



JUDWAA

STORRINGTON ROAD, THAKEHAM

FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

September 2023

Cygnature Homes Ltd

STORRINGTON ROAD, THAKEHAM

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

Quality Management

Issue/revision	Issue 1	Revision 1	Revision 2	Revision 3
Remarks	FOR PLANNING			
Date	06/09/2023			
Prepared by	HG			
Checked by	HG			



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A Vision to Better Solutions

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FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

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1. INTRODUCTION

- 1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been prepared by Judwaa Consulting on behalf of Cygnature Homes Ltd to support a planning application for their proposed residential development at Duke's Hill, Storrington Road, Thakeham. The site nearest postcode is RH20 3EN.

Aim

- 1.2 The aim of this NPPF compliant FRA is to identify flood risk to the site and those that may arise as a result of the Proposed Development. Where risks are identified, mitigation measures are proposed to manage the risks over the lifetime of the development, accounting for the effects of climate change. This includes presentation of an outline surface and foul drainage strategy for the Proposed Development.

- 1.3 To achieve this aim the following objectives have been met:

- A review of flood sources local to the site.
- A review of the impact of those flood sources to the proposed development.
- A review of the impact the proposed development could have on local flood sources.
- A review of the national planning policy position of the proposed development in relation to local flood risks; and
- Where necessary identification of mitigation measures for incorporation into the proposed development to mitigate flood risk to and/or arising from the proposed development.

- 1.4 To achieve these objectives the following documents have been consulted and/or referenced:

- The National Planning Policy Framework (NPPF).
- Development and Flood Risk – Guidance for the Construction Industry, (CIRIAC624);
- The SUDS Manual (CIRIA C753).
- Existing Sewer Map Record.
- Environmental Agency Flood maps.
- Ground condition obtained from BGS mapping/Percolation test report.
- Topographical Survey.

Study Methodology

- 1.5 The FRA process consists of a desk study, data research, and consultation with regulatory bodies and third parties.
- 1.6 Preliminary calculation of surface water flows has been undertaken based on the current conditions at the Application Site and existing drainage systems. Post development surface water flows have been calculated based on the development proposals.
- 1.7 This document presents an assessment of flooding to the Application Site and Proposed Development from all possible sources, including tidal, fluvial, pluvial, groundwater, sewers, and man-made infrastructure. The assessment also examines the residual flood risk to the proposed development and neighboring property from these sources.

2. POLICY

National Planning Policy Framework (NPPF)

- 2.1 The NPPF states ‘a site specific flood risk assessment is required for proposals of 1 hectare (ha) or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency), and where Proposed Development or a change of use to a more vulnerable class may be subject to other sources of flooding’. See **Table 1** for flood zones classifications.

Flood Zone	Flood Zone Classification	Definition
Zone 1	Low Probability	This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Zone 2	Medium Probability	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Zone 3a	High Probability	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b	Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

Table 1 - Flood Zones

- 2.2 The Application Site is situated within **Flood Zone 1**.
- 2.3 Paragraph 159 of the NPPF states that ‘inappropriate development in areas at risk of flooding should be avoided by directing development away from areas of highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere’.
- 2.4 Paragraph 167 states ‘when determining planning applications, Local Planning Authorities (LPAs) should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment. Development should only be allowed in areas at risk of flooding where, in the light of this assessments (and the sequential and exception tests, as applicable) it can be demonstrated that;
- Within the site, the most vulnerable development is located in areas of lowest flood risk unless there are overriding reasons to prefer a different location.
 - The development is appropriately flood resistant and resilient.
 - It incorporates Sustainable Drainage Systems, unless there is clear evidence that this would be inappropriate.
 - Any residual risk can be safely managed; and
 - Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.
- 2.5 The Planning Practice Guidance (PPG) provides additional direction to the NPPF and details each section to provide information on how to conform to the NPPF.
- 2.6 Within Table 2 (Flood Risk Vulnerability Classification) of the PPG, a residential development is classified as ‘More Vulnerable’.
- 2.7 Table 3 (Flood Risk vulnerability and Flood Zone Compatibility) of the PPG shown below, states that ‘More Vulnerable’ development is appropriate development within Flood Zone 1.
- 2.8 The Application Site is in Flood Zone 1 and is considered appropriate development, it is therefore passes the Sequential Test.

Flood Zones	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Table 3 - Flood risk vulnerability and flood zone ‘compatibility’

Key: ✓ Development is appropriate ✗ Development should not be permitted.

3. SITE DETAILS

- 3.1 The proposed development site is situated south of Duke's Hill (B2139), in Thakeham, Pulborough, with Storrington Road to east.
- 3.2 The site area is approximately 0.706ha and the site is mainly agricultural land and open field. There is currently a rectangular shaped building and a shed located within the site. The land currently appears to be used for agricultural and farming. See **Figure 1** for site location.



Figure 1: Site location plan

- 3.3 The development proposals comprise demolition of the existing building and construction of 5 new dwellings together with associated driveways and access road. See **Appendix A** for proposed site plan.
- 3.4 The development site is classified as greenfield as such majority of the site is permeable. The existing building footprint can be classified as impermeable but this is a very small area compared to the overall development site area.
- 3.5 Existing levels onsite range from 67.543m Above Ordnance Datum (AOD) at the northern end of the site to 60.087m AOD in the south. Refer to **Appendix B** for the full topographical survey.

- 3.6 A review of the British Geological Survey (BGS) mapping indicates that the bedrock geology beneath the site is a Fittleworth Member - Sandstone and mudstone. Sedimentary bedrock formed between 126.3 and 113 million years ago during the Cretaceous period. See **Figure 2** for the BGS map extract.

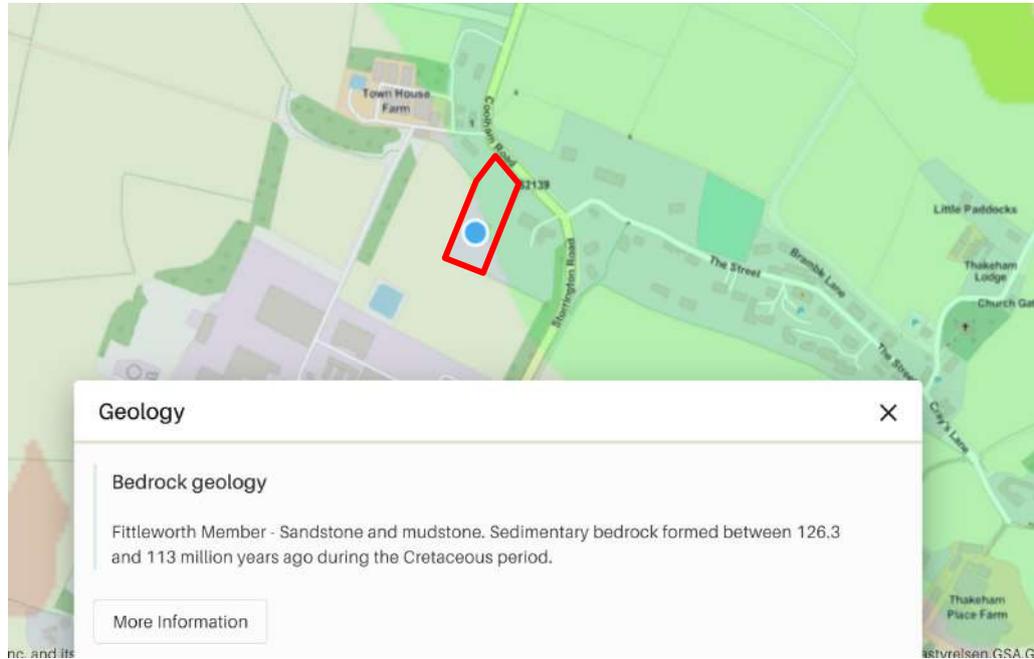


Figure 2: BGS Map Extract

- 3.7 There a borehole situated north-east of the development site. The borehole is located approximately 500m away from the site boundary and its number is TQ11NW17 with a depth of 36.52m which shows the soil is sandstone with mudstone underneath.
- 3.8 A percolation test was undertaken at the site in February 2023 by Albury S.I Ltd and the trial pit log confirmed the presence of made ground consisting of slightly gravelly, clayey sand with roots and gravel consists of flint to depths of 0.3m bgl (metres below ground level). Underneath the made ground, the trial pit log shows slightly gravelly, very sandy clay and gravel consists of flint and sandstone fragments. Refer to **Appendix C** for the percolation test report.

4. EXISTING DRAINAGE

Existing Surface Water Drainage

- 4.1 The site is mainly Agricultural land and has no existing surface water infrastructure. Any surface water runoff currently generated at the site appears to drain freely into the ground via infiltration and to adjacent land south of the development site without any attenuation.
- 4.2 The application site is located within Southern Water drainage area. According to Southern Water existing sewer map record, there are no existing surface water sewers located within the development site or anywhere close to the site. See **Appendix E** for Southern Water sewer map record.
- 4.3 The Application site is classified as a greenfield development site. The site area is 0.706ha and most of the site permeable. The greenfield run-off rates for the existing site have been estimated using the HR Wallingford online calculator on the UK SuDS website. An extract of the information can be found below in **Table 4** which shows a Qbar rate of 4.28 l/s. A full copy of the calculations can be found in **Appendix F**.

Return Period	Discharge Rates (l/s)
1 in 1 year	3.64
1 in 30 year	9.84
1 in 100 year	13.65

Table 4: Existing Greenfield Discharge Rates

Existing Foul Water Drainage

- 4.1 According to Southern Water existing sewer map record, there are no existing foul water sewers running through the site application boundary but it shows there is an existing 150mm diameter foul sewer running along Duke's Hill (B2139) north of the site and Storrington Road (B2139) east of the site. See **Appendix E** for Southern Water sewer map record.

