FOUL AND SURFACE WATER

DRAINAGE STRATEGY

FOR

LAND EAST OF PINES HILL, STANSTED MOUNTFITCHET

MARCH 2023

CONTENTS

APPENDICES

Report prepared by:

Richard James BEng (Hons) IEng MICE

1. INTRODUCTION

1.1. This report has been commissioned by Luxus Homes Limited to provide a Drainage Strategy for the proposed development of Land East of Pines Hill Stansted Mountfitchet. The report commissioned is an update to the previous revision (dated December 2021) that was issued as part of the refused application UTT/21/2730/OP. Following the refusal, BRE 365 Infiltration Soakaway testing was undertaken and the results are contained herein.

1.2. The purpose of this report is to demonstrate that a viable and sustainable strategy for the management and disposal of surface water runoff with climate change allowances for the development can be achieved whilst simultaneously achieving a viable solution for foul water disposal.

1.3. The proposed works comprise of redevelopment of the existing site to create 31 residential units, access road, associated hard and soft landscaping, driveways and car parking.

1.4. This report has been prepared using the following data/information from various sources including:

- Brown 2 Green Phase 1 Geo- Environmental Report dated June 2021
- Herts and Essex Site Investigation Soakaway Testing Report Dated 2nd December 2021
- One Architecture Proposed site plan 002.21 SK05
- The Essex Design Guide – Sustainable Drainage Design Guide

1.5. This report has been prepared in accordance with the NPPF, local planning policies and the accompanying Technical Guidance.

1.6. This report has been prepared by Richard James BEng (Hons) IEng MICE.

Footnote

Confirmation has been received from Essex County Council Drainage Engineer, Alison Vaughan, that the proposals contained herein meet the requirements in terms of SUDS drainage for the site. Consequently, no further objections would be made to any subsequent planning application and any concerns arising under the holding objection raised against the previous planning application (UTT/21/2730/OP) for this site have now been fully addressed. (Ref email dated 14/01/22 appended).

2. SITE CONDITIONS

SITE LOCATION AND USE

2.1 The site extends of an approximate area of 1Ha and is site is located on land East of Pines Hill Stansted Mountfitchet.

2.2 The site is bounded by Pines Hill to the west and Stoney Common Road to the north.

2.3 The site is centred on National Grid reference 550860, 224440

SITE LOCATION PLAN

2.4 The existing site is currently vacant undeveloped land and a copy of the existing site topographical survey is included in Appendix A.

SITE GEOLOGY

2.5 The conditions at the site are detailed below in Table 1 and are based on the findings noted in the Brown 2 Green Associates Ltd Phase 1 Geo-Environmental Desk Study Dated June 2021.

TABLE 1: GEOLOGICAL GROUND CONDITIONS

Formation	Description
Superficial Deposits	Glaciofluvial Deposits sand and gravel.
Solid	Lewis Nodular Chalk Formation and Seaford Chalk Formation

2.6 A review of Geological logs held by the British Geological Survey indicate the nearest is located immediately north of Stoney Common Road which indicates the area is underlain by approximately 1m of gravelly clay, overlying sand and gravel.

2.7 A borehole log for a borehole drilled 100m to the west identified the top of the chalk to be at 9.3m below ground level.

2.8 Hydrogeological mapping suggests that the groundwater level lies at around 62m AOD with site levels from around 72-77m AOD.

2.9 The Superficial Deposits are classified as a Secondary A Aquifer. The solid geology is classified as a Principal Aquifer.

2.10 The site does not lie within a Source Protection Zone within the vicinity of the site. The nearest is a Zone 1 located 200m to the north. The Source protection Zone surrounds an abstraction well used for the potable water supply.

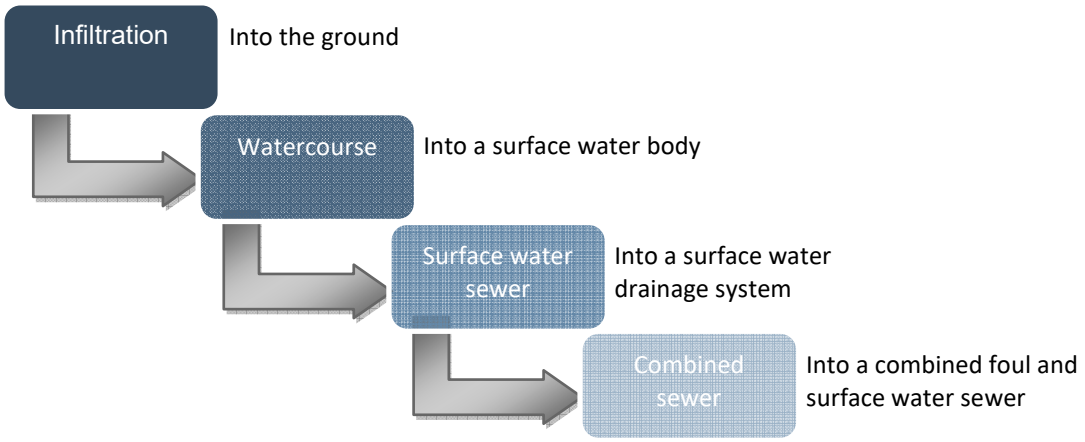
2.11 A previous geotechnical desk study report produced in 2013 by ST Consult on the development site confirmed that the soakage potential within the sands and gravels is likely to be good.

2.12 Soakaway testing undertaken at the site by Herts and Essex Site Investigations obtained infiltration rates across the site that varied from $5.68x10^{-6}$m/s to $2.68x10^{-6}$m/s. Based on this information the report confirmed that soakaways would provide

a viable drainage option for the site. A copy of the test results have been included in appendix H.

2.13 The aim of sustainable drainage systems is to dispose of surface water using the following hierarchy were reasonably practicable.

TABLE 1: SURFACE WATER DISPOSAL HIERARCHY



2.14 The assessment of what is considered to be reasonably practicable in terms of sustainable drainage system provision should consider the costs associated with the design, construction, operation and maintenance of the system, and whether these are economically proportionate in relation to the consumer costs for an effective drainage system that instead connects directly to a public sewer.

3. PROPOSED DEVELOPMENT

3.1 The proposal for the site consists of the construction of 31 new residential units including the associated access road, driveways and hard and soft landscaping.

3.2 Refer to Appendix B for a copy of the Proposed Site Plan.

4 SURFACE AND FOUL WATER DRAINAGE DESIGN

EXISTING

4.1 A copy of the Thames Water sewer asset plans is included in Appendix C.

4.2 The records indicate that the only public surface water sewer in the area is located at the junction of Stoney Common Road and Old Bell Close.

4.3 The records also indicate a 450mm diameter public foul water sewer running through the site from North East to South West.

EAST EXISTING RUNOFF RATES

4.4 In Table 5 below, is a summary of the approximate greenfield run off rates for the entire developable site (1.0Ha). Refer to Appendix D for calculations.

TABLE 5: GREENFIELD RUN OFF RATES

Event	Greenfield Run Off Rate
QBar	3.1 l/s
1 in 1 year	2.6 l/s
1 in 30 year	6.9 l/s
1 in 100 year	9.7 l/s

4.5 The total site area is 1.0Ha of which it is calculated that 0.49 Ha is impermeable made up of 0.27 Ha roads and driveways and 0.22Ha buildings.

CLIMATE CHANGE ALLOWANCES

4.6 The guidance by the EA is replicated below in Table 6 where the drainage system is to be designed to accommodate a 20% climate change allowance on top of the 1 in 100-year storms. Applicants should apply a sensitivity test against the 40% climate change allowance to ensure that the additional runoff is wholly contained within the site and that there is no increase in the rate of runoff discharged from the site.

TABLE 6: PEAK RAINFALL INTENSITY CLIMATE CHANGE ALLOWANCE

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%

LOCAL GUIDANCE

4.7 Essex County Council Sustainable Drainage Systems Design Guide sets out the aims to incorporate SuDS into developments to reduce surface water flood risk.

4.8 We reviewed the selection of drainage/attenuation and SuDS components in line with the drainage hierarchy listed in the London Plan policy 5.13 and the table below provides the justification of the SuDS measures:

SUDS technique	Adopted	Not Adopted	Reason
Store Rainwater for later use		×	Rainwater harvesting is not proposed on the scheme due to the high initial installation cost making the provision of RWH economically unviable.
Use infiltration technics	×		The site is underlain by sands and gravels and therefore the use of infiltration is viable. It is proposed that individual soakaways will be used for each building and permeable surfacing will be used for the roads and driveways.
Attenuate rainwater in ponds or open water features i.e. Filter Strips / swales		×	There is not sufficient open space within the development to accommodate open water features.
Attenuate rainwater in sealed tanks		×	Below ground attenuation is not proposed on the site due to the provision of SuDS.
Discharge direct to a watercourse		×	There are no watercourses surrounding the site.
Discharge to a surface water drain		×	Infiltration drainage is proposed at the site and so a connection to a surface water sewer is not required.
Discharge to a combined sewer		×	There are no combined sewers surrounding the site.

PROPOSED SURFACE WATER STRATEGY

4.9 The site is currently undeveloped and considered greenfield.

4.10 The site is underlain by sands and gravels and therefore the use of infiltration drainage is viable.

4.11 Infiltration testing undertaken has been undertaken at the site, the worst rate obtained was $2.68x10^{-6}$m/s and this rate has been used in the design of the infiltration features on the site.

4.12 It is proposed that the new roads and driveways will be constructed using a permeable surface with a low fines sub base storage.

4.13 Based on an area of 2700m^3 for the impermeable area of the roads and driveways and a worst-case infiltration rate obtained on the site of $2.68x10^{-6}$m/s then a depth of sub base of 500mm is required. See attached a copy of the supporting calculations in appendix F. The design has been sized to accommodate events up to an including the 1 in 100-year event plus an allowance of 40% for climate change.

