

LAND EAST OF LONGWATER ROAD, FINCHAMPSTEAD

Flood Risk Assessment and Drainage Strategy Addendum

794-DES-ARC-30429
Longwater Road, Finchampstead
2
November 2024

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
1	Addendum	J. Grady	E. Bullen	C. Patmore	20.11.2024
2	Revised layout added	J. Hughes	E. Bullen	C. Patmore	29.11.2024

Approval for issue

C. Patmore

29.11.2024

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**Catesby Strategic Land Ltd and
Stonebond Properties (Guildford) Ltd**

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1 INTRODUCTION

- 1.1 RPS was commissioned by Catesby Strategic Land Ltd and Stonebond Properties (Guildford) Ltd to prepare an addendum to the Flood Risk Assessment (ref: 794-DES-ARC-30429_Longwater Rd, Finchampstead_FRA_v2 dated 20240607) previously produced for land to the east of Longwater Road, Finchampstead, RG40 3TT, in relation to the proposed development of up to 38 dwellings and associated infrastructure.
- 1.2 The addendum will address updates to the development proposals, and associated drainage strategy and flood constraints for the site.

2 SITE DESCRIPTION AND DEVELOPMENT PROPOSAL

Site Description

- 2.1 The site is located at National Grid Reference SU 79644 62704, is irregular in shape and occupies an area of approximately 2.3 hectares (ha). The site location is presented in Figure 1.

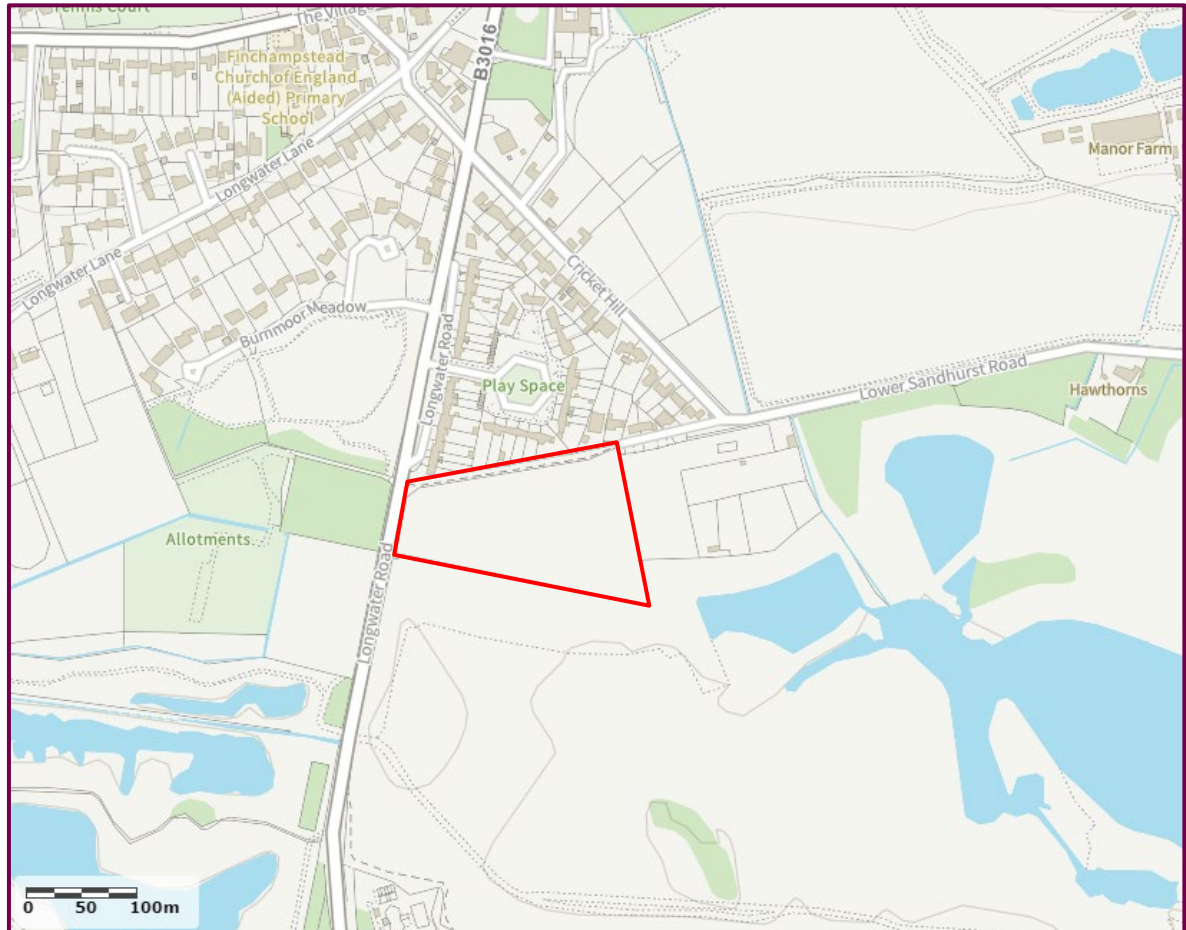


Figure 1. Site Location

- 2.2 The site is currently occupied by greenfield land.

Development Proposals

- 2.3 The proposed development comprises
“Erection of 38 no. residential dwellings, together with associated parking, landscaping and open space”.
- 2.4 Development plans are shown in Appendix A.
- 2.5 The proposed use of the site is classified as ‘More Vulnerable’ within the PPG.

3 FLOOD RISK SOURCES

- 3.1 Below is a summary of the flood risk sources at the site. Please note, a review of the available flood mapping has confirmed that this information has not changed from the original FRA for each source of flooding. As mentioned below, mapping is available online, but is also provided within Section 6 and 8 of the FRA.

Fluvial Flooding

- 3.2 The EA Flood Map for Planning¹, which is available online, indicates that the site is located within Flood Zone 1, whereby the annual probability of flooding from fluvial or tidal sources is classified as less than 1 in 1,000 (0.1%) chance of flooding from rivers or the sea in any given year.

Surface Water Flooding

- 3.3 The EA's Flood Map for Surface Water², which is available online, indicates that the majority of the site is at 'Very Low' risk of surface water flooding. The southeast corner of the site and southern boundary are at predominantly 'low' risk of surface water flooding, with some very small patches of 'medium' risk. The proposed plots are located outside of surface water flood risk extents, as shown in Figure 2 below.
- 3.4 Once the site is developed, the proposed surface water drainage strategy will intercept and manage surface water runoff. This will ensure that surface water generated onsite will be managed sustainably.