5. FLOOD RISK

Fluvial/tidal flooding

- 5.1 Flood mapping obtained from the government's 'flood map for planning' website has identified that the site falls within Flood Zone 1 which shows a very low risk of flooding. This means the site is assessed as having a less than 0.1% annual probability of river or sea flooding (i.e. less than a 1 in 1,000 chance of flooding in any year). See **Figure 3** for map extract.

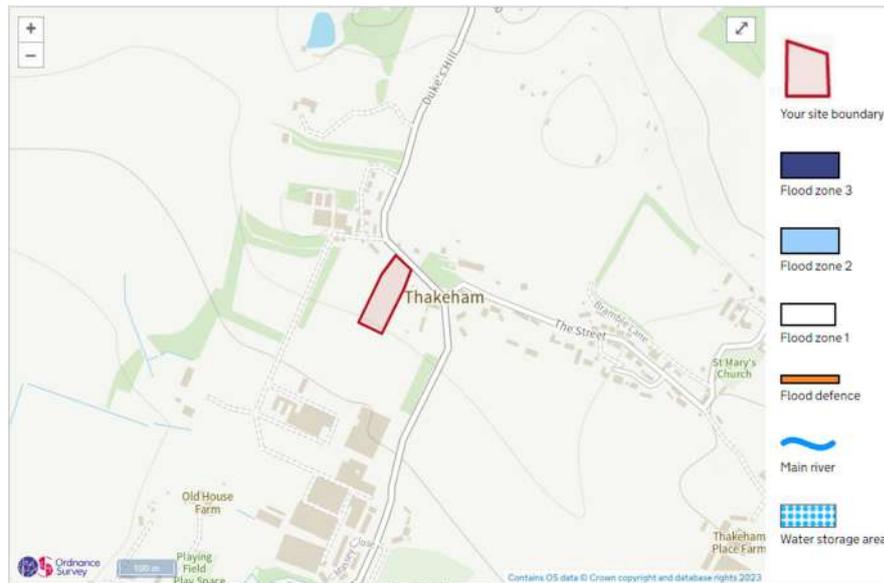


Figure 3: Flood Zone Map

Long term flood risk from rivers and seas

- 5.2 The long-term flood risk from rivers and seas mapping shows that the proposed development site has a very low risk of flooding which means chance of flooding is less than 0.1% each year. See **Figure 4**

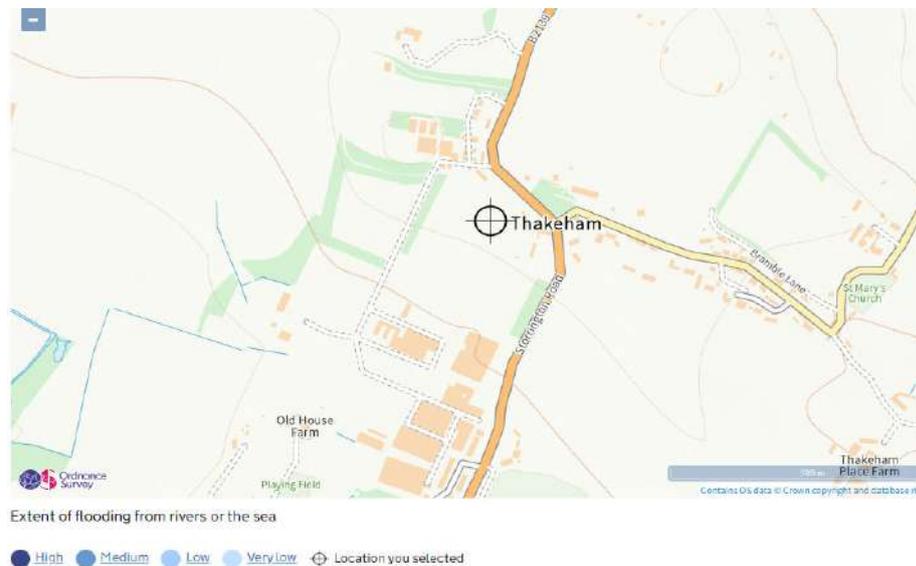
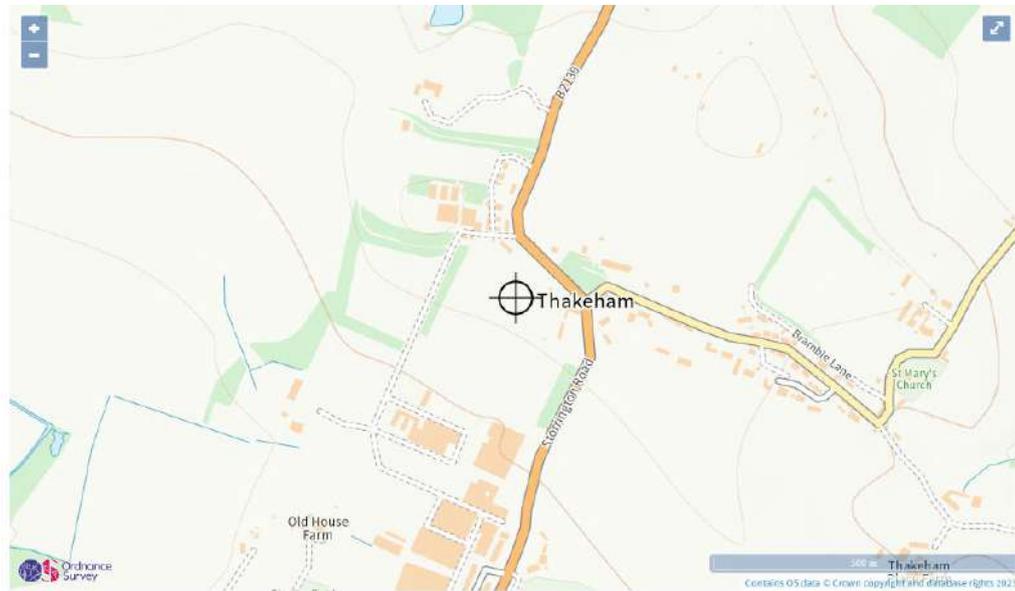


Figure 4: Extent of flooding from rivers or the sea

Long-term flood risk from reservoirs

5.3 The long-term flood risk from reservoirs shows that the site has no risk of flooding from reservoirs. (See

5.4 **Figure5)**



Maximum extent of flooding from reservoirs:

● when river levels are normal ■ when there is also flooding from rivers ⊕ Location you selected

Figure 5: Long-term flood risk from reservoirs

Long-term surface water flood risk

- 5.5 Surface water or 'pluvial' flooding results from rainfall running over ground before eventually entering a watercourse or sewer. It is usually associated with high intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is already saturated, frozen, developed (for example in an urban setting), or otherwise has low permeability.
- 5.6 The surface water flood risk map is shown in **Figure 6** and indicates that the development site itself has a very low risk of flooding (less than 0.1%) in any given year, the access road also has a very low risk of flooding which means that the access road has less than 0.1% chance of flooding annually.

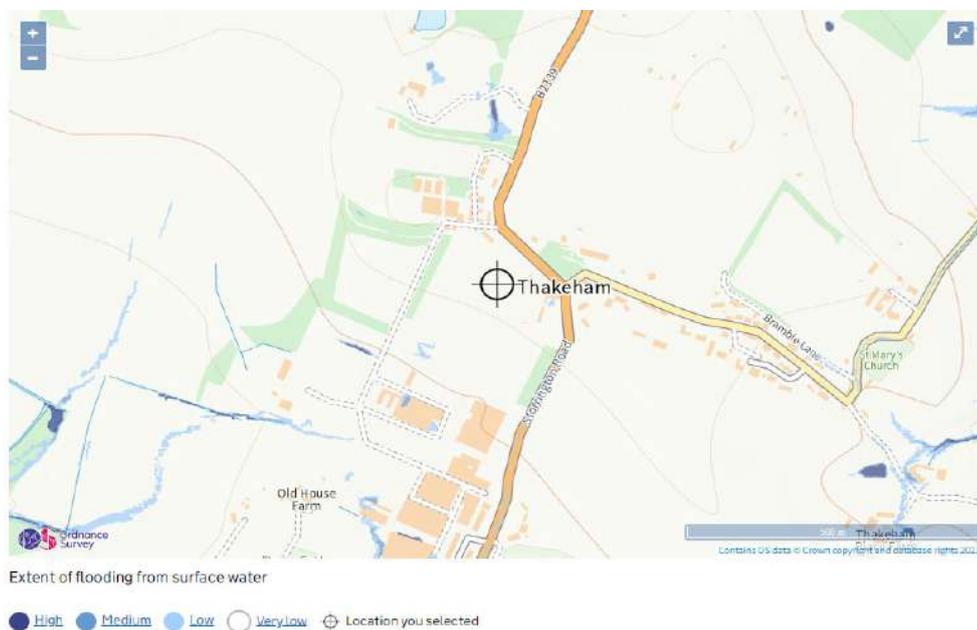


Figure 6: Long term flood risk from Surface water

6. DRAINAGE STRATEGY

Surface Water Drainage Strategy

- 6.1 In line with the Building Regulations Part H3, surface water shall discharge to one of the following, listed in order of priority:
- An adequate infiltration system: or, where not reasonably practicable,
 - A watercourse; or, where not reasonably practicable,
 - A sewer,
 - A combined sewer.
- 6.2 The review of the British Geological Survey (BGS) mapping for the site indicates that the bedrock geology beneath the site comprise of sandstone and mudstone which generally indicate poor infiltration rate. In addition to this a percolation test was undertaken at the site in February 2023 by Albury S.I Ltd. The percolation test was performed at two separate locations with two trial pits dug, percolation test result from both trial pits confirms significantly poor infiltration rate and therefore infiltration systems are not suitable to use on this site to disposed of surface water. Please refer to **Appendix C** for Albury S.I percolation test report.
- 6.3 Both the EA maps and google maps have not shown any watercourse within the vicinity of the development site. Therefore, discharging surface water into watercourse is not a feasible option to disposed of surface water from the site.
- 6.4 According to Southern Water existing sewer map record, there are no existing surface water sewers located within the development site or anywhere close to the site. Therefore, it is not possible to discharge the surface water coming from the development to existing surface water drainage.
- 6.5 Southern Water sewer map shows existing foul sewer running along Storrington Road. Therefore, the only remaining feasible option to disposed off surface water from the site is to connect to existing foul water sewer located on Storrington Road.
- 6.6 The post development impermeable area is greater than the predevelopment impermeable area. However, the aim is to make sure there is no increase in post development surface water runoff leaving the site. For betterment of the site and to reduce the surface water runoff, the proposed surface water drainage system will discharge into the existing foul water drainage at a restricted rate of 4.0 l/s which is equivalent to greenfield QBar rate via a hydro-brake flow control for all rainfall events up to and including the 1 in 100 year rainfall event plus an allowance for climate change (+45%) which is significantly less than the existing runoff rates as shown in **Table 5** below.