4.14 The surface water for each house will connect to a suitably sized soakaway. The soakaway being sized to accommodate events up to an including the 1 in 100-year event plus an allowance of 40% for climate change plus an additional allowance in area of 10% to allow for future urban creep.

For areas up to 180m2 – 4mx3mx1m Soakaway

For areas up to 150m^2 – 3x4x1m Soakaway

For areas up to 100m^2 – 3x3x1m Soakaway

4.15 Drainage calculation justifying the size of each soakaway are included in Appendix E

4.16 The proposed drainage strategy for the site is indicated in Appendix F

PROPOSED FOUL WATER STRATEGY

4.17 The new proposed buildings will have a proposed foul water network that will convey all generated foul flows through a gravity system and connect in to the public foul water sewer running through the site.

4.18 The public foul water sewer will be diverted to avoid the proposed new buildings, subject to agreement with Thames Water.

4.19 The foul water drainage for each plot will connect to the Thames Water public foul water sewer running through the site.

4.20 A Thames Water pre-development enquiry will be submitted in due course which will confirm that there is capacity within the public foul sewer network to accommodate the post development flows from the site.

5 SUDS MAINTENANCE AND MANAGEMENT

5.1 The responsibility for the enacting of this SuDS Maintenance and Management Plan will be the responsibility of each property owner, the roads and the associated drainage for the roads will be maintained by a management company set up by the property owners.

GULLIES

5.2 Gullies provide a degree of pollution control in preventing silt and debris passing into the sewer network.

GULLY MAINTENANCE

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Clean and empty gullies.	Quarterly.

CATCHPITS

5.3 Catchpit chambers and manholes provide a degree of pollution control in preventing silt and debris passing forwards into the drainage network.

5.4 The operation and maintenance requirements are given in the table below:

CATCHPIT MAINTENANCE

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Clean and empty catchpits.	Quarterly.

BELOW GROUND MANHOLES AND DRAINAGE - GENERAL

5.5 Manholes and Catchpit Inspections should be frequent and regular, depending on local conditions, but at least annually. The drainage system should be cleaned / jetted as necessary.

PERMEABLE PAVING

5.6 Permeable block paving allows water to infiltrate through gaps between the blocks into a lined layer of granular material, from which it is collected and discharges into the below ground drainage network.

5.7 The operation and maintenance requirements are given the table below:

PERMEABLE PAVING MAINTENANCE

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Sweeping. **Note:** Any jointing material between the blocks that is lost or displaced as a result of sweeping must be replaced. New jointing material must be the same type as that removed or a suitable replacement.	Three times a year at the end of winter, mid-summer and after autumn lead fall. Also as required based on site-specific observations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas to prevent excess sediment being washing into the paving. Removal of weed.	As required
Remedial actions	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users. Rehabilitation of surface and underlying sand and geotextile.	As required
Monitoring	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	Monthly for three months after installation, then during regular maintenance visits.

5.8 Over time the ability of the permeable paving to infiltrate and convey surface water run-off may degrade due to clogging of the joints by silt and other sediments.

5.9 All areas of permeable pavement should be regularly inspected by those responsible, preferably during and after heavy rainfall to check effective operation and to identify any areas of ponding.

MODULAR CELLULAR SOAKAWAYS

5.10 These plastic geocellular systems wrapped in a permeable geomembrane have a high void ratio, which is used to provide storm water storage and may allow for infiltration into the ground where soils permit.

5.11 Water from the proposed areas of hardstanding is routed to a cellular Soakaway tank as set out in drainage strategy drawings.

5.12 The operation and maintenance requirements are given in the table below:

MODULAR SOAKAWAY MAINTENANCE

MAINTENANCE SCHEDULE	REQUIRED ACTION	RECOMMENDED FREQUENCY
Regular maintenance	Remove sediment and debris from catchpits and geocellular crates.	Annually.
Remedial actions	Repair/rehabilitation of inlets, outlets, vents.	As required.
Monitoring	Inspect catchpits and note rate of sediment accumulation.	Monthly in the first year and then annually.

6 RECOMMENDATIONS AND CONCLUSIONS

6.1 The proposed works comprise of redevelopment of the existing site to create 31 residential units, access road, associated hard and soft landscaping, driveways and car parking.

6.2 Geological conditions at the site are based on the Brown 2 Green phase 1 desk study which indicates the site is underlain by superficial deposits of sands and gravels over Chalk.

6.3 Based on the ground conditions it is understood that infiltration drainage will be viable on the site and infiltration testing will be undertaken in order to verify the proposed design. An assumed infiltration rate of $1x10^{-5}$m/s has been used as the basis for the design.

6.4 The proposed development site is located entirely within Flood Zone 1 land classified as Land having less than 1 in 1000 annual probability of river or sea flooding. The site is classified as 'More Vulnerable' (Flood Risk Vulnerability Classification) and therefore, the development is classified as 'appropriate'.

6.5 If is proposed that runoff from each property will drain to a suitably sized individual soakaway while runoff from the roads will be dealt with via permeable surfacing with sub base storage. This arrangement will also ensure that any runoff is suitably treated in line with the requirement of the SuDS manual.

6.6 The drainage has been sized to accommodate storm events up to and including the 1 in 100-year event plus an allowance of 40% for climate change.

6.7 As the buildings will be 150mm higher than the surrounding ground and the levels will be designed to ensure that falls are generally away from the buildings. This will ensure that during any exceedance event the properties will remain protected.

6.8 The surface water drainage design principles set out in this document will ensure that the development does not increase the risk of flooding to the surrounding area.

6.9 The proposed surface water drainage and SuDS design principles set out in this document will ensure that the development does not increase the risk of flooding to the surrounding area and will mimic the pre-development site.

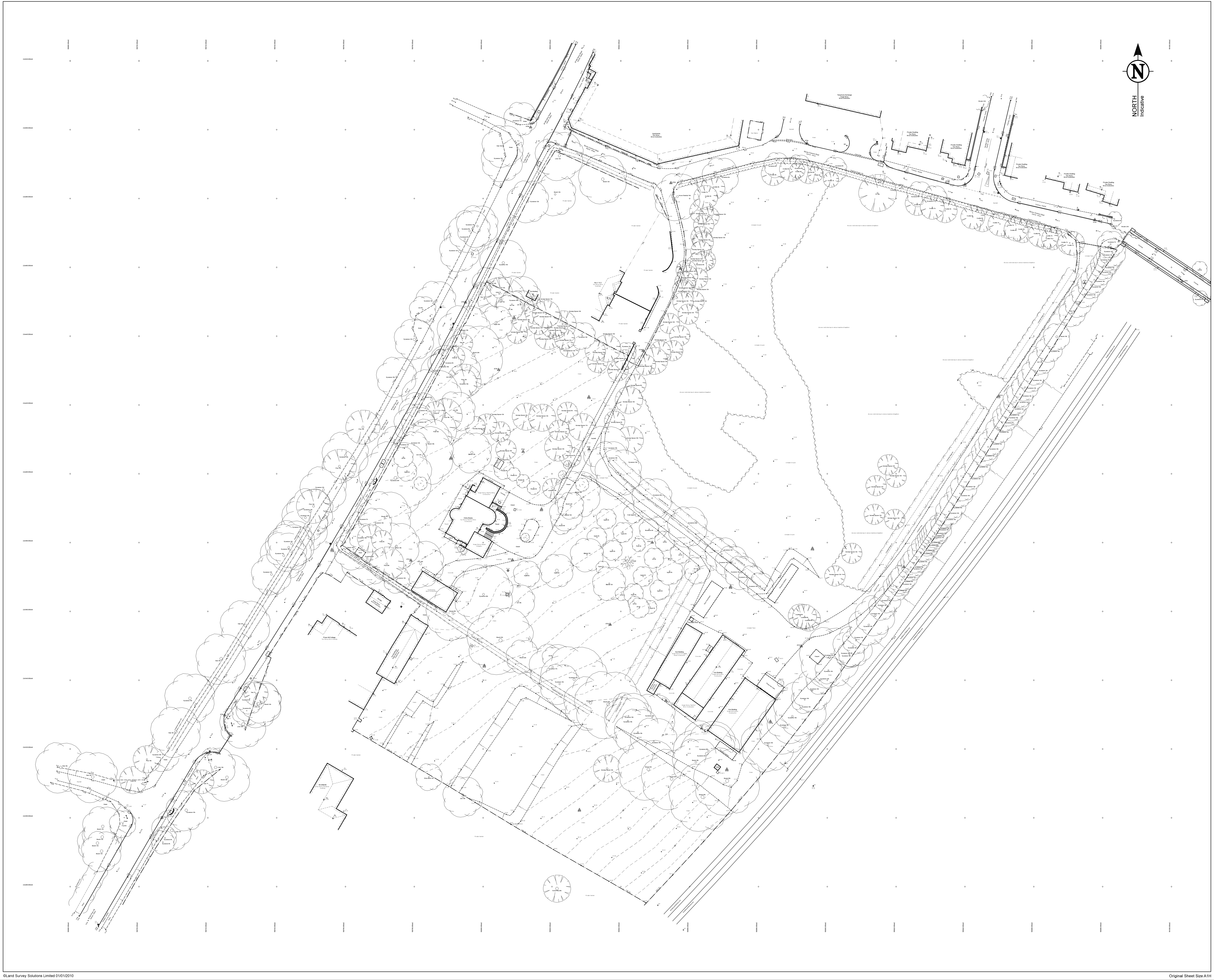
6.10 Taking into account the flood risks to the site from all sources following the proposed development, the overall post-development flood risk is deemed to remain low.

6.11 A copy of the Essex County Council SuDS and Water Quality Proforma is included in Appendix G

6.12 Foul water from the development will be connected to the Thames Water public sewer running through the site. It is anticipated that there is sufficient capacity within this sewer to accommodate the development.