¹ <https://flood-map-for-planning.service.gov.uk/>

² <https://www.gov.uk/check-long-term-flood-risk>

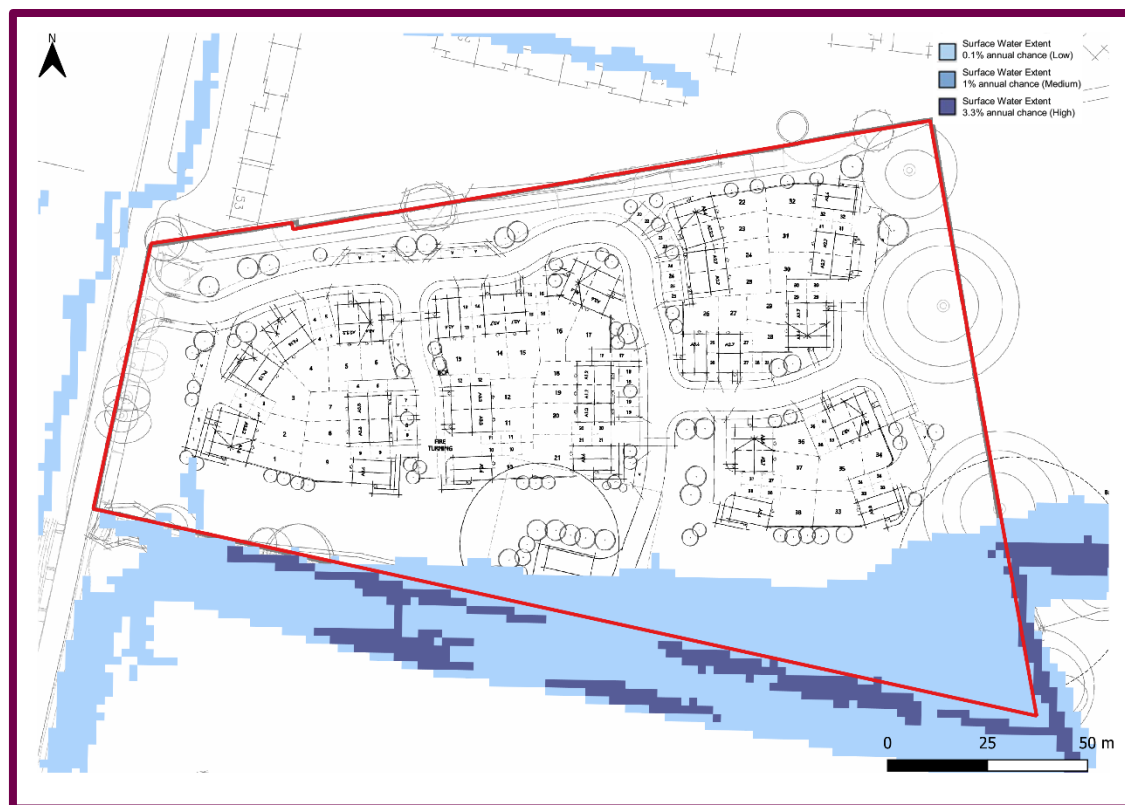


Figure 2. Surface Water Extents and Development Layout
(extract from EA surface water flood mapping Nov 2024)

Reservoir Flooding

- 3.5 EA reservoir mapping³ indicates that the site is not located within an area potentially at risk from reservoir flooding.

Sewer Flooding

- 3.6 The TW sewer records (copies are contained within the original FRA and reproduced as Appendix B) indicate that there are currently no surface water sewers located within the site boundary. Once the site is developed, the drainage system will be designed to accommodate flows up to the 1 in 100 year +40% climate change storm event.

Groundwater Flooding

- 3.7 The Wokingham Borough Council (WBC) SFRA⁴ does not identify any historic incidents of groundwater flooding in Finchampstead. The SFRA Susceptibility to Groundwater Flooding Map indicates that the site is located in an area with limited potential for groundwater flooding to occur. The site-specific assessment of the site in the SFRA indicates that there is potential for basement flooding as a result of the groundwater flood risk. No basements are proposed on the site.

³ <https://www.gov.uk/check-long-term-flood-risk>

⁴ <https://www.wokingham.gov.uk/sites/wokingham/files/2023-07/1.%20WBC%20SFRA%202020%20Report.pdf>

- 3.8 BGS borehole logs (contained within the original FRA) indicate that the groundwater table is approximately 1-1.2m bgl. It is recommended that a groundwater monitoring study is undertaken in winter months prior to the commencement of construction.

Other Sources of Flooding

- 3.9 As with any urban location, there is the potential risk of a break in a water main causing localised flooding at the site. A burst pipe can result in flooding of roads and property. Areas at most risk are low points in topography along open roads. The development proposals will be designed to ensure that any overland flows are routed away from buildings and intercepted by gullies and or drainage channels, therefore potential risks posed by a break in a water main can be considered negligible.

4 DRAINAGE STRATEGY

Existing Surface Water Drainage

- 4.1 TW sewer records, included for reference in Appendix B indicate that there are no public surface water sewers located within the site boundary.
- 4.2 Public surface water sewers are located within the vicinity of the site, most notably a 225mm diameter sewer located in Burnmoor Meadow to the northwest.
- 4.3 The greenfield nature of the site means that surface water will slowly soak into the ground (infiltrate), be intercepted by vegetation or run off by way of overland flow, according to the soil characteristics and following the topography of the site.
- 4.4 Greenfield runoff rates for the site have been calculated by way of Interim Code of Practice for Sustainable Drainage Systems (ICP SUDS). This implements a pro rata IH124 methodology, for sites below 50ha in size. The calculation has been included for reference within Appendix C and outputs are summarised within Table 2.

Return Period	Greenfield Runoff Rate (l/s)
Q1	5.35
QBar	6.29
Q30	14.48
Q100	20.08

Table 1: Greenfield Runoff Rates

Existing Foul Water Drainage

- 4.5 TW sewer records are included for reference in Appendix B indicating that a 150mm diameter public foul water sewer is located in the site. This sewer is located along the northern boundary, flowing in a westerly direction to a foul pumping station located approximately 130m west of the site.

