



Drainage Strategy Update

**Proposed Residential Development
Land off Gray's Lane
Hitchin
Hertfordshire**

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1.0 Introduction

1.1 Instructions

- 1.1.1 This Drainage Strategy Update has been prepared from instructions received from Hill Residential Limited to support a S73 application to change the layout of the site. The application seeks changes to the proposed house types with consequential changes to the layout.
- 1.1.2 The purpose of this report is to support the S73 application, explain any implications arising from the changes in drainage terms and to demonstrate the acceptability of the proposals and their consistency with the approved scheme and relevant policy. It has been prepared in line with the same standards and criteria as the approved for the full planning application, reference 22/03092/FP. The drainage strategy is based upon updated calculations and drained areas to correspond with the proposed amended layout.
- 1.1.3 The benefit of this report is to our instructing Client.

1.2 Site Location

- 1.2.1 The proposed development is located at Gray's Lane, Hitchin, Hertfordshire, as shown in approximately red in **Figure 1.1** below. The National Grid Reference for the site is E517460 N229155.

Figure 1.1: Site Location Plan



1.3 Current Use and Description

- 1.3.1 The site currently comprises greenfield land and extends to 2.194ha. The existing site is shown on the topographical survey enclosed in **Appendix A**.

1.4 Proposed Development

- 1.4.1 The proposed development will comprise 47 dwellings. The proposed development can be seen on the plan enclosed in **Appendix B**.

2.0 Surface Water Management

2.1 Existing Drainage

- 2.1.1 The existing site represents undeveloped grass land. The site broadly comprises two catchment with a 'ridge' running from the north western corner towards the southern boundary, see **Appendix D**. Land to the west of the ridge falls to the south western corner of the site whilst land to the east falls towards the north eastern corner of the site.
- 2.1.2 There is no sign of any ditches or other open watercourses adjoining the site as such surface water is assumed to permeate into the ground or flow overland towards other drainage features beyond the site boundary.

2.2 Existing Discharge Rate

- 2.2.1 The existing discharge rate for the element of the site which is to outfall to a sewer has been calculated using the IH124 method. Full calculations are enclosed in **Appendix E**; whilst the input parameters and results are summarised in **Table 2.1** below.

Table 2.1: Existing Run-off Rate Calculation Parameters and Results

Parameter	Value
SAAR (mm)	605
Soil Index / SPR	4 / 0.47
Region	5
Proposed Drained Area (ha), see App E	0.452
Results	Value
Q_{Bar} (l/s)	1.8
Q_1 (l/s)	1.6
Q_{30} (l/s)	3.6
Q_{100} (l/s)	4.6

*The Soil Index and SPR values identified for the site are 1 and 0.1 respectively; however, alternative values are shown in the **Table 2.1** above. The alternative values used are considered conservative estimation of the likely soil characteristics which can be found beneath the application site, in the event that the infiltration does not work.

- 2.2.2 The discharge from the site will be limited to the Q_{Bar} rate of 1.8l/s.

2.3 Proposed Method of Discharge

2.3.1 Paragraph 80 of the Planning Practice Guidance for 'Flood Risk and Coastal Change' defines the hierarchy of drainage options. Where reasonably practicable the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable:

1. into the ground (infiltration);
2. to a surface water body;
3. to a surface water sewer, highway drain, or another drainage system; and
4. to a combined sewer.

2.3.2 Each of these is considered separately below:

Into the ground

2.3.3 Inspection of the geological maps show that the superficial deposits on the site are Glaciofluvial Deposits, Mid Pleistocene – Sand and Gravel. The bedrock geology which underlies the site is West Melbury Chalk Formation – Chalk.

2.3.4 Infiltration testing was undertaken by Environmental Management Solutions on 6th January 2017, see **Appendix F**. A thickness of 0.20m to 0.30m of topsoil is present across the site. Topsoil comprised organic dark brown slightly sandy slightly gravelly clay with occasional rootlets. Strata considered to represent the Glaciofluvial Deposits was present directly beneath the topsoil in all locations and to the base of all the trial pits ranging in maximum depth from 0.75m to 3.60m. The strata comprised an initial layer of clay with varying proportions of sand and gravel. The clay layer was not fully penetrated in SA01-S or SA02-S but was found to range in maximum depth from 1.10m to 2.40m in the other three, deeper trial pits. Granular Material was found to underlie the initial clay layer in SA01 to SA03. In SA01 it comprised slightly silty slightly gravelly sand to 2.3m. A layer of very clayey slightly sandy gravel was recorded to 2.90m in SA02 followed by very silty gravelly sand to 3.60m. Clean sand (with no secondary constituents) was intersected to 2.10m in SA03.

2.3.5 Two conventional soakaway tests were successfully completed in SA03 to the west of the site. Infiltration was insufficient to calculate infiltration rates in SA01 and SA02. The conventional soakaway test results are summarised in **Table 2.2** below.

Table 2.2: Conventional Soakaway Test Results

Location	Infiltration Rate (m/s)		
	1	2	3
SA01	-	Not undertaken	Not undertaken
SA02	Not undertaken	Not undertaken	Not undertaken
SA03	2.6x10 ⁻⁵	1.7x10 ⁻⁵	Not undertaken

- 2.3.7 Two shallow soakaway tests were successfully completed in SA02-S. Infiltration was insufficient to calculate infiltration rates in SA01-S. The shallow soakaway test results are summarised in **Table 2.3** below.

Table 2.3: Shallow Soakaway Test Results

Location	Infiltration Rate (m/s)		
	1	2	3
SA01	-	Not undertaken	Not undertaken
SA02	-	Not undertaken	Not undertaken
SA03	2.1×10^{-5}	8.1×10^{-6}	Not undertaken

- 2.3.8 Due to the varying nature of the underlying strata further infiltration testing was undertaken in October 2021 by Geo-Environmental, see **Appendix F**. This testing completed more extensive testing on the eastern portion of the site where infiltration rates were found to be viable in the first investigation. Ten additional tests were completed at varying depths which found that the underlying strata is typically sufficient to for use with infiltration techniques. The results of the testing are summarised in **Table 2.4** below.

Table 2.4: Infiltration Testing Results 2021

Location	Pit depth (m bgl)	Infiltration Rate (m/s)		
		1	2	3
SA101	1.25	Insufficient fall to complete test		
SA102	0.6	2.3×10^{-5}	7.1×10^{-6}	3.9×10^{-6}
SA103	0.7	2.9×10^{-5}	1.5×10^{-5}	1.2×10^{-5}
SA104	1.6	1.0×10^{-5}	7.6×10^{-6}	6.6×10^{-6}
SA105	1.75	2.3×10^{-5}	1.4×10^{-5}	1.1×10^{-5}
SA106	0.64	6.3×10^{-5}	1.9×10^{-5}	1.2×10^{-5}
SA107	1.92	2.8×10^{-5}	1.5×10^{-5}	1.0×10^{-5}
SA108	0.67	1.3×10^{-4}	4.0×10^{-5}	3.3×10^{-5}
SA109	1.88	Insufficient fall to complete test		
SA110	0.65	2.2×10^{-5}	9.9×10^{-6}	8.3×10^{-6}

- 2.3.9 Infiltration testing will be used in the form of permeable paving for private roads and private driveways also taking roofs for dwellings and roads to the east of the site where infiltration techniques are viable.

To a Surface Water Body

- 2.3.10 There are no surface water bodies within the vicinity of the site which offer a viable outfall for the proposed development.

To a surface water sewer, highway drain, or another drainage system

- 2.3.11 The nearest adopted sewers are located within Gray's Lane as shown on the asset plan enclosed in **Appendix G**. Where infiltration is not viable surface water will outfall to the existing infrastructure in this location.
- 2.3.12 As a surface water sewer is viable the use of alternative drainage methods will not be considered further in this report.

2.4 Proposed Drainage Strategy

2.4.1 Surface water discharge from the proposed development will utilise infiltration techniques where these are viable in the form of permeable paving and an infiltration basin. For the other areas of the site surface water will outfall to the surface water sewer located in Gray's Lane. It is not feasible to use the infiltration basin for these areas due to the level differences. Where surface water discharges from the site the rate of discharge will be restricted to minimum viable run-off rates to ensure that the rate of surface water run-off from the site does not increase as a result of the proposed development.

2.4.2 The proposed drainage strategy will comprise a:

- A piped network.
- Hydrobrake flow control.
- Permeable paving - untanked and tanked for private drives.
- Infiltration basin
- Online detention basin.

2.4.3 The proposed surface water drainage strategy is shown on the drawing enclosed in **Appendix C**.

2.4.4 All design parameters are unaltered and the principles of the drainage strategy are the same as the approved planning application. The new drainage calculations have updated impermeable areas as a result there have been some slight alterations to the depth of sub-base needed for permeable paving areas, to the size of the infiltration basin and detention basin but these alterations are minor.

Design Parameters

2.4.5 Surface water drainage will be designed using the rainfall parameters from the Flood Estimation Handbook (FEH).

2.4.6 Climate change allowances are defined by the Environment Agency in their document 'Flood risk assessments: climate change allowances' first published in February 2016. Table 2 of this document shows anticipated changes in extreme rainfall intensity in small and urban catchments. The Environment Agency advise that flood risk assessments and strategic flood risk assessments, assess both the central and upper end allowances to understand the range of impact. Table 2 of the Environment Agency's guidance is replicated below in **Table 2.5**.

Table 2.5: Table 2 Peak rainfall intensity allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

- 2.4.7 To ensure a worst-case assessment is undertaken a 40% climate change allowance will be used throughout.

2.5 Explanation of Likely Forms of SuDS for the Site

- 2.5.1 The following **Table 3.6**, provides a summarised assessment for a range of SuDS features which have been considered for implementation at the development site, based on viability and a cost benefit analysis.

Table 2.6: SuDS Technique Viability Assessment for Development Site

SuDS Feature	Design Considerations	Will this be Implemented?
Rainwater Harvesting	This will be incorporated in the form of rainwater butts attached to rainwater pipes, which can reduce future residents' dependence on a clean water supply when using water for garden related purposes.	Yes
Green Roofs	This type of feature should typically be used for betterment as opposed to implementation on a Greenfield site. The hydraulic performance of this roof during extreme events is similar to a standard roof; therefore, additional attenuation would still be required. The cost of providing and maintaining green roofs on a large scale is likely to exceed the benefit it will bring to the site.	No
Infiltration Systems	Where the ground is suitable for use with infiltration techniques these will be used either in the form of permeable paving or infiltration basin	Yes
Filter Strips/ Filter Drains	As most of the surface water is being managed via permeable paving there is limited requirement for the use of filter strips or drains. Where, permeable paving is not being provided treatment is being provided by other open SUDS systems.	No
Swales	As above.	Yes
Bioretention Systems (including rain gardens)	All private driveways are utilising permeable paving either infiltration or tanked. Therefore rain gardens are not required.	No.
Pervious Pavements	This is being used throughout for private and shared drives, and some roads either as tanked or permeable depending on the permeability of the soil.	Yes
Attenuation Storage Tanks	This feature can be used; however, it is considered more sustainable to incorporate other SuDS features listed in this table.	No
Detention Basins	Where infiltration is not able to be used surface water attenuation is being provided within a basin.	Yes
Ponds and Wetlands	Infiltration is generally being used which prevents the use of ponds or wetlands. Where a non-infiltration basin is being used it's dimensions do not allow it to be used as a pond, however, it is an online basin so offers many advantages over other attenuation techniques.	No

2.6 Drainage Design

Infiltration – Permeable Paving

2.6.1 Permeable paving will be utilised to drain parts of the site where infiltration is viable. This will typically be used for private, shared drives and dwelling roofs. The infiltration design is based on the worst-case infiltration rate for the test nearest to the infiltration area, using the values set out in **Table 2.4**. The minimum depths of sub-base or subbase replacement (SR) required to achieve adequate storage for a 1 in 100 year plus climate change event is set out in **Table 2.7**. Full calculations are enclosed in **Appendix E**.

Table 2.7: Attenuation Calculation Parameters and Results

Plot(s) Served	Nearest Test	Infiltration Rate (m/s)	Subbase / subbase replacement (SR) depth (m)
1	SA103	1.2×10^{-5}	0.262 (SR)
2-3	SA103	1.2×10^{-5}	0.567
4-5	SA103	1.2×10^{-5}	0.442
6-7	SA103	1.2×10^{-5}	0.669
28-30	SA102	3.9×10^{-6}	0.382
31	SA103	1.2×10^{-5}	0.443
17-18	SA103	1.2×10^{-5}	0.346(SR)
19-20	SA110	8.3×10^{-6}	0.339(SR)
21-22	SA110	8.3×10^{-6}	0.451
38-40	SA108	8.3×10^{-6}	0.251
41-47	SA108	8.3×10^{-6}	0.281
11-16	SA108	8.3×10^{-6}	0.301
8-10	SA103	1.2×10^{-5}	0.207

*The LLFA in their comments dated 23/02/23 have expressed concern regarding infiltration in the area of plots 7 and 30 as the nearest test SA101 failed. This was completed within deeper material at a depth of 1.25m compared to depths of 0.6m and 0.7m for locations SA102 and SA103. The trial pit logs show that tests in pit SA101 were undertaken in different material which began at a depth of 1.10m. As the depth of permeable paving around plots 7 and 30 would be around 0.382m plus surfacing material this base of the infiltration material would be located within the upper geological layer which would be more permeable as demonstrated by tests in SA102 and SA103. Additional testing could be located in this area if required further if the infiltration rate is found to be lower, the subbase depth could be increase or a subbase replace used.

Infiltration – Infiltration Basin

- 2.6.2 Some areas of the road which would traditionally have been offered for adoption to the Local Highway Authority will be drained to an infiltration basin. Full calculations are enclosed in **Appendix E** whilst design parameters are set out below.

Table 2.8: Attenuation Calculation Parameters and Results

Parameter	Value
Return Period (years)	100 + 40% Climate Change
Rainfall Parameters	FEH22
Drained Area (ha)	0.190, see Appendix D includes 10% urban creep
Infiltration Rate (m/s)	1.1×10^{-5}
Results	Value
Storage Requirement	133

Outfall to sewer – Detention Basin

- 2.6.3 Surface water attenuation is required to store excess water during an extreme event whilst an allowable discharge rate of 1.8 l/s. Surface water will be attenuated within an online detention basin. Full calculations are enclosed in **Appendix F** whilst design parameters are set out below.

Table 2.9: Attenuation Calculation Parameters and Results

Parameter	Value
Return Period (years)	100 + 40% Climate Change
Rainfall Parameters	FEH22
Drained Area (ha)	0.246, see Appendix D includes 10% urban creep
Discharge Rate (l/s)	1.8
Results	Value
Storage Requirement	115

2.7 Overland Flows

- 2.7.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate. Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.

2.8 Water Quality Assessment – Simple Index Approach

2.8.1 The details for the simple index method are set out in the SUDS Manual. This document specifies the pollution load from various use types and is shown below in **Figure 2.1**.

Figure 2.1: Pollution Hazard Indices - From SUDS Manual

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

2.8.2 Various SUDS components have different SUDS mitigation incidences which are also set out in the SUDS Manual and replicated below in **Figure 2.2**.

Figure 2.2: SUDS Mitigation Indices - From SUDS Manual

Type of SuDS component	Mitigation indices ¹		
	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4 ²	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ⁴	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

- 2.8.3 The drainage network can be split into three area and categories which are described below:

East to Permeable Paving

- 2.8.4 This part of the site comprises individual and shared private drives and dwellings draining to permeable paving.

Land Use (worst case)	TSS	Metals	Hydrocarbons
Individual property driveways, low traffic roads, less than 300 vehicles per day	0.5	0.4	0.4
Mitigation	TSS	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.7

- 2.8.5 The proposed mitigation is greater than or equal to the pollution loading, therefore, the proposed strategy is acceptable.

East to Infiltration Basin

- 2.8.6 This part of the site comprises a road which will have more than 300 trips per day. The road is drained via an infiltration basin and permeable paving.

Land Use (worst case)	TSS	Metals	Hydrocarbons
All roads	0.7	0.6	0.7
Mitigation	TSS	Metals	Hydrocarbons
Permeable paving (MI1)	0.7	0.6	0.7
Detention Basin (MI2)	0.5	0.5	0.6
Total = MI1 * 0.5MI2	0.95	0.85	1.0

- 2.8.7 The proposed mitigation is greater than or equal to the pollution loading, therefore, the proposed strategy is acceptable.

West to Detention Basin

- 2.8.8 This part of the site comprises a road which will have less than 300 trips per day, individual and shared private drives, and dwellings. The is drained via a detention basin to a surface water sewer. Some elements of the site also incorporate permeable paving. However, to reflect a worst case calculation only the detention basin is considered.

Land Use (worst case)	TSS	Metals	Hydrocarbons
Individual property driveways, low traffic roads, less than 300 vehicles per day	0.5	0.4	0.4
Mitigation	TSS	Metals	Hydrocarbons
Detention Basin (MI2)	0.5	0.5	0.6
Total = MI1 * 0.5MI2	0.95	0.85	1.0

- 2.8.9 The proposed mitigation is greater than or equal to the pollution loading, therefore, the proposed strategy is acceptable.

2.9 Exceedance Events and Overland Flows

- 2.9.1 The surface waster drainage system has been designed to accommodate a 1 in 100 year plus climate change event. In case of an extreme rainfall event, where the threshold of the design parameters noted above are exceeded, overland flows will be directed away from building and areas of the site which are least vulnerable to include areas of open space and the drainage features. A plan showing proposed overland routes is enclosed in **Appendix H**. It should be noted that the likelihood of failure is low due to an exceedance of the design parameters.

2.10 Maintenance Requirements

- 2.10.1 The drainage will be designed in line with Building Regulations, Design and Construction Guidance for foul and surface water sewers offered for adoption under the Code for adoption agreements for water and sewerage companies operating wholly or mainly in England ("the Code"); as well as local SUDS guidance to ensure compliance with best practice guidance, thus minimising the maintenance requirements.
- 2.10.2 The person / authority responsible for maintenance of the drainage will depend on ownership which will vary across the site; as detailed design and adoption progresses the exact body responsible for adoption of the various surface water aspects will become clear. Typical responsibilities are set out below in **Table 2.10**.

Table 2.10: Surface Water Maintenance

Drainage	Maintainer
Drains	Home owner
Private Sewers	Home owner / management company
Household SUDS	Home owner
Communal SUDS - private	Management company / home owner.
Adopted SUDS	SUDS Body: Local Authority / water company / other SUDS adopting body.
Adopted sewers	Water company

- 2.10.3 A detailed drainage maintenance plan will be prepared by the body responsible for maintenance once detailed design has been undertaken. This will follow the principles set out in the SUDS Manual, which are set out below:

Permeable Paving – taken from the SUDS Manual

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs onto pervious pavement from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional Maintenance	Stabilise and mow contribution and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly to the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements.
Remedial Actions	Remedial any landscaping which through vegetation maintenance or soil slip has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitate of surface and upper structure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly. 48h after large storms in first 6 months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Detention Basin – taken from the SUDS Manual

Maintenance Schedule	Required Action	Typical Frequency
Detention basins would be expected to last as long as the development with appropriate maintenance.		
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
Occasional Maintenance	Reseed poor areas of vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years / as required
	Remove sediment from inlets, outlets and main basin when required.	Every 5 years, or as required)
Remedial Actions	Repair erosion or other damage by reseedling or re-turfing	As required
	Repair / rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Pipes

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Open any inspection chambers and remove and debris.	Annually
Remedial Actions	Remediate any damaged pipe works.	As required
Monitoring	Monitor inspection chambers	Annually

Hydrobrake

- 2.10.5 All maintenance should follow manufacturer's current guidance. As hydrobrakes include no moving parts maintenance is limited.

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Open any inspection chambers and remove any debris.	Annually
Remedial Actions	Remediate any damaged elements.	As required
Monitoring	Monitor inspection chambers	Annually

3.0 Foul Water Management

3.1 Existing Drainage

- 3.1.1 The site is currently a field and therefore does not have any existing foul water infrastructure.
- 3.1.2 Existing adopted sewers within the vicinity of the site are shown on the asset plan enclosed in **Appendix G**.

3.2 Proposed Drainage Strategy

- 3.2.1 Foul water will discharge to Anglian Water's sewer located within Gray's Lane as per the approved planning application.

3.3 Maintenance Requirements

- 3.3.1 The drainage will be designed in line with Building Regulations, Sewers for Adoption to ensure compliance with best practice guidance thus minimising the maintenance requirements. A full maintenance plan for the site will be developed at the detailed design stage.
- 3.3.2 The person / authority responsible for maintenance of the drainage will depend on ownership which will vary across the site as detailed design and adoption progresses the exact body responsible for adoption of the various surface water aspects will become clear. Typical responsibilities are set out below in **Table 3.1**.