APPENDIX A

Existing Site Layout



TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	FH	Fire Hydrant	RSJ	Rolled Steel Joist
AR	Assumed Route	FBD	Floor Board Direction	SI	Sign Post
AV	Air Valve	FH	Fire Hydrant	SP	Arch Spring Point Height
BB	Belisha Beacon	FL	Floor Level	SV	Stop Valve
BH	Bore Hole	FP	Flag Pole	SW	Surface Water
BL	Bed Level	FW	Foul Water	SY	Stay
BO	Bollard	GG	Gully Grate	Tac	Tactile Paving
BrP	Brace Post	GV	Gas Valve	TC	Telecom Cover
BS	Bus Stop	HH	Head Height	TH	Trial Pit
BU	Bush	IC	Inspection Cover	THL	Threshold Level
B/W	Barbed Wire Fence	IL	Invert Level	TL	Traffic Light
BX	Box (Utilities)	I/R	Iron Railings	ToW	Top of Wall
C/B	Close Board Fence	KO	Kerb Outlet	TP	Telegraph Pole
CH	Cill Height	LP	Lamp Post	TV	Cable TV Cover
CL	Cover Level	MH	Manhole	UB	Universal Beam
C/L	Chain Link Fence	MP	Marker Post	UC	Unknown Cover
C-Lev	Ceiling Level	NB	Name Board	UK	Unknown Tree
Col	Column	OHL	Overhead Line (approx)	USB	Under Side Beam
C/P	Chestnut Paling Fence	Pan	Panel Fence	UTL	Unable To Lift
CR	Cable Riser	PB	Post Box	VP	Vent Pipe
DC	Drainage Channel	PM	Parking Meter	WB	Waste Bin
DH	Door Head Height	PO	Post	WH	Weep Hole
DP	Down Pipe	P/R	Post & Rail Fence	WL	Water Level
DR	Drain	P/W	Post & Wire Fence	WM	Water Meter
EL	Eaves Level	P/Wall	Partition Wall	WO	Wash Out
EP	Electric Pole	RE	Rodding Eye	(X.XX)	Floor to Ceiling Height
ER	Earth Rod	RL	Ridge Level		
ET	EP+Transformer	RP	Reflector Post	(X.XX) F/C	Floor to False Ceiling Ht
FB	Flower Bed	RS	Road Sign		
FBD	Floor Board Direction	RSD	Roller Shutter Door	△	Survey Control Station

DRAWING NOTE

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

Do not scale from this drawing.

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	551003.046	224455.912	71.011	PK Nail
ST02	550977.732	224473.827	71.542	PK Nail
ST03	550939.994	224484.138	73.834	PK Nail
ST04	550894.107	224496.044	77.700	PK Nail
ST05	550854.555	224484.509	79.592	PK Nail
ST06	550813.797	224500.711	80.510	PK Nail
ST07	550794.892	224449.794	78.634	PK Nail
ST08	550756.079	224377.942	75.786	PK Nail
ST09	550724.883	224329.805	73.805	PK Nail
ST10	550706.637	224299.954	72.544	PK Nail
ST20	550974.745	224455.435	71.369	PK Nail
ST21	550949.859	224422.477	70.667	PK Nail
ST22	550922.212	224372.888	68.513	PK Nail
ST23	550892.428	224349.878	69.060	PK Nail
ST24	550883.472	224327.998	68.907	Peg & Nail
ST25	550870.822	224314.112	68.717	Peg & Nail
ST26	550863.505	224326.034	68.975	PK Nail
ST27	550853.110	224334.091	69.253	PK Nail
ST28	550895.698	224378.305	71.422	Peg & Nail
ST30	550871.860	224367.128	69.826	PK Nail
ST31	550827.975	224302.335	68.953	Peg & Nail
ST32	550800.355	224344.243	73.086	Peg & Nail
ST33	550808.528	224374.926	74.828	PK Nail
ST34	550778.992	224374.812	76.245	Peg & Nail
ST35	550790.631	224404.600	77.379	Peg & Nail
ST36	550804.502	224430.231	78.302	Peg & Nail
ST37	550809.016	224445.369	79.162	Peg & Nail
ST38	550830.728	224422.347	76.837	Peg & Nail
ST40	550857.344	224459.658	77.829	PK Nail
ST41	550816.977	224389.714	75.179	PK Nail
ST42	550836.892	224356.167	72.695	Peg & Nail
ST43	550849.102	224380.021	73.665	Peg & Nail
ST44	550811.620	224406.438	76.712	Peg & Nail
ST45	550830.777	224407.113	75.486	PK Nail
ST46	550846.490	224435.755	76.785	Peg & Nail

SURVEY GRID AND LEVEL DATUM

Ordnance Survey (OS) national grid coordinates have been established for survey control point ST01 using GPS and related to OSTN02(GB) and OSGM02(GB). The survey grid is orientated to Grid North with a scale factor of 1.000.

All levels relate to the Ordnance Survey (OS) level datum at survey control point ST01 established by GPS using OSGM02(GB).

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

Ipswich Coventry Yeovil Norwich Perth Nottingham Brentwood

Tel No: 0845 0405 969 Fax No: 0845 0405 970
[redacted] enquiries@survey-solutions.co.uk

LAND SURVEYING BUILDING SURVEYING UNDERGROUND SURVEYING

PROJECT TITLE PINES HILL, STANSTED MOUNTFITCHET, ESSEX, CM24 8EY				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 1 of 1				
CLIENT GALLIFORD TRY				SCALE 1:500
SURVEYOR KJS/MWK	SURVEY DATE 01/12/2020	CHECKED BY MWK	APPROVED BY GJN	DWG STATUS FINAL
DRAWING NUMBER 30108NOLS-04			REVISION	ISSUE DATE 01/12/2020

Original Sheet Size A1H

APPENDIX B

Proposed Site Layout

N

Revision Note & Date
Rev Date Note Initial

ON ARCHITECTURE

Canterbury Studio
Logan House, St Andrews Close
Canterbury
CT1 2RP

info@onarchitecture.co.uk
[redacted]
01227 634334

Project Title
Land at Pines Hill, Stansted Mountifitchet

Client Details
Luxus Homes

Drawing Title
Illustrative Masterplan

BIM Number

Scale	Date	Drawn	Checked
1:500 @ A1	August 2021		

Drawing Status
Planning

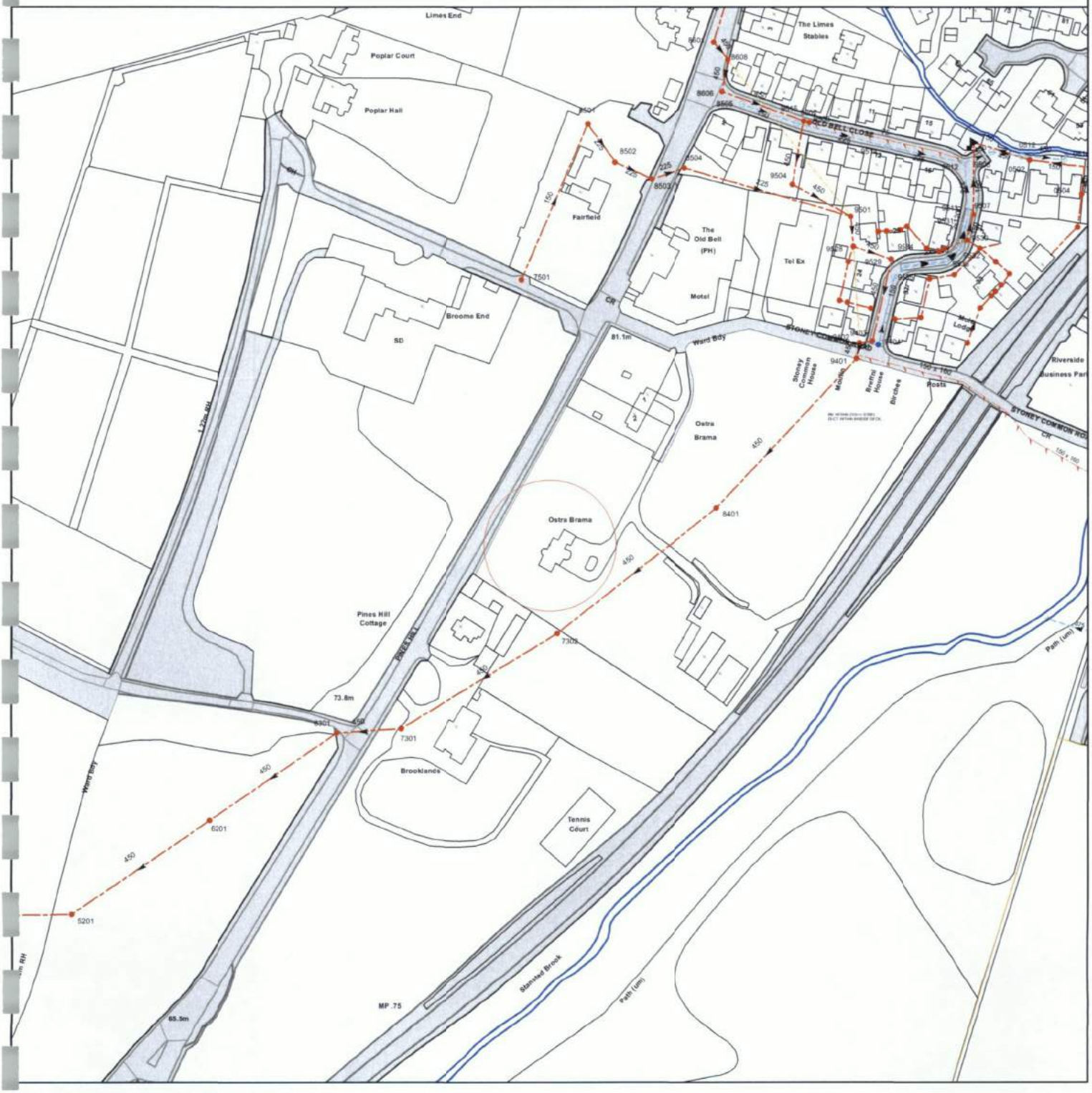
Project Number	Drawing Number	Drawing Revision
002.21	SK20	