Consideration of Drainage Hierarchy

4.4 The PPG advises of the following hierarchy for the disposal of surface water;

1. Infiltration;
2. To a surface water body;
3. To a surface water sewer, highway drain or another drainage system; or
4. To a combined sewer.

The drainage hierarchy has been considered as follows.

Infiltration

4.5 The soakaway testing undertaken at the site concluded that an infiltration to 75% was unachievable and an accurate infiltration rate could not be calculated for any of the soakaway tests. As a result, an alternative method for disposing of surface water will be considered. Soakaway testing is included as Appendix D.

To a Surface Water Body

4.6 It is proposed to discharge surface water to a nearby watercourse, located to the southwest of the site. The ordinary watercourse is located outside of the site boundary. Therefore third party consent may be required from the landowner, and permission should be sought to establish this outfall to the ordinary watercourse.

To a Surface Water Sewer, Highway Drain or Another Drainage System

4.7 TW records indicate that the closest surface water sewer is located on Burnmoor Meadow, to the northwest of the site. This is at a higher elevation and may require pumping, however, as an outfall to a surface water body is proposed, discharging to a surface water sewer has not been considered.

To a Combined Sewer

4.8 TW records indicate there are no combined sewers located in the vicinity of the site. As an outfall is proposed to a surface water body, discharging to a combined sewer has not been considered.

Proposed Surface Water Drainage

4.9 Based on the current information available, the proposed surface water drainage strategy will make use of local attenuation with a positive outfall.

4.10 The Conceptual Drainage Strategy illustrating drainage proposals based upon a discharge to a nearby ordinary watercourse is provided within Appendix E. The strategy has been designed based upon the following parameters:

- Total Site Area = 2.290 ha
- Total Impermeable Area plus 10% Urban Creep Allowance = 0.7 ha
- Greenfield Runoff Rate = 6.29 l/s

- Restriction Rate = 4.6 l/s
 - Storage requirement for 1 in 100 year +40% Climate Change event = 465m³
- 4.11 It is proposed that surface water will be collected and conveyed, by a gravity sewer system and attenuated prior to discharge in an attenuation basin located in the southeast corner of the site. Surface water will outfall to an ordinary watercourse located to the southwest of the site at a restricted rate of 4.6l/s
- 4.12 Surface water storage is provided within an attenuation basin, providing a total storage volume of 465m³. Surface water calculations are provided in Appendix F for reference, demonstrating that the proposed drainage network can accommodate flows up to the 1 in 100 year +40% climate change storm event.
- 4.13 A surface water outfall is proposed to an ordinary watercourse located approximately 250m to the southwest of the site. A 300mm diameter surface water sewer will be installed in Longwater Road, with a headwall outfall into the watercourse as it passes under the road. An ordinary watercourse consent will be required from the LLFA for the outfall. As the ordinary watercourse is located outside of the site boundary, third party consent may be required from the landowner, and permission should be sought to establish this outfall to the ordinary watercourse.
- 4.14 It should be noted that both the Conceptual Drainage Strategy indicated within Appendix G, and supporting calculations within Appendix H, are preliminary, and as such, subject to further detailed design and approval by the relevant authorities. However, the designs illustrate that surface water arising from the development may be sustainably managed such that it does not pose a flood risk, either to proposed or existing development, up to and including the 1 in 100 year +40% climate change storm event.

Site Specific SuDS Benefits

- 4.16 Sustainable drainage is a departure from the traditional approach to draining sites. There are some key principles that influence the planning and design process enabling SuDS to mimic natural drainage by:
- storing run-off and releasing it slowly (attenuation);
 - allowing water to soak into the ground (infiltration);
 - slowly transporting (conveying) water on the surface;
 - filtering out pollutants;
 - allowing sediments to settle out by controlling the flow of water.
- 4.17 CIRIA has produced several guidance documents covering a range of water management scenarios. A summary of the publications used as reference when the site drainage strategy was produced are listed below.
- Planning for SUDS – making it happen (C687)
 - Site handbook for the construction of SUDS (C698)
 - The SUDS Manual 2015 (C753)
 - Sustainable Drainage Systems – Hydraulic, structural and water quality advice (C609)

Attenuation Basin

- 4.18 The attenuation basin will allow peak flow rates to be reduced and enable flows to be limited to significantly below the existing run-off rate during storm events. The SuDS features are also useful in providing water treatment predominantly through the settlement of silts and suspended sediments. The basin will take the form of a depression within the application site and can be landscaped to provide aesthetic and amenity value. Planting can be used to improve biodiversity and attract wildlife.

Water Quality

- 4.19 Surface water run-off should be managed by SuDS that are designed to attenuate flows and to avoid water quality impacts downstream. To demonstrate that surface water arising from the development will be appropriately treated prior to discharge, the Simple Index Approach, as outlined within the SuDS Manual (CIRIA C753) has been followed.
- 4.20 As stated in the SuDS Manual 2015 (C753), the risk posed by surface water runoff to the receiving environment is a function of:
- the pollution hazard at a particular site (i.e. the *pollutant source*)
 - the effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels, groundwater (i.e. the *pollutant pathway*)
 - the sensitivity of the receiving environment (i.e. the *environmental receptor*).
- 4.21 The most significant pollutant load within the site will arise from individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change. These have an identified pollutant hazard level of 'Low' as per the SuDS Manual (CIRIA C753) Table 26.2, with identified pollutant hazard indices of 0.5 for Total Suspended Solids (TSS), 0.4 for Metals, and 0.4 for Liquid Hydrocarbons.
- 4.22 The attenuation basin, as proposed, has identified mitigation indices (The SuDS Manual, CIRIA C753, Table 26.3), of 0.5 for TSS, 0.5 for Metals and 0.6 for Liquid Hydrocarbons. Mitigation indices therefore exceed maximum anticipated pollutant hazard indices. This confirms that surface water arising from the development will receive an appropriate level of treatment in advance of discharge from site.
- 4.23 The maintenance and adoption of the SuDS features are described below.

