02	Test No:	3	Date:	01/11/2024
Length (m):	1.000	Datum Height:	0.00 m agl		
Width (m):	0.30	Granular infill:	None		
Depth (m):	1.70	Porosity of infill:	1	(assumed)	

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	0.300	50	0.720
1	0.310	55	0.770
2	0.320	60	0.800
3	0.350	75	0.840
4	0.380	90	0.880
5	0.400	105	0.910
10	0.430	120	0.950
15	0.460	135	1.010
20	0.480	150	1.050
25	0.510	165	1.100
30	0.570	180	1.100
35	0.610		
40	0.650		
45	0.690		



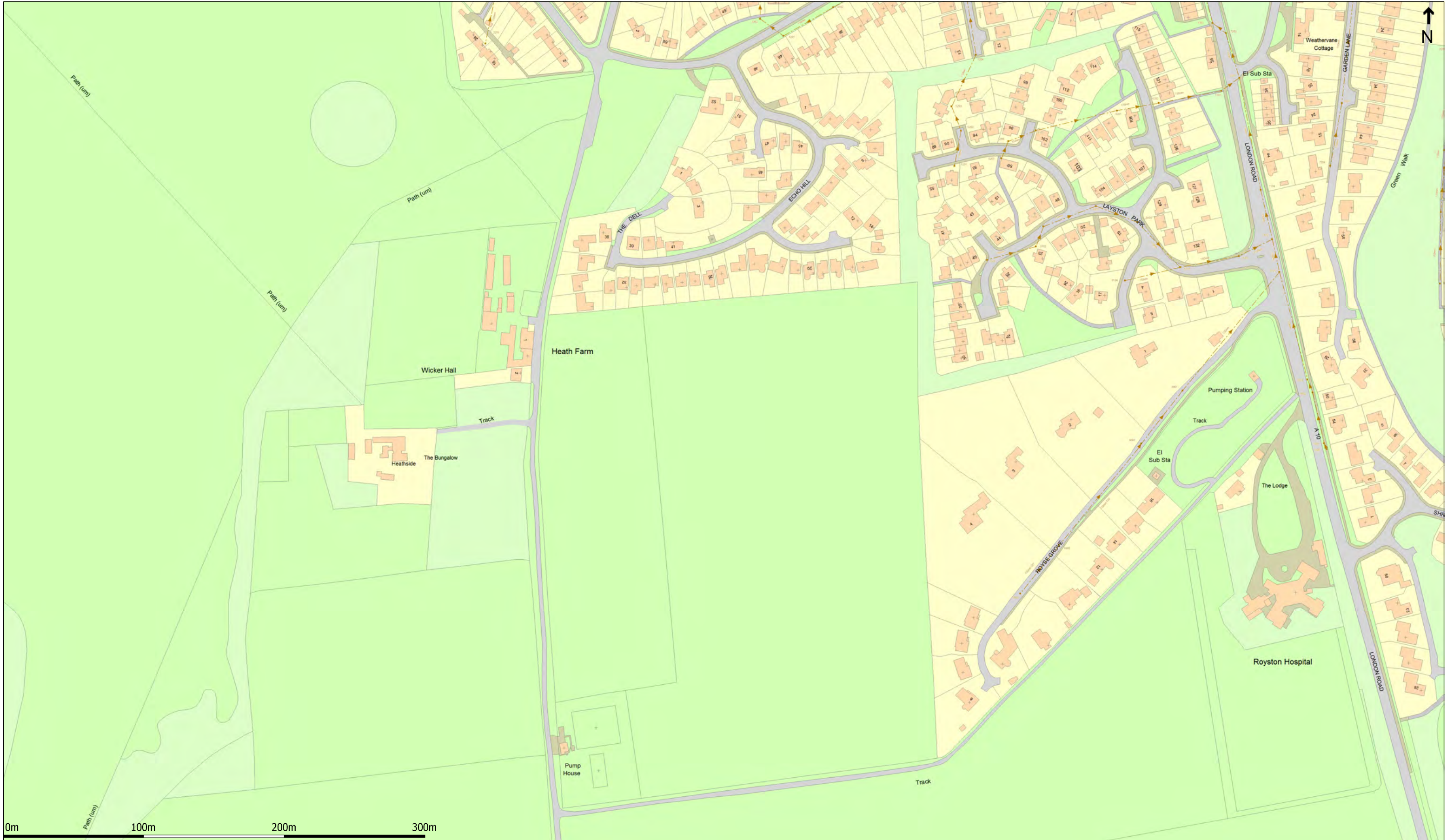
Start water depth for analysis (mbgl)	0.30		
75% effective depth (mbgl):	0.65	Elapsed time (mins):	40.0
50% effective depth (mbgl):	1.00		
25% effective depth (mbgl):	1.35	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.70		
Volume outflow between 75% and 25% effective depth (m ³):			
Mean surface area of outflow (m ²):			2.12
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.
Remarks	Results processed following BRE 365 (2007).