APPENDIX C

Thames Water Sewer Records

Based on the Ordnance Survey Map with the sanction of the Controller of H.M Stationary Office License Number 10019345

DWS/DWS Standard/2012_2260234



Scale:	1:2526
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Printed By:	mrajen
Print Date:	26/06/2012
Map Centre:	550794,224392
Grid Reference:	TL5024SE

Comments:

APPENDIX D

Greenfield Runoff Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	SAAR (mm)	638	Urban	0.000
Area (ha)	1.000	Soil	0.400	Region Number	Region 6

Results	**l/s**
QBAR Rural	3.1
QBAR Urban	3.1
Q100 years	9.7
Q1 year	2.6
Q30 years	6.9
Q100 years	9.7

APPENDIX E

Microdrainage Surface Water Calculations

Date 05/12/2021 19:10	Designed by
File Roads and Driveways.SRCX	Checked by
Innovyze	Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 619 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	69.746	0.346	1.5	57.5	Flood Risk
30 min Summer	69.802	0.402	1.7	77.5	Flood Risk
60 min Summer	69.849	0.449	1.9	96.6	Flood Risk
120 min Summer	69.886	0.486	2.1	113.3	Flood Risk
180 min Summer	69.902	0.502	2.1	120.9	Flood Risk
240 min Summer	69.910	0.510	2.2	124.8	Flood Risk
360 min Summer	69.915	0.515	2.2	127.1	Flood Risk
480 min Summer	69.914	0.514	2.2	126.8	Flood Risk
600 min Summer	69.913	0.513	2.2	126.1	Flood Risk
720 min Summer	69.911	0.511	2.2	125.2	Flood Risk
960 min Summer	69.906	0.506	2.2	123.0	Flood Risk
1440 min Summer	69.894	0.494	2.1	117.2	Flood Risk
2160 min Summer	69.873	0.473	2.0	107.4	Flood Risk
2880 min Summer	69.852	0.452	1.9	98.0	Flood Risk
4320 min Summer	69.813	0.413	1.8	81.8	Flood Risk
5760 min Summer	69.779	0.379	1.6	69.1	Flood Risk
7200 min Summer	69.751	0.351	1.5	59.1	Flood Risk
8640 min Summer	69.726	0.326	1.4	51.1	Flood Risk
10080 min Summer	69.704	0.304	1.3	44.4	Flood Risk
15 min Winter	69.771	0.371	1.6	66.1	Flood Risk
30 min Winter	69.830	0.430	1.8	88.6	Flood Risk
60 min Winter	69.879	0.479	2.0	110.1	Flood Risk
120 min Winter	69.919	0.519	2.2	129.2	Flood Risk
180 min Winter	69.936	0.536	2.3	138.1	Flood Risk
240 min Winter	69.945	0.545	2.3	142.7	Flood Risk
360 min Winter	69.952	0.552	2.4	146.0	Flood Risk
480 min Winter	69.952	0.552	2.4	146.3	Flood Risk
600 min Winter	69.949	0.549	2.3	144.7	Flood Risk
720 min Winter	69.946	0.546	2.3	143.0	Flood Risk
960 min Winter	69.940	0.540	2.3	139.7	Flood Risk
1440 min Winter	69.922	0.522	2.2	130.8	Flood Risk
2160 min Winter	69.892	0.492	2.1	116.4	Flood Risk
2880 min Winter	69.863	0.463	2.0	103.0	Flood Risk
4320 min Winter	69.810	0.410	1.8	80.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	143.169	0.0	26
30 min Summer	92.371	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.671	0.0	128
180 min Summer	24.520	0.0	186
240 min Summer	19.481	0.0	244
360 min Summer	14.011	0.0	362
480 min Summer	11.097	0.0	442
600 min Summer	9.254	0.0	496
720 min Summer	7.976	0.0	558
960 min Summer	6.303	0.0	684
1440 min Summer	4.519	0.0	958
2160 min Summer	3.235	0.0	1368
2880 min Summer	2.550	0.0	1764
4320 min Summer	1.821	0.0	2552
5760 min Summer	1.433	0.0	3296
7200 min Summer	1.190	0.0	4040
8640 min Summer	1.022	0.0	4760
10080 min Summer	0.898	0.0	5464
15 min Winter	143.169	0.0	26
30 min Winter	92.371	0.0	40
60 min Winter	56.713	0.0	68
120 min Winter	33.671	0.0	126
180 min Winter	24.520	0.0	182
240 min Winter	19.481	0.0	240
360 min Winter	14.011	0.0	352
480 min Winter	11.097	0.0	460
600 min Winter	9.254	0.0	560
720 min Winter	7.976	0.0	580
960 min Winter	6.303	0.0	732
1440 min Winter	4.519	0.0	1034
2160 min Winter	3.235	0.0	1476
2880 min Winter	2.550	0.0	1900
4320 min Winter	1.821	0.0	2688

Date 05/12/2021 19:10	Designed by
File Roads and Driveways.SRCX	Checked by
Innovyze	Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
5760 min Winter	69.766	0.366	1.6	64.3	Flood Risk
7200 min Winter	69.729	0.329	1.4	51.9	Flood Risk
8640 min Winter	69.697	0.297	1.3	42.4	O K
10080 min Winter	69.671	0.271	1.2	35.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
5760 min Winter	1.433	0.0	3464
7200 min Winter	1.190	0.0	4184
8640 min Winter	1.022	0.0	4928
10080 min Winter	0.898	0.0	5648

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Innovyze	Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Ratio R	0.443	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.270

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.090	4	8	0.090	8	12	0.090

Date 05/12/2021 19:10
File Roads and Driveways.SRCX

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Model Details

Storage is Online Cover Level (m) 70.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00960	Width (m)	16.0
Membrane Percolation (mm/hr)	1000	Length (m)	170.0
Max Percolation (l/s)	755.6	Slope (1:X)	200.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	69.400	Membrane Depth (m)	0

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 996 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	68.318	0.318	0.1	2.7	O K
30 min Summer	68.408	0.408	0.1	3.5	O K
60 min Summer	68.494	0.494	0.1	4.2	O K
120 min Summer	68.571	0.571	0.1	4.9	O K
180 min Summer	68.608	0.608	0.1	5.2	O K
240 min Summer	68.629	0.629	0.1	5.4	O K
360 min Summer	68.646	0.646	0.1	5.5	O K
480 min Summer	68.650	0.650	0.1	5.6	O K
600 min Summer	68.647	0.647	0.1	5.5	O K
720 min Summer	68.638	0.638	0.1	5.5	O K
960 min Summer	68.617	0.617	0.1	5.3	O K
1440 min Summer	68.578	0.578	0.1	4.9	O K
2160 min Summer	68.527	0.527	0.1	4.5	O K
2880 min Summer	68.481	0.481	0.1	4.1	O K
4320 min Summer	68.399	0.399	0.1	3.4	O K
5760 min Summer	68.328	0.328	0.1	2.8	O K
7200 min Summer	68.267	0.267	0.0	2.3	O K
8640 min Summer	68.214	0.214	0.0	1.8	O K
10080 min Summer	68.170	0.170	0.0	1.5	O K
15 min Winter	68.356	0.356	0.1	3.0	O K
30 min Winter	68.458	0.458	0.1	3.9	O K
60 min Winter	68.555	0.555	0.1	4.7	O K
120 min Winter	68.644	0.644	0.1	5.5	O K
180 min Winter	68.688	0.688	0.1	5.9	O K
240 min Winter	68.714	0.714	0.1	6.1	O K
360 min Winter	68.737	0.737	0.1	6.3	O K
480 min Winter	68.747	0.747	0.1	6.4	O K
600 min Winter	68.747	0.747	0.1	6.4	O K
720 min Winter	68.742	0.742	0.1	6.3	O K
960 min Winter	68.721	0.721	0.1	6.2	O K
1440 min Winter	68.672	0.672	0.1	5.7	O K
2160 min Winter	68.604	0.604	0.1	5.2	O K
2880 min Winter	68.538	0.538	0.1	4.6	O K
4320 min Winter	68.418	0.418	0.1	3.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	143.169	0.0	26
30 min Summer	92.371	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.671	0.0	130
180 min Summer	24.520	0.0	188
240 min Summer	19.481	0.0	246
360 min Summer	14.011	0.0	364
480 min Summer	11.097	0.0	482
600 min Summer	9.254	0.0	602
720 min Summer	7.976	0.0	720
960 min Summer	6.303	0.0	822
1440 min Summer	4.519	0.0	1066
2160 min Summer	3.235	0.0	1472
2880 min Summer	2.550	0.0	1876
4320 min Summer	1.821	0.0	2684
5760 min Summer	1.433	0.0	3464
7200 min Summer	1.190	0.0	4184
8640 min Summer	1.022	0.0	4928
10080 min Summer	0.898	0.0	5648
15 min Winter	143.169	0.0	26
30 min Winter	92.371	0.0	41
60 min Winter	56.713	0.0	70
120 min Winter	33.671	0.0	128
180 min Winter	24.520	0.0	184
240 min Winter	19.481	0.0	242
360 min Winter	14.011	0.0	358
480 min Winter	11.097	0.0	472
600 min Winter	9.254	0.0	586
720 min Winter	7.976	0.0	698
960 min Winter	6.303	0.0	910
1440 min Winter	4.519	0.0	1134
2160 min Winter	3.235	0.0	1588
2880 min Winter	2.550	0.0	2044
4320 min Winter	1.821	0.0	2896

Date 05/12/2021 19:19
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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
5760 min Winter	68.314	0.314	0.1	2.7	O K
7200 min Winter	68.227	0.227	0.0	1.9	O K
8640 min Winter	68.155	0.155	0.0	1.3	O K
10080 min Winter	68.099	0.099	0.0	0.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
5760 min Winter	1.433	0.0	3688
7200 min Winter	1.190	0.0	4408
8640 min Winter	1.022	0.0	5104
10080 min Winter	0.898	0.0	5744