Proposed Foul Water Drainage

- 4.24 As illustrated by the Conceptual Drainage Strategy in Appendix E, it is proposed that foul water will be conveyed by a gravity sewer system to a foul water pumping station located in the south of the site. Foul flows will then be pumped to the existing 150mm diameter public foul water sewer located in Longwater Road to the northwest.
- 4.25 It is recommended that a pre-planning enquiry is submitted to TW, to confirm whether there is capacity within the local sewer network to accommodate foul water from the proposed development.
- 4.26 The foul water connection into the existing network will be subject to the successful submission of a Section 106 agreement under the Water Industry Act and approval from TW.

Maintenance and Adoption

- 4.27 A specialist management company will be identified at the detailed design stage and appointed to maintain the SuDS features for the lifetime of the development.
- 4.28 Tables 2 to 4, below, indicate the envisaged maintenance activities associated with the proposed attenuation basin, associated headwalls and the flow control manhole, along with the approximate frequency within which they should be completed.

Table 2. Attenuation Basin Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Remove litter and debris	As required potentially monthly
	Cut grass – public areas	Monthly (during growing season)
	Cut grass – meadow grass in and around basin	Half yearly (spring, before nesting season, and autumn)
	Inspect vegetation to pond edge and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from forebay	1 – 5 years, or as required
	Remove sediment from one quadrant of the main body of ponds without sediment forebays	2 – 10 years (usually)
Occasional Maintenance	Remove sediment from the main body of big ponds, when pool volume is reduced by 20%	>25 years (usually)
Remedial Actions	Repair of erosion or other damage	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realignment of rip rap or other damage	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect banksides, structures, pipework etc. for evidence of physical damage	Monthly/after large storms
	Inspect water body for signs of eutrophication	Monthly (May - October)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
	Check penstocks and other mechanical devices	Half yearly

Table 3. Flow Control Manhole Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Inspect vegetation above and around flow control chamber and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Remove sediment from flow control chambers	Annually
	Flow control devices: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of Penstock and flow control device	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storm
	Inspect structures, flow control and pipework etc. for evidence of physical damage	Monthly/after large storm
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly

Table 4. Inlet and Outlet Headwalls Suggested Maintenance Schedule

Maintenance schedule	Require Action	Typical Frequency
Regular Maintenance	Litter removal	As required
	Inspect vegetation above and around headwall and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from aprons	Annually
	Flap valves and grilles: Check for and clear obstructions	Quarterly
Remedial Actions	Repair of erosion or other damage around headwalls	As required
Monitoring	Inspect structures for evidence of poor operation	Monthly/after large storms
	Inspect structures, pipework etc. for evidence of physical damage	Monthly/after large storms

REPORT

Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
Check flap valves	Half yearly

5 SUMMARY AND CONCLUSIONS

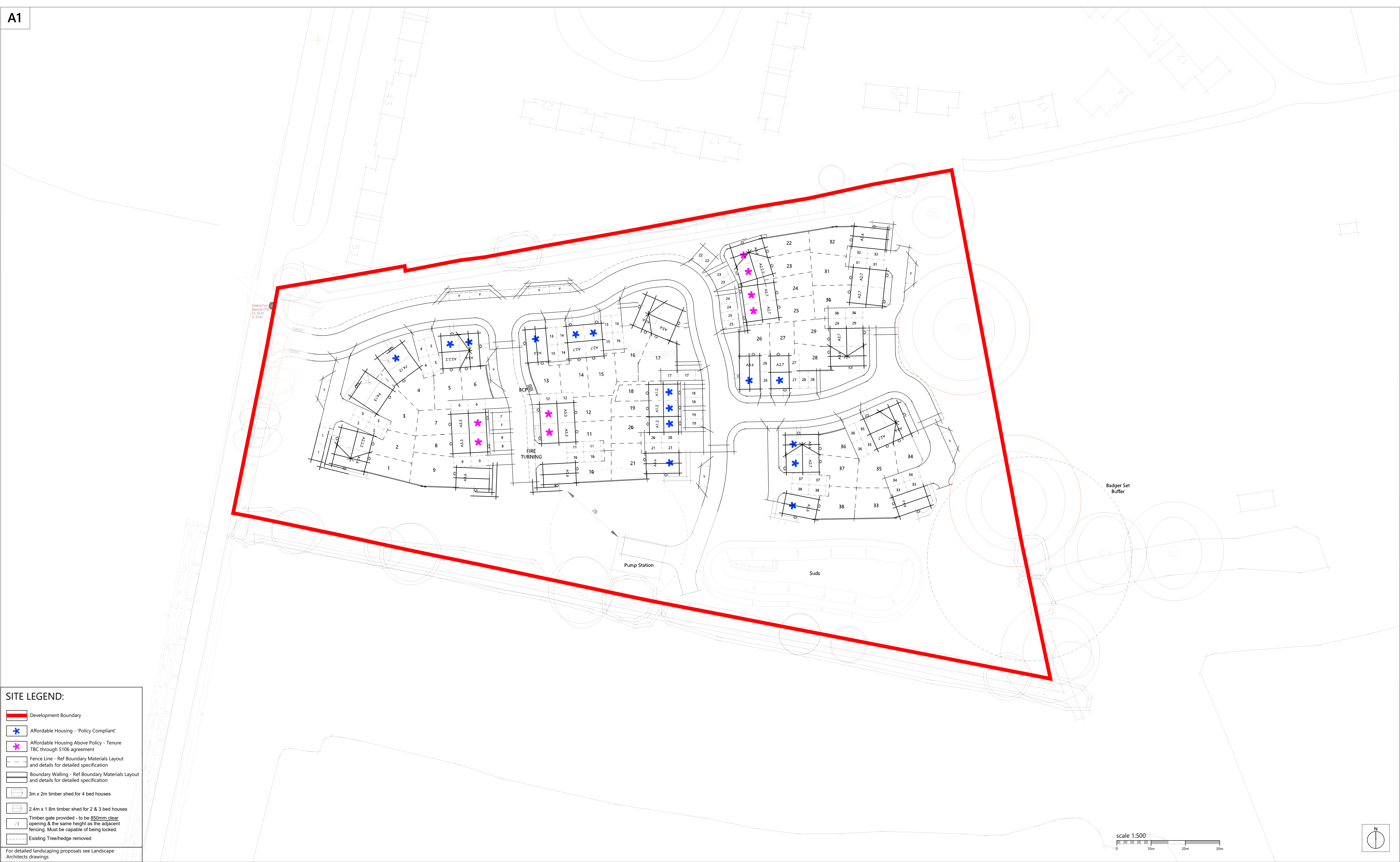
- 5.1 The aim of the addendum is to address updates to the development proposals, and associated drainage strategy and flood constraints for the site.
- 5.2 The potential flood risks to the site, and the measures proposed to mitigate the identified risks, are summarised in Table 5.