Table 3.1: Foul Water Maintenance

Drainage	Maintainer
Drains	Home owner
Private Sewers	Home owner / Management company
Adopted sewers	Water company

4.0 Conclusions

4.1 Site location and proposed development

- 4.1.1 The proposed development is located at Gray's Lane, Hitchin, Hertfordshire. The proposed development will comprise 47 dwellings associated car parking, open space, landscaping and new access arrangements.
- 4.1.2 This report has been submitted to support a S73 application to change the layout of the site.

4.2 Surface Water Management

- 4.2.1 The key proposed surface water parameters are:
- Outfall: infiltration and sewer
 - SUDS features
 - A piped network.
 - Hydrobrake flow control.
 - Permeable paving - untanked and tanked for private drives.
 - Infiltration basin
 - Online detention basin.
- 4.2.2 All design parameters are unaltered and the principles of the drainage strategy are the same as the approved planning application. The new drainage calculations have updated impermeable areas as a result there have been some slight alterations to the depth of sub-based needed for permeable paving areas, to the size of the infiltration basin and detention basin but these alterations are minor.

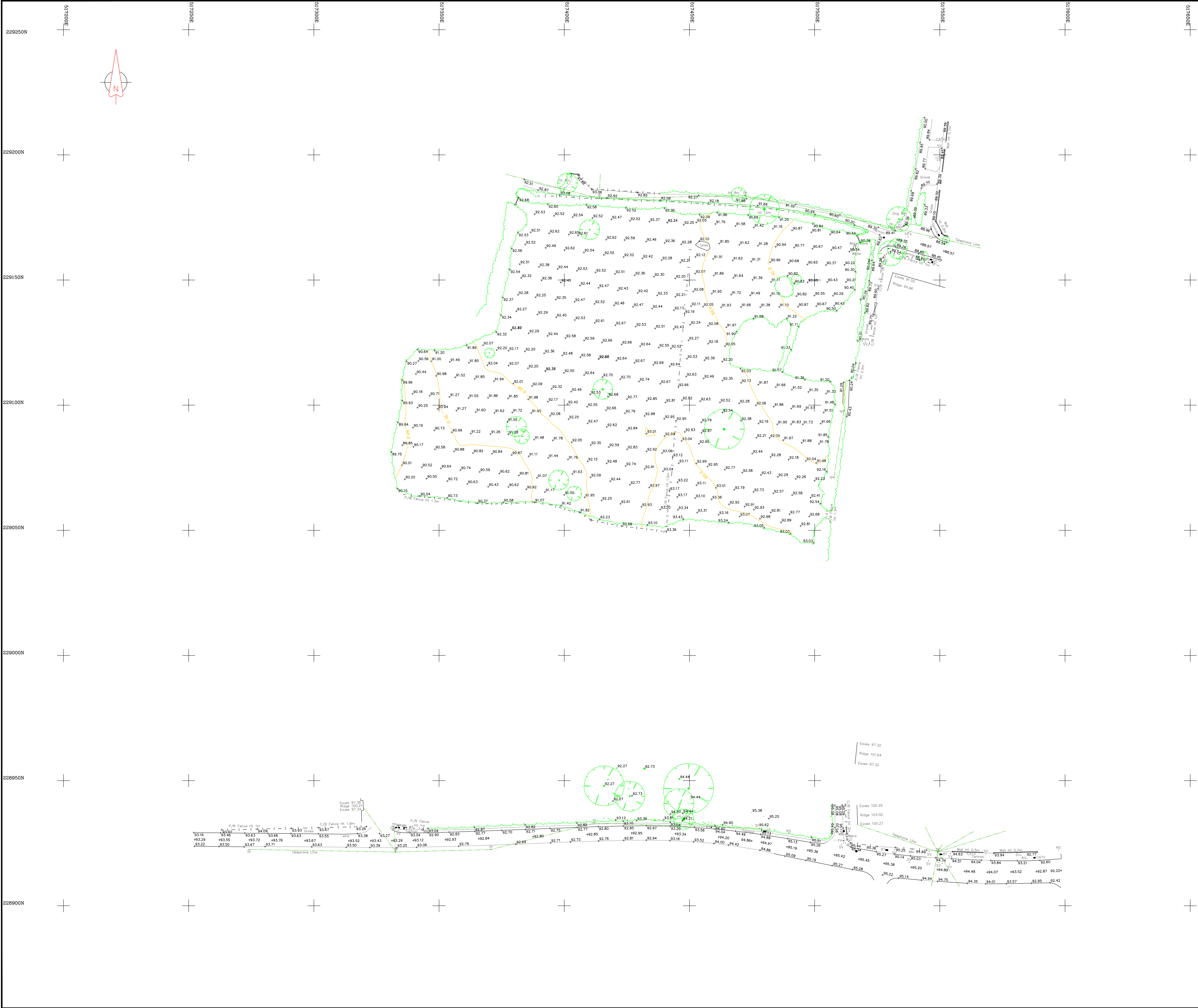
4.3 Foul Water Management

- 4.3.1 Foul water will discharge to the adopted sewer located in Gray's Lane.



Appendix A

Topographical Survey
MSurv drawing no. 1215/1649/1



Notes

Grid and levels have been referenced to O.S. National Grid using the Active GPS Network

LEGEND:

- Bol Bolard
- BH Benchole
- CL Cover Level
- Conc Concrete
- dk Drop Kerb
- Dr Drain
- Elec Electric
- EP Electricity Pole
- ER Earth Rod
- FB Flower Bed
- PH Fire Hydrant
- g Gully
- GP Gate Post
- GV Gas Valve
- IC Inspection Cover
- IL Invert Level
- Ko Kerb Offset
- LC Light Column
- MI Manhole
- Mir Mirror
- O/H Overhead
- PS Post Box
- PM Parking Meter
- re Rodding Eye
- RS Road Sign
- rep Rainwater Pipe
- SV Stop Valve
- TGB Telephone Call Box
- TL Traffic Light
- VP Vent Pipe
- WL Water Level
- WM Water Meter

Suffix	Revision	Date	Initial

MSURV
your surveying solution

Rainsborough Barns
Charlton
Banbury, Oxon
OX17 3DT
Tel: 01295 814417
Fax: 01295 814410

client

Manor Oak Homes

project

Hitchin
Topographical Survey

Drawn	Date	Checked	Date	Scale
JS	2/10/15			1:500 @A0

drawing no.

1215/1649/1



Appendix B

Proposed Layout
Hills Residential Limited drawing no.181-PS-2-101



Client:
Hill Residential Limited
The Courtyard, Abbey Barns,
Ickleton, CB101SX

Project:
Land off Gray's Lane & Crow Furlong
Hitchin
Hertfordshire

Drawing:
Proposed Site Plan

Scale: 1:1250@A3	Date: June 2025		
Drawn By: CK	Checked By: PD	Drawing No: 181-PS-2-101	Rev. No:
CAD Ref:			



Appendix C

Proposed Drainage Strategy
MAC drawing no. 1318-FRA113C
and
Indicative Extent of Permeable Paving
MAC drawing no. 1318-FRA114B



Notes:

- Based on MSurv 'Topographical Survey', drawing number 1215/1649/1 dated 09/10/15.
- Based on Hill Residential Limited 'Proposed Layout Section 73', drawing number 181-PA-2-001 A dated 29/04/25.
- CLs are typically (expect the SW corner) based on existing ground levels. These are subject to change depending on results of the final level design for the site.

- Key
- Site Boundary = 21,935m²
 - Existing Surface Water Drainage
 - Proposed Surface Water Drainage
 - Proposed Surface Water Attenuation
 - Approximate Ridge Line of Drainage Catchment

- Boundary where infiltration techniques are to be used as permeable paving
- Pipe code - diameter @ fall
- Drains to infiltration basin
- Drains to permeable paving



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Martin Andrews Consulting Ltd

- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes	Project: Land off Crow Furlong Hitchin
Title: Proposed Drainage Strategy	Date: 30/06/25
	Drw: MJA
	Chk: MJA
Drawing No: 1318-FRA113	Revision: C
	Scale: 1:500
	Size: A2



Key
— Site Boundary = 21,935m²

Indicative Extent of Permeable Paving - tanked where infiltration is unviable with connection to proposed SW drainage system

- Notes:
1. Based on MSurv 'Topographical Survey', drawing number 1215/1649/1 dated 09/10/15.
 2. Based on Hill Residential Limited 'Proposed Layout Section 73', drawing number 181-PA-2-001 A dated 29/04/25.
 3. Extent of permeable paving is indicative. Exact areas to be confirmed once surfacing types have been fixed.

MAC

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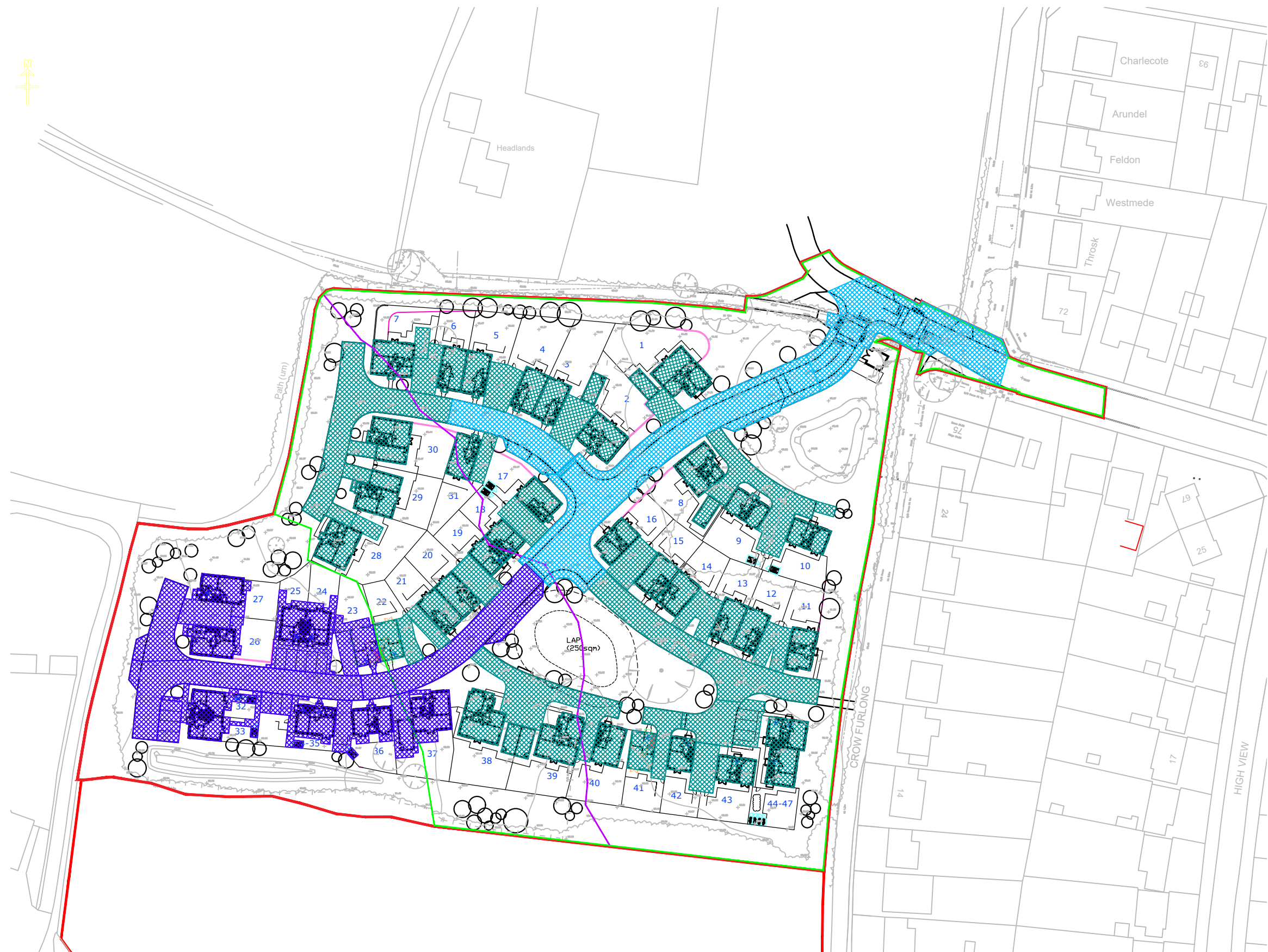
- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes		Project: Land off Crow Furlong Hitchin	
Title: Indicative Extent of Permeable Paving		Date: 18/06/25	
		Drw: MJA	
Drawing No: 1318-FRA114		Chk: MJA	
		Scale: 1:500	
		Revision: B	Size: A2



Appendix D

Proposed Impermeable Area
MAC drawing no. 1318-FRA112B



- Notes:
1. Based on MSurv 'Topographical Survey', drawing number 1215/1649/1 dated 09/10/15.
 2. Based on Hill Residential Limited 'Propsoed Layout Section 73', drawing number 181-PA-2-001 A dated 29/04/25.

- Key:
- Site Boundary = 21,935m²
 - Indicative Ridge Line of Drainage Catchment
 - Boundary where infiltration techniques are to be used as permeable paving

- Proposed Impermeable Area
- Eastern Catchment
- To Infiltration Basin = 1,723m²
 - To Permeable Paving = 5,047m²
- Western Catchment = 2,233m²
- Total = 9,023m²



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- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes		Project: Land of Gray's Lane Hitchin	
Title: Proposed Impermeable Area		Date: 18/06/25	
		Drw: MJA	
		Chk: MJA	
Drawing No: 1318-FRA112		Revision: B	
		Scale: 1:1000 Size: A3	

Appendix E
Drainage Design Calculations

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	Cover Level (m)	Node Type	Depth (m)
1	0.019	100.000	Manhole	0.900
2-3	0.028	100.000	Manhole	0.800
4-5	0.023	100.000	Manhole	0.800
6-7	0.027	100.000	Manhole	1.000
28-30	0.084	100.000	Manhole	0.800
31	0.012	100.000	Manhole	0.800
17-18	0.020	100.000	Manhole	0.900
19-20	0.020	100.000	Manhole	0.900
21-22	0.022	100.000	Manhole	0.900
38-40	0.067	100.000	Manhole	0.900
41-47	0.069	100.000	Manhole	0.900
11-16	0.118	100.000	Manhole	0.700
8-10	0.054	100.000	Manhole	0.700

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	0.7	100 year +40% 360 minute (m³)	382
Summer CV	0.750	Drain Down Time (mins)	240	30 year (l/s)	1.6		
Winter CV	0.840	Additional Storage (m³/ha)	20.0	100 year (l/s)	2.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	✓		

Storm Durations

60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160 | 2880 | 4320 | 5760 | 7200 | 8640 | 10080

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	4	Growth Factor 30 year	1.95	Q 1 year (l/s)	0.7
Greenfield Method	IH124	SPR	0.47	Growth Factor 100 year	2.48	Q 30 year (l/s)	1.6
Positively Drained Area (ha)	0.203	Region	5	Betterment (%)	0	Q 100 year (l/s)	2.0
SAAR (mm)	604	Growth Factor 1 year	0.85	QBar	0.8		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	4	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.47	Climate Change (%)	40	PR	0.454
Positively Drained Area (ha)	0.203	CWI	91.111	Storm Duration (mins)	360	Runoff Volume (m³)	82

Node 1 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.95	Width (m)	5.512	Depth (m)	0.650
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	7.707	Inf Depth (m)	0.650
Safety Factor	2.0	Time to half empty (mins)	792	Slope (1:X)	500.0		

Node 2-3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.30	Width (m)	6.803	Depth (m)	0.650
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.200	Length (m)	11.679	Inf Depth (m)	0.650
Safety Factor	2.0	Time to half empty (mins)	208	Slope (1:X)	500.0		

Node 4-5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.30	Width (m)	7.064	Depth (m)	0.650
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.200	Length (m)	11.243	Inf Depth (m)	0.650
Safety Factor	2.0	Time to half empty (mins)	208	Slope (1:X)	500.0		

Node 6-7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.30	Width (m)	5.433	Depth (m)	0.800
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.000	Length (m)	12.338	Inf Depth (m)	0.800
Safety Factor	2.0	Time to half empty (mins)	292	Slope (1:X)	500.0		

Node 28-30 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.01404	Porosity	0.30	Width (m)	10.247	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.200	Length (m)	44.656	Inf Depth (m)	0.400
Safety Factor	2.0	Time to half empty (mins)	514	Slope (1:X)	500.0		

Node 31 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.30	Width (m)	3.400	Depth (m)	0.445
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.200	Length (m)	12.100	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	185	Slope (1:X)	500.0		

Node 17-18 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.95	Width (m)	3.005	Depth (m)	0.650
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	11.685	Inf Depth (m)	0.650
Safety Factor	2.0	Time to half empty (mins)	792	Slope (1:X)	500.0		

Node 19-20 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.04320	Porosity	0.95	Width (m)	3.057	Depth (m)	0.650
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	11.671	Inf Depth (m)	0.650
Safety Factor	2.0	Time to half empty (mins)	792	Slope (1:X)	500.0		

Node 21-22 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.02988	Porosity	0.30	Width (m)	6.810	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	12.086	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	301	Slope (1:X)	500.0		

Node 38-40 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.11880	Porosity	0.30	Width (m)	7.479	Depth (m)	0.600
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	38.052	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	91	Slope (1:X)	500.0		

Node 41-47 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.11880	Porosity	0.30	Width (m)	9.020	Depth (m)	0.500
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.100	Length (m)	28.526	Inf Depth (m)	
Safety Factor	2.0	Time to half empty (mins)	76	Slope (1:X)	500.0		

Node 11-16 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.11880	Porosity	0.30	Width (m)	7.584	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.300	Length (m)	61.574	Inf Depth (m)	0.300
Safety Factor	2.0	Time to half empty (mins)	60	Slope (1:X)	500.0		

Node 8-10 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.11880	Porosity	0.30	Width (m)	8.094	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	99.300	Length (m)	32.072	Inf Depth (m)	0.300
Safety Factor	2.0	Time to half empty (mins)	61	Slope (1:X)	500.0		

Results for 2 year +2% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	168	99.154	0.054	0.6	1.8325	0.0000	OK
120 minute winter	2-3	88	99.292	0.092	1.4	1.9649	0.0000	OK
120 minute winter	4-5	84	99.270	0.070	1.1	1.4237	0.0000	OK
180 minute winter	6-7	128	99.110	0.110	1.1	2.0166	0.0000	OK
240 minute winter	28-30	176	99.305	0.105	2.8	8.4645	0.0000	OK
120 minute winter	31	86	99.273	0.073	0.6	0.7689	0.0000	OK
180 minute winter	17-18	136	99.172	0.072	0.8	2.0271	0.0000	OK
180 minute winter	19-20	136	99.171	0.071	0.8	2.0172	0.0000	OK
120 minute winter	21-22	90	99.180	0.080	1.1	1.7046	0.0000	OK
60 minute summer	38-40	37	99.152	0.052	5.4	1.5765	0.0000	OK
60 minute summer	41-47	37	99.146	0.046	5.6	1.5199	0.0000	OK
60 minute winter	11-16	40	99.376	0.076	7.8	3.5616	0.0000	OK
60 minute summer	8-10	37	99.342	0.042	4.4	1.1228	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	1	Infiltration	0.3
120 minute winter	2-3	Infiltration	0.5
120 minute winter	4-5	Infiltration	0.5
180 minute winter	6-7	Infiltration	0.4
240 minute winter	28-30	Infiltration	0.9
120 minute winter	31	Infiltration	0.2
180 minute winter	17-18	Infiltration	0.2
180 minute winter	19-20	Infiltration	0.2
120 minute winter	21-22	Infiltration	0.3
60 minute summer	38-40	Infiltration	3.2
60 minute summer	41-47	Infiltration	3.4
60 minute winter	11-16	Infiltration	4.8
60 minute summer	8-10	Infiltration	2.8

Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	228	99.292	0.192	1.8	7.3714	0.0000	OK
180 minute winter	2-3	172	99.613	0.413	3.3	9.7595	0.0000	OK
180 minute winter	4-5	168	99.524	0.324	2.7	7.5175	0.0000	OK
180 minute winter	6-7	176	99.492	0.492	3.1	9.9095	0.0000	OK
240 minute winter	28-30	236	99.492	0.292	7.9	34.5604	0.0000	OK
180 minute winter	31	160	99.518	0.318	1.4	3.8526	0.0000	OK
240 minute winter	17-18	236	99.358	0.258	1.9	8.2471	0.0000	OK
240 minute winter	19-20	236	99.353	0.253	1.9	8.2169	0.0000	OK
180 minute winter	21-22	176	99.431	0.331	2.6	7.9917	0.0000	OK
60 minute winter	38-40	47	99.277	0.177	16.2	12.1243	0.0000	OK
60 minute winter	41-47	48	99.295	0.195	16.7	13.1268	0.0000	OK
60 minute winter	11-16	47	99.522	0.222	28.6	23.1501	0.0000	OK
60 minute winter	8-10	46	99.444	0.144	13.1	8.9393	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	1	Infiltration	0.3
180 minute winter	2-3	Infiltration	0.5
180 minute winter	4-5	Infiltration	0.5
180 minute winter	6-7	Infiltration	0.4
240 minute winter	28-30	Infiltration	0.9
180 minute winter	31	Infiltration	0.2
240 minute winter	17-18	Infiltration	0.2
240 minute winter	19-20	Infiltration	0.2
180 minute winter	21-22	Infiltration	0.3
60 minute winter	38-40	Infiltration	4.7
60 minute winter	41-47	Infiltration	4.2
60 minute winter	11-16	Infiltration	7.7
60 minute winter	8-10	Infiltration	4.3

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	232	99.362	0.262	2.3	10.1455	0.0000	OK
180 minute winter	2-3	176	99.767	0.567	4.2	13.5161	0.0000	OK
180 minute winter	4-5	172	99.642	0.442	3.4	10.3792	0.0000	OK
180 minute winter	6-7	176	99.669	0.669	4.0	13.5741	0.0000	OK
240 minute winter	28-30	236	99.582	0.382	10.1	47.0409	0.0000	OK
120 minute winter	31	120	99.643	0.443	2.4	5.4283	0.0000	OK
240 minute winter	17-18	236	99.446	0.346	2.4	11.1721	0.0000	OK
240 minute winter	19-20	236	99.439	0.339	2.4	11.1406	0.0000	OK
240 minute winter	21-22	236	99.551	0.451	2.7	11.0101	0.0000	OK
60 minute winter	38-40	49	99.351	0.251	21.5	18.5061	0.0000	OK
60 minute winter	41-47	52	99.381	0.281	22.2	19.8873	0.0000	OK
60 minute winter	11-16	50	99.601	0.301	37.9	34.5692	0.0000	OK
60 minute winter	8-10	48	99.507	0.207	17.4	13.9467	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)
240 minute winter	1	Infiltration	0.3
180 minute winter	2-3	Infiltration	0.5
180 minute winter	4-5	Infiltration	0.5
180 minute winter	6-7	Infiltration	0.4
240 minute winter	28-30	Infiltration	0.9
120 minute winter	31	Infiltration	0.2
240 minute winter	17-18	Infiltration	0.2
240 minute winter	19-20	Infiltration	0.2
240 minute winter	21-22	Infiltration	0.3
60 minute winter	38-40	Infiltration	4.7
60 minute winter	41-47	Infiltration	4.2
60 minute winter	11-16	Infiltration	7.7
60 minute winter	8-10	Infiltration	4.3

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓ 1	0.056	5.00	91.800	Manhole	Adoptable	1350	517397.299	229088.435	1.575
✓ 2	0.027	5.00	91.500	Manhole	Adoptable	1350	517383.528	229087.550	1.325
✓ 3	0.043	5.00	91.300	Manhole	Adoptable	1350	517370.279	229088.561	1.175
✓ 4	0.043	5.00	91.000	Manhole	Adoptable	1350	517342.327	229092.036	0.975
✓ 5	0.058	5.00	91.000	Manhole	Adoptable	1350	517338.577	229074.457	1.040
✓ 6	0.000		91.000	Manhole	Adoptable	1350	517341.168	229069.687	1.060
✓ 7			91.000	Manhole	Adoptable	1350	517377.090	229065.956	1.060
✓ 8			91.000	Manhole	Adoptable	1350	517385.103	229067.974	1.130
✓ 9			91.750	Manhole	Adoptable	1200	517387.783	229084.737	1.961
✓ 10			91.800	Manhole	Adoptable	1200	517399.752	229086.403	2.092
✓ 11			92.500	Manhole	Adoptable	1200	517414.417	229093.006	2.899
✓ 12			92.300	Manhole	Adoptable	1200	517445.879	229127.454	3.010
✓ 13			91.700	Manhole	Adoptable	1200	517464.366	229144.007	2.575
✓ 14			91.400	Manhole	Adoptable	1200	517477.845	229151.270	2.377
✓ 15			90.700	Manhole	Adoptable	1200	517496.659	229159.352	1.814
✓ 16			90.650	Manhole	Adoptable	1200	517503.692	229165.307	1.825
✓ 17			90.000	Manhole	Adoptable	1200	517513.729	229180.523	1.297
✓ 18			90.000	Manhole	Adoptable	1200	517526.189	229174.241	1.390
✓ 18_OUT			89.601	Manhole	Adoptable	1200	517529.063	229165.889	1.050
✓ 19	0.025	5.00	92.350	Manhole	Adoptable	1200	517433.478	229148.000	1.425
✓ 20	0.048	5.00	92.300	Manhole	Adoptable	1200	517450.992	229129.139	1.525

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓ 21			91.700	Manhole	Adoptable	1200	517465.935	229142.915	1.425
✓ 22	0.048	5.00	91.390	Manhole	Adoptable	1200	517476.597	229149.891	1.425
✓ 23	0.068	5.00	90.300	Manhole	Adoptable	1200	517497.667	229146.222	1.050

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	1 year (l/s)	1.6	100 year +40% 360 minute (m³)	382
Summer CV	0.750	Drain Down Time (mins)	240	30 year (l/s)	3.6		
Winter CV	0.840	Additional Storage (m³/ha)	20.0	100 year (l/s)	4.6		
Analysis Speed	Normal	Check Discharge Rate(s)	✓	Check Discharge Volume	✓		

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 %)
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	4	Growth Factor 30 year	1.95	Q 1 year (l/s)	1.6
Greenfield Method	IH124	SPR	0.47	Growth Factor 100 year	2.48	Q 30 year (l/s)	3.6
Positively Drained Area (ha)	0.452	Region	5	Betterment (%)	0	Q 100 year (l/s)	4.6
SAAR (mm)	605	Growth Factor 1 year	0.85	QBar	1.8		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	4	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.47	Climate Change (%)	40	PR	0.454
Positively Drained Area (ha)	0.452	CWI	91.111	Storm Duration (mins)	360	Runoff Volume (m³)	182

Node 8 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	89.870	Product Number	CTL-SHE-0064-1800-1000-1800
Design Depth (m)	1.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	1.8	Min Node Diameter (mm)	1200

Node 23 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03960	Safety Factor	2.0	Invert Level (m)	89.250
Side Inf Coefficient (m/hr)	0.03960	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	132.7	132.7	0.700	246.5	246.5	0.701	0.0	246.5

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	89.940
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	47.8	0.0	0.500	193.0	0.0	0.750	282.0	0.0	0.751	0.0	0.0

Appendix F
Infiltration Test Results

Manor Oak Homes
Cedar Barn
White Lodge
Walgrave
Northampton
NN6 9PY

6th January 2017

EMS6636a – Report on soakaway investigation at land at Gray's Lane, Hitchin, Hertfordshire

Background

Environmental Management Solutions Limited (EMS) have been commissioned by Manor Oak Homes (of White Lodge Farm, Walgrave, Northampton, NN6 9PY) to undertake soakaway testing at a site located at Gray's Lane, Hitchin, Hertfordshire, SG5 2HW. The scope of works was agreed with JPP Consulting (Civil and Structural Engineers).

The site is located to the south-west of Gray's Lane on the western edge of Hitchin. The site is a rectangle with a protrusion in the south-west corner. The site is broadly level in the centre and slopes very gently downhill to the south-west and north-east. It measures approximately 130 m by 170 m. The site is largely short mown grass with an area of grass left unmown in the south-east and a small area of small deciduous trees in the east. A number of single trees are dotted around the site. A topographic survey and proposed layout plan are included as Appendix A.

1:50,000 scale BGS geological mapping for the site indicates the site to be underlain by superficial Glaciofluvial Deposits. Beneath the Glaciofluvial Deposits, the West Melbury Marly Chalk Formation is conjectured to be present at depth across the majority of the site with the Zig Zag Chalk Formation in the western part of the site.

Scope of Works

EMS was commissioned to undertake soakaway tests at three locations (for conventional depth soakaways) and two shallow soakaway tests (for permeable paving design). The scope of works was agreed with JPP Consulting. The test pits were excavated using a JCB-3CX type excavator with a 450 mm wide toothed bucket.

Three trial pits (SA01 to SA03) were excavated to depths of between 2.10 m and 3.60 m. Soakaway testing was then undertaken in these pits. Two shallow pits (SA01-S and SA02-S) were excavated to 0.80 m and 0.75 m adjacent to SA01 and SA02 and soakaway testing for permeable pavement design was undertaken at these locations.

Following the completion of testing all trial pits were backfilled with the arising soils.

The locations of the trial pits are shown on the exploratory hole location plan included as Appendix C. Details of the trial pits, including a description of the strata encountered, trial pit depths, and notes on any groundwater entries are included on the trial pit logs (Appendix D). Photographs of the trial pits are included as Appendix E.

Soakaway testing was undertaken in broad accordance with BRE Digest 365:2016 (Soakaway Design). Details of the soakaway tests, and the soakaway test results, including calculated soil infiltration rates, are included as Appendix E.

Ground Conditions

Topsoil

A thickness of 0.20 m to 0.30 m of topsoil is present across the site. The topsoil comprised organic dark brown slightly sandy slightly gravelly clay with occasional rootlets.

Glaciofluvial Deposits

Strata considered to represent the Glaciofluvial Deposits were present directly beneath the topsoil in all locations and to the base of all the trial pits ranging in maximum depth from 0.75 m to 3.60 m.

These strata comprised an initial layer of clay with varying proportions of sand and gravel. The clay layer was not fully penetrated in SA01-S or SA02-S but was found to range in maximum depth from 1.10 m to 2.40 m in the other three, deeper, trial pits.

Granular material was found to underlie the initial clay layer in SA01 to SA03. In SA01 it comprised slightly silty slightly gravelly sand to 2.30 m. A layer of very clayey slightly sandy gravel was recorded to 2.90 m in SA02 followed by very silty gravelly sand to 3.60 m. Clean sand (with no secondary constituents) was intersected to 2.10 m in SA03.

West Melbury Marly Chalk Formation

Soils considered to represent the West Melbury Marly Chalk Formation were not encountered during the investigation.

Zig Zag Chalk Formation

Soils considered to represent the Zig Zag Chalk Formation were not encountered during the investigation.

Groundwater

No groundwater entries occurred in any of the five trial pits.

Soakaway Test Results

Conventional Soakaway Tests

Two test runs were successfully completed in SA03. Infiltration was insufficient to calculate infiltration rates in SA01 and SA02. The following infiltration rates were recorded:

Test Run	Test Location		
	SA01	SA02	SA03
1	-	-	2.6×10^{-5} m/s
2	Second test run not undertaken		1.7×10^{-5} m/s

Shallow Soakaway Tests

Two test runs were successfully completed in SA02-S (with some extrapolation of data in test run 2). Infiltration was insufficient to calculate infiltration rates in SA01-S. The following infiltration rates were recorded:

Test Run	Test Location	
	SA01-S	SA02-S
1	-	2.1×10^{-5} m/s
2	Second test run not undertaken	8.1×10^{-6} m/s

Conclusions/Recommendations

At shallow depths the site is underlain to varying depths by clays (Glaciofluvial Deposits). The clay soils are underlain by granular material (also Glaciofluvial Deposits) containing variable proportions (none in one location) of cohesive material.

The deeper granular materials are variably permeable with good permeability in SA03 (in clean sand) and low permeability in SA01 and SA02 (slightly silty sand and very clayey sand). Use of conventional soakaway drainage will be appropriate in the clean sand strata intersected in SA03. The results of this investigation indicate that use of conventional soakaway drainage will be suitable in some parts of the site, but not others. At present insufficient data is available to zone the site into areas where use of soakaway drainage will be acceptable, and areas where use of soakaway drainage will not be appropriate.

It should be noted that chalk is conjectured to be present at depth below the site. This material is potentially permeable but its depth is not known. The nearest BGS borehole record to the site (100 m south-west) does not encounter chalk within 50 m of ground level. If this record is accurate, disposal of surface water to the chalk is unlikely to be viable. If desired, boring at the site could be undertaken to confirm the depth and infiltration characteristics of the chalk.

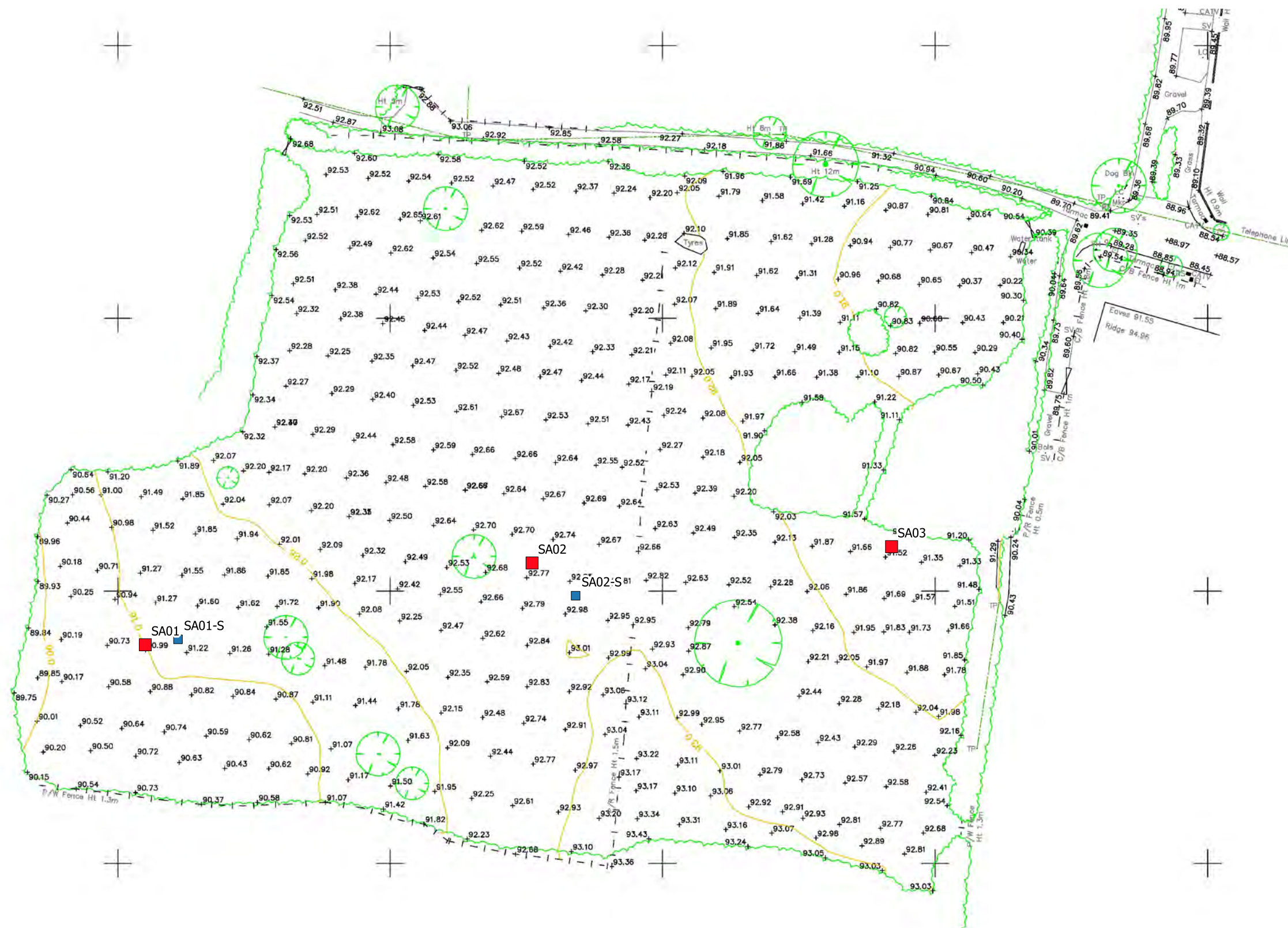
The shallow clay-based soils (tested in two locations) showed variable permeability with slow infiltration in one location (SA01-S) and good infiltration in another (SA02-S). Permeable paving could be appropriate at the site but should be designed with a maximised surface area to account for the variable permeability of the near-surface soils at the site.

Written by	Shaun Armitage BSc FGS
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Checked by	James Woodier BSc FGS
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Authorised by	James Woodier BSc FGS
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North

Legend

- Soakaway test location (conventional)
- Soakaway test location (permeable paving)



EXPLORATORY HOLE LOCATION PLAN

Job name:
Land off Gray's Lane, Hitchin

Job number:
EMS6636

Date:
21.12.2015

Scale:
1:800 @ A3



Legend

- Soakaway test location (conventional)
- Soakaway test location (permeable paving)



EXPLORATORY HOLE LOCATION PLAN WITH PROPOSED LAYOUT

Job name:

Land off Gray's Lane, Hitchin

Job number:

EMS6636

Date:

21.12.2015

Scale:

1:800 @ A3

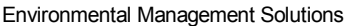
EXPLORATORY HOLE LOG

Project Land off Gray's Lane, Hitchin, Hertfordshire				HOLE No SA01
Job No EMS6636	Date 19-12-16	Ground Level (m) 91.00	Co-Ordinates () E 517,355.0 N 229,090.0	
Contractor				Sheet 1 of 1

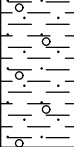
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Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											1. Sides stable. 2. No groundwater encountered. 3. Infiltration testing undertaken. 4. Backfilled with arisings.
All dimensions in metres Scale 1:25		Client Manor Oak Homes				Method/ JCB 3CX with 18 inch toothed Plant Used bucket			Logged By SMA		

EXPLORATORY HOLE LOG EMS6636 HITCHIN.GPJ GINT STD AGS 3 1.GDT 4/1/17



Project Land off Gray's Lane, Hitchin, Hertfordshire				HOLE No SA01-S
Job No EMS6636	Date 19-12-16	Ground Level (m) 91.20	Co-Ordinates () E 517,361.0 N 229,091.0	
Contractor				Sheet 1 of 1

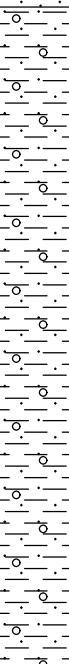
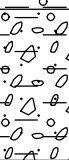
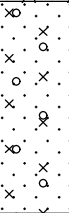
SAMPLES & TESTS		Water	STRATA				Geology	Instrument/ Backfill
Depth	Sample No.		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
			90.90		(0.30) 0.30	Soft organic dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. (Topsoil)		
			90.40		(0.50) 0.80	Firm grey-brown slightly sandy slightly gravelly CLAY. Gravel is medium sub-rounded and sub-angular stone. (Glaciofluvial Deposits) 0.50 - 0.80 Becoming orange-brown		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											1. Sides stable. 2. No groundwater encountered. 3. Infiltration testing undertaken. 4. Backfilled with arisings.
All dimensions in metres Scale 1:25		Client	Manor Oak Homes			Method/ Plant Used	JCB 3CX with 18 inch toothed bucket			Logged By SMA	

EXPLORATORY HOLE LOG EMS6636 HITCHIN.GPJ GINT STD AGS 3 1.GDT 4/1/17

EXPLORATORY HOLE LOG

Project Land off Gray's Lane, Hitchin, Hertfordshire				HOLE No SA02
Job No EMS6636	Date 19-12-16	Ground Level (m) 92.70	Co-Ordinates () E 517,426.0 N 229,105.0	
Contractor				Sheet 1 of 1

SAMPLES & TESTS		Water	STRATA			Geology	Instrument/ Backfill
Depth	Sample No.		Reduced Level	Legend	Depth (Thick-ness)		
			92.50		(0.20) 0.20	Soft organic dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. (Topsoil)	
					(2.20)	Firm orange-brown slightly sandy gravelly CLAY with rare cobbles. Gravel is medium sub-rounded and sub-angular stone including flint. (Glaciofluvial Deposits)	
			90.30		2.40		
			89.80		(0.50) 2.90	Medium dense orange-brown very clayey slightly sandy GRAVEL of medium and coarse sub-rounded and sub-angular stone mostly flint. (Glaciofluvial Deposits)	
			89.10		(0.70) 3.60	Medium dense fine orange-brown very silty gravelly SAND with some cobble-size sandy silt pockets. medium and coarse sub-rounded and sub-angular stone mostly flint. (Glaciofluvial Deposits)	