Client:	Gladman	TP02
Site:	Land off Echo Hill, Royston	

Appendix D

Sewer Records



(c) Crown copyright and database rights 2016 Ordnance Survey 100022432

Date: 13/07/16 Scale: 1:2500 Map Centre: 535367,240019 Title: G2117780-3

DRAINAGE AND WATER ENQUIRY

Foul Sewer

Surface Sewer

Combined Sewer

Proposed Sewer Diversion

Final Effluent

Decommissioned Sewer
(colour denotes effluent type)

Private Sewer
(colour denotes effluent type)

Rising Main
(colour denotes effluent type)

Manhole

Public Pumping Station

Private Pumping Station

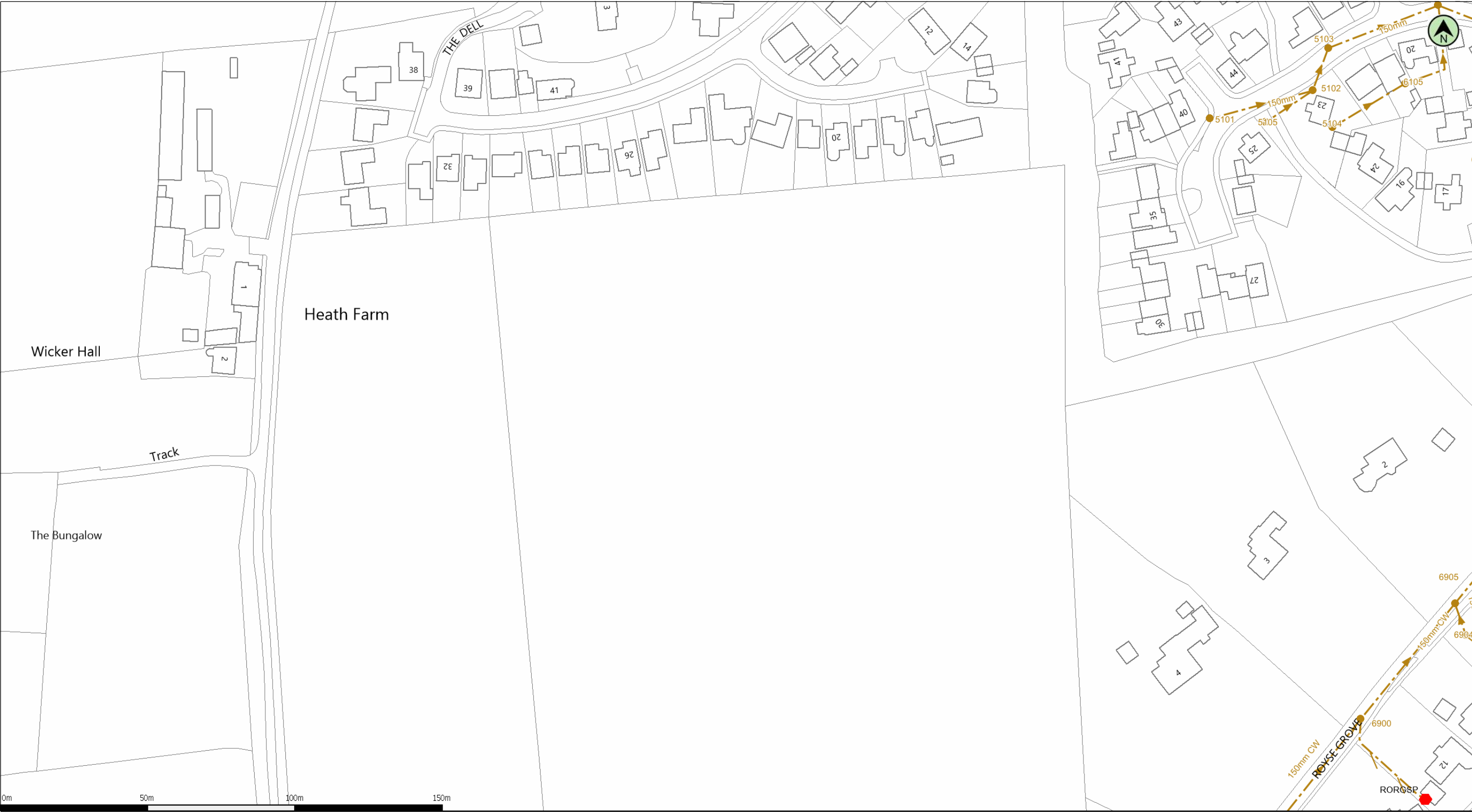
Sewage Treatment Works

Outfall

Inlet

LAND & PROPERTY INFORMATION

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2016 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.