Table 5. Proposed mitigation

Source of Flooding	Identified Risk			Mitigation Proposed	Residual Risk		
	L	M	H		L	M	H
Fluvial/ Tidal	✓			No mitigation required	✓		
Sewers	✓			No mitigation required	✓		
Surface Water	✓			All residential dwellings have been located outside of the surface water flood extents. The proposed drainage strategy will intercept and manage surface water run off at the site to the 1 in100 year+40% event.	✓		
Groundwater	✓			Potentially high groundwater table may require SuDS features to be lined to prevent groundwater ingress.	✓		
Other Sources (e.g. reservoirs, water mains)	✓			No mitigation required	✓		

- 5.3 The EA Flood Map for Planning, which is available online, indicates that the site is located within Flood Zone 1, whereby the annual probability of flooding from fluvial or tidal sources is classified as less than 1 in 1000 year.
- 5.4 It is proposed that surface water will be conveyed and attenuated prior to discharge within an attenuation basin. Surface water will be discharged to a nearby watercourse at a restricted rate. Surface water arising from the development will be sustainably managed such that it does not pose a flood risk, either to proposed or existing development, to the 1 in 100 year +40% climate change storm event.
- 5.5 Overall, it has been demonstrated that the flood risks to the development can be managed, without increasing flood risk elsewhere, and will not result in an increase in flood risk off-site.

Appendix A – Development Plans



SITE LEGEND:

- Development Boundary
- Affordable Housing - 'Policy Compliant'
- Affordable Housing Above Policy - Tenure TBC through S106 agreement
- Fence Line - Ref Boundary Materials Layout and details for detailed specification
- Boundary Walling - Ref Boundary Materials Layout and details for detailed specification
- 3m x 2m timber shed for 4 bed houses
- 2.4m x 1.8m timber shed for 2 & 3 bed houses
- Timber gate provided - to be 850mm clear opening & the same height as the adjacent fencing. Must be capable of being locked.
- Existing Tree/hedge removed

For detailed landscaping proposals see Landscape Architects drawings

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London T:01794 367703

www.thrivearchitects.co.uk

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Rev	Description	Date	Au	Ch
A	Issued for Planning	31.05.24	MK	
B	Amended to suit CMP-02	16.10.24	MK	
	Amended to suit Client comments	21.10.24	MK	
	Amended to suit Engineer's comments	23.10.24	MK	
	Amended to allow 19.2m RPA.	01.11.24	RA/MK	
	Affordable annotations added, engineer's info added.	19.11.24	MK	

Project	Land at Longwater Road, Finchampstead		
Drawing	Coloured Site Layout		

Client	Catesby Estates PLC & Stonebond Properties (Guildford) Limited		
Job no.	CATE230603	Date	26.03.24
Dwg no.	CSL01	Rev.	B
Author	MK	Checked	
Status	PLANNING	Scale	1:500 at A1
Client ref.		Office	Romsey



Appendix B – Thames Water Sewer Records

CommercialDW Drainage and Water Enquiry Sewer Map- CDWS/CDWS Standard/2017_ 3571212



The width of the displayed area is 500m

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

Based on the Ordnance Survey Map with the Sanction of the controller of H.M. Stationery Office, License no. 100019345 Crown Copyright Reserved.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates no survey information is available.

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6701	56.7	54.5
7702	56.91	55.02
6704	58.4	57.12
6703	58.53	56.65
6801	59.58	57.53
5701	55.01	53.76
5702	55.04	53.84
571A	n/a	n/a
571B	n/a	n/a
5703	n/a	n/a
5704	n/a	n/a
5705	57.63	56.31
581A	n/a	n/a
5706	57.84	56.22
5707	58.29	56.05
6702	58.49	56.17

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.



Sewer Key - Commercial Drainage and Water Enquiry

Public Sewer Types (Operated & Maintained by Thames Water)

	Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.
	Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.
	Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.
	Trunk Surface Water
	Trunk Foul
	Storm Relief
	Trunk Combined
	Vent Pipe
	Bio-solids (Sludge)
	Proposed Thames Surface Water Sewer
	Proposed Thames Water Foul Sewer
	Gallery
	Foul Rising Main
	Surface Water Rising Main
	Combined Rising Main
	Sludge Rising Main
	Proposed Thames Water Rising Main
	Vacuum

Notes:

- 1) All levels associated with the plans are to Ordnance Datum Newlyn.
- 2) All measurements on the plans are metric.
- 3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
- 4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
- 5) 'na' or '0' on a manhole level indicates that data is unavailable.

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

	Air Valve
	Dam Chase
	Fitting
	Meter
	Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

	Control Valve
	Drop Pipe
	Ancillary
	Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

	Outfall
	Undefined End
	Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

	Public/Private Pumping Station
	Change of characteristic indicator (C.O.C.I.)
	Invert Level
	Summit

Areas

Lines denoting areas of underground surveys, etc.

	Agreement
	Operational Site
	Chamber
	Tunnel
	Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

	Foul Sewer		Surface Water Sewer
	Combined Sewer		Gulley
	Culverted Watercourse		Proposed
			Abandoned Sewer

Appendix C – Greenfield Runoff Rate



GRM Development Solutions
Limited
Laurus House
Centrum 100
First Avenue
Burton On Trent
DE14 2WH

Telephone: (01283) 551249
Facsimile: (01283) 211968
Email: info@grm-uk.com
Web Site: www.grm-uk.com

Our Ref: P7995 SA.1
Date: 28/06/2017

Mr James Finlay,
Catesby Property Group,
Catesby House,
5B Tournament Drive
Edgehill Drive,
Warwick
CV34 6LG

Dear James,

RE: Longwater Road, Finchampstead – Soakaway Testing

Further to your instruction, GRM attended site between the 20th and 21st June 2017 to undertake soakaway infiltration testing at the above location. Testing was undertaken at four locations (SA-01 to SA-04) to test the underlying strata and determine the feasibility of the use of soakaway drainage. The tests were undertaken in general accordance with the methodology outlined within BRE 365.