Event	Existing Brownfield Discharge Rates (l/s)	Proposed Discharge Rates (l/s)
1 in 1 year	3.64	3.393
1 in 30 year	9.84	4.0
1 in 100 year	13.65	4.0
1 in 100 year + 40%	-	4.0

Table 5: Proposed Discharge Rates

- 6.7 The proposed surface water network consists of gravity pipe system incorporating proposed permeable pavement. Surface water will be conveyed through gravity pipes and stored within the road sub-base material before it discharges to existing foul sewer located on Storrington road via hydro-brake flow control at restricted rate of 4.0 l/s via new manhole connection.
- 6.8 The proposed outfall manhole location or connection point is slightly downstream of existing foul manhole 4302 located east of the development site on Storrington Road. Both proposed surface and foul water drainage will be discharging to the same proposed outfall manhole. Please refer to **Appendix G** for proposed drainage strategy layout.
- 6.9 The proposed SuDS features have been designed to accommodate a 1 in 100 year storm plus 45% to account for climate change. A 10% increase in impermeable area has been incorporated within the drainage calculations to account for urban creep. Proposed drainage calculations can be found in **Appendix H** and the breakdown of all SuDS features is shown in **Table 6** below.

SuDS Feature	Dimensions
Permeable Paving	665.73m ² x 0.800m deep storage material

Table 6: Proposed SuDS Features

- 6.10 The connection into the existing foul water sewer will be subject to a S106 (Water Industry Act 1991) with Southern Water.

Foul Water Drainage Strategy

- 6.11 The proposed foul water network will be a gravity drainage system and is proposed to discharge foul flows from the proposed development to existing Southern Water drainage network located on Storrington Road via a new manhole connection.
- 6.12 The proposed outfall manhole location or connection point is slightly downstream of existing foul manhole 4302 located east of the development site on Storrington Road. Both proposed surface and foul water drainage will be discharging to the same proposed outfall manhole. Please refer to **Appendix G** for proposed drainage strategy layout.
- 6.13 The foul flow estimates utilised in the strategy are based on the assumption of design flow rates for dwellings of 4,000 litres/dwelling/day as detailed within Design and Construction Guidance (DCG dated June 2022).
- 6.14 The connection into the existing foul water sewer will be subject to a S106 (Water Industry Act 1991) with Southern Water.

7. WATER QUALITY

- 7.1 The surface water drainage strategy has been designed to ensure any residual pollutants will be filtered out of the surface water before leaving the site.
- 7.2 Using the UK SuDS Water Quality Toolkit, all systems of surface water drainage have been assessed in regards to water treatment. We have proposed to use permeable pavement to mitigate the potential surface water pollution,
- 7.3 All surface water runoff from the proposed development site will be passed through the road permeable sub-base which will filter out any residual pollutant before discharging to existing sewer.
- 7.4 Permeable pavement provides high levels of surface water treatment and therefore provide sufficient water quality treatment as demonstrated in the output from the UKSuDS Water Quality toolkit shown in **Appendix D**.
- 7.5 Using the UK SuDS Water Quality Toolkit, it can be confirmed that all proposed SuDS components have been assessed and shall provide sufficient treatment for the proposed development. **See Table 7** for summary of the SuDS used on site and their respective pollution mitigation indices.

Land Use	Pollution Hazard Indices		
	Total Suspended Solids	Metals	Hydrocarbons
Residential roofing	0.2	0.2	0.05
SuDS Component	Pollution Mitigation Indices		
	Total Suspended Solids	Metals	Hydrocarbons
Pervious pavement	0.7	0.6	0.7
Sufficiency of water treatment	Sufficient	Sufficient	Sufficient

Land Use	Pollution Hazard Indices		
	Total Suspended Solids	Metals	Hydrocarbons
Low Traffic Roads/Residential Parking	0.5	0.4	0.4
SuDS Component	Pollution Mitigation Indices		
	Total Suspended Solids	Metals	Hydrocarbons
Pervious pavement	0.7	0.6	0.7
Sufficiency of water treatment	Sufficient	Sufficient	Sufficient

Table 7: UK SuDS Water Quality Toolkit Output

8. SUDS MAINTENANCE STRATEGY

- 8.1 The management and maintenance of the SuDS features and private drainage system located in communal areas would be the responsibility of the appointed estate management company.
- 8.2 All drainage is to be designed in accordance with Water UK – Design and Construction Guidance (DCG dated June 2022).
- 8.3 Any management company appointed is to follow the maintenance schedule shown below in **Table 8** and **Table 9**.

Drainage Component	Required Action	Typical Frequency
Pavement Areas/Parking Court	Sweeping of paved areas, disposal of sweepings in a legal manner; removal of trash and litter from pavement	Monthly
Gullies	To be cleaned annually and any found to be non-functioning to be recorded for more detailed attention. A list of problems gullies is to be maintained and these will be cleaned at six monthly intervals.	Cleaned annually Problems gullies to be cleaned at six monthly intervals.
Underground drainage pipes	Drainage pipes to be inspected once every two years and cleared when required. Where there is evidence more regular attention is required, then frequency of inspection is to be reviewed.	Inspection at two year intervals.
Catchpits/Manholes	Monthly inspections with Quarterly cleaning, removal of sediments, oils and floatables.	Monthly Inspection, Quarterly cleaning.
Drainage Outlets	Removal of trash and sediments from drainage outlets twice a year.	April October
Flow control device	Inspect and identify any areas that are not operating correctly	Monthly (for the first 3 months), then six monthly
	Remove sediment from upstream silt trap(sump)	Six monthly, or as required
	Hose down unit/chamber	Six monthly, or as required

Table 8: Maintenance Schedule for drainage components

Maintenance Schedule	Required Action	Typical Frequency Schedule
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 manufacturer's recommendations - pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required - once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm 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
	Rehabilitation of surface and upper substructure 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, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

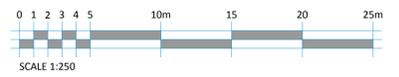
Table 9: Maintenance schedule for permeable pavement

9. SUMMARY AND CONCLUSION

- 9.1 JUDWAA has been commissioned by Cygnature Homes to prepare a site specific Flood Risk Assessment and a Drainage Strategy to support an application for a residential development comprising 5 new dwellings.
- 9.2 The Application Site has a gross area of approximately 0.706 ha and the development proposals are located within Flood Zone 1. This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
- 9.3 The proposed development passes the Sequential Test and is considered to be appropriate development within Flood Zone 1, in accordance with the NPPF and PPG. There are no records of historic flooding at the Application Site.
- 9.4 The flood risk to and arising from the Proposed Development has been classified as low to negligible.
- 9.5 For the surface water drainage strategy, all attenuation storage will be provided by the road permeable sub-base. This SuDS feature have been designed to attenuate surface water runoff for all rainfall events up to and including the 1 in 100 year rainfall event plus an allowance for climate change (+45% increase in peak rainfall intensity) prior to discharge to the existing foul public sewer on Storrington Road at QBAR rate.
- 9.6 Foul flows from the proposed development will be discharged by gravity to the existing foul public sewers on Storrington Road.
- 9.7 The development proposals are therefore compliant with the requirements of NPPF and do not increase flood risk in all areas upstream and downstream of the site. The application should therefore be looked at positively by the planning authority with regards to flood risk and drainage.