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											1. Slight spalling of sides from 2.40 m to 3.60 m. 2. No groundwater encountered. 3. Infiltration testing undertaken. 4. Backfilled with arisings.
All dimensions in metres Scale 1:25			Client Manor Oak Homes			Method/ Plant Used JCB 3CX with 18 inch toothed bucket			Logged By SMA		

EXPLORATORY HOLE LOG EMS6636 HITCHIN GPJ GINT STD AGS 3.1 GDT 4/1/17

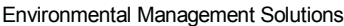
EXPLORATORY HOLE LOG

Project Land off Gray's Lane, Hitchin, Hertfordshire				HOLE No SA02-S
Job No EMS6636	Date 19-12-16	Ground Level (m) 92.90	Co-Ordinates () E 517,434.0 N 229,099.0	
Contractor				Sheet 1 of 1

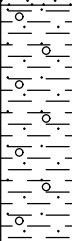
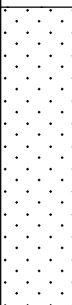
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Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											1. Sides stable. 2. No groundwater encountered. 3. Infiltration testing undertaken. 4. Backfilled with arisings.
All dimensions in metres Scale 1:25		Client Manor Oak Homes				Method/ JCB 3CX with 18 inch toothed Plant Used bucket			Logged By SMA		

EXPLORATORY HOLE LOG EMS6636 HITCHIN.GPJ GINT STD AGS 3 1.GDT 4/1/17



Project Land off Gray's Lane, Hitchin, Hertfordshire				HOLE No SA03
Job No EMS6636	Date 19-12-16	Ground Level (m) 91.50	Co-Ordinates () E 517,492.0 N 229,108.0	
Contractor				Sheet 1 of 1

SAMPLES & TESTS		Water	STRATA				Geology	Instrument/ Backfill
Depth	Sample No.		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
			91.20		0.30 (0.30)	Soft organic dark brown slightly sandy slightly gravelly CLAY with occasional rootlets and rare gravel-size brick. (Topsoil)		
			90.40		1.10 (0.80)	Soft brown-orange slightly sandy slightly gravelly CLAY. Gravel is medium sub-rounded and sub-angular stone including flint. (Glaciofluvial Deposits)		
			89.40		2.10 (1.00)	Medium dense fine yellow-brown SAND. (Glaciofluvial Deposits)		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											1. Sides stable. 2. No groundwater encountered. 3. Infiltration testing undertaken. 4. Backfilled with arisings.
All dimensions in metres Scale 1:25		Client	Manor Oak Homes			Method/ Plant Used	JCB 3CX with 18 inch toothed bucket			Logged By SMA	

EXPLORATORY HOLE LOG EMS6636 HITCHIN.GPJ GINT STD AGS 3 1.GDT 4/1/17

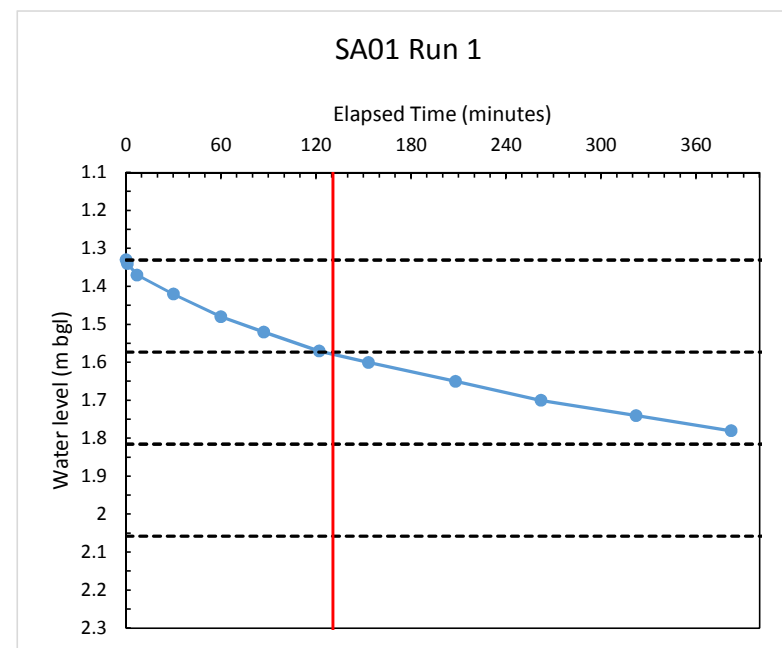
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA01 Run 1
 The test pit was not filled with gravel.

Depth of pit (m): 2.30
 Width of pit (m): 0.50
 Length of pit (m): 1.40

$V_{p75-25} =$ 0.34
 $a_{s50} =$ 2.54
 $t_{p75-25} =$ N/R minutes
 f (soil infiltration rate) = N/A m/s

Time elapsed (mins)	Water level (m below ground level)
0	1.33
1	1.34
7	1.37
30	1.42
60	1.48
87	1.52
122	1.57
153	1.60
208	1.65
262	1.70
322	1.74
382	1.78

Soakaway Test Result Sheet



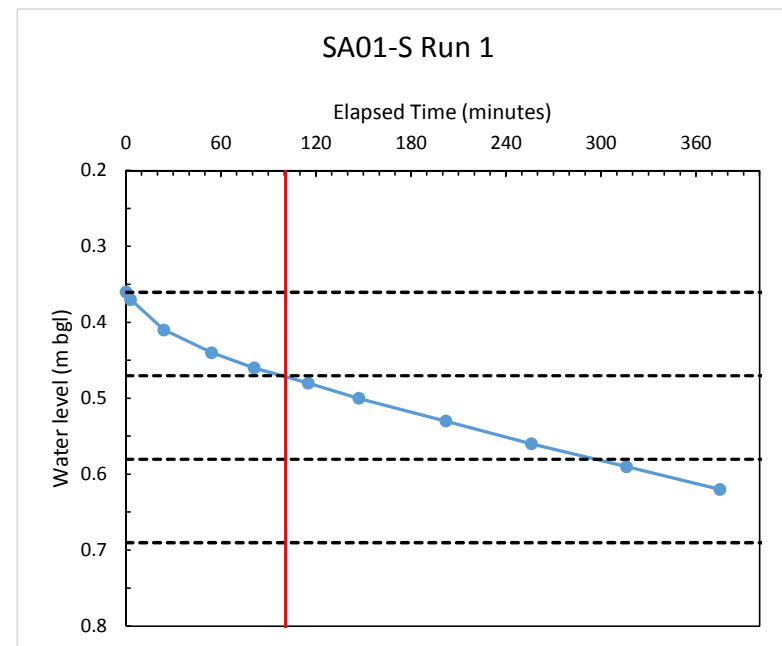
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA01-S Run 1
 The test pit was not filled with gravel.

Depth of pit (m): 0.80
 Width of pit (m): 0.50
 Length of pit (m): 1.00

$V_{p75-25} = 0.11$
 $a_{s50} = 1.16$
 $t_{p75-25} = \text{N/R}$ minutes
 f (soil infiltration rate) = N/A m/s

Time elapsed (mins)	Water level (m below ground level)
0	0.36
3	0.37
24	0.41
54	0.44
81	0.46
115	0.48
147	0.50
202	0.53
256	0.56
316	0.59
375	0.62

Soakaway Test Result Sheet



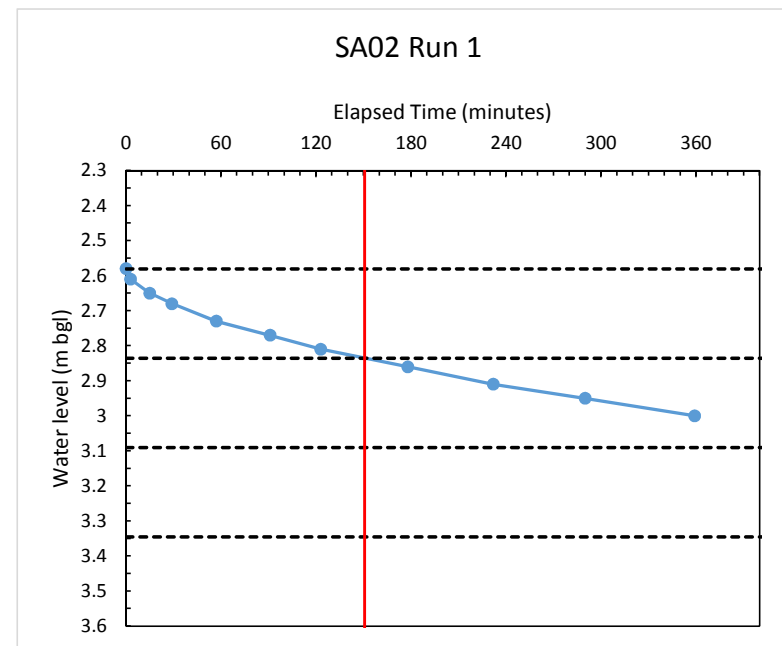
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA02 Run 1
 The test pit was not filled with gravel.

Depth of pit (m): 3.60
 Width of pit (m): 0.50
 Length of pit (m): 1.60

$V_{p75-25} = 0.41$
 $a_{s50} = 2.94$
 $t_{p75-25} = \text{N/R}$ minutes
 f (soil infiltration rate) = N/A m/s

Time elapsed (mins)	Water level (m below ground level)
0	2.58
3	2.61
15	2.65
29	2.68
57	2.73
91	2.77
123	2.81
178	2.86
232	2.91
290	2.95
359	3.00

Soakaway Test Result Sheet



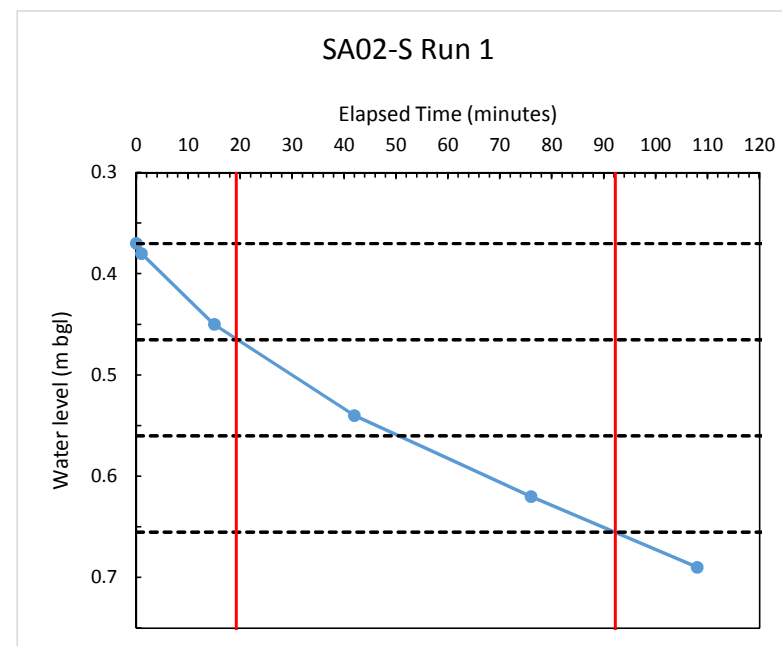
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA02-S Run 1
 The test pit was not filled with gravel.

Depth of pit (m): 0.75
 Width of pit (m): 0.50
 Length of pit (m): 1.10

$V_{p75-25} = 0.10$
 $a_{s50} = 1.16$
 $t_{p75-25} = 73 \text{ minutes}$
 f (soil infiltration rate) = $2.06E-05 \text{ m/s}$

Time elapsed (mins)	Water level (m below ground level)
0	0.37
1	0.38
15	0.45
42	0.54
76	0.62
108	0.69

Soakaway Test Result Sheet



Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA02-S Run 2
 The test pit was not filled with gravel.

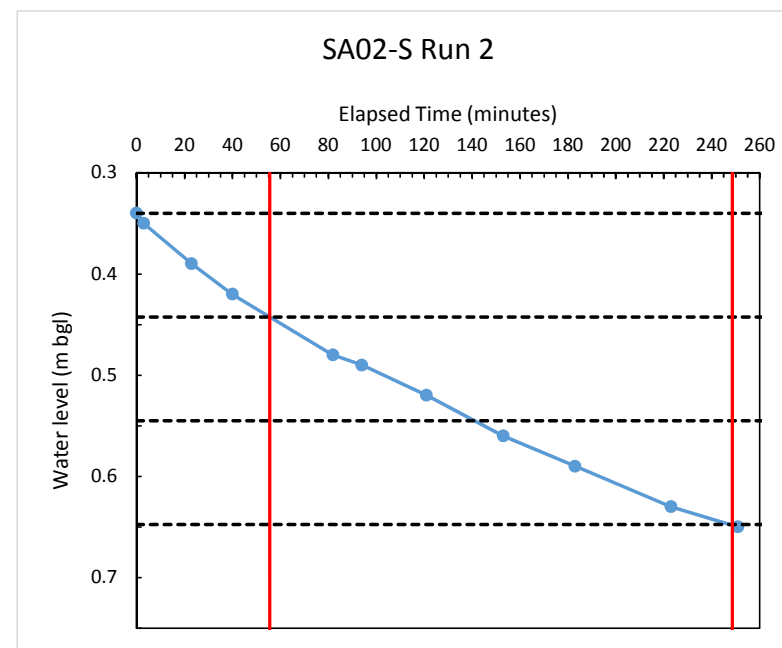
Depth of pit (m): 0.75
 Width of pit (m): 0.50
 Length of pit (m): 1.10

$V_{p75-25} = 0.11$
 $a_{s50} = 1.21$
 $t_{p75-25} = 193$ minutes
 f (soil infiltration rate) = $8.07E-06$ m/s

Time elapsed (mins)	Water level (m below ground level)
0	0.34
3	0.35
23	0.39
40	0.42
82	0.48
94	0.49
121	0.52
153	0.56
183	0.59
223	0.63
251	0.65

Red data is extrapolated

Soakaway Test Result Sheet



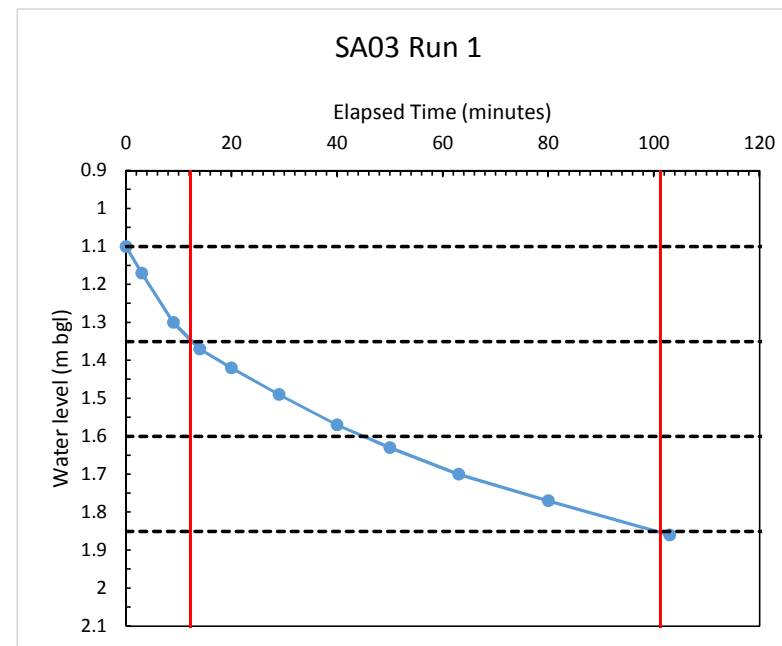
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA03 Run 1
 The test pit was not filled with gravel.

Depth of pit (m): 2.10
 Width of pit (m): 0.50
 Length of pit (m): 1.80

$V_{p75-25} = 0.45$
 $a_{s50} = 3.20$
 $t_{p75-25} = 89$ minutes
 f (soil infiltration rate) = $2.63E-05$ m/s

Time elapsed (mins)	Water level (m below ground level)
0	1.10
3	1.17
9	1.30
14	1.37
20	1.42
29	1.49
40	1.57
50	1.63
63	1.70
80	1.77
103	1.86

Soakaway Test Result Sheet



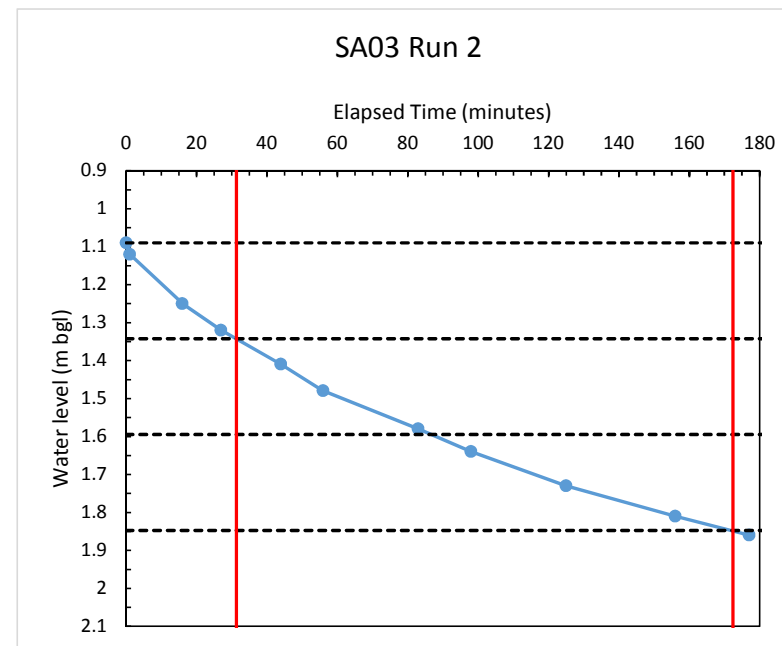
Project Name: Gray's Lane, Hitchin
 Project Number: EMS6636
 Date of Test: 19/12/2016
 Test Location: SA03 Run 2
 The test pit was not filled with gravel.

Depth of pit (m): 2.10
 Width of pit (m): 0.50
 Length of pit (m): 1.80

$V_{p75-25} = 0.45$
 $a_{s50} = 3.22$
 $t_{p75-25} = 141$ minutes
 f (soil infiltration rate) = $1.67E-05$ m/s

Time elapsed (mins)	Water level (m below ground level)
0	1.09
1	1.12
16	1.25
27	1.32
44	1.41
56	1.48
83	1.58
98	1.64
125	1.73
156	1.81
177	1.86

Soakaway Test Result Sheet



27th October 2021

Our ref: GE20375/SA02/211027



Oscar Briggs
Manor Oak Homes
White Lodge Farm
Walgrave
Northampton
NN6 9PY

Dear Oscar,

RE: Land at Gray's Lane, Hitchin, Hertfordshire – Soakage Testing

We are pleased to present the results of the soakage testing undertaken at the above site. The soakage tests were undertaken in accordance with BRE Digest 365 'Soakaway Design' BRE, 2016 with the testing limited to a two day period.

A geo-environmental engineer attended site on the 18th and 19th October 2021 to undertake the intrusive investigation. Five trial pits (TP101 to TP105) were excavated to assess ground and groundwater conditions followed by a further ten trial pits (SA101 to SA110) which were utilised for soakage testing at various depths. Two additional trial pits (TP106 and TP107) were excavated to assess ground and groundwater conditions in the west of the site in the location of proposed attenuation ponds.

The locations for testing were specified by the drainage engineer MAC Pre-planning Engineering and are shown on Figure 2.

Background

It is understood that the site is proposed to be developed for a residential land use, with gardens and/or landscaping and associated development infrastructure. As such, soakage testing was required to confirm the suitability of underlying soils for soakaway drainage and to inform the planning, design and construction strategies for the site.

Published geological records indicate that the ground conditions are likely to comprise Glaciofluvial Deposits overlying West Melbury Marly Chalk Formation and Zig Zag Chalk Formation in the west of the site.

Previous soakage testing was undertaken at the site by Environmental Management Solutions (ref. EMS6636a, dated January 2017). Testing in three locations across five trial pits was undertaken at various depths of between 0.75m and 3.60m bgl. The ground conditions reportedly comprised a mantle of Topsoil overlying clay based soils of the Glaciofluvial Deposits with more granular soils present at depth. Soakage testing recorded insufficient infiltration to successfully complete tests in three of the five test pits. Infiltration rates of between 1.7×10^{-5} m/s and 2.6×10^{-5} m/s were recorded in SA03 at a depth of 2.10m bgl and rates of between 8.1×10^{-6} m/s and 2.1×10^{-5} m/s were recorded in SA02-S at 0.75m bgl. Only two test cycles were completed in these locations. For further details reference should be made to the full EMS report.