Ground Conditions

The British Geological Survey (BGS) map for the area indicates that River Terrace Deposits (comprising sand and gravel) overly the Bagshot Formation (comprising sand).

The four soakaway trial pits were excavated to depths of between 1.7m to 2.0m begl. Topsoil was recorded to depths of between 0.3m to 0.4m begl, the River Terrace Deposits were recorded below the topsoil in all four holes as either brown or light grey very clayey fine to coarse SAND or very sandy CLAY with gravel of quartzite and chert and were recorded to depths of 1.7m to depths exceeding 1.9m begl. The underlying Bagshot Formation was only recorded in SA-04 from 1.7m begl as a light brown slightly clayey fine to coarse SAND. An exploratory hole location plan, the exploratory hole logs and site photographs are enclosed for reference.

Groundwater was encountered in all holes as damp strata between 1.2m and 1.5m begl, SA-04 recorded ingress at 1.7m begl.

A land drain was encountered within SA-04 at a depth of 1.1m begl on the northern and southern face of the soakaway pit, and it is believed to have run north to south following local topography. No water was observed within the drain throughout the site works.

Soakaway Testing

The following table below indicates the calculated infiltration rates:-

Location	Depth of Soakaway Pit (m)	Infiltration Material	25% Effective Drainage	75% Effective Drainage	Infiltration Rate (m/s)
SA01 Test 1	1.80	River Terrace Deposits	NO	NO	-
SA02 Test 1	1.70	River Terrace Deposits	YES	NO	-
SA03 Test 1	1.9	River Terrace Deposits	YES	NO	-
SA04 Test 1	2.0	River Terrace Deposits and Bagshot Formation	YES	NO	-

Results have been enclosed for reference.

Summary

An infiltration to 75% was unachievable and an accurate infiltration rate could not be calculated for any of the soakaways. High fines content of the soils has resulted in low infiltration rates, as none of the soakaways were close to 75% an estimated rate calculated by extrapolation could not be undertaken.

Accordingly, it is recommended that an alternative method of disposing of surface water is sought.

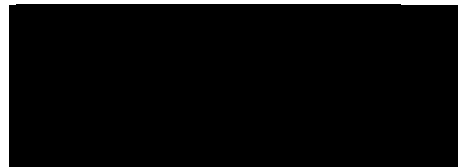
This report should be forwarded to the projects drainage engineer for review and consideration in the design process. The use of permeable paving, or shallow swales, where granular strata is present, may be possible.

I trust that the above is sufficient for your current purposes, however if you have any queries please do not hesitate to contact us.

Yours sincerely



George Salloway
Geo-Environmental Scientist



Clive Kirby
Principal Geologist

Enclosed:

- Exploratory Hole Location Plan
- Exploratory Hole Logs
- Site Photographs
- Soakaway Results

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info@grm-uk.com www.grm-uk.com

CLIENT:

Catesby Estates Ltd

PROJECT:

**Longwater Road,
Finchampstead**

TITLE:

**Soakaway Location
Plan**

SCALE@SIZE

NTS

ISSUE:

1

DESIGN/DRAWN:

GS

DATE:

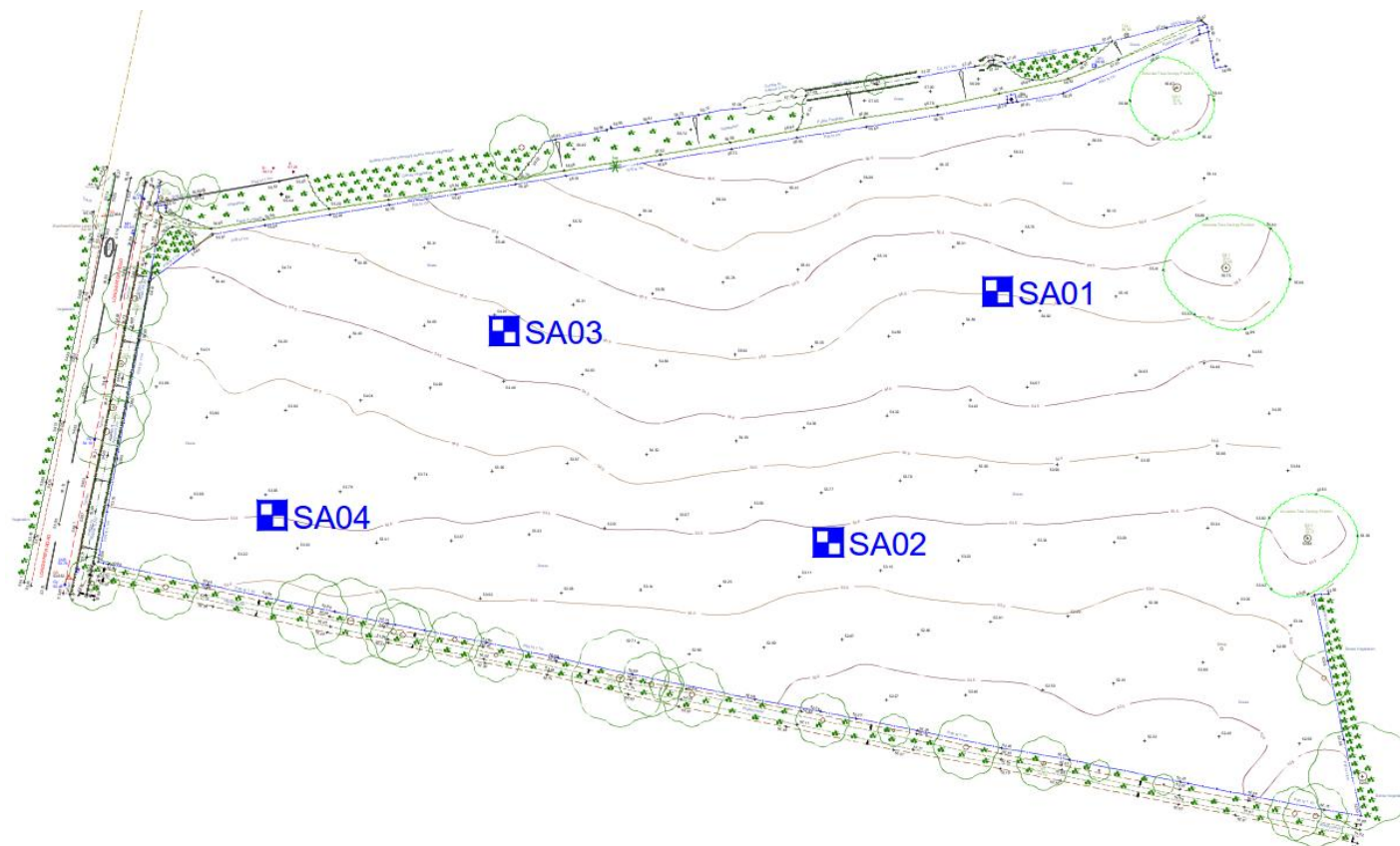
June 2017

PROJECT No:

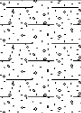
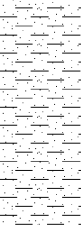
P7995

DRAWING No:

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		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA-01 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead							Ground Level (mAOD)	
Client: Catesby Estates Ltd					GRM Project Ref: P7995		Coordinates 479684 E 162722 N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert. TOPSOIL	
	0.70 - 0.80	D		0.70			Orange brown mottled grey, very clayey, slightly gravelly fine to coarse SAND with pockets of sandy clay throughout. Gravel is fine to coarse, subrounded quartzite. RIVER TERRACE DEPOSITS	
							Firm orange brown mottled grey, very sandy CLAY. Sand is fine to coarse. Pockets of sandy silt and rare organic material observed. RIVER TERRACE DEPOSITS	1
	1.60 - 1.70	D		1.80			<i>Becoming grey mottled brown and slightly gravelly from 1.8m. Gravel is fine to medium subangular to subrounded chert.</i>	
							End of Pit at 1.80m	2
								3
								4

Date Excavated: 20/06/2017		Groundwater Observations:	
Date Backfilled: 21/06/2017		Pockets of damp clayey sand recorded from 1.4m begl.	
Shoring: Not used.			
Stability: Stable during excavation.			
Plant Used: JCB 3CX		Reason for termination of Trial Pit:	
Logged by: GS		Target depth acquired.	

Trial Pit Dimensions (m):

0.60

1.80

General Remarks: Soak away test undertaken.

Strata consistencies/densities determined by observation only	Version: FINAL	Scale: 1:25
---	----------------	-------------

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA-02 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead							Ground Level (mAOD)	
Client: Catesby Estates Ltd					GRM Project Ref: P7995		Coordinates 479660 E 162675 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to medium, subangular to subrounded chert and quartzite. TOPSOIL	
	0.60 - 0.70	D		0.60			Light brown very clayey fine to coarse SAND. RIVER TERRACE DEPOSITS	
				0.80			Soft brown very sandy, slightly gravelly CLAY. Sand is fine to coarse, gravel is fine to coarse, subrounded quartzite and chert. RIVER TERRACE DEPOSITS	
	1.10 - 1.20	D		1.00			Firm orangish brown mottled grey sandy CLAY with pockets of grey sandy silt. Sand is fine to coarse. RIVER TERRACE DEPOSITS	1
							Light grey clayey to very clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS	
	1.60 - 1.70	D		1.70			End of Pit at 1.70m	
								2
								3
								4
Date Excavated: 20/06/2017 Date Backfilled: 21/06/2017 Shoring: Not used. Stability: Stable during excavation. Plant Used: JCB 3CX Logged by: GS				Groundwater Observations: Becoming damp at approximately 1.2m begl				
				Trial Pit Dimensions (m): 0.60  1.90		Reason for termination of Trial Pit: Target depth acquired.		
General Remarks: Soak away test undertaken.								
Strata consistencies/densities determined by observation only					Version: FINAL		Scale: 1:25	

Trial Pit Log

Trial Pit No	
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
93	94
95	96
97	98
99	100

SA-03

Sheet 1 of 1

Site Name: Longwater Road, Finchampstead

**Ground Level
(mAOD)**

Client: Catesby Estates Ltd

GRM Project Ref: P7995

Coordinates

479610 E
162718 N

[illegible]

Date Excavated: 20/06/2017

Date Backfilled: 21/06/2017

Shoring: Not used.

Stability:	Stable during excavation.
-------------------	---------------------------

Plant Used: JCB 3CX

Logged by: GS

Groundwater Observations:

Pockets of damp clayey sand recorded from 1.4m begl.

Trial Pit Dimensions (m):

0.60

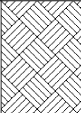
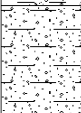
1.80

Reason for termination of Trial Pit:

Target depth acquired.

General Remarks: Soak away test undertaken.	
---	--

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No SA-04 Sheet 1 of 1	
Site Name: Longwater Road, Finchampstead							Ground Level (mAOD)	
Client: Catesby Estates Ltd					GRM Project Ref: P7995		Coordinates 479582 E 162676 N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.30 - 0.40	D		0.40			Light brown clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert. TOPSOIL	
	0.50 - 0.60	D					Soft to firm, orangish brown mottled grey, sandy (locally very sandy), slightly gravelly CLAY. Sand is fine to coarse, gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS <i>Rare organic material from 0.7m begl.</i>	
	1.30 - 1.40	D		1.20			Land drain observed between 1.0m to 1.2m begl.	1
	1.50 - 1.60	D					Light grey clayey to very clayey, slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded chert and quartzite. RIVER TERRACE DEPOSITS <i>Becoming slightly clayey and very gravelly at 1.5m begl.</i>	
	1.80 - 1.90	D		1.70			Light brown slightly clayey fine to coarse SAND. BAGSHOT FORMATION	2
				2.00			End of Pit at 2.00m	
								3
								4

Date Excavated: 20/06/2017		Groundwater Observations:	
Date Backfilled: 21/06/2017		Damp strata recorded at 1.5m begl, ingress observed at 1.7m begl and pooling at base of pit.	
Shoring: Not used.			
Stability: Stable during excavation.			
Plant Used: JCB 3CX		Reason for termination of Trial Pit:	
Logged by: GS		Target depth acquired.	
General Remarks: Soak away test undertaken.			