APPENDICES

APPENDIX A
Proposed Site Plan



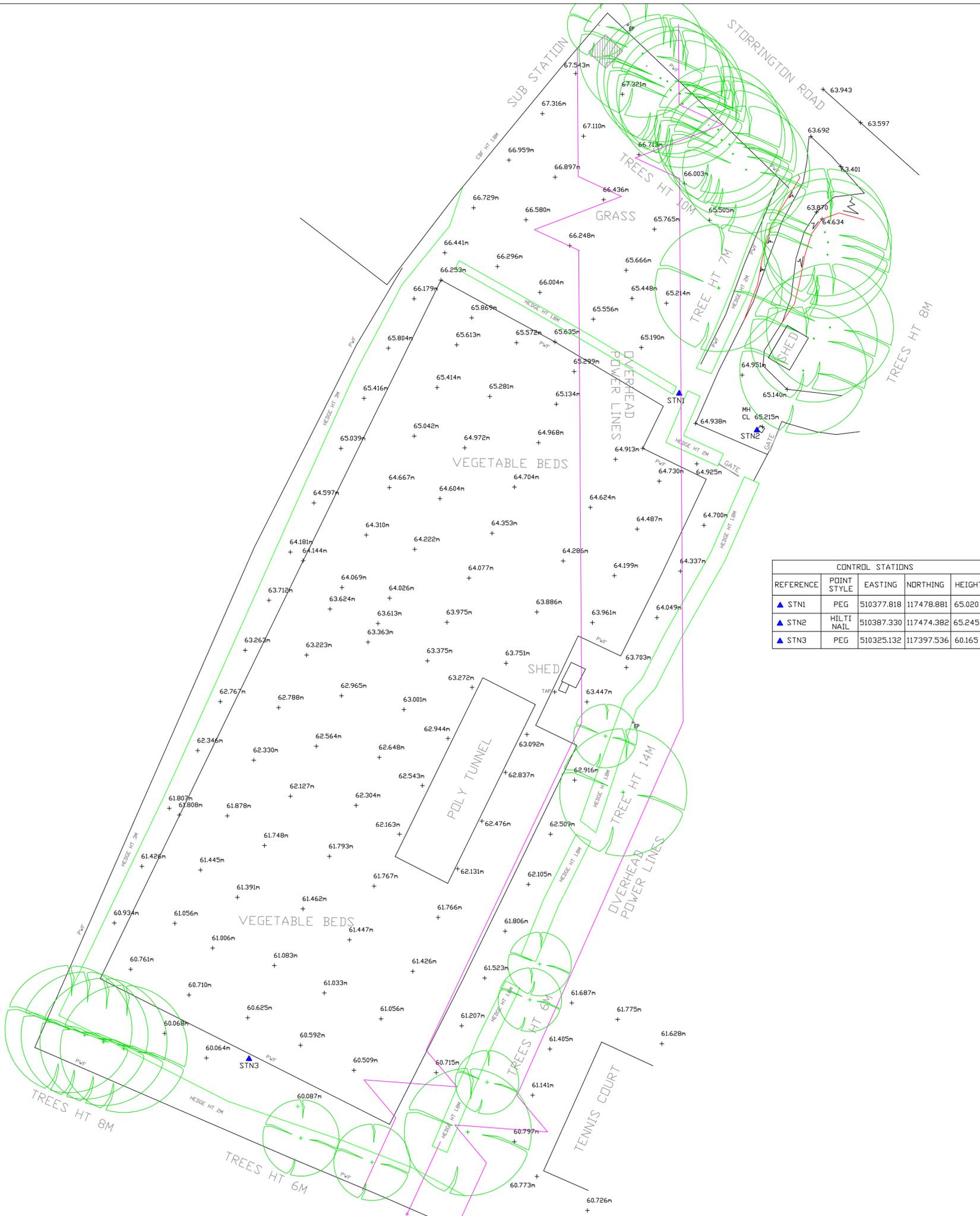
PLANNING APPLICATION DRAWING

REV.	DATE	REVISIONS	REV.	DATE	REVISIONS	CLIENT:	CYGNATURE HOMES LTD	PROJECT:	SOUTH HILL, STORINGTON ROAD, THAKEHAM, PULBOROUGH, RH20 3EN
						SCALE:	1:250 (A1 ORIGINAL)	DRAWING:	PROPOSED SITE PLAN DRAWING
						DRAWN:	CdeO	JOB NO.:	2021 / P0173
						DATE:	NOV 21	DRAWING NO.:	001
								REVISION:	F



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APPENDIX B
Topographical Survey



CONTROL STATIONS				
REFERENCE	POINT STYLE	EASTING	NORTHING	HEIGHT
▲ STN1	PEG	510377.818	117478.881	65.020
▲ STN2	HILTI NAIL	510387.330	117474.382	65.245
▲ STN3	PEG	510325.132	117397.536	60.165

LEGEND	
BANKING	Top Bottom
BUSHES & HEDGES	STILE
MARSH	WALL (when drawn to scale)
TREES 0.2 / 6 % of ground Side of tree	BUILDING
NOTE:- SPREADS AND HEIGHTS ARE INDICATIVE ONLY	OPEN SIDED BUILDING
GATES	GLASS ROOFED
RETAINING WALL	CONTOURS

ABBREVIATIONS (WHERE APPLICABLE)		
AIR VALVE	AV	INVERT LEVEL
BED LEVEL	BL	LAMP POST
BELISHA BEACON	BB	LETTER BOX
BOLLARD	B	MANHOLE
BRITISH TELECOM BOX	BTB	MARKER
BRITISH TELECOM MANHOLE	BTMH	NOTICE BOARD
BRICKWORK	BKWK	NAME PLATE
BUS STOP	BS	OVERHEAD WIRES
COVER LEVEL	CL	PARKING METER
CABLE MARKER	CM	ROAD SIGN
DOWN PIPE	DP	RODDING EYE
ELECTRICITY CABLE PIT	ELCP	RETAINING WALL
ELECTRICITY CONTROL BOX	ECB	SLUICE VALVE
ELECTRICITY POLE	EP	STOP COCK
FIRE HYDRANT	FH	TELEGRAPH POLE
FLOWER BED	FB	TELEPHONE CALL BOX
FOOTPATH	FP	TOP OF KERB
FLOOR LEVEL	FL	TRAFFIC LIGHT
GAS VALVE	GV	UNDERGROUND
GULLY OUTLET	GO	UNABLE TO LIFT
INSPECTION COVER	IC	VENT PIPE
		WATER METER
		WATER VALVE

BUILDING		FENCES	
ACCESS HATCH	AH	BARBED WIRE FENCE	BWF
ARCH HEAD LEVEL	AHL	CORRUGATED IRON FENCE	CIF
ARCH SPRINGER LEVEL	ASL	CLOSE BOARD FENCE	CBF
BEAM SOFFIT LEVEL	BSL	CHAIN LINK FENCE	CLF
CILL HEIGHT	CH	CHESTNUT PALING FENCE	CPF
CEILING LEVEL	CL	INTERWOVEN FENCE	IWF
FALSE CEILING	FC	IRON RAILING FENCE	IRF
FLOOR TO CEILING HEIGHT	234	LARCH LAP FENCE	LLF
LAVATORY BASIN	LB	MISCELLANEOUS FENCING	MiscF
ROOF LEVEL	RL	POST AND CHAIN FENCE	PCF
RADIATOR	RAD	POST AND RAIL FENCE	PRF
RAIN WATER PIPE	RWP	POST AND WIRE	PWF
SKYLIGHT	SL	TUBULAR STEEL RAIL	TSRF
SOIL AND VENT PIPE	SVP		
WASH BASIN	WB		
WATER TANK	WT		
WINDOW CILL LEVEL	WCL		
WINDOW HEAD LEVEL	WHL		

Please note :-
All Information Relate to OSTN15 Data.
All Levels Relate to OSGM15 Data.

**MCKENNA CIVIL
ENGINEERING LTD**
107 Conway Street,
Hove,
East Sussex.
ollie_mckenna@yahoo.co.uk Tel:07387 023656

SURVEYED	OM
DRAWN	OM
CHECKED	LR

SCALE
Not to Scale

SOUTH HILL
STORINGTON ROAD
THAKEHAM
TOPOGRAPHICAL SURVEY

Job No	Rev	Drawing Number
MCE31	-	MCE31_OM_001
Date	23/10/21	

APPENDIX C
Percolation Test Report and BGS Extracts

FACTUAL DATA

Site

**SOUTH HILL, STORRINGTON ROAD,
THAKEHAM, WEST SUSSEX RH20 3EN**

Client

CYGNATURE HOMES LIMITED

Report Ref

23/12538/JAM

Issued

FEBRUARY 2023



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www.alburysi.co.uk

LIMITATIONS

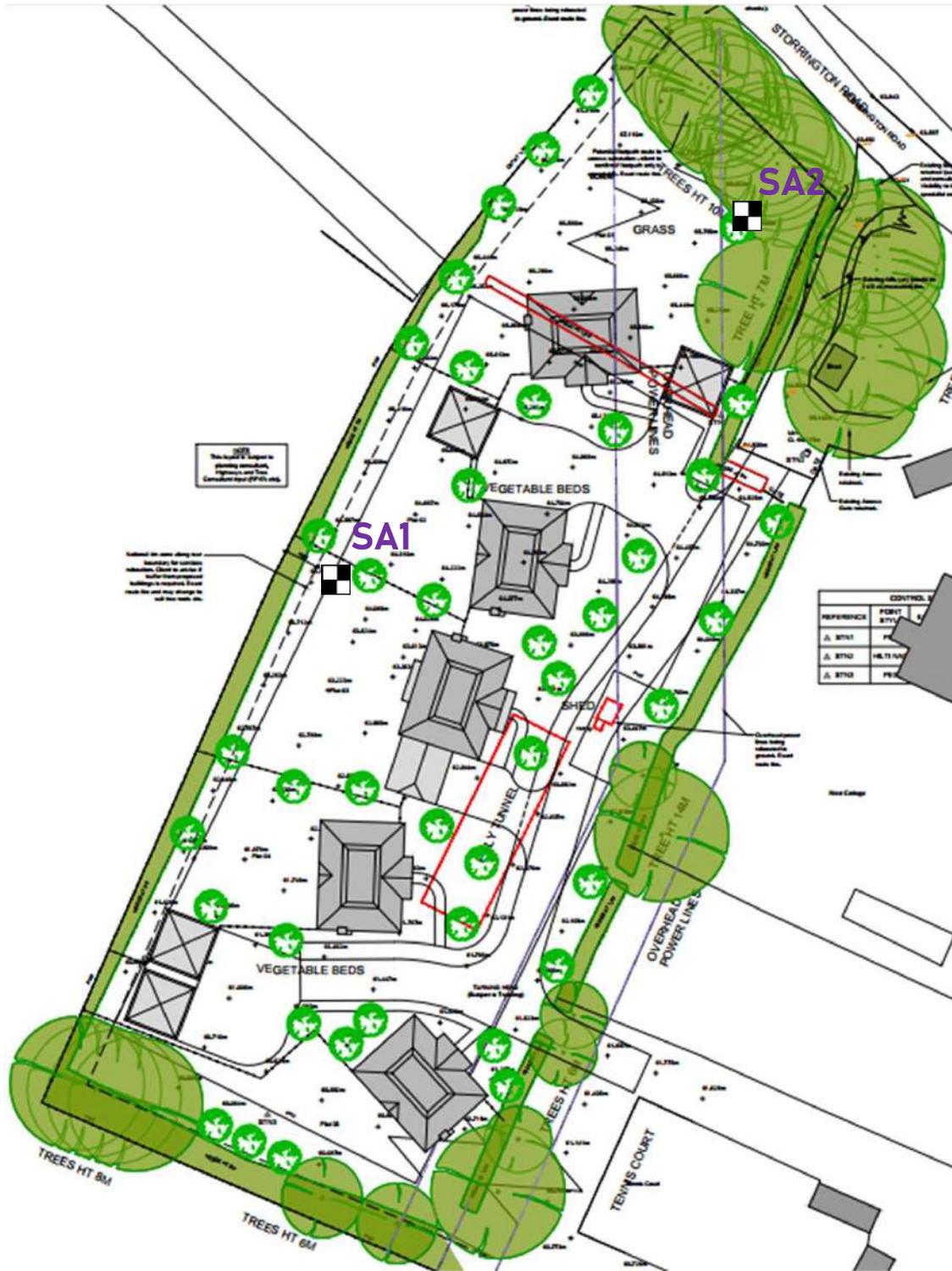
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The groundwater observations entered on exploratory records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. It should be noted that groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The word 'none' indicates that groundwater was sealed off by the borehole casing or that no water was observed in the exploratory hole upon completion.