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Environmental Consultants | Geotechnical Engineers | Site Investigations

Geo-Environmental Services Ltd incorporated in England number 3214980 VAT number 679544479



Site Description

At the time of the investigation works, the site comprised an approximately rectangular shaped field covered by grass with a number of mature deciduous trees species present. A water trough was present in the north-eastern corner. Access to the site was also in the north-eastern corner via a farm gate. The majority of the site sloped gently downhill to the south-east with the western part sloping downhill to the south-west.

The whole site was bounded by a post and wire stock fence and high deciduous hedgerows or trees. A track ran along the northern boundary with an open grass field and residential property and garden beyond. Large buildings, assumed to be in residential usage, were present to the west. Crow Furlong access road was located to the east providing access to residential bungalows. Woodland was present to the south of the site.

Ground Conditions

The ground conditions encountered comprised a mantle of Topsoil overlying Glaciofluvial Deposits. A generalised summary of the encountered conditions is presented in Table 1.

Top (m bgl)	Base (m bgl)	Geology	Locations
0	0.20 – 0.25	TOPSOIL: Dark brown SILT with varying sand and gravel component, and dark brown SAND with varying silt and gravel content. Dark brown slightly gravelly sandy CLAY in TP107. Roots and rootlets frequently noted throughout. Rare metal and glass in SA102 and rare brick cobbles in SA103.	All
0.20 – 2.60	0.60 – 3.10	GLACIOFLUVIAL DEPOSITS (cohesive): Brownish orange, yellowish orange, yellowish brown, dark orangish brown, orange and orange to brown CLAY with varying silt, sand and gravel content. Flint cobbles occasional present. Orangish greyish brown CLAY with rare yellowish off-white weak chalk inclusions encountered in TP102 from 2.60m to 3.00m bgl. Yellowish orange slightly gravelly clayey sandy SILT recorded in TP101 from 2.60m to 3.00m bgl. Orangish brown slightly clayey slightly sandy SILT with rare sub-angular gravel encountered in SA103 from 0.20m to 0.60m bgl.	TP101, SA101, SA102, TP102, SA103, SA104, TP103, SA106, TP105, TP106 & TP107
0.20 – 1.80	0.70 – 3.20	GLACIOFLUVIAL DEPOSITS (granular): Typically SAND with varying proportions of clay, silt and gravel or GRAVEL with varying proportions of clay, silt and sand. Some soil components were absent in some locations. SAND with no, or rare, secondary constituents recorded in TP103 from 1.80m to 3.10m bgl and SA105 from 0.90m to 1.80m bgl. Colouration was variously orange, yellowish brown, orangish brown, orangish yellow, brownish orange and yellowish grey.	TP101, SA101, TP102, SA104, TP103, SA105, TP104, SA107, SA108, TP105, SA109, SA110, TP106 & TP107

Table 1 Summary of Ground Conditions

For further details of the ground conditions encountered, reference should be made to the trial pit logs included within Appendix A.

Obstructions

No manmade or natural obstructions were encountered during the investigation. The presence of obstructions elsewhere at the site cannot be completely discounted.

Groundwater

No groundwater was recorded within the trial pits during the investigation. Monitoring to determine any possible variation in groundwater levels over time did not form part of the agreed scope of investigation.

Soakage Testing

Soakage testing was undertaken in accordance with BRE Digest 365 Soakaway Design in ten trial pits. Testing was undertaken in SA101, SA104, SA105, SA107 and SA190 at depths between 1.25m and 1.92m bgl, suitable for likely proposed conventional soakaways. Testing in SA102, SA103, SA106, SA108 and SA110 was undertaken at depths between 0.60m and 0.70m bgl to inform the design of permeable pavement. Wherever possible within the two day testing period agreed, three filling and drainage cycles were completed in each trial pit.

The results of the testing are summarised in Table 2 below. The soakage test results are included within Appendix B.

Location	Pit depth (m bgl)	Infiltration Rate (m/s)		
		Test 1	Test 2	Test 3
SA101	1.25	Insufficient fall in water to complete test	Insufficient fall in water to complete test	-
SA102	0.60	2.3×10^{-5}	7.1×10^{-6}	3.9×10^{-6}
SA103	0.70	2.9×10^{-5}	1.5×10^{-5}	1.2×10^{-5}
SA104	1.60	1.0×10^{-5}	7.6×10^{-6}	6.6×10^{-6}
SA105	1.75	2.3×10^{-5}	1.4×10^{-5}	1.1×10^{-5}
SA106	0.64	6.3×10^{-5}	1.9×10^{-5}	1.2×10^{-5}
SA107	1.92	2.8×10^{-5}	1.5×10^{-5}	1.0×10^{-5}
SA108	0.67	1.3×10^{-4}	4.0×10^{-5}	3.3×10^{-5}
SA109	1.88	Insufficient fall in water to complete test	Insufficient fall in water to complete test	-
SA110	0.68	2.2×10^{-5}	8.9×10^{-6}	8.3×10^{-6}

Table 2 Soakage Test Results

Conclusions

The testing undertaken indicates that the majority of the granular soils of the Glaciofluvial Deposits are likely to be suitable for drainage via conventional soakaways. However, where more cohesive soils and bands have been identified as part of the investigation (SA101 and SA109), soakaways in these soils are considered unlikely to be effective. The near-surface soils tested are also likely to be suitable for permeable paving. Soakaways should be designed with suitable clearance above groundwater levels. Soakaways should be located no closer than 5m from any buildings.

Closure

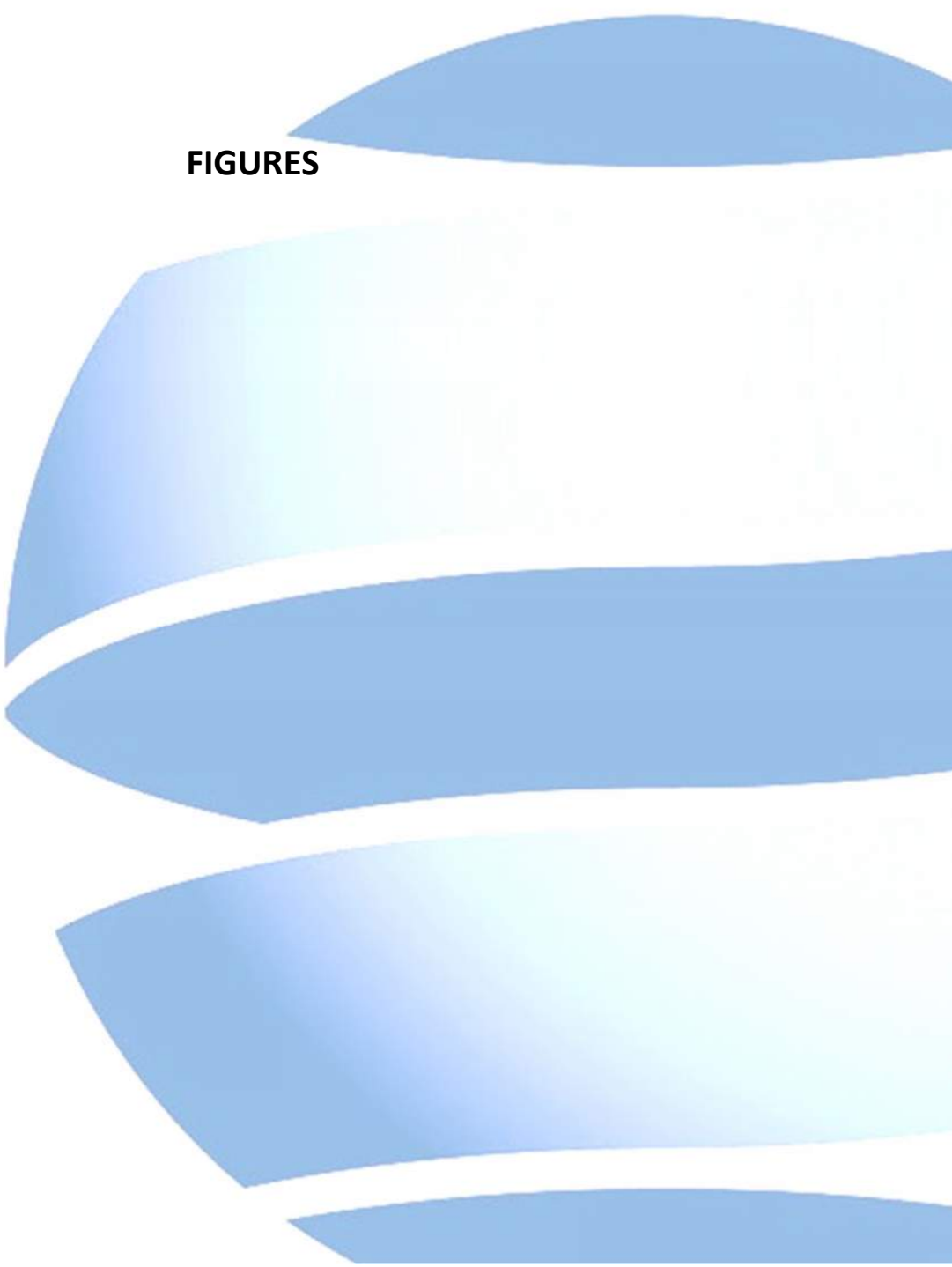
We trust that we have interpreted your instructions correctly, and please do not hesitate to contact us should you have any queries.

Yours sincerely
For and on Behalf of Geo-Environmental



SHAUN ARMITAGE BSc (Hons), FGS
Principal Engineer
shaun.armitage@gesl.net

Enc	Figure 1	Site Location Plan
	Figure 2	Exploratory Hole Locations Plan
	Appendix A	Exploratory Hole Logs
	Appendix B	Soakage Test Results



FIGURES



Project:	Gray's Lane, Hitchin, SG5 2HN			Title	Site Location Plan	
Client:	Manor Oak Homes			Geo-Environmental Services Ltd Unit 7 Danworth Farm, Cuckfield Road Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net	 Geo-Environmental	
Ref No:	GE20375	Revision:	0			
Drawn:	SA	Date:	08/10/2021			
Figure:	1	Scale:	Not To Scale			

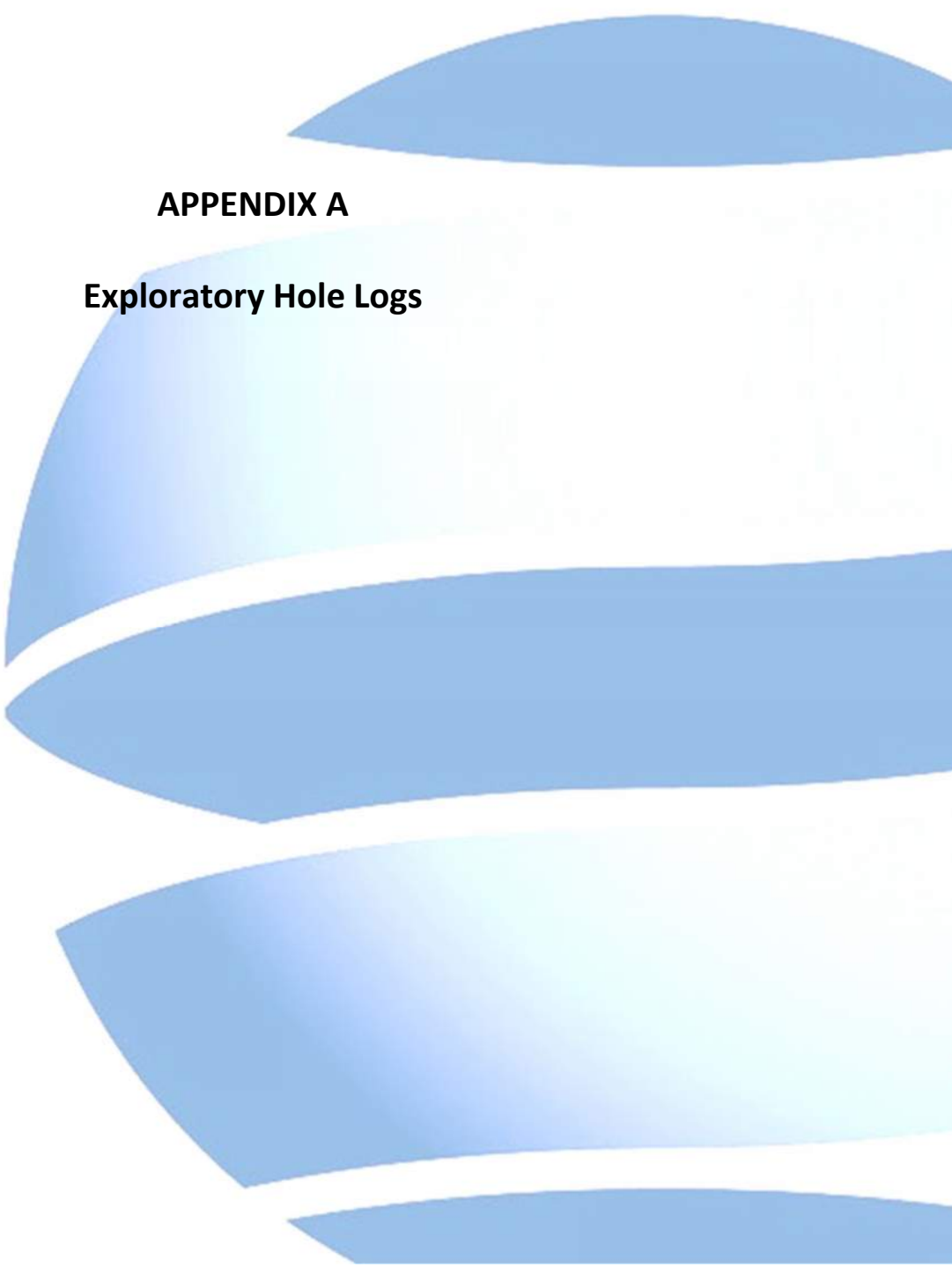
Project Title: Gray's Lane, Hitchin
Location : Hertsfordshire, SG5 2HN
Project No. : GE20375
Client : Manor Oak Homes

Title : Figure 2 - Exploratory Hole Location Plan
Scale: 1:1250
Engineer: SA



- Legend Key
- Locations By Type - Empty
 - Locations By Type - TP





APPENDIX A

Exploratory Hole Logs

Trial Pit Log

TrialPit No
SA101
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517385.55 - 229153.32
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 1.80

Scale
1:25

Client: Manor Oak Homes

Depth
1.25

0.45

1.80

Logged
JC

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown gravelly sandy SILT. Gravel composed of rounded to angular flint. Frequent rootlets TOPSOIL
							Yellowish brown silty very sandy GRAVEL composed of rounded to sub-angular flint. Occasional flint cobbles. GLACIOFLUVIAL DEPOSITS
	1.20	PP	PP=3kg/cm2	1.10			Yellowish orange gravelly sandy CLAY. Gravel composed of sub-angular flint.
				1.25			GLACIOFLUVIAL DEPOSITS End of Pit at 1.25m

Water Strikes		Remarks
Depth Strike	Rose to (mkg)	
		No groundwater encountered. Soakage testing undertaken
		Stability Sides stable



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Trial Pit Log

Trial Pit No
SA102
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517382.92 - 229133.34
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 1.40

Depth
0.60

0.45



Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly silty SAND. Gravel composed of sub-angular flint. Rare metal and glass. Frequent rootlets.
				0.60			Dark orangish brown sandy silty CLAY. Rare sub-angular flint gravel.
							GLACIOFLUVIAL DEPOSITS
							End of Pit at 0.60m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rosen to (m)	Stability	Sides stable



Trial Pit Log

TrialPit No

SA103

Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517428.71 - 229151.44
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 2.00

Scale
1:25

Client: Manor Oak Homes

Depth
0.70

0.45

2.00

Logged
JC

[illegible]

Remarks	No groundwater encountered. Soakage testing undertaken
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Stability	Sides stable
-----------	--------------



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Trial Pit Log

Trial Pit No
SA104
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517443.52 - 229150.12
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 2.00

Depth
1.60

0.45

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	PP	PP=3.5kg/cm2	0.20			Dark brown slightly gravelly slightly clayey SILT. Gravel composed of sub-angular gravel. Rare rootlets. TOPSOIL
				1.40			Slightly gravelly sandy CLAY. Gravel is composed of rounded to angular flint. Occasional rounded to angular flint cobbles. GLACIOFLUVIAL DEPOSITS
				1.60			Brownish orange slightly gravelly clayey SAND. Gravel composed of rounded to angular flint. GLACIOFLUVIAL DEPOSITS
							End of Pit at 1.60m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rosen to (m)	Stability	Sides stable





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Trial Pit Log

Trial Pit No
SA105
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517495.80 - 229140.33
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 2.00

Depth
1.80

0.45

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	PP	PP=3kg/cm2	0.25			Dark brown slightly gravelly silty SAND. Gravel is composed of sub-angular flint. Frequent rootlets and rare roots 1-3mm. TOPSOIL	
				0.90			Dark orangish brown slightly clayey silty SAND. GLACIOFLUVIAL DEPOSITS	
				1.80			Orangish yellow SAND. Rare sub angular flint gravel. GLACIOFLUVIAL DEPOSITS	1
							End of Pit at 1.80m	2
								3
								4
								5

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rose to (m)	Stability	Sides stable





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Trial Pit Log

Trial Pit No
SA106
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517484.82 - 229148.30
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 1.80

Depth
0.65

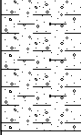
0.45



Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	PP	PP=3.5kg/cm2	0.20 0.65		 	Dark brown slightly gravelly silty SAND. Gravel is composed of sub-angular flint. Frequent rootlets and rare roots 1-3mm. TOPSOIL Orange slightly gravelly sandy CLAY. Gravel is sub-angular flint. GLACIOFLUVIAL DEPOSITS
							End of Pit at 0.65m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rose to (m)ggl	Stability	Sides stable





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Trial Pit Log

Trial Pit No
SA107
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517466.63 - 229070.76
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m):

2.00

Depth
1.90

0.45

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly silty SAND. Gravel is composed of sub-angular flint. Frequent rootlets and rare 1-2mm roots. TOPSOIL
				1.90			Brownish orange silty SAND. Rare sub-angular flint gravel. GLACIOFLUVIAL DEPOSITS
							End of Pit at 1.90m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rosen to (m) (g)	Stability	Sides stable





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Trial Pit Log

Trial Pit No
SA108
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517456.12 - 229082.09
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 1.90

Depth
0.70

0.45



Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			Dark brown slightly gravelly silty SAND. Gravel is composed of sub angular to angular flint. Frequent rootlets and occasional roots 1-15mm. TOPSOIL
				0.70			Orangish brown slightly gravelly slightly silty SAND. Gravel is composed of rounded to angular flint. Rare rootlets and roots 1-2mm. GLACIOFLUVIAL DEPOSITS
							End of Pit at 0.70m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rosen to (m) (g)	Stability	Sides stable





Unit 7, Danworth Farm
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Trial Pit Log

Trial Pit No
SA109
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517405.46 - 229104.60
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 2.00

Depth
1.90

0.45

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	PP	PP=4kg/cm2	0.25			Dark brown gravelly sandy SILT. Gravel is sub-angular to angular flint. Frequent rootlets. TOPSOIL
				1.00			Brownish orange slightly gravelly clayey SAND. Gravel is composed of sub-angular flint. GLACIOFLUVIAL DEPOSITS
				1.90			Orangish brown gravelly very clayey SAND. Gravel is sub-angular flint and rare sandstone. GLACIOFLUVIAL DEPOSITS
							End of Pit at 1.90m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rose to (mdeg)	Stability	Sides stable





Unit 7, Danworth Farm
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Trial Pit Log

Trial Pit No

SA110

Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517416.44 - 229102.63
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 2.00

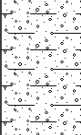
Depth
0.70

0.45

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly gravelly silty fine to medium SAND. Gravel is sub-angular flint. Abundant rootlets and occasional roots 1 - 15mm
				0.70			Yellowish brown slightly sandy clayey GRAVEL composed of sub rounded to angular flint. Rare roots. GLACIOFLUVIAL DEPOSITS
							End of Pit at 0.70m

Depth Strike	Water Strikes	Remarks	No groundwater encountered. Soakage testing undertaken
	Rose to (m)	Stability	Sides stable





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Trial Pit Log

Trial Pit No

TP101

Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517385.79 - 229161.66
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.00