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Rainfall Details

Rainfall Model	FSR	Ratio R	0.443	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.010

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.004	4	8	0.003	8	12	0.003

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File Houses up to 100m2 Revised Infiltration Rat...	Checked by
Innovyze	Source Control 2020.1

Model Details

Storage is Online Cover Level (m) 70.000

Cellular Storage Structure

Invert Level (m) 68.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00960

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	9.0	9.0	1.000	9.0	21.0	1.001	0.0	21.0

Date 05/12/2021 19:17	Designed by
File Houses up to 150m2 Revised Infiltration Rat...	Checked by
Innovyze	Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1121 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	68.346	0.346	0.1	3.9	O K
30 min Summer	68.445	0.445	0.1	5.1	O K
60 min Summer	68.539	0.539	0.1	6.1	O K
120 min Summer	68.625	0.625	0.1	7.1	O K
180 min Summer	68.667	0.667	0.1	7.6	O K
240 min Summer	68.691	0.691	0.1	7.9	O K
360 min Summer	68.713	0.713	0.1	8.1	O K
480 min Summer	68.721	0.721	0.1	8.2	O K
600 min Summer	68.720	0.720	0.1	8.2	O K
720 min Summer	68.713	0.713	0.1	8.1	O K
960 min Summer	68.691	0.691	0.1	7.9	O K
1440 min Summer	68.650	0.650	0.1	7.4	O K
2160 min Summer	68.597	0.597	0.1	6.8	O K
2880 min Summer	68.549	0.549	0.1	6.3	O K
4320 min Summer	68.465	0.465	0.1	5.3	O K
5760 min Summer	68.390	0.390	0.1	4.4	O K
7200 min Summer	68.324	0.324	0.1	3.7	O K
8640 min Summer	68.266	0.266	0.1	3.0	O K
10080 min Summer	68.216	0.216	0.1	2.5	O K
15 min Winter	68.389	0.389	0.1	4.4	O K
30 min Winter	68.499	0.499	0.1	5.7	O K
60 min Winter	68.606	0.606	0.1	6.9	O K
120 min Winter	68.705	0.705	0.1	8.0	O K
180 min Winter	68.755	0.755	0.1	8.6	O K
240 min Winter	68.784	0.784	0.1	8.9	O K
360 min Winter	68.813	0.813	0.1	9.3	O K
480 min Winter	68.826	0.826	0.1	9.4	O K
600 min Winter	68.830	0.830	0.1	9.5	O K
720 min Winter	68.827	0.827	0.1	9.4	O K
960 min Winter	68.809	0.809	0.1	9.2	O K
1440 min Winter	68.758	0.758	0.1	8.6	O K
2160 min Winter	68.689	0.689	0.1	7.9	O K
2880 min Winter	68.622	0.622	0.1	7.1	O K
4320 min Winter	68.498	0.498	0.1	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	143.169	0.0	26
30 min Summer	92.371	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.671	0.0	130
180 min Summer	24.520	0.0	188
240 min Summer	19.481	0.0	248
360 min Summer	14.011	0.0	366
480 min Summer	11.097	0.0	484
600 min Summer	9.254	0.0	602
720 min Summer	7.976	0.0	722
960 min Summer	6.303	0.0	868
1440 min Summer	4.519	0.0	1106
2160 min Summer	3.235	0.0	1496
2880 min Summer	2.550	0.0	1904
4320 min Summer	1.821	0.0	2724
5760 min Summer	1.433	0.0	3512
7200 min Summer	1.190	0.0	4256
8640 min Summer	1.022	0.0	5016
10080 min Summer	0.898	0.0	5664
15 min Winter	143.169	0.0	26
30 min Winter	92.371	0.0	41
60 min Winter	56.713	0.0	70
120 min Winter	33.671	0.0	128
180 min Winter	24.520	0.0	186
240 min Winter	19.481	0.0	244
360 min Winter	14.011	0.0	360
480 min Winter	11.097	0.0	474
600 min Winter	9.254	0.0	588
720 min Winter	7.976	0.0	700
960 min Winter	6.303	0.0	918
1440 min Winter	4.519	0.0	1170
2160 min Winter	3.235	0.0	1620
2880 min Winter	2.550	0.0	2076
4320 min Winter	1.821	0.0	2940

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
5760 min Winter	68.388	0.388	0.1	4.4	O K
7200 min Winter	68.293	0.293	0.1	3.3	O K
8640 min Winter	68.212	0.212	0.1	2.4	O K
10080 min Winter	68.145	0.145	0.1	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
5760 min Winter	1.433	0.0	3752
7200 min Winter	1.190	0.0	4536
8640 min Winter	1.022	0.0	5200
10080 min Winter	0.898	0.0	5856

Date 05/12/2021 19:17
File Houses up to 150m2 Revised Infiltration Rat...

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Rainfall Details

Rainfall Model	FSR	Ratio R	0.443	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.015

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.005	4	8	0.005	8	12	0.005

Date 05/12/2021 19:17	Designed by
File Houses up to 150m2 Revised Infiltration Rat...	Checked by
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Model Details

Storage is Online Cover Level (m) 70.000

Cellular Storage Structure

Invert Level (m) 68.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00960

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	12.0	1.000	12.0	26.0	1.100	0.0	26.0

Date 05/12/2021 19:14	Designed by
File Houses up to 180m2 Revised Infiltration Rat...	Checked by
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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1327 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	68.417	0.417	0.1	4.8	O K
30 min Summer	68.535	0.535	0.1	6.1	O K
60 min Summer	68.650	0.650	0.1	7.4	O K
120 min Summer	68.757	0.757	0.1	8.6	O K
180 min Summer	68.810	0.810	0.1	9.2	O K
240 min Summer	68.842	0.842	0.1	9.6	O K
360 min Summer	68.874	0.874	0.1	10.0	O K
480 min Summer	68.889	0.889	0.1	10.1	O K
600 min Summer	68.894	0.894	0.1	10.2	O K
720 min Summer	68.891	0.891	0.1	10.2	O K
960 min Summer	68.873	0.873	0.1	10.0	O K
1440 min Summer	68.827	0.827	0.1	9.4	O K
2160 min Summer	68.767	0.767	0.1	8.7	O K
2880 min Summer	68.714	0.714	0.1	8.1	O K
4320 min Summer	68.623	0.623	0.1	7.1	O K
5760 min Summer	68.541	0.541	0.1	6.2	O K
7200 min Summer	68.467	0.467	0.1	5.3	O K
8640 min Summer	68.401	0.401	0.1	4.6	O K
10080 min Summer	68.342	0.342	0.1	3.9	O K
15 min Winter	68.467	0.467	0.1	5.3	O K
30 min Winter	68.601	0.601	0.1	6.9	O K
60 min Winter	68.731	0.731	0.1	8.3	O K
120 min Winter	68.852	0.852	0.1	9.7	O K
180 min Winter	68.915	0.915	0.1	10.4	O K
240 min Winter	68.953	0.953	0.1	10.9	O K
360 min Winter	68.994	0.994	0.1	11.3	O K
480 min Winter	69.019	1.019	0.1	11.6	O K
600 min Winter	69.039	1.039	0.1	11.7	O K
720 min Winter	69.045	1.045	0.1	11.7	O K
960 min Winter	69.022	1.022	0.1	11.6	O K
1440 min Winter	68.968	0.968	0.1	11.0	O K
2160 min Winter	68.891	0.891	0.1	10.2	O K
2880 min Winter	68.821	0.821	0.1	9.4	O K
4320 min Winter	68.689	0.689	0.1	7.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	143.169	0.0	27
30 min Summer	92.371	0.0	41
60 min Summer	56.713	0.0	70
120 min Summer	33.671	0.0	130
180 min Summer	24.520	0.0	188
240 min Summer	19.481	0.0	248
360 min Summer	14.011	0.0	366
480 min Summer	11.097	0.0	486
600 min Summer	9.254	0.0	604
720 min Summer	7.976	0.0	722
960 min Summer	6.303	0.0	960
1440 min Summer	4.519	0.0	1172
2160 min Summer	3.235	0.0	1544
2880 min Summer	2.550	0.0	1960
4320 min Summer	1.821	0.0	2772
5760 min Summer	1.433	0.0	3576
7200 min Summer	1.190	0.0	4336
8640 min Summer	1.022	0.0	5104
10080 min Summer	0.898	0.0	5856
15 min Winter	143.169	0.0	26
30 min Winter	92.371	0.0	41
60 min Winter	56.713	0.0	70
120 min Winter	33.671	0.0	128
180 min Winter	24.520	0.0	186
240 min Winter	19.481	0.0	244
360 min Winter	14.011	0.0	360
480 min Winter	11.097	0.0	476
600 min Winter	9.254	0.0	592
720 min Winter	7.976	0.0	706
960 min Winter	6.303	0.0	928
1440 min Winter	4.519	0.0	1340
2160 min Winter	3.235	0.0	1664
2880 min Winter	2.550	0.0	2112
4320 min Winter	1.821	0.0	3024

Date 05/12/2021 19:14
File Houses up to 180m2 Revised Infiltration Rat...
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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
5760 min Winter	68.569	0.569	0.1	6.5	O K
7200 min Winter	68.461	0.461	0.1	5.3	O K
8640 min Winter	68.366	0.366	0.1	4.2	O K
10080 min Winter	68.283	0.283	0.1	3.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
5760 min Winter	1.433	0.0	3864
7200 min Winter	1.190	0.0	4680
8640 min Winter	1.022	0.0	5448
10080 min Winter	0.898	0.0	6152

Date 05/12/2021 19:14
File Houses up to 180m2 Revised Infiltration Rat...