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Title: Site Layout Plan
 Dwg No: 23/12538/1
 Client: Cygnature Homes Ltd
 Contract: Storrington Road, Thakeham
 Job Ref: 23/12538/JAM
 Scale: NTS
 Revision: 0
 Issue Date: 01/02/2023

Legend:
 Trial Pit Location

 **ALBURY S.I. LTD**
 Miltons Yard,
 Petworth Road,
 Witley,
 Surrey GU8 5LH

**ALBURY S.I. LTD**

Miltons Yard, Petworth Road, Witley, Surrey GU8 5LH

TRIAL PIT**SA1**

Contract	Storrington Road, Thakeham	Report Ref	23/12538/JAM
Client	Cygnature Homes Ltd	Date	30/01/2023
Site Address	South Hill, Storrington Road, Thakeham, West Sussex RH20 3EN	Ground Level	
Type of excavator	Machine	Water level after completion, m	0.70*
Water strikes, m	Pit Dimensions, m	Ease of excavation, m	
1 none	Length 1.9	Very easy GL - 1.10	Difficult 1.30 - 1.70
2	Breadth 0.6	Moderate 1.10 - 1.30	Very hard 1.70 - 2.00

Remarks

BRE365 soakaway test performed in trial pit. Test failed due to the time to fall to 50% being greater than 24 hours

*From soakaway test

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10		0.30		MADE GROUND (dark brown slightly gravelly, clayey SAND with roots. Gravel consists of flint)
D	1.00		1.10		Brown slightly gravelly, very sandy CLAY. Gravel consists of flint and sandstone fragments
D	1.90		2.00		Yellow gravelly, silty SAND. Gravel consists of sandstone fragments
					END OF TRIAL PIT

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TRIAL PIT**SA2**

Contract	Storrington Road, Thakeham	Report Ref	23/12538/JAM
Client	Cygnature Homes Ltd	Date	30/01/2023
Site Address	South Hill, Storrington Road, Thakeham, West Sussex RH20 3EN	Ground Level	
Type of excavator	Machine	Water level after completion, m	1.04*
Water strikes, m	Pit Dimensions, m	Ease of excavation, m	
1 none	Length 2.1	Very easy GL - 0.45	Difficult
2	Breadth 0.65	Moderate 0.45 - 0.80	Very hard 0.80 - 1.80

Remarks

BRE365 soakaway test performed in trial pit. Test failed due to the time to fall to 50% being greater than 24 hours

*From soakaway test

Samples or tests		Shear Strength kPa	Depth	Legend	Strata Description
Type	Depth, m				
D	0.10				MADE GROUND (dark brown slightly gravelly, sandy CLAY with roots. Gravel consists of flint)
D	0.50		0.45		Yellow-brown silty SAND
			0.80		Grey silty SAND
D	1.50		1.80		END OF TRIAL PIT

SOAKAWAY INFILTRATION TEST RESULTS



Contract	Storrington Road, Thakeham
Report Ref	23/12538/JAM
Test Location	SA2 - Cycle 1

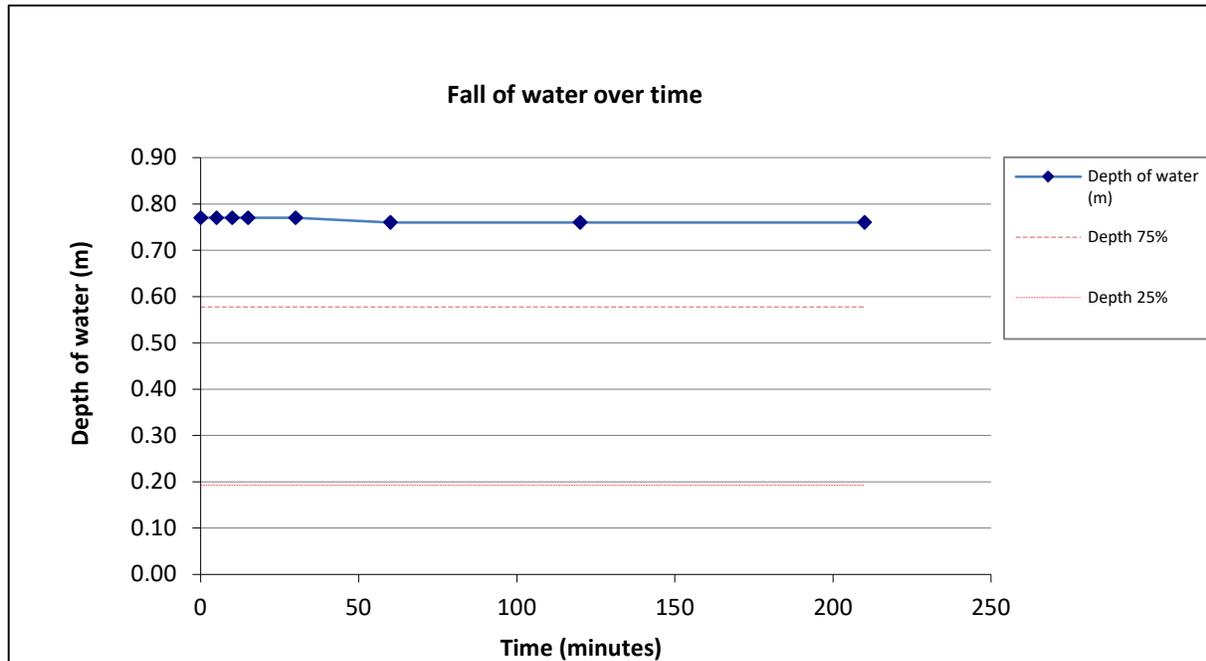
Time (mins)	Depth of Water (m)
0	0.77
5	0.77
10	0.77
15	0.77
30	0.77
60	0.76
120	0.76
210	0.76

Pit Dimensions (m)

Length	2.1
Width	0.65
Depth	1.80

Remarks:

1. Test undertaken in general accordance with BRE Digest 365
2. Test would have taken greater than 24 hours to discharge half the initial volume, hence, the test is deemed to have failed according to BRE365 Guidance.
3. Trial pit backfilled with granular material.



V_{p75-25}	Effective depth storage volume of water in trial pit between 75% and 25% effective depth	
α_{p50}	Internal surface area of trial pit up to 50% effective depth and including base	
t_{p75-25}	Time for water level to fall from 75% to 25% effective depth	

Soil Infiltration Rate (m/sec) *f*



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RECORD OF SHAFT OR BOREHOLE

6-inch or 1:10 000 Map Registration No.

TQ 11 NW / 17

Name and Number of Shaft or Borehole:

THAKEHAM

National Grid Reference

TQ 1084 1765

For whom made I.G.S.

Town or Village THAKEHAM County WEST SUSSEX

1-in or 1:50 000
New Series Map No.

Enter 'C' if
Confidential

Exact site (reference to a fixed point on 1-in or 1:50 000 Map)

At Bramble Buildings, approx 3/40m NNE of St. Mary's Church,
Thakeham.

318
BRIGHTON

Purpose for which made Stratigraphical Research

Ground level at ~~shaft~~ bore relative to O.D. APPROX +04 m. If not ground level give O.D. of beginning of shaft bore _____ / _____ m.

Made by I.G.S.

Date of sinking September 20-25 1979

Information from Cores

Examined by B. Young



Institute of Geological Sciences
RECORD OF SHAFT OR BOREHOLE

6-inch or 1:10 000 Map Registration No.

TQ 11 NW /17

Name and Number of Shaft or Borehole:

THAKEHAM

National Grid Reference

TQ 1084 1765

For whom made I.G.S.

Town or Village THAKEHAM County WEST SUSSEX

1-in or 1:50 000 New Series Map No.

Enter 'C' if Confidential

Exact site (reference to a fixed point on 1-in or 1:50 000 Map)

318 BRIGHTON

at Bramble Buildings, approx 340m NNW of St. Mary's Church, Thakeham.

Purpose for which made Stratigraphical Research

Ground level at bore ~~mark~~ relative to O.D. APPROX +64m. If not ground level give O.D. of beginning of shaft bore / m.

Made by I.G.S. Date of sinking September 20-25 1979

Information from Cores Examined by B. Young

Specimen Numbers and Additional Notes

Geological Classification	Description of Strata	Thickness metres	Depth metres
	6 1/2' ROCK BIT - NO CORES	6.0	6.0
LOWER GREENSAND - UNDIVIDED	SANDSTONE: very fine grained, silty, firm to friable, generally yellowish grey (5Y7/2) with occasional grey streaks and disturbed laminae of ? more clay-rich material, bioturbated, some scattered glauconite, some hollow casts of sponge spicules		
	[generally poor core condition]	1.09	7.09
	MUDSTONE: [extremely poor core - much disturbed and re-constituted by drilling, this lithology interpreted and described from fragmentary samples]		

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Name and Number of Borehole

THAKENAM

6-in or 1: 10 000 Map Registration No.