Depth
3.00

0.60

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			Dark brown slightly gravelly sandy SILT. TOPSOIL	
				0.80			Orange slightly gravelly clayey SAND GLACIOFLUVIAL DEPOSITS	
	1.00	PP	PP=3.5kg/cm2				Orange and brownish orange slightly sandy silty CLAY. Rare flint cobbles GLACIOFLUVIAL DEPOSITS	1
	1.50	PP	PP=4kg/cm2					
	2.00	PP	PP=3kg/cm2					2
				2.60			Yellowish orange slightly gravelly clayey sandy SILT. Gravel is composed of rounded to sub angular flint. Occasional silt laminations. GLACIOFLUVIAL DEPOSITS	
	3.00	PP	PP=2kg/cm2	3.00				3
							End of Pit at 3.00m	
								4
								5

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
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Trial Pit Log

Trial Pit No
TP102
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517429.77 - 229161.81
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.00

Scale
1:25

Client: Manor Oak Homes

Depth
3.00

0.60

Logged
JC

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Dark brown slightly sandy SILT. Frequent rootlets and rare 10mm -20mm roots. TOPSOIL
	0.50	PP	PP=3kg/cm2				Orange silty fine SAND with grey greyish brown clay inclusions. Clay has dark brown staining. GLACIOFLUVIAL DEPOSITS
	1.00	PP	PP=3kg/cm2				
	1.50	PP	PP=3kg/cm2				
	2.00	PP	PP=3kg/cm2				
	2.40	PP	PP=3.5kg/cm2				
				2.60			Orangish greyish brown CLAY. Rare yellowish off-white weak chalk inclusions. GLACIOFLUVIAL DEPOSITS
	3.00	PP	PP=4kg/cm2	3.00			End of Pit at 3.00m

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
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Trial Pit Log

Trial Pit No

TP103

Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517509.04 - 229144.53
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.00

Depth
3.10

0.60

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			Dark brown slightly gravelly silty SAND. Gravel is composed of sub-angular to angular flint. Abundant rootlets. Rare roots <10mm TOPSOIL	
	0.70	PP	PP=4kg/cm2				Orangish brown sandy silty CLAY. Rare rounded to angular flint gravel and cobbles. Rare rootlets and roots 1-2mm. GLACIOFLUVIAL DEPOSITS	1
	1.30	PP	PP=3kg/cm2	1.20			Yellowish brown sandy silty CLAY. Rare white to yellowish white very weak chalk inclusions. GLACIOFLUVIAL DEPOSITS	
				1.80			Orangish yellow SAND. Rare very weathered chalk/grey clay. Rare sub-angular fine to medium flint gravel. GLACIOFLUVIAL DEPOSITS	2
				3.10			End of Pit at 3.10m	3
								4
								5

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

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Trial Pit Log

Trial Pit No
TP104
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517472.18 - 229065.89
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.00

Depth
3.00

0.60

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20						Dark brown slightly gravelly sandy SILT. Gravel is composed of sub angular to angular flint.
	0.50	PP	PP=4kg/cm2				TOPSOIL
							Brownish orange slightly clayey silty SAND. Rare roots
							GLACIOFLUVIAL DEPOSITS
				3.00			End of Pit at 3.00m

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No
TP105
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517408.70 - 229089.54
Level:

Date
18/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.20

Scale
1:25

Client: Manor Oak Homes

Depth
3.20

0.60

Logged
JC

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.25			Dark brown slightly gravelly sandy SILT. Gravel is composed of sub-angular flint. Frequent rootlets TOPSOIL	
	0.50	PP	PP=2kg/cm2	0.70			Yellowish brown slightly gravelly slightly sandy CLAY. Gravel is composed of rounded to angular flint. Rare flint cobbles and single rounded flint boulder. GLACIOFLUVIAL DEPOSITS	
	1.00	PP	PP=2.5kg/cm2	1.20			Yellowish grey slightly gravelly very clayey fine SAND. Gravel is sub-angular flint. GLACIOFLUVIAL DEPOSITS	1
				2.30			Brownish orange slightly gravelly silty SAND. Gravel is sub-angular to angular flint. Rare sub-angular cobbles. Rare grey clay. GLACIOFLUVIAL DEPOSITS	2
				3.20			Orange slightly gravelly clayey SAND. Gravel is sub-angular to angular flint. Rare sub-angular flint. GLACIOFLUVIAL DEPOSITS	3
							End of Pit at 3.20m	4
								5

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No
TP106
Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517364.92 - 229114.37
Level:

Date
19/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m): 3.10

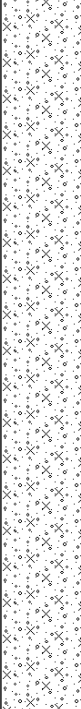
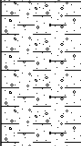
Depth
3.10

0.60

Scale
1:25

Logged
JC

Client: Manor Oak Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			Brown slightly silty gravelly SAND. Gravel is composed of sub-angular flint. Rare charcoal. Frequent rootlets and occasional roots <30mm TOPSOIL
							Orange slightly silty very sandy GRAVEL composed of well rounded to angular flint. Frequent well rounded to angular flint cobbles. GLACIOFLUVIAL DEPOSITS
				2.60			Orange to brown slightly gravelly slightly sandy CLAY. Gravel is composed white weak chalk and rare sub-angular flint. Occasional roots 10-20mm. GLACIOFLUVIAL DEPOSITS
	3.00	PP	PP=5kg/cm2	3.10			End of Pit at 3.10m

Remarks No groundwater encountered

Stability Sides stable





Unit 7, Danworth Farm
Hurstpierpoint
BN6 9GL

Geo-Environmental www.gesl.net

Trial Pit Log

Trial Pit No

TP107

Sheet 1 of 1

Project Name: Gray's Lane, Hitchin

Project No.
GE20375

Co-ords: 517356.46 - 229068.40
Level:

Date
19/10/2021

Location: Hertfordshire, SG5 2HN

Dimensions (m):

3.10

Scale
1:25

Client: Manor Oak Homes

Depth
3.10

0.60

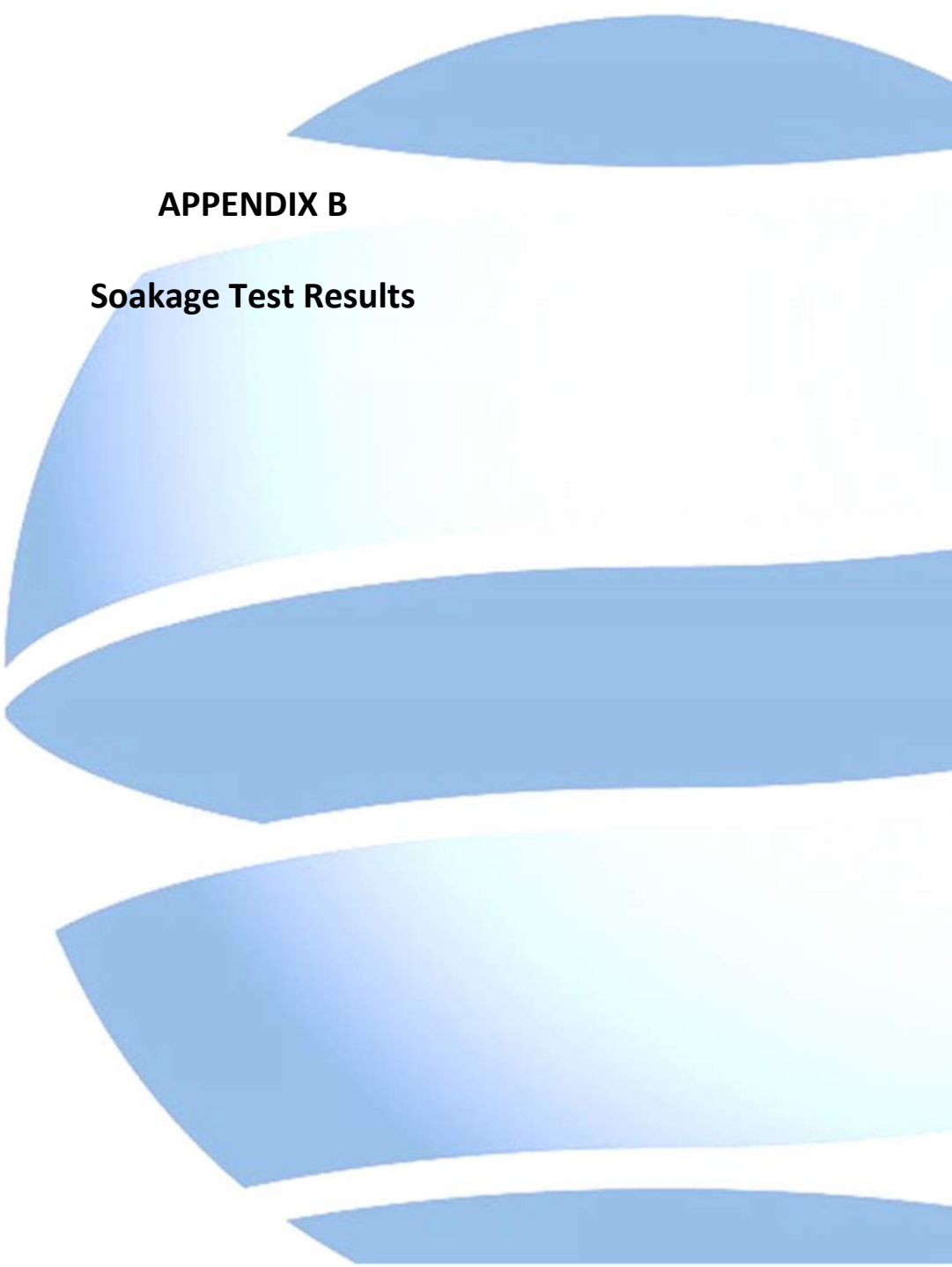
Logged
JC

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.25			Dark brown slightly gravelly sandy CLAY. Gravel is composed of sub angular flint. TOPSOIL
				1.20			Brownish orange slightly gravelly slightly sandy silty CLAY. Gravel is composed of sub-angular to angular flint. Rare sub-angular flint cobbles. GLACIOFLUVIAL DEPOSITS
				2.10			Orangish brown to brownish white slightly clayey sandy GRAVEL composed of rounded to sub-angular white weak chalk and rare rounded to sub-angular flint. Rare rounded to sub-rounded flint cobbles. GLACIOFLUVIAL DEPOSITS
				3.10			Orangish brown slightly gravelly very sandy silty CLAY. Gravel is composed of rounded to angular white chalk and flint and rare sandstone. GLACIOFLUVIAL DEPOSITS
							End of Pit at 3.10m

Remarks No groundwater encountered

Stability Sides stable





APPENDIX B

Soakage Test Results

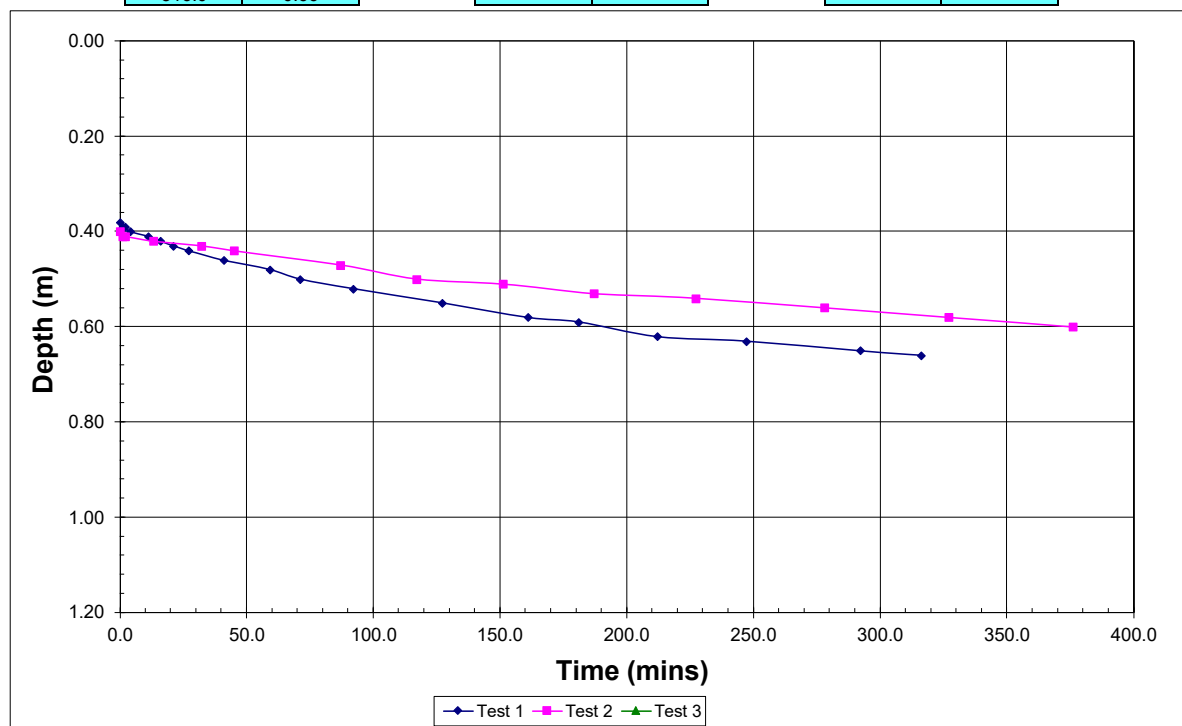
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesi.net
Project Name : Grays Lane, Hitcham		Job No. : GE20375
Client : Manor Oak Homes		Date : 18/10/2021 to 19/10/2021

Pit reference	SA101
Pit depth (m)	1.25
Pit width (m)	0.45
Pit length (m)	1.40
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.38
1.0	0.39
2.0	0.39
4.0	0.40
11.0	0.41
16.0	0.42
21.0	0.43
27.0	0.44
41.0	0.46
59.0	0.48
71.0	0.50
92.0	0.52
127.0	0.55
161.0	0.58
181.0	0.59
212.0	0.62
247.0	0.63
292.0	0.65
316.0	0.66

Test 2	
Time (min)	Depth (m)
0.0	0.40
1.0	0.41
2.0	0.41
13.0	0.42
32.0	0.43
45.0	0.44
87.0	0.47
117.0	0.50
151.0	0.51
187.0	0.53
227.0	0.54
278.0	0.56
327.0	0.58
376.0	0.60

Test 3	
Time (min)	Depth (m)



Max. depth (m)	1.25	1.08	1.25
Effective depth (m)	0.87	0.85	1.25
75% effective depth (m)	0.60	0.61	0.31
50% effective depth (m)	0.82	0.83	0.63
25% effective depth (m)	1.03	1.04	0.94
t75 (min)			
t50 (min)			
t25 (min)			
Vp 75-25	0.27	0.27	0.39
ap 50	2.2395	2.2025	2.9425
tp 75-25	0.00	0.00	0.00

Soil infiltration rate (m/s)	Insufficient fall in water to complete test	
Soil infiltration rate (mm/hr)	Insufficient fall in water to complete test	

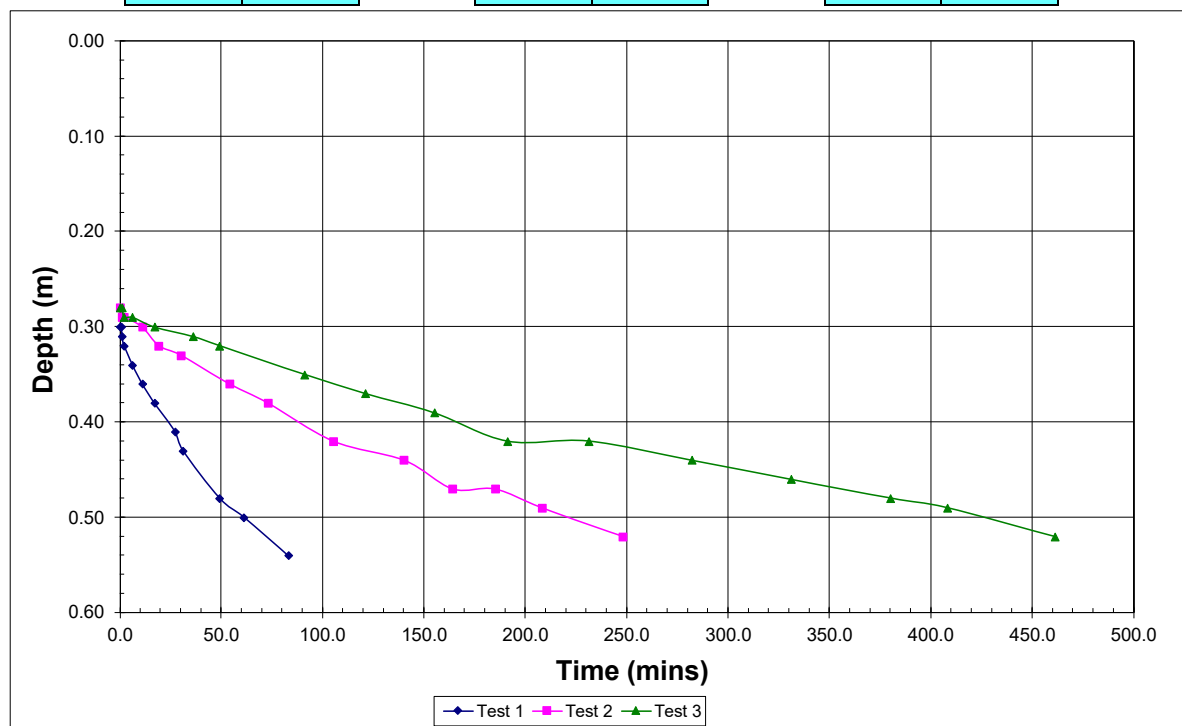
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA102
Pit depth (m)	0.60
Pit width (m)	0.45
Pit length (m)	1.40
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.30
0.5	0.30
1.0	0.31
2.0	0.32
6.0	0.34
11.0	0.36
17.0	0.38
27.0	0.41
31.0	0.43
49.0	0.48
61.0	0.50
83.0	0.54

Test 2	
Time (min)	Depth (m)
0.0	0.28
1.0	0.29
2.0	0.29
11.0	0.30
19.0	0.32
30.0	0.33
54.0	0.36
73.0	0.38
105.0	0.42
140.0	0.44
164.0	0.47
185.0	0.47
208.0	0.49
248.0	0.52

Test 3	
Time (min)	Depth (m)
0.0	0.28
1.0	0.28
2.0	0.29
6.0	0.29
17.0	0.30
36.0	0.31
49.0	0.32
91.0	0.35
121.0	0.37
155.0	0.39
191.0	0.42
231.0	0.42
282.0	0.44
331.0	0.46
380.0	0.48
408.0	0.49
461.0	0.52



Max. depth (m)	0.60	0.55	0.55
Effective depth (m)	0.30	0.32	0.32
75% effective depth (m)	0.38	0.36	0.36
50% effective depth (m)	0.45	0.44	0.44
25% effective depth (m)	0.53	0.52	0.52
t75 (min)	17.00	54.00	110.00
t50 (min)	35.00	140.00	282.00
t25 (min)	75.00	248.00	461.00
Vp 75-25	0.09	0.10	0.10
ap 50	1.185	1.222	1.222
tp 75-25	58.00	194.00	351.00

Soil infiltration rate (m/s)	2.3E-05	7.1E-06	3.9E-06
Soil infiltration rate (mm/hr)	8.25E+01	2.55E+01	1.41E+01