(c) Crown copyright and database rights 2024 Ordnance Survey AC0000813445 Date: 22/10/24 Scale: 1:1250 Map Centre: 535393,240036 Data updated: 30/09/24 Our Ref: 1601462 - 1 Wastewater Plan A3
Powered by digdat

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2024 Ordnance Survey AC0000813445. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer					
Surface Sewer		Outfall*		Sewage Treatment Works	
Combined Sewer				Public Pumping Station	
Final Effluent		Inlet*		Decommissioned Pumping Station	
Rising Main*					
Private Sewer*		Manhole*			
Decommissioned Sewer*					

*(Colour denotes effluent type)

kdaines@gtacivils.co.uk
13378/FVV



Appendix E

Scheme Drawings



Proposals

- Site boundary: 8.90ha
- Proposed residential development: 3.01ha (84 dwellings @ 28dph)
- Proposed green infrastructure: 5.89ha

Movement

- Bridleway
- Public Footpath
- Proposed primary street
- Proposed secondary streets
- Proposed private drives and courts
- Proposed recreational routes
- Proposed shared surfaces / key spaces

Landscape

- SSSI: Therfield Heath
- Existing vegetation
- Proposed native woodland
- Proposed native thicket
- Proposed trees
- Proposed meadows
- Proposed drainage features/wetland
- Proposed children's play area
- Proposed focal seating areas