TQ 11NW/17

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National Grid Reference

TQ 1084 1765

Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	1.09	7.09
	compact, massive, smooth texture, resembles Fuller's earth, yellowish grey (5Y7/2) to dusky yellow (5Y6/4) and yellowish-orange (10YR6/6), core condition does not allow thickness to be determined but probably does not exceed 0.1m	0.10	77.19
	SANDSTONE: as above mudstone but strongly calcareous [very poor core condition to 8.07]	0.88	8.07
	SANDSTONE: fine-grained, silty, calcareous, some scattered glauconite and occasional scattered hollow sponge spicule casts, generally yellowish-grey (5Y7/2) with grey streaks and disturbed laminae, strongly bioturbated, some oblique to sub-horizontal burrows up to c. 2cm diameter with dark concentric fill, solid limonite in burrows at 8.50, 8.73 and between 9.00 and 9.05, some sub-vertical fissures, becoming harder below 9.10 and passing down to	1.33	9.40
LOWER GREENSAND - UNDIVIDED	HARD SANDSTONE: fine-grained, compact, calcareous, a little scattered white mica, some scattered glauconite, yellowish-grey (5Y4/1) wisps and laminae - these especially abundant between 9.46 and 9.68, bivalve cast at 9.48, a little very finely comminuted shell debris, ? a few hollow spicule casts, strongly bioturbated, passing down rapidly to	0.42	9.82
	SANDSTONE: as at 8.07, locally relatively friable, some vertical to sub-vertical fissures, rare spicule casts, limonite-filled burrow at 9.34	0.83	10.65

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Name and Number of Borehole

THAKEHAM

6-in or 1: 10 000 Map Registration No.

TQ 11 NW/17

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National Grid Reference

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Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	0.83	10.65
	CORE LOSS:	0.29	10.94
	SANDSTONE: as above, patchy limonite associated with burrows at 11.33, rather harder between 11.85 and 11.95 and between 12.20 and 12.50 and between 13.00 and 13.21, grey wisps die out below 13.25, passing down rapidly to	2.79	13.73
	HARD SANDSTONE: fine-grained, compact, massive, strongly calcareous, scattered glauconite, a few small dark grey wisps, generally yellowish-grey (5Y8/1 to 5Y7/2), dark grey-brown ?phosphatic patches -? burrow fills up to 1cm diameter at 14.06, ammonite at 14.10, passing down rapidly to	0.47	14.20
LOWER GREENSAND - UNDIVIDED	SANDSTONE: fine-grained, silty, calcareous, scattered glauconite, generally yellowish-grey (5Y7/2), some grey wisps, bioturbated, ?rare hollow spicule casts, friable, [core rather broken] passing down to	1.22	15.42
	HARD SANDSTONE: fine-grained, silty, massive, calcareous, scattered glauconite, yellowish-grey (5Y8/1) with numerous olive grey (5Y4/1) clay-rich wisps, disturbed laminae and burrow fills, strongly bioturbated, a few burrows up to 1.5cm diameter with grey concentric fill, passing down to	0.43	15.85
	SANDSTONE: fine-grained, silty, non-calcareous, scattered glauconite, near yellowish-grey (5Y7/2) with light olive grey (5Y6/1 to 5Y5/2)		

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Name and Number of Borehole

TIIAKEHAM

6-in or 1: 10 000 Map Registration No.

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National Grid Reference

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Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	0.45	16.30
	wisps and disturbed laminae, strongly bioturbated, a few hollow spicule casts, this unit cut by vertical fissure with limonite-stained surfaces	0.45	16.30
	CORE LOSS:	1.32	17.62
	SANDSTONE: fine-grained, silty, calcareous, scattered glauconite, yellowish-grey (5Y7/2), a few grey wisps, bioturbated, grey wisps and disturbed laminae more numerous between 17.90 and 18.10 and slightly harder between 17.90 and 18.05, cut by sub-vertical fissures, weakly calcareous between 18.95 and 19.38		
LOWER GREENSAND - UNDIVIDED	passing down to	1.76	19.38
	HARD SANDSTONE: fine-grained, silty, massive, compact, strongly calcareous, some scattered glauconite, generally yellowish-grey (5Y7/2), olive grey (5Y4/1 to 5Y3/2) rather more clay-rich wisps and burrow linings, harder and more compact with only rare greyish wisps below 19.56 but with occasional limonite-stained patches roughly parallel to bedding, sharp change	0.39	19.77
	HARD SANDSTONE: fine-grained, silty, some scattered glauconite, calcareous, some scattered forams and very finely comminuted shell debris, generally olive grey (5Y5/1) with olive grey (5Y4/1) and light olive grey (5Y6/1) disturbed laminae giving strongly streaked appearance, bioturbated,		
	passing down to	0.12	19.89

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6-in or 1: 10 000 Map Registration No.

Name and Number of Borehole

THAKEHAM

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National Grid Reference
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Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	0.12	19.89
	SANDSTONE: fine-grained, silty, non-calcareous, generally yellowish-grey (5Y7/2) with numerous olive grey (5Y/2) clay-rich wisps giving roughly striped appearance, bioturbated, some limonite staining adjacent to vertical fissures, becoming relatively friable below about 20.20		
	[poor core condition between 20.00 and 20.50 with ? about 10cm lost between 20.10 and 20.20]		
	calcareous between 20.47 and 20.57, non-calcareous between 20.57 and 20.67, weakly calcareous between 20.67 and 20.83, non-calcareous below 20.83, rather harder below 20.70	1.51	21.40
	CORE LOSS: - between 21.40 and 23.06 lumps and very short cores up to 10cm long of relatively soft yellowish-grey (5Y7/2) sandstone, as above recovered.	1.66	23.06
LOWER GREENSAND - UNDIVIDED	SANDSTONE: fine-grained, silty, calcareous, some scattered glauconite, some scattered ? forams and ? very finely comminuted shell debris, streaked light grey (N7) and olive grey (5Y4/1), patchy yellowish-grey (5Y7/2) mottling locally ? adjacent to fissures, bioturbated, cut by vertical to sub-vertical fissure, firm, becoming friable below 23.50, glauconite becoming common in lowest 10 cm, clasts and ? lentils of smooth light grey (N7) to light olive grey (5Y6/1) mudstone in lowest 5cm [core much broken]		
	sharp base	0.97	24.03

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Name and Number of Borehole

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6-in or 1: 10 000 Map Registration No.

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National Grid Reference

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Geological Classification	Description of Strata	Thickness metres	Depth metres
	<p style="text-align: right;">Brought Forward</p> <p><u>MUDSTONE</u>: massive, smooth-textures, non-calcareous, somewhat resembles a Fuller's earth, silty, light grey (N7) to light olive grey (5Y6/1) with dark yellowish-orange (10YR6/9) staining along fractures to 24.06, rather blocky fracture, core rather disturbed but appears to show burrows up to 1cm diameter filled with glauconitic silty sand from above penetrating to 24.06, a few indeterminate small shell fragments locally, echinoid fragment at c. 24.20.</p> <p>[Box containing un-logged core from 24.06 - 25.65 accidentally dropped at Gorat Road]</p>	<p>0.97</p> <p>c 0.27</p>	<p>24.03</p> <p>c 24.30</p>
ATHERFIELD CLAY	<p><u>MUDSTONE</u>: massive, silty, locally calcareous, light olive grey (5Y8/1), rather smooth-textured, occasional shell fragments, ? becoming more silty downwards and ? passing down to</p>	<p>c 0.45</p>	<p>c 24.75</p>
	<p><u>SILTY MUDSTONE</u>: relatively massive, light olive grey (5Y6/1), ? bioturbated, locally calcareous, some pyritised trails, occasional bivalves, ? becoming rather less silty downwards and passing into</p>	<p>c 0.75</p>	<p>c 25.50</p>
	<p><u>MUDSTONE</u>: (very like above but less silty), silty, relatively massive, light olive grey (5Y6/1 to 5Y5/1), bioturbated, bivalve fragments fairly common, 2cm ironstone (or phosphate) nodule near pale yellowish-brown (10YR7/2) at 26.82, a few very thin glauconitic sand laminae between 26.80 and 27.00, yellowish-grey (5Y7/2) to moderate yellowish-</p>		

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Name and Number of Borehole

THAKEHAM

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National Grid Reference

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Geological Classification	Description of Strata	Thickness metres	Depth metres
ATHERFIELD CLAY	<p>Brought Forward</p> <p>brown (10YR5/4) 5cm ironstone septarian nodule with open cracks and ? sphalerite crystals at 27.58, bivalve in nodule at 27.58, mudstone surrounding nodule assumes olive grey (5Y6/2) colouration and becomes relatively hard, colour becoming predominantly dark yellowish-brown (10YR4/2) to light olive grey (5Y5/2) below 27.50, large yellowish-brown (10YR5/2) across core between 28.11-28.19 with small bivalve at 28.15 ?coated with sphalerite, ?sphalerite crystal at 28.18, smaller nodule at 28.31, colour returning to olive grey (5Y5/1) between 28.50 and 28.60, glauconitic silt? in burrows at 28.60, passing down to</p>	<p>c 0.75</p>	<p>c 25.50</p>
	<p>MILSTONE: silty, compact, (closely resembles above), dark yellowish-brown (10YR4/2) to brownish-grey (5YR5/1), generally smooth, even fracture, a few very thin silt wisps and ? burrow fills, glauconitic micaceous silt wisps at 28.60, 29.15 and 31.23, small bivalve at 28.80, 29.15, 29.74, 29.76, 29.77 and a few very scattered bivalves below 31.45, fragment of ribbed bivalve at 31.00, small 1cm ironstone nodule at 29.42, 2cm nodule at 29.63, 29.78, 4cm ironstone nodule at 30.00 with small ?sphalerite crystal and 1cm nodule at 30.14, 3cm nodule at 30.38, 6cm nodule at 30.56 and 7cm nodule at 30.70, 4cm thick ironstone septarian across core at 30.92, 2cm nodule at 31.10, 1cm nodule at 31.14, 8cm nodule with a few ?sphalerite crystals at 31.32, 5cm nodule at 31.55 and 3cm nodule at 31.85, colour becoming</p>	<p>1.15</p>	<p>28.65</p>

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Name and Number of Borehole

THAKEHAM

6-in or 1: 10 000 Map Registration No.