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Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Ratio R	0.443	Cv (Winter)	0.840
Return Period (years)	100	Summer Storms	Yes	Shortest Storm (mins)	15
Region	England and Wales	Winter Storms	Yes	Longest Storm (mins)	10080
M5-60 (mm)	20.000	Cv (Summer)	0.750	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.018

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.006	4	8	0.006	8	12	0.006

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File Houses up to 180m2 Revised Infiltration Rat...	Checked by
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Model Details

Storage is Online Cover Level (m) 70.000

Cellular Storage Structure

Invert Level (m) 68.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00960

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	12.0	12.0	1.000	12.0	26.0	1.100	0.0	26.0

APPENDIX F

Proposed Drainage Strategy

Soakaway Sizes based on an infiltration rate of $2.68x10^{-6}$m/s obtained from on-site infiltration testing. Please refer to Herts and Essex letter report dated 2nd December 2021

Scale:
0 10 30 50m

3mx3mx1m deep modular soakaway
4mx3mx1m deep modular soakaway
4mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
4mx3mx1m deep modular soakaway
4mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
4mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway
3mx3mx1m deep modular soakaway

TURNING HEAD
TURNING HEAD

Existing Public Foul Water Sewer

Proposed Sewer Diversion Route, subject to TW Approval

Permeable surfacing with 500mm thick type 3 sub base storage

Modular Soakaway

Proposed Private Surface Water Sewer

Proposed Private Foul Water Sewer

PROPOSED SITE PLAN

Stoney Common Road
Proposed Drainage Strategy

05/12/21
SK100 Rev P03
Scale 1:500 @ A1

APPENDIX G

Essex County Council SuDS Proforma

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Introduction

This proforma identifies the information required by Essex LLFA to enable technical assessment the Designers approach to water quantity and water quality as part of SuDS design approach in compliance with Essex SuDS Design Guide.

Completion of the proforma will also allow for technical assessment against Non-statutory technical standards (NSTS) for Sustainable Drainage. The proforma will accompany the site specific Flood Risk Assessment and Drainage Strategy submitted as part of the planning application.

Please complete this form in full for full applications and the coloured sections for outline appllications. This will help us identify what information has been included and will assist with a smoother and quicker application.

Instructions for use

Use the units defined for input of figures

Numbers in brackets refer to accompanying notes.

Where ……m^3 .....m^3/m^2 *are noted – both values should be filled in.*

Site details

1.1	Planning application reference (if known)		
1.2	Site name	Land East of Pines Hill, Stansted Mountfitchet	
1.3	Total application site area (1)	1	ha
1.4	Predevelopment use (4)	Greenfield	
1.5	Post development use	Residential	
	If other, please sepcify		
1.6	Urban creep applicable	Yes	if yes, factor applied: 10%
1.7	Proposed design life / planning application life		
1.8	Method(s) of discharge: (5)		

☐ *Reuse* ☑ *Infiltration* ☐ *Hybrid* ☐ *Waterbody* ☐ *Storm sewer* ☐ *Combined sewer*

1.9	Is discharge direct to estuary / sea	No
1.10	Have agreements in principle (where applicable) for discharge been provided	No

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment

Calculation inputs

2.1	Area within site which is drained by SuDS (2)	4900	m^2
2.2	Impermeable area drained pre development (3)	0	m^2
2.3	Impermeable area drained post development (3)	4900	m^2
2.4	Additional impermeable area (2.3 minus 2.2)	4900	m^2
2.5	Method for assessing greenfield runoff rate	ICP SUDS	
2.6	Method for assessing brownfield runoff rate	Site was greenfield so N/A	
2.7	Coefficient of runoff (Cv) (6)	1	
2.8	Source of rainfall data (FEH Preferred)	FSR	
2.9	Climate change factor applied 40	%	

Attenuation (positive outlet)

2.10 Drainage outlet at risk of drowning (tidal locking, elevated water levels in watercourse/sewer)
Note: Vortex controls require conditions of free discharge to operate as per manufacturers specification.

2.11 Invert level at final outlet N/A mAOD

2.12 Design level used for surcharge water level at point of discharge (16) N/A mAOD

Infiltration (Discharge to Ground)

2.13 Have infiltration tests been undertaken Yes

2.14 If yes, which method has been used BRE Digest 365

2.15 Infiltration rate (where applicable) 2.68x10-6m/s m/s

2.16 Depth to highest known ground water table mAOD

2.17 If there are multiple infiltration features please specify where they can be found in the FRA

2.18 Depth of infiltration feature 2 mAOD

2.19 Factor of safety used for sizing infiltration storage 2

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Calculation outputs

Sections 3 and 4 refer to site where storage is provided by full attenuation or partial infiltration. Where all flows are infiltrated to ground go straight to Section 6.

3.0	**Greenfield runoff rates** (incl. Urban Creep)			
3.1	1 in 1 year rainfall	l/s/ha, 2.6	l/s for the site	
3.2	1 in 30 year rainfall	l/s/ha, 6.9	l/s for the site	
3.3	1 in 100 year rainfall + CCA	l/s/ha, 9.7	l/s for the site	
4.0	**Brownfield runoff rates** (incl. Urban Creep)			
4.1	1 in 1 year rainfall	l/s/ha, n/a	l/s for the site	
4.2	1 in 30 year rainfall	l/s/ha, n/a	l/s for the site	
4.3	1 in 100 year rainfall + CCA	l/s/ha, n/a	l/s for the site	
5.0	Proposed maximum rate of runoff from site (incl. Urban Creep) (7)			
5.1	1 in 1 year rainfall	n/a	l/s/ha, n/a	l/s for the site
5.2	1 in 30 year rainfall	n/a	l/s/ha, n/a	l/s for the site
5.3	1 in 100 year rainfall + CCA	n/a	l/s/ha, n/a	l/s for the site
6.0	Attenuation storage to manage flow rates from site (incl. **Climate Change Allowance** (CCA) and Urban Creep)			
6.1	Storage - 1 in 100 year + CCA (9)	N/A	m^3	m^3/m^2
6.2	50% storage drain down time 1 in 30 years		hours	
7.0	Controlling volume of runoff from the site(10)			
7.1	Pre development runoff volume(12) (development area)	N/A	m^3 for the site	
7.2	Post development runoff volume (unmitigated) (12)	N/A	m^3 for the site	
7.3	Volume to be controlled (5.2 - 5.1)	N/A	m^3 for the site	

Essex County Council

7.4 Volume control provided by:

- Interception losses[13] N/A m^3
- Rain harvesting [14] N/A m^3
- Infiltration 507 m^3
- Attenuation N/A m^3
- Separate volume designated as long term storage[15] N/A m^3

7.5 Total volume control (sum of inputs for 5.4) m^3 [17]

8.0 Site storage volumes (full infiltration only)

8.1	Storage - 1in 30 year + CCA [8]		m^3	m^3/m^2 (of developed impermeable area)
8.2	Storage - 1 in 100 year + CCA [11]	507	m^3 507	m^3/m^2

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Design Inputs

Proposed site use Residential Roofs and Driveways and low traffic roads

Pollution hazard category (see C753 Table 26.2) Very Low / Low

High risk area defined as area storing fuels chemicals, refuelling area, washdown area, loading bay.

Design Outputs

List order of SuDS techniques proposed for treatment Permeable surfaces with sub base and soakaways

Note that gully pots, pipes and tanks are not accepted by Essex LLFA as a form of treatment (for justification see C753 Section 4.1, Table 26.15 and Box B.2)

Are very high pollution risk areas drained separate from SuDS to foul system Yes

Other

Please include any other information that is relevant to your application

Essex County Council

SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

Notes

1. All area with the proposed application site boundary to be included.
2. The site area which is positively drained includes all green areas which drain to the SuDS system and area of surface SuDS features. It excludes large open green spaces which do not drain to the SuDS system.
3. Impermeable area should be measured pre and post development. Impermeable surfaces include, roofs, pavements, driveways and paths where runoff is conveyed to the drainage system.
4. Predevelopment use may impact on the allowable discharge rate. The LLFA will seek for reduction in flow rates to GF (Essex SuDS Design Guide).
5. Runoff may be discharge via one or more methods.
6. Sewers for Adoption 6th Edition recommends a Cv of 100% when designing drainage for impermeable area (assumes no loss of runoff from impermeable surfaces) and 0% for permeable areas. Where lower Cv's are used the applicant should justify the selection of Cv.
7. It is Essex County Council's preference that discharge rates for all events up to the 1 in 100 year event plus climate change are limited to the 1 in 1 greenfield rate. This is also considered to mitigate the increased runoff volumes that occur with the introduction of impermeable surfaces. If discharge rates are limited to a range of matched greenfield flows then it is necessary to provide additional mitigation of increased runoff volumes by the provision of Long-term Storage.
8. Storage for the 1 in 30 year must be fully contained within the SuDS components. Note that standing water within SuDS components such as ponds, basins and swales is not classified as flooding. Storage should be calculated for the critical duration rainfall event.
9. Runoff generated from rainfall events up to the 1 in 100 year will not be allowed to leave the site in an uncontrolled way. Temporary flooding of designated areas to shallow depths and velocities may be acceptable.
10. The following information should only be provided if increased runoff volumes are not mitigated by limiting all discharge rates back to the greenfield 1 in 1 year rate.
11. Climate change is specified as 40% increase to rainfall intensity, unless otherwise agreed with the LLFA / EA.
12. To be determined using the 100 year return period 6 hour duration winter rainfall event.
13. Where Source Control is provided Interception losses will occur. An allowance of 5mm rainfall depth can be subtracted from the net inflow to the storage calculation where interception losses are demonstrated. The Applicant should demonstrate use of subcatchments and source control techniques. Further information is available in the SuDS Design Guide.
14. Please refer to Rain harvesting BS for guidance on available storage.
15. Flows within long term storage areas should be infiltrated to the ground or discharged at low flow rate of maximum 2 l/s/ha.
16. Careful consideration should be used for calculations where flow control / storage is likely to be influenced by surcharged sewer or peak levels within a watercourse. Outlets can be tidally locked where discharge is direct to estuary or sea. Calculations should demonstrate that risk of downed outlet has been taken into consideration. Vortex controls require conditions of free discharge to operate as per specification.
17. In controlling the volume of runoff the total volume from mitigation measures should be greater than or equal to the additional volume generated.