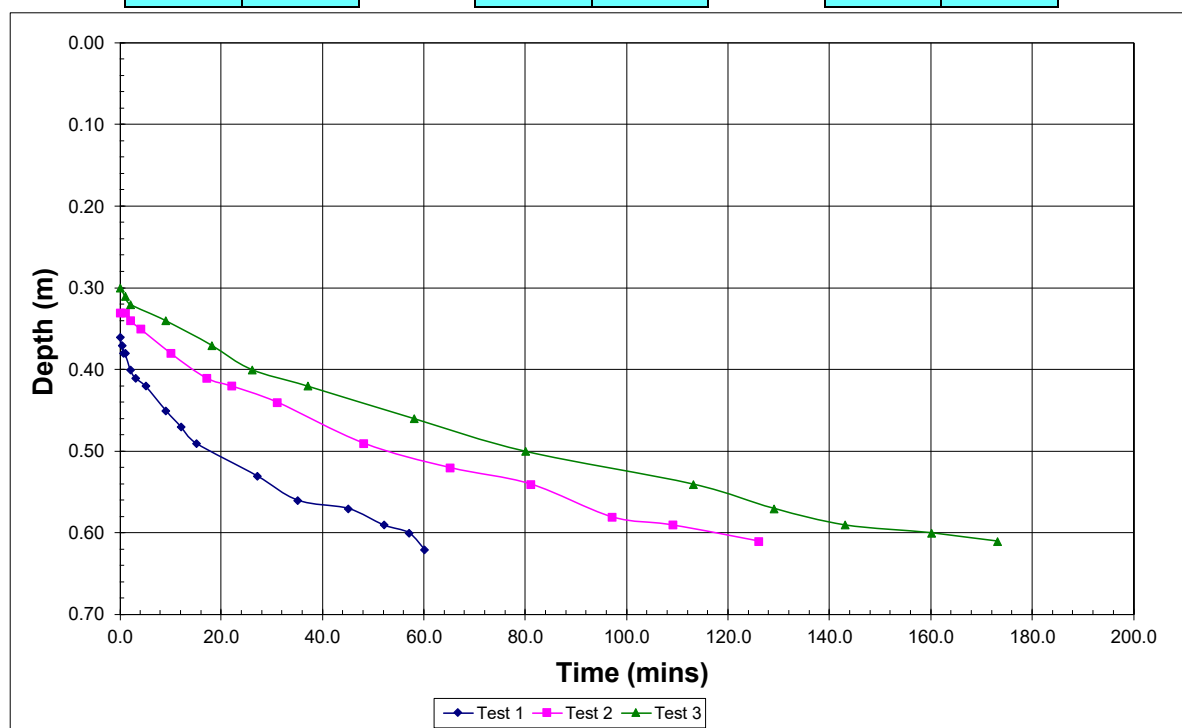
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA103
Pit depth (m)	0.70
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.36
0.3	0.37
0.7	0.38
1.0	0.38
2.0	0.40
3.0	0.41
5.0	0.42
9.0	0.45
12.0	0.47
15.0	0.49
27.0	0.53
35.0	0.56
45.0	0.57
52.0	0.59
57.0	0.60
60.0	0.62

Test 2	
Time (min)	Depth (m)
0.0	0.33
1.0	0.33
2.0	0.34
4.0	0.35
10.0	0.38
17.0	0.41
22.0	0.42
31.0	0.44
48.0	0.49
65.0	0.52
81.0	0.54
97.0	0.58
109.0	0.59
126.0	0.61

Test 3	
Time (min)	Depth (m)
0.0	0.30
1.0	0.31
2.0	0.32
9.0	0.34
18.0	0.37
26.0	0.40
37.0	0.42
58.0	0.46
80.0	0.50
113.0	0.54
129.0	0.57
143.0	0.59
160.0	0.60
173.0	0.61



Max. depth (m)	0.60	0.60	0.60
Effective depth (m)	0.34	0.37	0.40
75% effective depth (m)	0.45	0.42	0.40
50% effective depth (m)	0.53	0.52	0.50
25% effective depth (m)	0.62	0.61	0.60
t75 (min)	9.00	22.00	26.00
t50 (min)	27.00	65.00	80.00
t25 (min)	60.00	126.00	160.00
Vp 75-25	0.15	0.17	0.18
ap 50	1.733	1.8065	1.88
tp 75-25	51.00	104.00	134.00

Soil infiltration rate (m/s)	2.9E-05	1.5E-05	1.2E-05
Soil infiltration rate (mm/hr)	1.04E+02	5.32E+01	4.29E+01

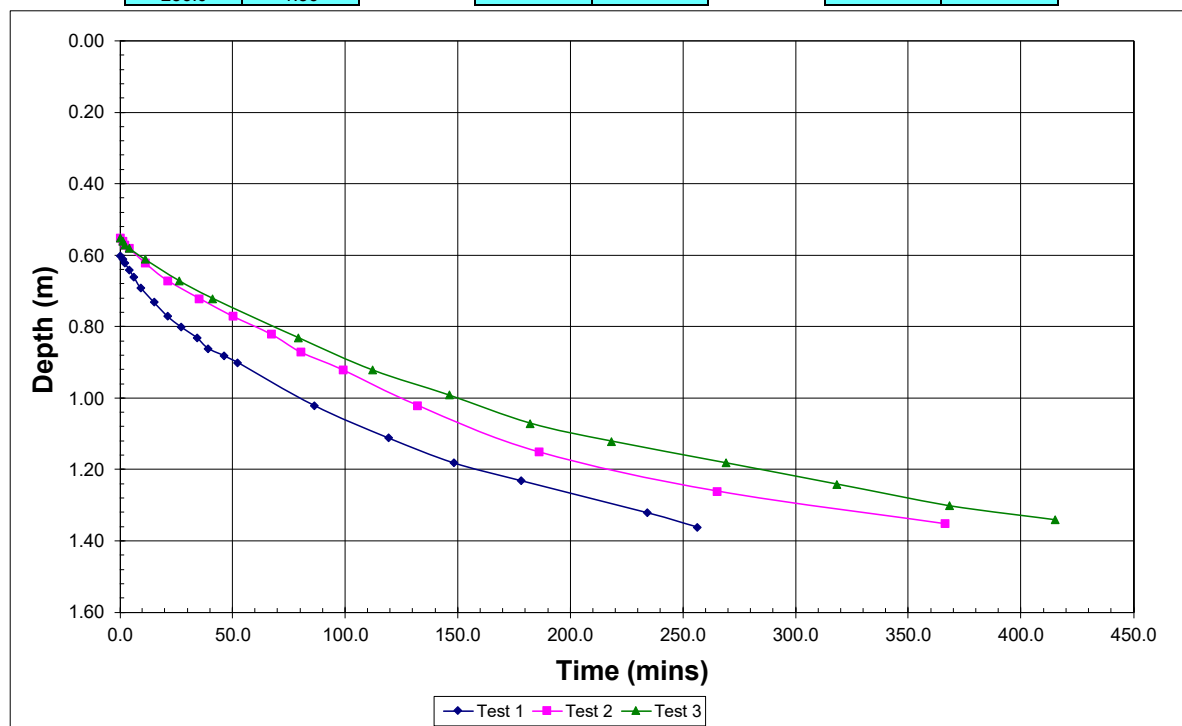
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA104
Pit depth (m)	1.60
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.60
1.0	0.61
2.0	0.62
4.0	0.64
6.0	0.66
9.0	0.69
15.0	0.73
21.0	0.77
27.0	0.80
34.0	0.83
39.0	0.86
46.0	0.88
52.0	0.90
86.0	1.02
119.0	1.11
148.0	1.18
178.0	1.23
234.0	1.32
256.0	1.36

Test 2	
Time (min)	Depth (m)
0.0	0.55
1.0	0.56
2.0	0.57
4.0	0.58
11.0	0.62
21.0	0.67
35.0	0.72
50.0	0.77
67.0	0.82
80.0	0.87
99.0	0.92
132.0	1.02
186.0	1.15
265.0	1.26
366.0	1.35

Test 3	
Time (min)	Depth (m)
0.0	0.55
1.0	0.56
2.0	0.57
4.0	0.58
11.0	0.61
26.0	0.67
41.0	0.72
79.0	0.83
112.0	0.92
146.0	0.99
182.0	1.07
218.0	1.12
269.0	1.18
318.0	1.24
368.0	1.30
415.0	1.34



Max. depth (m)	1.60	1.55	1.50
Effective depth (m)	1.00	1.05	1.05
75% effective depth (m)	0.85	0.81	0.81
50% effective depth (m)	1.10	1.08	1.08
25% effective depth (m)	1.35	1.34	1.34
t75 (min)	36.00	62.00	70.00
t50 (min)	112.00	160.00	185.00
t25 (min)	250.00	360.00	415.00
Vp 75-25	0.45	0.47	0.47
ap 50	3.35	3.4725	3.4725
tp 75-25	214.00	298.00	345.00

Soil infiltration rate (m/s)	1.0E-05	7.6E-06	6.6E-06
Soil infiltration rate (mm/hr)	3.77E+01	2.74E+01	2.37E+01

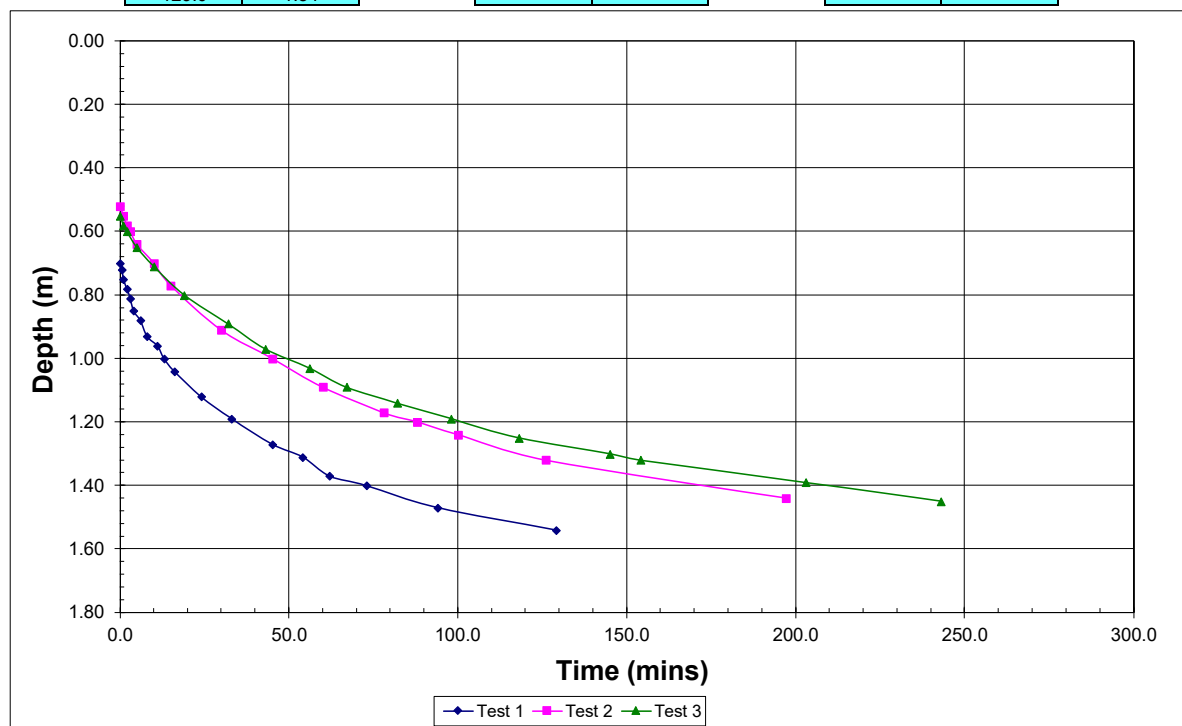
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesi.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA105
Pit depth (m)	1.75
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.70
0.5	0.72
1.0	0.75
2.0	0.78
3.0	0.81
4.0	0.85
6.0	0.88
8.0	0.93
11.0	0.96
13.0	1.00
16.0	1.04
24.0	1.12
33.0	1.19
45.0	1.27
54.0	1.31
62.0	1.37
73.0	1.40
94.0	1.47
129.0	1.54

Test 2	
Time (min)	Depth (m)
0.0	0.52
1.0	0.55
2.0	0.58
3.0	0.60
5.0	0.64
10.0	0.70
15.0	0.77
30.0	0.91
45.0	1.00
60.0	1.09
78.0	1.17
88.0	1.20
100.0	1.24
126.0	1.32
197.0	1.44

Test 3	
Time (min)	Depth (m)
0.0	0.55
1.0	0.58
2.0	0.60
5.0	0.65
10.0	0.71
19.0	0.80
32.0	0.89
43.0	0.97
56.0	1.03
67.0	1.09
82.0	1.14
98.0	1.19
118.0	1.25
145.0	1.30
154.0	1.32
203.0	1.39
243.0	1.45



Max. depth (m)	1.75	1.57	1.57
Effective depth (m)	1.05	1.23	1.20
75% effective depth (m)	0.96	0.83	0.85
50% effective depth (m)	1.23	1.14	1.15
25% effective depth (m)	1.49	1.44	1.45
t75 (min)	11.00	25.00	30.00
t50 (min)	40.00	70.00	83.00
t25 (min)	110.00	197.00	243.00
Vp 75-25	0.47	0.55	0.54
ap 50	3.4725	3.9135	3.84
tp 75-25	99.00	172.00	213.00

Soil infiltration rate (m/s)	2.3E-05	1.4E-05	1.1E-05
Soil infiltration rate (mm/hr)	8.25E+01	4.93E+01	3.96E+01

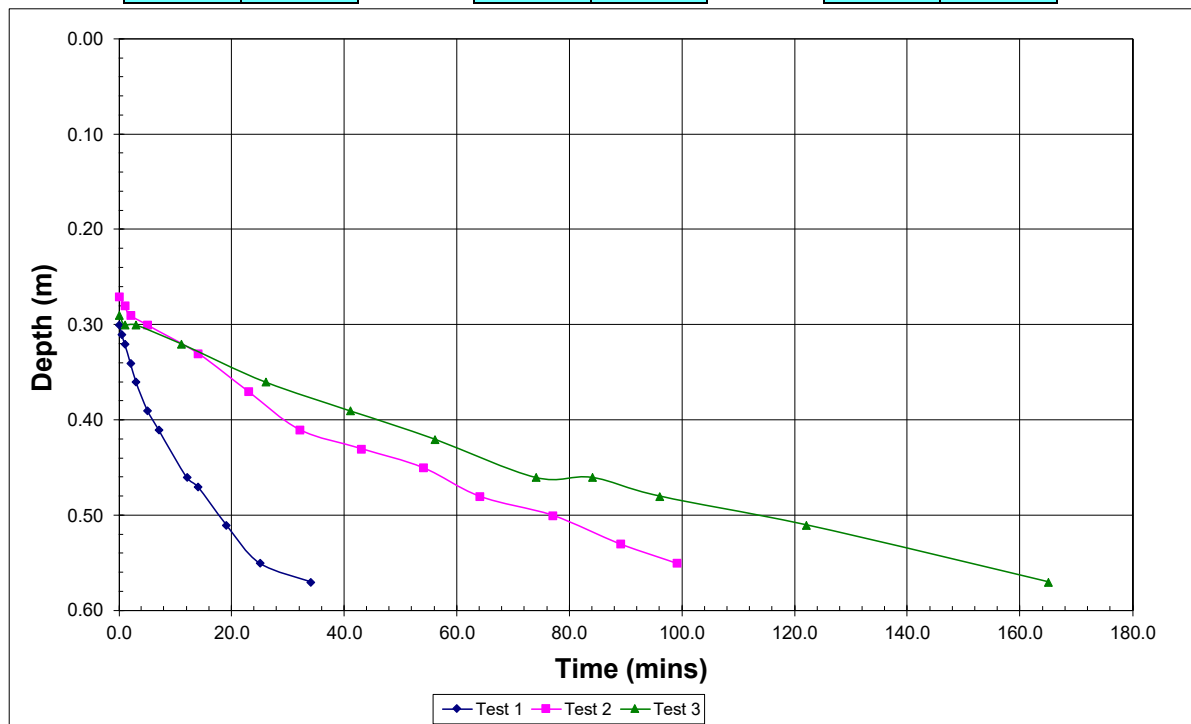
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesi.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA106
Pit depth (m)	0.64
Pit width (m)	0.45
Pit length (m)	1.80
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.30
0.5	0.31
1.0	0.32
2.0	0.34
3.0	0.36
5.0	0.39
7.0	0.41
12.0	0.46
14.0	0.47
19.0	0.51
25.0	0.55
34.0	0.57

Test 2	
Time (min)	Depth (m)
0.0	0.27
1.0	0.28
2.0	0.29
5.0	0.30
14.0	0.33
23.0	0.37
32.0	0.41
43.0	0.43
54.0	0.45
64.0	0.48
77.0	0.50
89.0	0.53
99.0	0.55

Test 3	
Time (min)	Depth (m)
0.0	0.29
1.0	0.30
3.0	0.30
11.0	0.32
26.0	0.36
41.0	0.39
56.0	0.42
74.0	0.46
84.0	0.46
96.0	0.48
122.0	0.51
165.0	0.57



Max. depth (m)	0.64	0.60	0.56
Effective depth (m)	0.34	0.37	0.35
75% effective depth (m)	0.39	0.36	0.38
50% effective depth (m)	0.47	0.46	0.47
25% effective depth (m)	0.56	0.55	0.55
t75 (min)	5.00	20.00	36.00
t50 (min)	14.00	56.00	90.00
t25 (min)	28.00	99.00	156.00
Vp 75-25	0.14	0.15	0.14
ap 50	1.575	1.6425	1.5975
tp 75-25	23.00	79.00	120.00

Soil infiltration rate (m/s)	6.3E-05	1.9E-05	1.2E-05
Soil infiltration rate (mm/hr)	2.28E+02	6.93E+01	4.44E+01

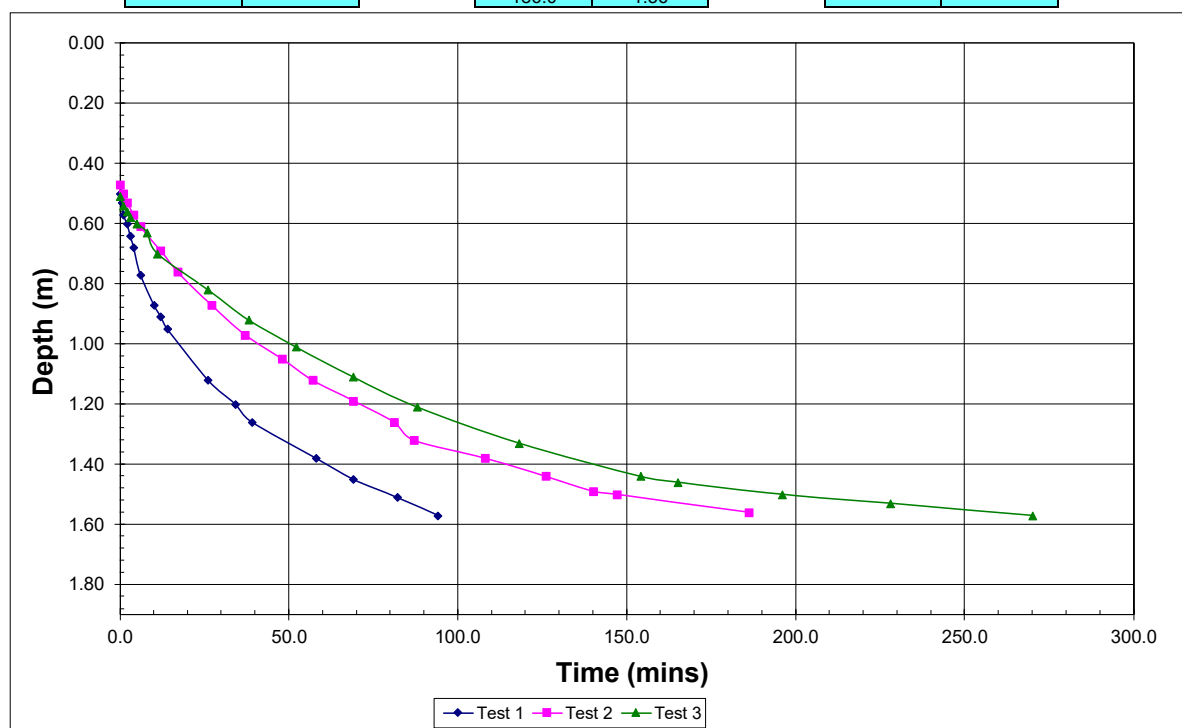
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA107
Pit depth (m)	1.92
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.50
0.5	0.53
1.0	0.57
2.0	0.60
3.0	0.64
4.0	0.68
6.0	0.77
10.0	0.87
12.0	0.91
14.0	0.95
26.0	1.12
34.0	1.20
39.0	1.26
58.0	1.38
69.0	1.45
82.0	1.51
94.0	1.57

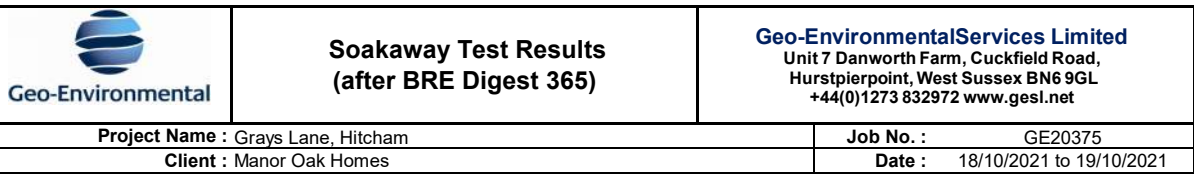
Test 2	
Time (min)	Depth (m)
0.0	0.47
1.0	0.50
2.0	0.53
4.0	0.57
6.0	0.61
12.0	0.69
17.0	0.76
27.0	0.87
37.0	0.97
48.0	1.05
57.0	1.12
69.0	1.19
81.0	1.26
87.0	1.32
108.0	1.38
126.0	1.44
140.0	1.49
147.0	1.50
186.0	1.56