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National Grid Reference
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Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	3.15	28.65
	predominantly olive grey (5Y4/1) to light olive grey (5Y6/1) between 30.48 and 30.60, colour becoming predominantly dark yellowish-brown (10YR4/2) and passing down gradually to	3.25	31.90
	MUDSTONE: very slightly silty, smooth, even textured, generally dark yellowish-brown (10YR5/2), a few very small pale grey reduced spots, 1cm ironstone nodule at 32.46, 2cm nodule at 32.57, small ribbed bivalve at 32.33, small fragment of echinoid at 32.73, relatively large bivalve at 32.88, ribbed bivalve fragment at 33.06, ribbed bivalve at 33.12 and small bivalve at 33.12,		
ATHERFIELD CLAY	[core much disturbed and reconstituted between 33.25 and 33.65 with pockets of coarse glauconitic sand - these are probably cavings and not in situ but difficult to suggest level from which they have been derived]		
	?sharp colour change	1.45	33.35
	MUDSTONE: silty, massive, ? a few glauconite grains, near medium light grey (N6), ?sharp base	0.15	33.50
	MUDSTONE: laminated, near olive grey (5Y5/1) with a few very thin pale grey silt laminae, becoming relatively fissile below 33.85, 3cm compact, fairly hard light olive grey (5Y6/1) ironstone across core at 34.21, passing down to	0.90	34.40
WEALD CLAY			

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Name and Number of Borehole

THAKEHAM

6-in or 1: 10 000 Map Registration No.

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National Grid Reference

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Geological Classification	Description of Strata	Thickness metres	Depth metres
	Brought Forward	0.90	34.40
	MUDSTONE: generally poorly laminated, some thin pale grey silt laminae, generally between medium grey (N5) and olive grey (5Y4/1), crushed gastropods common, bivalve at 34.41, fossils becoming fewer below 34.60, passing down to	0.36	34.76
	MUDSTONE: laminated, fissile, silty, between dark greenish-grey (5GY4/1) and medium dark grey (N4), numerous thin pale grey silt laminae, silt laminae becoming more numerous downwards with colour becoming paler and passing down to	0.39	35.15
	SILTSTONE: laminated, near light olive grey (5Y7/1) to very light grey (N8), some grey clay laminae, some channeling features locally, sharp change	0.27	35.42
WEALD CLAY	MUDSTONE: silty, evenly laminated, generally olive grey (5Y5/1) with numerous paler coloured silt laminae, passing down rapidly to	0.25	35.67
	SILTSTONE: very like that at 35.15, yellowish-grey (5Y8/1 to 5Y7/2), passing down to	0.03	35.70
	MUDSTONE: silty, laminated, generally olive grey (5Y5/1) <small>common, cross-bedding in silt laminae</small> paler thin silt laminae between 35.76 and 35.78, seen to	0.24	35.94
	CORE LOSS:	0.58	36.52
	Borehole completed at 36.52		

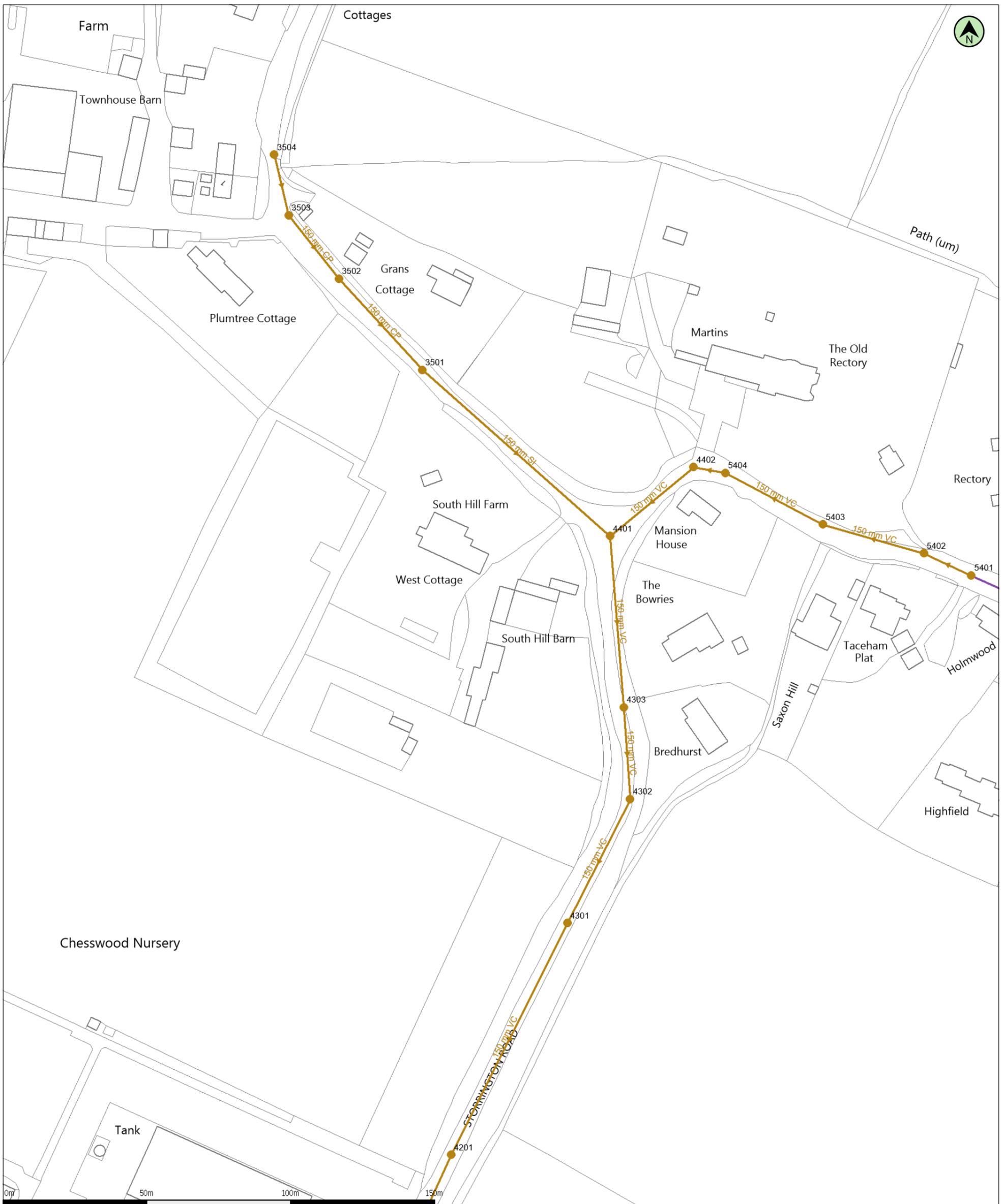
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APPENDIX D
UKSuDS Water Quality Toolkit Output

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type Pollution Hazard Level Pollution Hazard Indices TSS Metals Hydrocarbons	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day) Low 0.5 0.4 0.4				
SuDS components proposed Component 1 Component 2 Component 3	Pervious pavement (where the pavement is not designed as an infiltration component) None None	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
SuDS Pollution Mitigation Indices TSS Metals Hydrocarbons	0.7 0.6 0.7				
Groundwater protection type Groundwater protection Pollution Mitigation Indices TSS Metals Hydrocarbons	None 0 0 0				
Combined Pollution Mitigation Indices TSS Metals Hydrocarbons Acceptability of Pollution Mitigation TSS Metals Hydrocarbons	0.7 0.6 0.7 Sufficient Sufficient Sufficient				

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Residential roofing				
Pollution Hazard Level	Very low				
Pollution Hazard Indices					
TSS	0.2				
Metals	0.2				
Hydrocarbons	0.05				
SuDS components proposed					
Component 1	Pervious pavement (where the pavement is not designed as an infiltration component)	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B			
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.7				
Metals	0.6				
Hydrocarbons	0.7				
Groundwater protection type	None				
Groundwater protection					
Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices					
TSS		0.7 Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England			
Metals					
Hydrocarbons					
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

APPENDIX E
Southern Water Sewer Map Records



(c) Crown copyright and database rights 2023 Ordnance Survey 100031673
 Data updated: 06/01/23

Scale: 1:1250
 Map Centre: 510427,117428

Date: 24/01/23
 Our Ref: 1066388 - 1

Wastewater Plan A3
 Powered by digdat

hussainigiwa@judwaaconsulting.com

SOUTH HILL



The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2023 Ordnance Survey 100031673. This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.
 WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

APPENDIX F
Greenfield Runoff Rate Calculation

Calculated by: Hussaini Giwa

Site name: STORRINGTON ROAD

Site location: THAKEHAM,

Site Details

Latitude: 50.94615° N

Longitude: 0.43031° W

Reference: 2014177723

Date: Sep 03 2023 15:42

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

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	850	850
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Q_{BAR} (l/s):	4.28	4.28
1 in 1 year (l/s):	3.64	3.64
1 in 30 years (l/s):	9.84	9.84
1 in 100 year (l/s):	13.65	13.65
1 in 200 years (l/s):	16	16

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX G
Proposed Drainage Strategy Layout

APPENDIX H
Proposed Drainage Calculations

Network Details

Manhole Schedule

Manhole	Catchment Area (ha)	Diameter (m)	Type	CL (m)	IL (m)	Depth To Soffit (m)	Easting (m)	Northing (m)
S1	0.385	1.200	Type B	60.750	58.975	1.550	510347.014	117394.816
S2	0.000	1.200	Type B	61.407	58.895	2.287	510353.755	117404.701
S3	0.000	1.200	Type B	61.700	58.757	2.718	510374.214	117401.537