APPENDIX H

Infiltration Testing Report

HERTS & ESSEX SITE INVESTIGATIONS

'THE OLD POST OFFICE', WELLPOND GREEN, STANDON, WARE, HERTS, SG11 1NJ *TELEPHONE* [redacted] *E-MAIL:* *INFO@HESI.CO.UK* *WEBSITE* [redacted]

GEOTECHNICAL ASSESSMENTS – ENVIRONMENTAL ASSESSMENT - DESKTOP STUDY – CONTAMINATED LAND

2nd December 2021 Our Ref : CSG / 17150

Luxus Homes Ltd
2 Dairy Yard
Star Street
Ware
Herts
SG12 7DX

For the attention of R.Evans Ltd.,

Dear Sir,

Pines Hill, Stansted, Essex, CM24 8TD : BRE 365 SOAKAWAY TESTING.

Please find enclosed details of BRE 365 testing from the above site.

Based on the results available, we would suggest that the top of the site near the main road, (to the west of the site), provides better permeability that the lower section of the site where more claybound soils are recorded.

It is viable that soakaways will form a viable drainage option for the site based on this data.

Should you require any further information or assistance, please do not hesitate to contact us.

I hope the foregoing is sufficient for your requirements, although please do not hesitate to contact us should require any further information regarding the above.

Yours Faithfully

[redacted]

C.S.Gray M.Sc
Contract Engineer

HERTS & ESSEX SITE INVESTIGATIONS
The Old Post Office, Wellpond Green
Standon, Ware, Herts. SG11 1NJ
Telephone: 01920 822233
e-mail info@hesi.co.uk

Appendix No	1
Sheet No	1
Job No	17150
Date	Dec 2021

Pines Hill, Stansted, Essex, CM24 8TD

Existing Site Plan

N

Not to Scale

Sketch No. : GEO / 17150 / 01 / 01

HERTS & ESSEX SITE INVESTIGATIONS

The Old Post Office, Wellpond Green
Standon, Ware, Herts. SG11 1NJ

Telephone: 01920 822233
e-mail info@hesi.co.uk

Appendix No 2
Sheet No 1
Job No 17150
Date Dec 2021

Pines Hill, Stansted, Essex, CM24 8TD

Trial Pit One

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Loose light brown moderately silty claybound sandy topsoil FILL with occasional to much flint gravel		0.30	0.30								
Medium dense orange brown slightly claybound SAND & GRAVEL 1.0 Much flint gravel by 1.00m		1.80	1.50								
Medium dense to dense orange brown slightly to moderately claybound fine to medium SAND & GRAVEL 2.0		2.50	0.70								
Firm to stiff light orange brown mottled grey anfd orange moderately silty CLAY with occasional flint gravel Borehole Complete at 2.50m 3.0											

Remarks

Scale 1 : 15

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

HERTS & ESSEX SITE INVESTIGATIONS

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e-mail info@hesi.co.uk

Appendix No 2
Sheet No 2
Job No 17150
Date Dec 2021

Pines Hill, Stansted, Essex, CM24 8TD

Trial Pit Two

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Loose light brown moderately silty claybound sandy topsoil FILL with occasional to much flint gravel		0.30	0.30								
Medium dense orange brown slightly claybound SAND & GRAVEL 1.0 rare claybound pockets by 1.00m		1.80	1.50								
Soft orange brown very silty sandy CLAY / Medium dense orange brown sandy silty GRAVEL 2.0		2.30	0.50								
Borehole Complete at 2.50m 3.0											

Remarks

Scale 1 : 15

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

HERTS & ESSEX SITE INVESTIGATIONS

The Old Post Office, Wellpond Green
Standon, Ware, Herts. SG11 1NJ

Telephone: 01920 822233
e-mail info@hesi.co.uk

Appendix No 2
Sheet No 3
Job No 17150
Date Dec 2021

Pines Hill, Stansted, Essex, CM24 8TD

Trial Pit Three

Description Of Stratum	Legend	Depth	Thickness (m)	Water Level	Samples No	Samples Type	Samples Depth (m)	S.P.T N-Value or Vane Strength	VOC's (ppm)	Installations	Casing Depth, (m)
Loose light brown moderately silty claybound sandy topsoil FILL with occasional to much flint gravel		0.30	0.30								
Medium dense orange brown slightly claybound SAND & GRAVEL		1.00	0.70								
Firm to stiff light yellow brown moderately silty sandy CLAY with occasional flint gravel		1.50	0.50								
Medium dense /Firm to stiff light yellow brown mottled orange brown very claybound silty SAND and occasional flint gravel with clay pockets		2.10	0.50								
Firm to stiff / stiff light orange yellow brown very silty sandy CLAY with flint gravel		2.60	0.50								
Borehole Complete at 2.60m											

1.0
2.0
3.0

Remarks

Scale 1 : 15

Key : U - Undisturbed Sample (100mm **diameter**) B - Bulk Sample - Water Struck D - Disturbed Sample - Water Standing W - Water Sample T - Chemical Tub N - SPT N-Value V - Vane Test, (kN.m²)

HERTS & ESSEX SITE INVESTIGATIONS

The Old post Office, Wellpond Green, Ware
Hertfordshire SG11 1NJ

Telepl : Ware (01920) 822233
Fax : Ware (01920) 822200

DETERMINATION OF PERMEABILITY VALUE ***THE PINES, STONEY HILL ROAD, STANSTED, ESSEX***

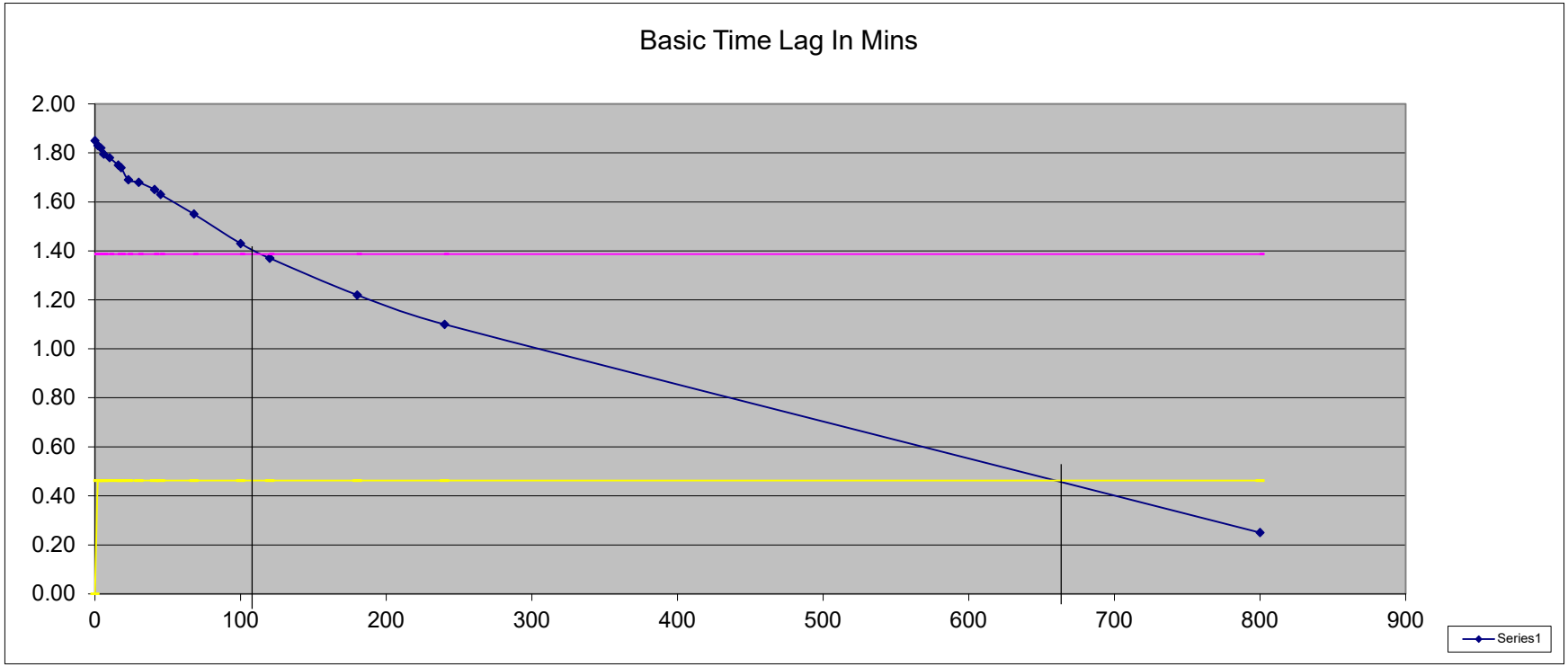
B.R.E 365 ***SOAKAWAY 1***

Depth of Test Hole		2.50 m
Dimensions of Test Hole	Width	0.60 m
	Length	2.30 m
Depth to Top of Water at Start of Test		0.65 m
Depth to discharge Drain		0.90 m

75%	1.39
25%	0.46
V75%-25%	1.28
ap50	6.745
tp75-25	555

Soil Infiltration Rate is **5.68E-06**

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)	Value to Note time at (m)	Time Equals (Mins)		
0	0.00	1.85	1.39	110	=	t75
2	0.02	1.83	0.46	665	=	t25
4	0.03	1.82				
6	0.06	1.80				
10	0.07	1.78				
16	0.10	1.75				
18	0.11	1.74				
23	0.16	1.69				
30	0.17	1.68				
41	0.20	1.65				
45	0.22	1.63				
68	0.30	1.55				
100	0.42	1.43				
120	0.48	1.37				
180	0.63	1.22				
240	0.75	1.10				
800	1.60	0.25				