Test 3	
Time (min)	Depth (m)
0.0	0.51
1.0	0.54
2.0	0.56
3.0	0.58
5.0	0.60
8.0	0.63
11.0	0.70
26.0	0.82
38.0	0.92
52.0	1.01
69.0	1.11
88.0	1.21
118.0	1.33
154.0	1.44
165.0	1.46
196.0	1.50
228.0	1.53
270.0	1.57



Max. depth (m)	1.92	1.81	1.76
Effective depth (m)	1.42	1.45	1.41
75% effective depth (m)	0.86	0.83	0.86
50% effective depth (m)	1.21	1.20	1.22
25% effective depth (m)	1.57	1.56	1.57
t75 (min)	8.00	23.00	28.00
t50 (min)	36.00	70.00	89.00
t25 (min)	94.00	186.00	270.00
Vp 75-25	0.64	0.65	0.63
ap 50	4.379	4.4525	4.3545
tp 75-25	86.00	163.00	242.00

Soil infiltration rate (m/s)	2.8E-05	1.5E-05	1.0E-05
Soil infiltration rate (mm/hr)	1.02E+02	5.39E+01	3.61E+01



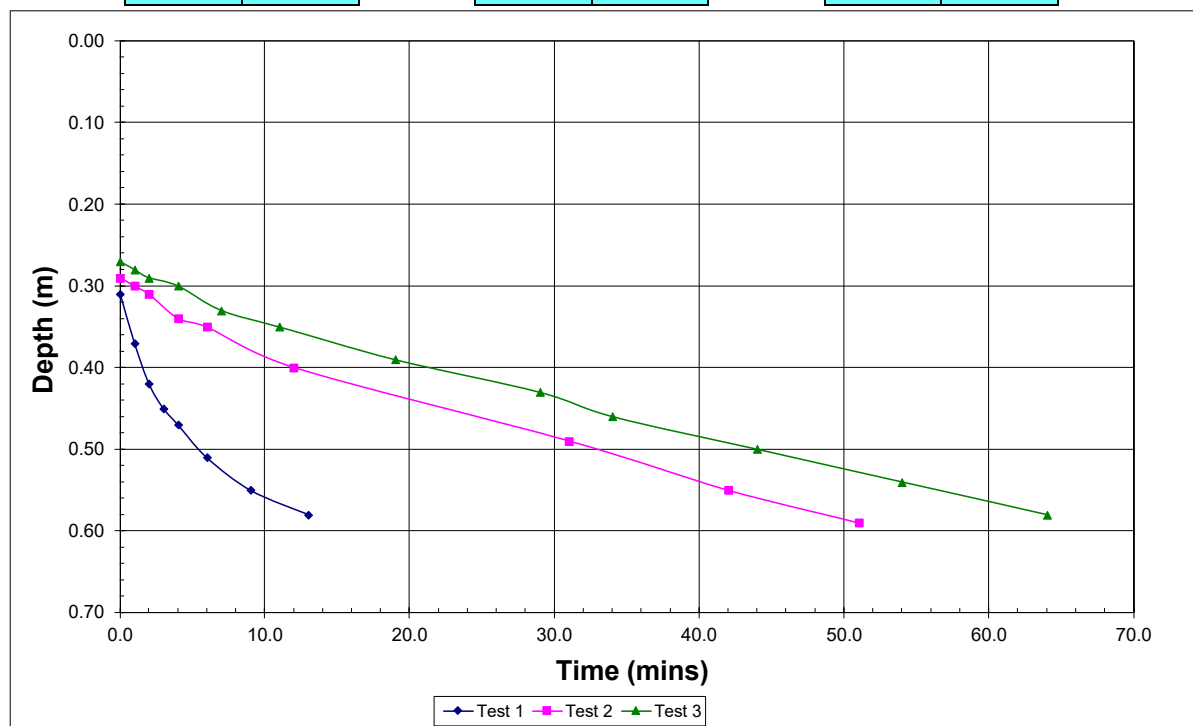
Job No. : GE20375

Date : 18/10/2021 to 19/10/2021

Pit reference	SA108
Pit depth (m)	0.67
Pit width (m)	0.45
Pit length (m)	1.90
Depth to standing water (m)	

[illegible][illegible]

Test 3	
Time (min)	Depth (m)
0.0	0.27
1.0	0.28
2.0	0.29
4.0	0.30
7.0	0.33
11.0	0.35
19.0	0.39
29.0	0.43
34.0	0.46
44.0	0.50
54.0	0.54
64.0	0.58



Max. depth (m)	0.67	0.67	0.67
Effective depth (m)	0.36	0.38	0.40
75% effective depth (m)	0.40	0.39	0.37
50% effective depth (m)	0.49	0.48	0.47
25% effective depth (m)	0.58	0.58	0.57
t75 (min)	1.50	10.00	15.00
t50 (min)	5.00	29.00	36.00
t25 (min)	13.00	49.00	63.00
Vp 75-25	0.15	0.16	0.17
ap 50	1.701	1.748	1.795
tp 75-25	11.50	39.00	48.00

Soil infiltration rate (m/s)	1.3E-04	4.0E-05	3.3E-05
Soil infiltration rate (mm/hr)	4.72E+02	1.43E+02	1.19E+02

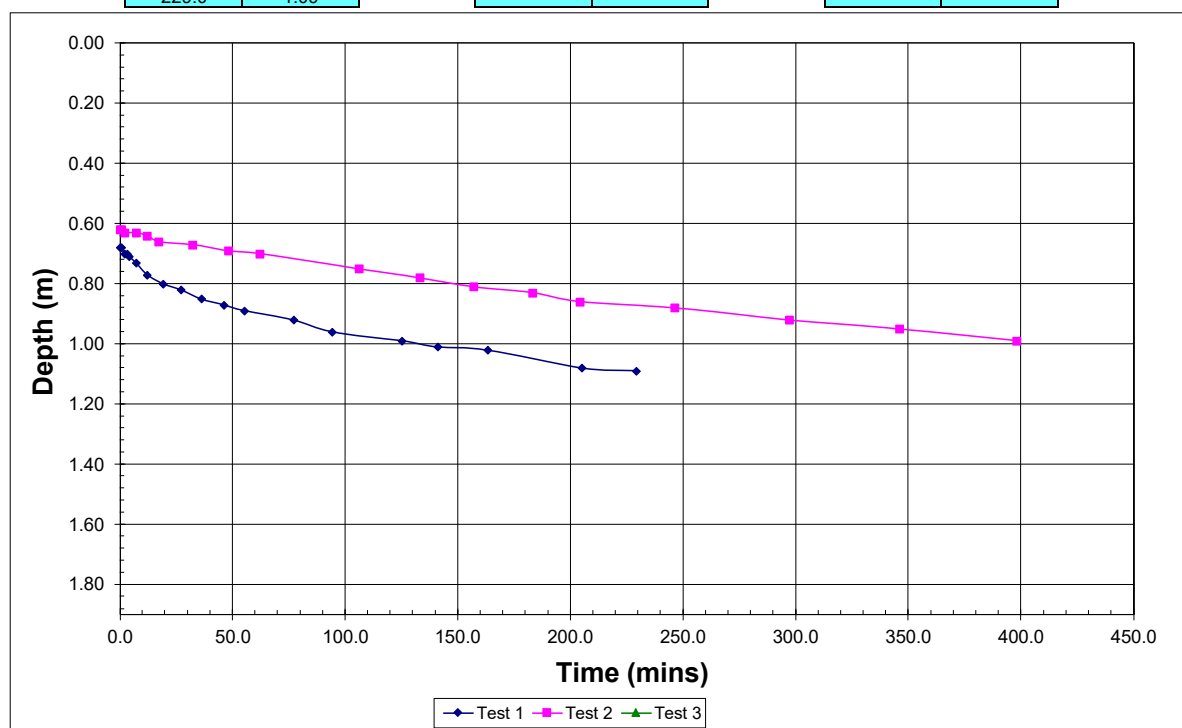
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesi.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA109
Pit depth (m)	1.88
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.68
0.5	0.68
2.0	0.70
3.0	0.70
4.0	0.71
7.0	0.73
12.0	0.77
19.0	0.80
27.0	0.82
36.0	0.85
46.0	0.87
55.0	0.89
77.0	0.92
94.0	0.96
125.0	0.99
141.0	1.01
163.0	1.02
205.0	1.08
229.0	1.09

Test 2	
Time (min)	Depth (m)
0.0	0.62
0.5	0.62
2.0	0.63
7.0	0.63
12.0	0.64
17.0	0.66
32.0	0.67
48.0	0.69
62.0	0.70
106.0	0.75
133.0	0.78
157.0	0.81
183.0	0.83
204.0	0.86
246.0	0.88
297.0	0.92
346.0	0.95
398.0	0.99

Test 3	
Time (min)	Depth (m)



Max. depth (m)	1.88	1.70	1.70
Effective depth (m)	1.20	1.26	1.88
75% effective depth (m)	0.98	0.94	0.47
50% effective depth (m)	1.28	1.25	0.94
25% effective depth (m)	1.58	1.57	1.41
t75 (min)			
t50 (min)			
t25 (min)			
Vp 75-25	0.54	0.57	0.85
ap 50	3.84	3.987	5.506
tp 75-25	0.00	0.00	0.00

Soil infiltration rate (m/s)	Insufficient fall in water to complete test	
Soil infiltration rate (mm/hr)	Insufficient fall in water to complete test	

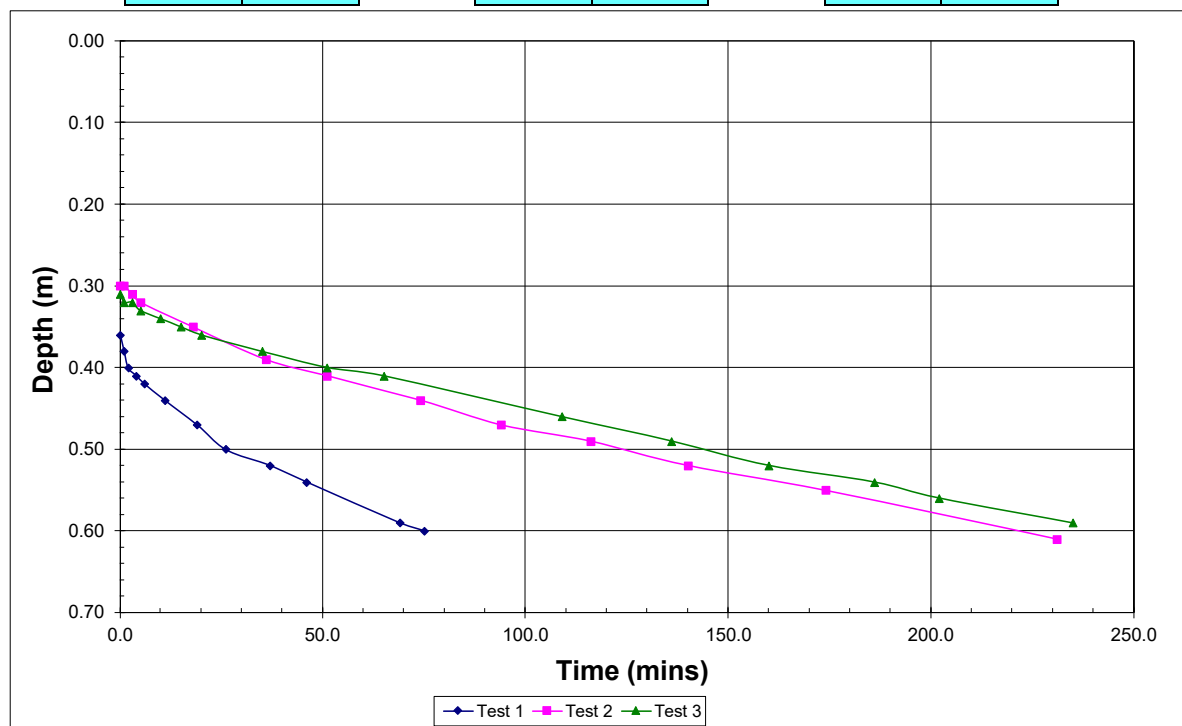
 Geo-Environmental	Soakaway Test Results (after BRE Digest 365)	Geo-Environmental Services Limited Unit 7 Danworth Farm, Cuckfield Road, Hurstpierpoint, West Sussex BN6 9GL +44(0)1273 832972 www.gesl.net
Project Name : Grays Lane, Hitcham Client : Manor Oak Homes		Job No. : GE20375 Date : 18/10/2021 to 19/10/2021

Pit reference	SA110
Pit depth (m)	0.68
Pit width (m)	0.45
Pit length (m)	2.00
Depth to standing water (m)	

Test 1	
Time (min)	Depth (m)
0.0	0.36
1.0	0.38
2.0	0.40
4.0	0.41
6.0	0.42
11.0	0.44
19.0	0.47
26.0	0.50
37.0	0.52
46.0	0.54
69.0	0.59
75.0	0.60

Test 2	
Time (min)	Depth (m)
0.0	0.30
1.0	0.30
3.0	0.31
5.0	0.32
18.0	0.35
36.0	0.39
51.0	0.41
74.0	0.44
94.0	0.47
116.0	0.49
140.0	0.52
174.0	0.55
231.0	0.61

Test 3	
Time (min)	Depth (m)
0.0	0.31
1.0	0.32
3.0	0.32
5.0	0.33
10.0	0.34
15.0	0.35
20.0	0.36
35.0	0.38
51.0	0.40
65.0	0.41
109.0	0.46
136.0	0.49
160.0	0.52
186.0	0.54
202.0	0.56
235.0	0.59



Max. depth (m)	0.68	66.00	0.61
Effective depth (m)	0.32	0.38	0.37
75% effective depth (m)	0.44	0.40	0.40
50% effective depth (m)	0.52	0.49	0.50
25% effective depth (m)	0.60	0.59	0.59
t75 (min)	11.00	45.00	51.00
t50 (min)	37.00	116.00	150.00
t25 (min)	75.00	220.00	235.00
Vp 75-25	0.14	0.17	0.17
ap 50	1.684	1.831	1.8065
tp 75-25	64.00	175.00	184.00

Soil infiltration rate (m/s)	2.2E-05	8.9E-06	8.3E-06
Soil infiltration rate (mm/hr)	8.02E+01	3.20E+01	3.01E+01



Notes:

- Based on MSurv 'Topographical Survey', drawing number 1215/1649/1 dated 09/10/15.
- Based on Hill Residential Limited 'Proposed Layout Section 73', drawing number 181-PA-2-001 A dated 29/04/25.
- Extent of permeable paving is indicative. Exact areas to be confirmed once surfacing types have been fixed.

Key

- Site Boundary = 21,935m²
- SA102 0.7mdp Viable Infiltration Test Result
- SA102 0.7mdp Unviable Infiltration Test Result
- Boundary where infiltration techniques are to be used as permeable paving

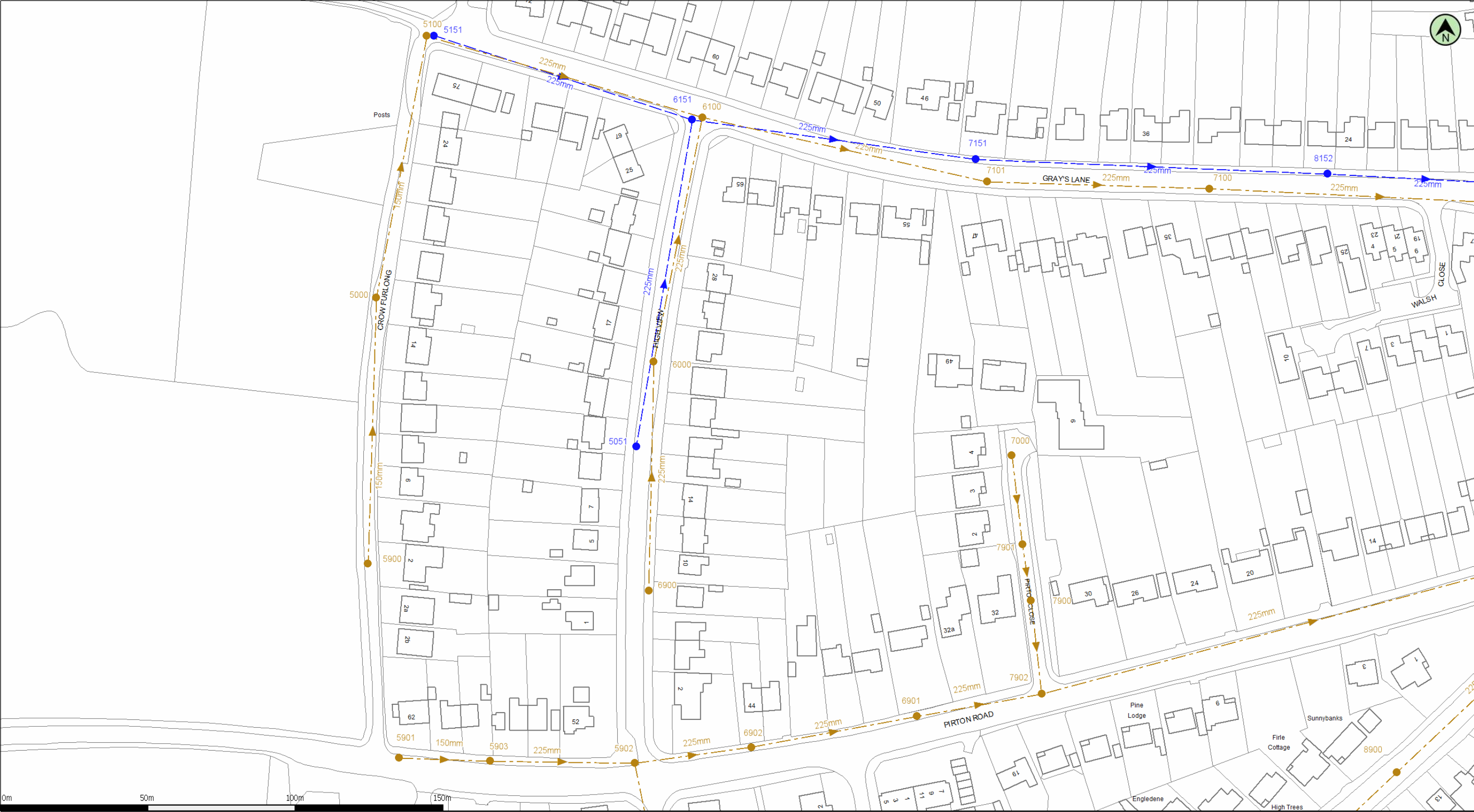


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- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes	Project: Land off Crow Furlong Hitchin
Title: Infiltration Test Locations with Viable Area of Use	Date: 09/06/25 Drw: MJA Chk: MJA
Drawing No: 1318-FRA105	Revision: A Scale: 1:500 Size: A2

Appendix G
Water Company Asset Plans



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Date: 13/01/15

Scale: 1:1250

Map Centre: 517632,229040

Data updated: 02/01/15

Our Ref: 125319 - 1

Wastewater Plan A3

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. The plan is produced by Anglian Water Services Limited from Ordnance Survey © Crown Copyright, 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.

Foul Sewer		Outfall	
Surface Sewer		(Colour denotes effluent type)	
Combined Sewer		Inlet	
Final Effluent		(Colour denotes effluent type)	
Rising Main		Manhole	
(Colour denotes effluent type)		(Colour denotes effluent type)	
Private Sewer		Sewage Treatment Works	
(Colour denotes effluent type)		Pumping Station	
Decommissioned Sewer			
(Colour denotes effluent type)			

martin.andrews@jppuk.net

Hitchin





Appendix H

Exceedance Routes
MAC drawing no. 1318-FRA106A



Notes:

1. Based on MSurv 'Topographical Survey', drawing number 1215/1649/1 dated 09/10/15.
2. Based on Hill Residential Limited 'Proposed Layout Section 73', drawing number 181-PA-2-001 A dated 29/04/25.

Key

- Site Boundary
- Direction of Overland Flow (indicative subject to final level design)



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Martin Andrews Consulting Ltd

- Transport Assessments
- Flood Risk Assessments
- Highway Advice
- Access Design
- Drainage Strategies
- Vehicle tracking

Client: Manor Oak Homes		Project: Land off Crow Furlong Hitchin	
Title: Exceedance Routes		Date: 09/06/25	
		Drw: MJA	
		Chk: MJA	
Drawing No: 1318-FRA106		Revision: A	Scale: 1:500
			Size: A2