ICENI PROJECTS LIMITED
DA VINCI HOUSE
44 SAFFRON HILL
LONDON
EC1N 8FH

T 020 3640 8508
mail@iceniprojects.com

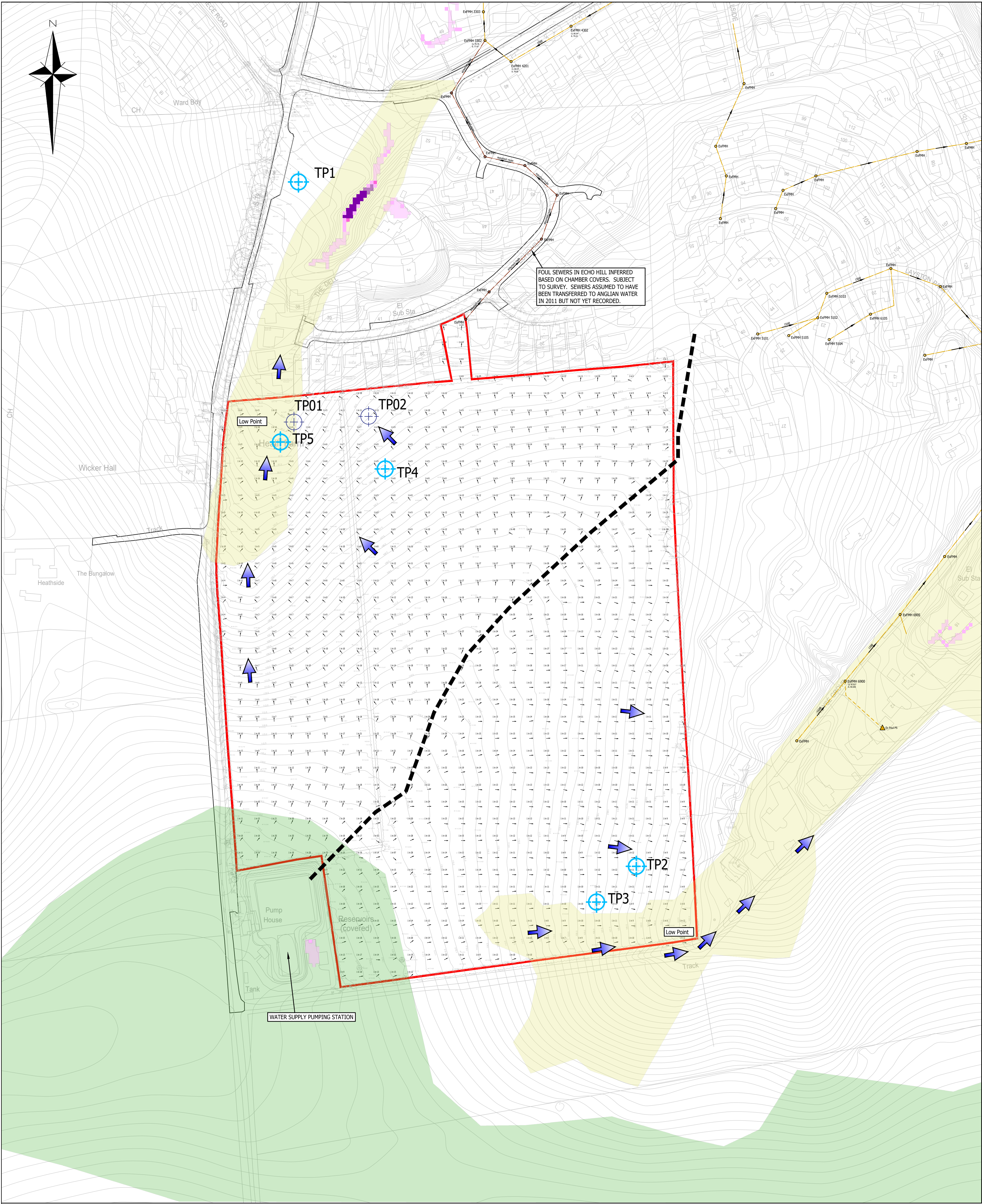
CLIENT
Gladman Developments Ltd

PROJECT
Land off Echo Hill, Royston

TITLE
Development Framework Plan

DRAWN BY	CHECKED BY		
MP	SG		
SCALE @ A3	DATE		
1:2,500	30.04.2025		
PROJECT NO.	DRAWING NO.	REV.	
1000619	DL_101	C	

iceni Projects accept no responsibility for any unauthorised amendments to this drawing. Only figured dimensions are to be worked to.



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LEGEND

Geology - superficial deposits

- Bedrock of New Pit Chalk Formation present throughout
- Head Deposits - Silt, Sand, Clay and Gravel
 - Deposits of Till, Mid Pleistocene - Diamicton

Surface water flood risk

- Surface Water Flood Risk - 1 in 30yr
- Surface Water Flood Risk - 1 in 100yr
- Surface Water Flood Risk - 1 in 1000yr

Special Designations

Site extent is within Groundwater SPZ 1 Inner.
Negligible risk of groundwater flooding (GeoSmart GW5).

Soakage Testing

- TP** Trial Pit - Infiltration testing conducted 4th April 2017
- TP** Trial Pit - Soakage testing conducted 1st November 2024

Site

- Site Boundary (8.97 ha)
- 0.5m Ground Level Contours (from topographical survey within site, otherwise from LIDAR data)
- Existing Gradients
- Watershed
- Indicative Overland Flow Route
- Existing foul sewers (from Anglian Water records)
- Assumed existing foul sewers (from topo survey and street photos - these are likely public sewers following 2013 sewer transfers, but not yet mapped)

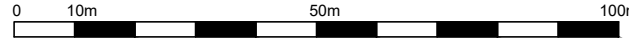
Infiltration Testing conducted 04.04.2017

Trial Pit No.	Infiltration Rate m/sec	Infiltration Rate m/hr	Pit depth (m bgl)	Top of Chalk Layer depth (m bgl)
TP2	7.25E-06	0.026	2.0	0.6
TP3	6.35E-05	0.229	2.0	0.4
TP4	2.04E-04	0.734	2.0	0.3
TP5	3.74E-06	0.013	2.0	1.6

Infiltration Testing conducted 01.11.2024

Trial Pit No.	Infiltration Rate m/sec	Infiltration Rate m/hr	Pit depth (m bgl)	Top of Chalk Layer depth (m bgl)
TP01	n/a	n/a	1.6	1.3
TP02	n/a	n/a	1.7	0.3

1:1250



P3	RoFSW MAPPING UPDATED	19.02.25	NG	PH
P2	ADDITIONAL GI DATA AND SEWERS ADDED	18.12.24	NG	PH
P1	INITIAL ISSUE	28.11.24	NG	PH
Rev	Amendments	Date	Dsn	Chk
Status				
PRELIMINARY				
Client				
GLADMAN DEVELOPMENTS LTD				
Architect				
Project				
LAND SOUTH OF ECHO HILL, ROYSTON				
Title				
FLOOD RISK CONSTRAINTS PLAN				
Date	NOVEMBER 2024	Scale @ A1	1:1250	
Clients Ref.		Project Ref.	13378	
 Maple House, 192-198 London Road, Burgess Hill, West Sussex, RH15 9RD Tel:01444 871444 Web: www.gtacivils.co.uk				
Drawing Number			13378-1000	Rev.
				P3