HERTS & ESSEX SITE INVESTIGATIONS

The Old post Office, Wellpond Green, Ware
Hertfordshire SG11 1NJ

Telepl : Ware (01920) 822233
Fax : Ware (01920) 822200

DETERMINATION OF PERMEABILITY VALUE ***THE PINES, STONEY HILL ROAD, STANSTED, ESSEX***

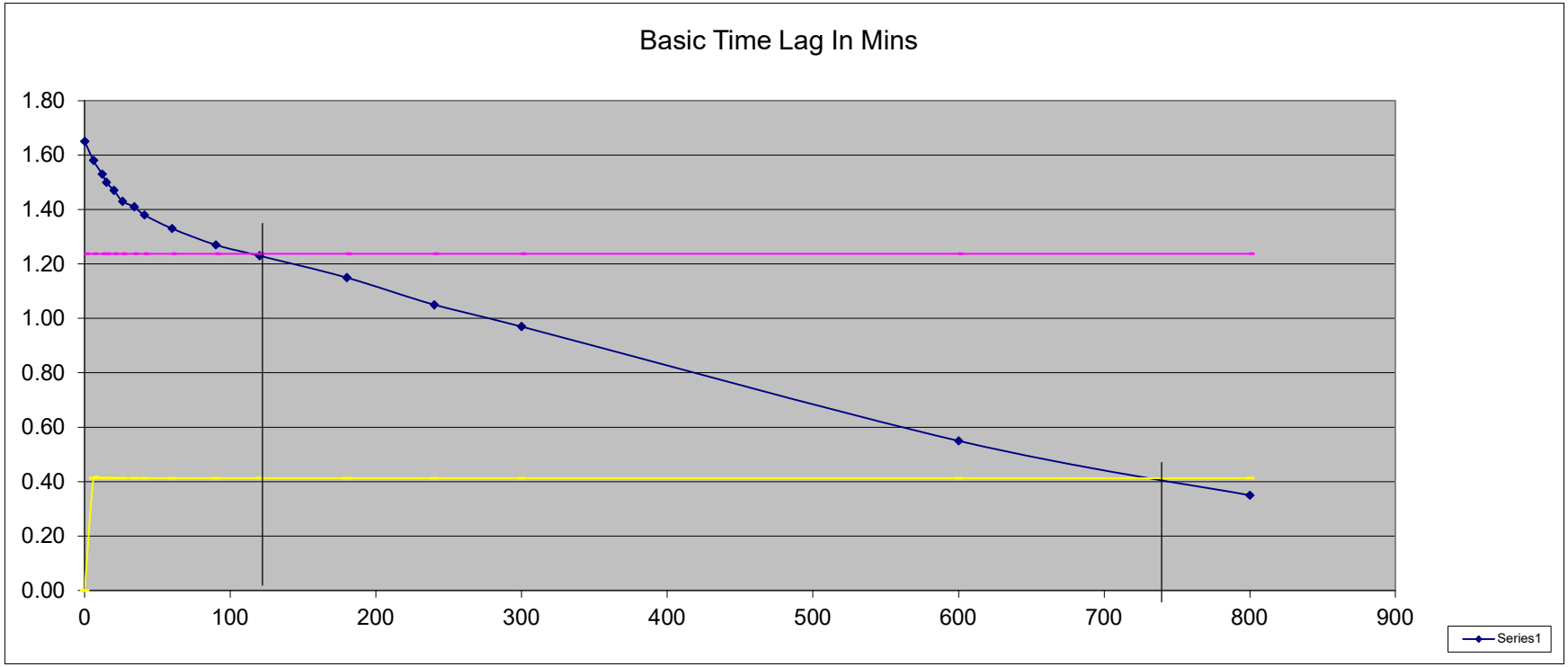
B.R.E 365 ***SOAKAWAY 2***

Depth of Test Hole		2.30 m
Dimensions of Test Hole	Width	0.60 m
	Length	2.30 m
Depth to Top of Water at Start of Test		0.65 m
Depth to discharge Drain		0.90 m

75%	1.24
25%	0.41
V75%-25%	1.14
ap50	6.165
tp75-25	640

Soil Infiltration Rate is **4.81E-06**

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)	Value to Note time at (m)	Time Equals (Mins)		
0	0.00	1.65	1.24	120	=	t75
6	0.07	1.58	0.41	760	=	t25
12	0.12	1.53				
15	0.15	1.50				
20	0.18	1.47				
26	0.22	1.43				
34	0.24	1.41				
41	0.27	1.38				
60	0.32	1.33				
90	0.38	1.27				
120	0.42	1.23				
180	0.50	1.15				
240	0.60	1.05				
300	0.68	0.97				
600	1.10	0.55				
800	1.30	0.35				



HERTS & ESSEX SITE INVESTIGATIONS

The Old post Office, Wellpond Green, Ware
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Telepl : Ware (01920) 822233
Fax : Ware (01920) 822200

DETERMINATION OF PERMEABILITY VALUE

THE PINES, STONEY HILL ROAD, STANSTED, ESSEX

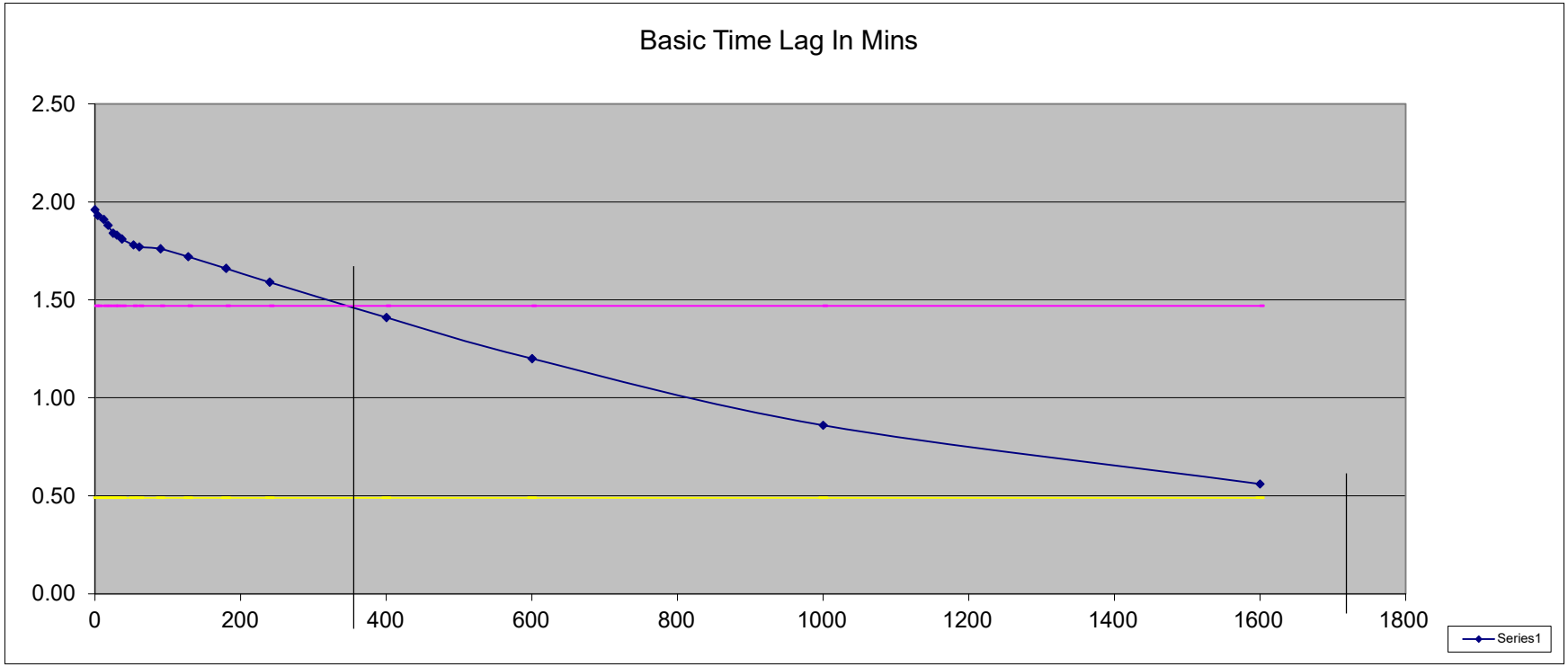
B.R.E 365 ***SOAKAWAY 3***

Depth of Test Hole		2.60 m
Dimensions of Test Hole	Width	0.60 m
	Length	2.30 m
Depth to Top of Water at Start of Test		0.64 m
Depth to discharge Drain		0.90 m

75%	1.47
25%	0.49
V75%-25%	1.35
ap50	7.064
tp75-25	1190

Soil Infiltration Rate is **2.68E-06**

Start Time (Mins)	Depth of Water Drop (m)	Depth of Water (m)	Value to Note time at (m)	Time Equals (Mins)		
0	0.00	1.96	1.47	290	=	t75
4	0.03	1.93	0.49	1480	=	t25
12	0.05	1.91				
18	0.08	1.88				
25	0.12	1.84				
30	0.13	1.83				
37	0.15	1.81				
53	0.18	1.78				
61	0.19	1.77				
90	0.20	1.76				
128	0.24	1.72				
180	0.30	1.66				
240	0.37	1.59				
400	0.55	1.41				
600	0.76	1.20				
1000	1.10	0.86				
1600	1.40	0.56				



-----Original Message-----
From: Suds <Suds@essex.gov.uk>
Sent: Friday, January 14, 2022 3:03 PM
To: Cliff Turnbull [redacted];
[redacted]
Subject: RE: Automatic reply: FW: Drainage Strategy - Pines Hill - Stansted Mountfitchet.

Hi Cliff and Ross

I can advise that it is not possible to withdraw the holding objection on application UTT/21/2730/OP, as the decision has already been made in respect of this. However, I can state that the drainage strategy submitted with this application along with the infiltration testing results would support any future outline application sufficiently with regard to sustainable drainage.

I hope this helps.

Kind Regards

Alison

Alison Vaughan
Development & Flood Risk Officer
Climate Adaptation and Mitigation
Environment & Climate Action
Essex County Council

Essex County Council | C422- C428 County Hall | Chelmsford | CM1 1QH