Pipe Schedule

Pipe Number	US Manhole	US IL (m)	DS Manhole	DS IL (m)	Diameter (m)	Length (m)	Gradient (1:x)	Roughness (mm)	US Depth To Soffit (m)	DS Depth To Soffit (m)
1.000	S1	58.975	S2	58.895	0.225	11.965	150.0	0.600	1.550	2.287
1.001	S2	58.895	S3	58.757	0.225	20.702	150.0	0.600	2.287	2.718

Outfall Details

Outfall Manhole S3 : Free Discharge

Flow Control Details

Tank Structure at Manhole S1

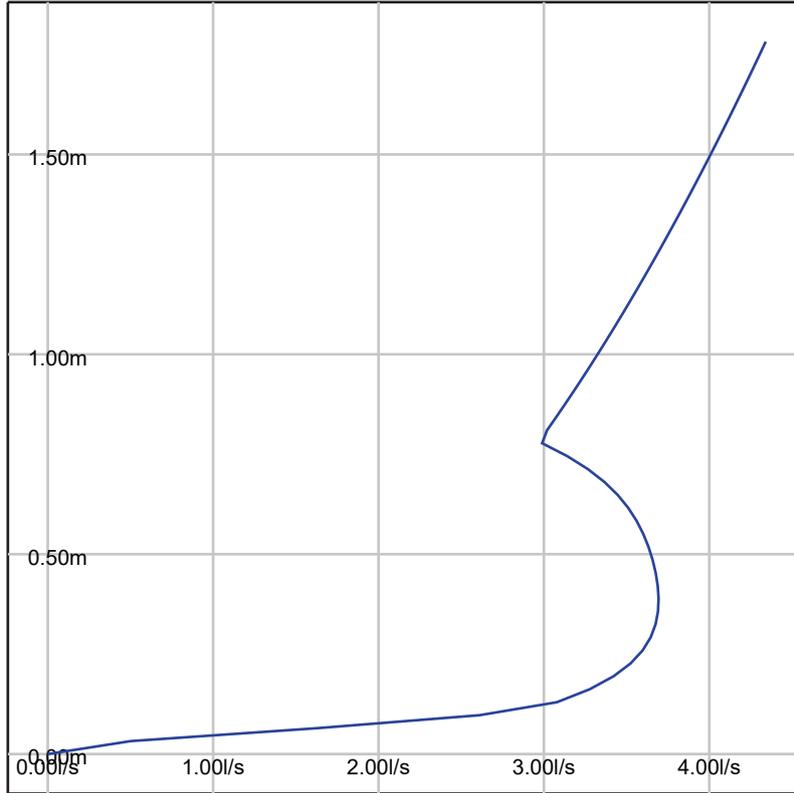
Tank Invert (m)	Tank Height (m)	Void Ratio (%)	Area (m2)	Effective Area (m2) Area x Void Ratio	Max Storage (m3) Effective Area x Height	Infil Base (m/hr)	Infil Side (m/hr)	Safety Factor
58.975	0.800	30.00	665.733	199.720	159.776	0.00000000	0.00000000	2.00

Controls within Manhole S2

Hydro-Brake® Optimum Control at Manhole S2

Model Ref	Design Depth (m)	Design Flow (l/s)	Depth Above Invert (m)	FF Head (m)	FF Flow (l/s)	KF Head (m)	KF Flow (l/s)
SHE-0088-4000-1500-4000 ID:477191	1.500	4.000	0.000	0.385	3.693	0.780	2.968

Hydro-Brake® Optimum Control at S2



Simulation Settings

FSR: M5-60=20.00, R=0.30, Locale=England and Wales

Summer (Cv: 0.75), Winter (Cv: 0.84)

Global Time of Entry: 5.0 mins

Durations (mins): 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440

Return Periods (yrs) + Climate Change: (1, +0%), (30, +0%), (100, +45%)

Simulated Rainfall Events

Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %	Storm	Average Intensity (mm/hr)	Runoff Continuity %	Flow Continuity %
1Yr 15Min Winter	33.357	0.00	0.00	30Yr 360Min Summer	9.053	0.00	0.04
1Yr 15Min Summer	33.357	0.00	-0.22	30Yr 360Min Winter	9.053	0.00	0.28
1Yr 30Min Winter	22.098	0.00	0.17	30Yr 480Min Summer	7.379	0.00	0.00
1Yr 30Min Summer	22.098	0.00	0.00	30Yr 480Min Winter	7.379	0.00	0.00
1Yr 60Min Winter	14.222	0.00	0.32	30Yr 600Min Summer	6.291	0.00	0.00
1Yr 60Min Summer	14.222	0.00	0.09	30Yr 600Min Winter	6.291	0.00	0.00
1Yr 120Min Summer	9.060	0.00	-0.09	30Yr 720Min Summer	5.520	0.00	0.00
1Yr 120Min Winter	9.060	0.00	0.00	30Yr 720Min Winter	5.520	0.00	0.00
1Yr 180Min Winter	6.971	0.00	0.00	30Yr 960Min Summer	4.488	0.00	0.00
1Yr 180Min Summer	6.971	0.00	0.00	30Yr 960Min Winter	4.488	0.00	0.00
1Yr 240Min Winter	5.784	0.00	0.00	30Yr 1440Min Summer	3.346	0.00	0.00
1Yr 240Min Summer	5.784	0.00	0.00	30Yr 1440Min Winter	3.346	0.00	0.00
1Yr 360Min Winter	4.440	0.00	0.00	100Yr +45% 15Min Summer	129.387	0.00	1.83
1Yr 360Min Summer	4.440	0.00	0.00	100Yr +45% 15Min Winter	129.387	0.00	1.99
1Yr 480Min Summer	3.679	0.00	0.00	100Yr +45% 30Min Summer	89.228	0.00	1.35
1Yr 480Min Winter	3.679	0.00	0.00	100Yr +45% 30Min Winter	89.228	0.00	1.14
1Yr 600Min Winter	3.180	0.00	0.00	100Yr +45% 60Min Summer	58.739	0.00	0.75
1Yr 600Min Summer	3.180	0.00	0.00	100Yr +45% 60Min Winter	58.739	0.00	0.59
1Yr 720Min Summer	2.824	0.00	0.00	100Yr +45% 120Min Summer	37.167	0.00	0.44
1Yr 720Min Winter	2.824	0.00	0.00	100Yr +45% 120Min Winter	37.167	0.00	0.41
1Yr 960Min Summer	2.341	0.00	0.00	100Yr +45% 180Min Summer	27.883	0.00	0.39
1Yr 960Min Winter	2.341	0.00	0.00	100Yr +45% 180Min Winter	27.883	0.00	0.36
1Yr 1440Min Winter	1.798	0.00	0.00	100Yr +45% 240Min Summer	22.657	0.00	0.35
1Yr 1440Min Summer	1.798	0.00	0.00	100Yr +45% 240Min Winter	22.657	0.00	0.33
30Yr 15Min Winter	68.992	0.00	0.92	100Yr +45% 360Min Summer	16.891	0.00	0.30
30Yr 15Min Summer	68.992	0.00	0.56	100Yr +45% 360Min Winter	16.891	0.00	0.29
30Yr 30Min Summer	47.082	0.00	0.94	100Yr +45% 480Min Summer	13.687	0.00	0.26
30Yr 30Min Winter	47.082	0.00	1.09	100Yr +45% 480Min Winter	13.687	0.00	0.26
30Yr 60Min Summer	30.811	0.00	0.81	100Yr +45% 600Min Summer	11.614	0.00	0.22
30Yr 60Min Winter	30.811	0.00	0.79	100Yr +45% 600Min Winter	11.614	0.00	0.23
30Yr 120Min Summer	19.530	0.00	0.62	100Yr +45% 720Min Summer	10.149	0.00	0.18
30Yr 120Min Winter	19.530	0.00	0.57	100Yr +45% 720Min Winter	10.149	0.00	0.20
30Yr 180Min Winter	14.749	0.00	0.49	100Yr +45% 960Min Summer	8.193	0.00	0.00
30Yr 180Min Summer	14.749	0.00	0.51	100Yr +45% 960Min Winter	8.193	0.00	0.12
30Yr 240Min Summer	12.050	0.00	0.41	100Yr +45% 1440Min Winter	6.044	0.00	0.00
30Yr 240Min Winter	12.050	0.00	0.43	100Yr +45% 1440Min Summer	6.044	0.00	0.00

Simulation Results

Return Period Yrs: 1.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	180 min Winter	141	59.608	0.633	3.446		Surcharged
S2	180 min Winter	141	59.607	0.712	3.395		Surcharged
S3	720 min Summer	466	58.802	0.044	3.693		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	180 min Winter	141	S1	S2	0.225	0.085	3.395	0.080	OK
1.001	180 min Winter	141	S2	S3	0.043	0.648	3.393	0.080	OK

Return Period Yrs: 30.0

Climate Change %: 0

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	360 min Winter	304	59.949	0.974	3.351		Surcharged
S2	360 min Winter	304	59.949	1.054	3.342		Surcharged
S3	1440 min Winter	1488	58.802	0.044	3.693		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	360 min Winter	304	S1	S2	0.225	0.084	3.342	0.079	OK
1.001	360 min Winter	304	S2	S3	0.042	0.645	3.342	0.079	OK

Return Period Yrs: 100.0

Climate Change %: 45

Manholes

Manhole	Critical Storm	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Flood (m3)	Status
S1	480 min Winter	456	60.187	1.212	3.664		Surcharged
S2	480 min Winter	456	60.187	1.291	3.680		Surcharged
S3	960 min Summer	1764	58.802	0.044	3.693		Outfall

Conduits

Pipe No.	Critical Storm	Peak (mins)	US Manhole	DS Manhole	Flow Depth (m)	Velocity (m/s)	Flow (l/s)	Flow / Capacity	Status
1.000	480 min Winter	456	S1	S2	0.225	0.093	3.680	0.087	OK
1.001	480 min Winter	456	S2	S3	0.044	0.663	3.680	0.087	OK