Strata consistencies/densities determined by observation only		Version: FINAL		Scale: 1:25	
---	--	-----------------------	--	--------------------	--



SA-01



SA-01 excavated material



SA-02



SA-02 excavated material

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CLIENT:

Catesby Estates Ltd

PROJECT:

**Land off Longwater
Road, Finchampstead**

TITLE:

Site Work Photographs

SCALE@SIZE

NTS

ISSUE:

DESIGN/DRAWN:

GS

DATE:

June 2017

PROJECT No:

P7995

DRAWING No:

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SA-03 with soakaway crate



SA-03 excavated material



SA-04



SA-04 (+1hrs)



SA-04 excavated material

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CLIENT:

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PROJECT:

**Land off Longwater
Road, Finchampstead**

TITLE:

Site Work Photographs

SCALE@SIZE

NTS

ISSUE:

DESIGN/DRAWN:

GS

DATE:

June 2017

PROJECT No:

P7995

DRAWING No:

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NAME OF SITE	Longwater Road, Finchampstead	
Project No.	P7995	
Soakaway Test No.	SA01 TEST 1	
Depth of pit begl	1.800	m
Pipe above ground	0.000	m
Water level at start of test	0.700	m
Start depth begl	0.700	m

Time (mins)	Depth begl	% empty
0	0.700	0.00
5	0.700	
10	0.700	
48	0.705	0.45
98	0.720	1.82
137	0.740	3.64
205	0.760	5.45
1186	0.930	20.91
1269	0.940	21.82
1347	0.960	23.64
1429	0.960	23.64
1440	0.960	23.64
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	
	0.000	

Pit width	0.600	m
Pit length	1.900	m
Volume	1.254	m3
Base area	1.140	m2
Side area	2.090	m2

Depth at 25% empty	0.975	m
Depth at 75% empty	1.525	m

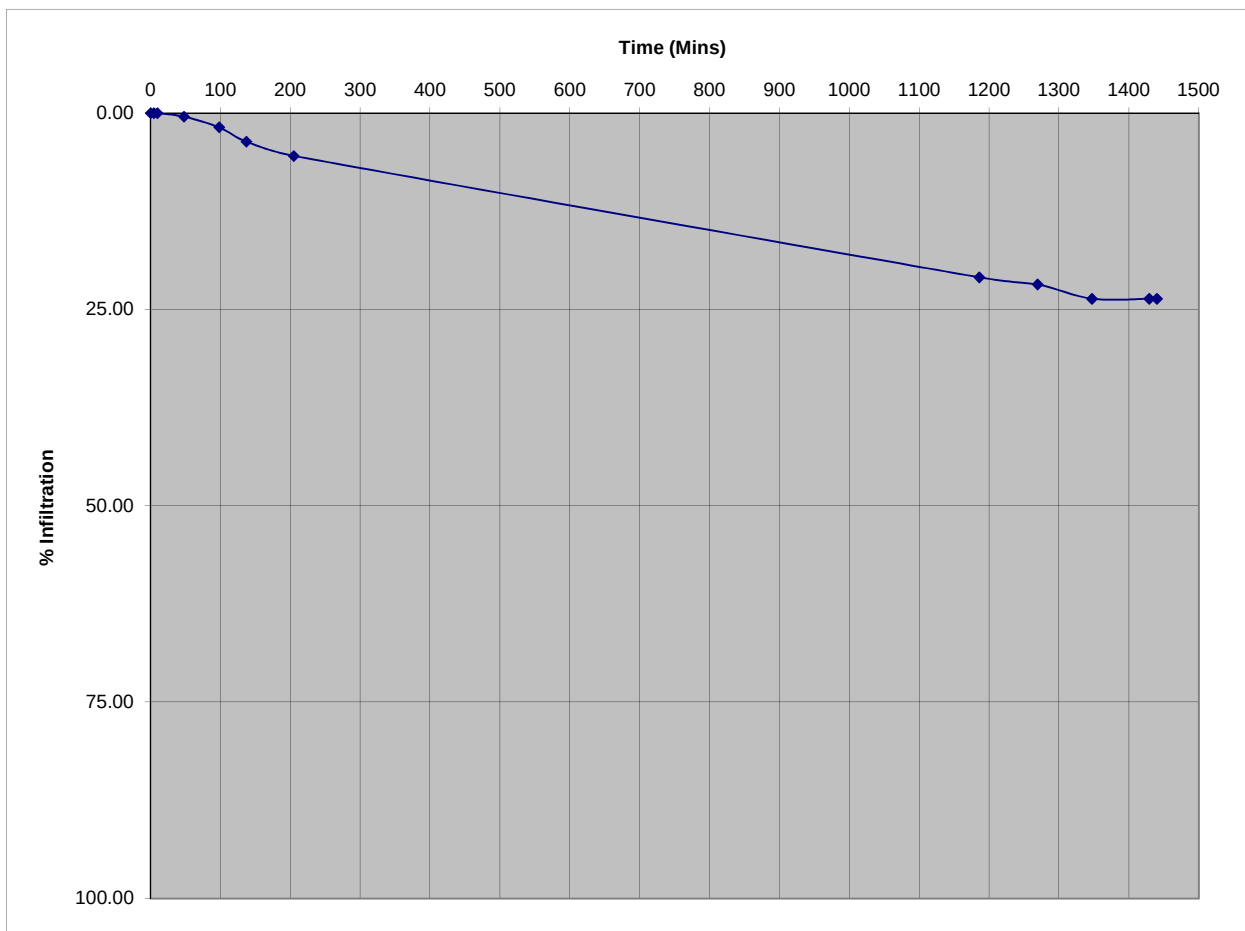
Vp75-25	0.627	m3
---------	-------	----

Depth at 50% empty	1.250	m
Area of base at 50% empty	1.140	m2
Area of sides at 50% empty	2.750	m2
Area of pit at 50% empty	3.890	m2

Time at 25% empty	n/a	Mins
Time at 75% empty	n/a	Mins
tp75-25	#VALUE!	Mins

Soil Infiltration (q) =	#VALUE!	m/min
	#VALUE!	m/sec

The data used for the time at 75% empty has been estimated using engineering judgement from the data recorded on site.



Appendix D – Soakaway Testing

Calculated by:	Craig Walker
Site name:	Finchamstead
Site location:	Finchamstead

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.

Site Details

Latitude:	51.35739° N
Longitude:	0.85818° W
Reference:	104911559
Date:	Mar 18 2024 16:51

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	2.29
-----------------------	------

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:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

(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):	674	674
Hydrological region:	6	6
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.

Greenfield runoff rates

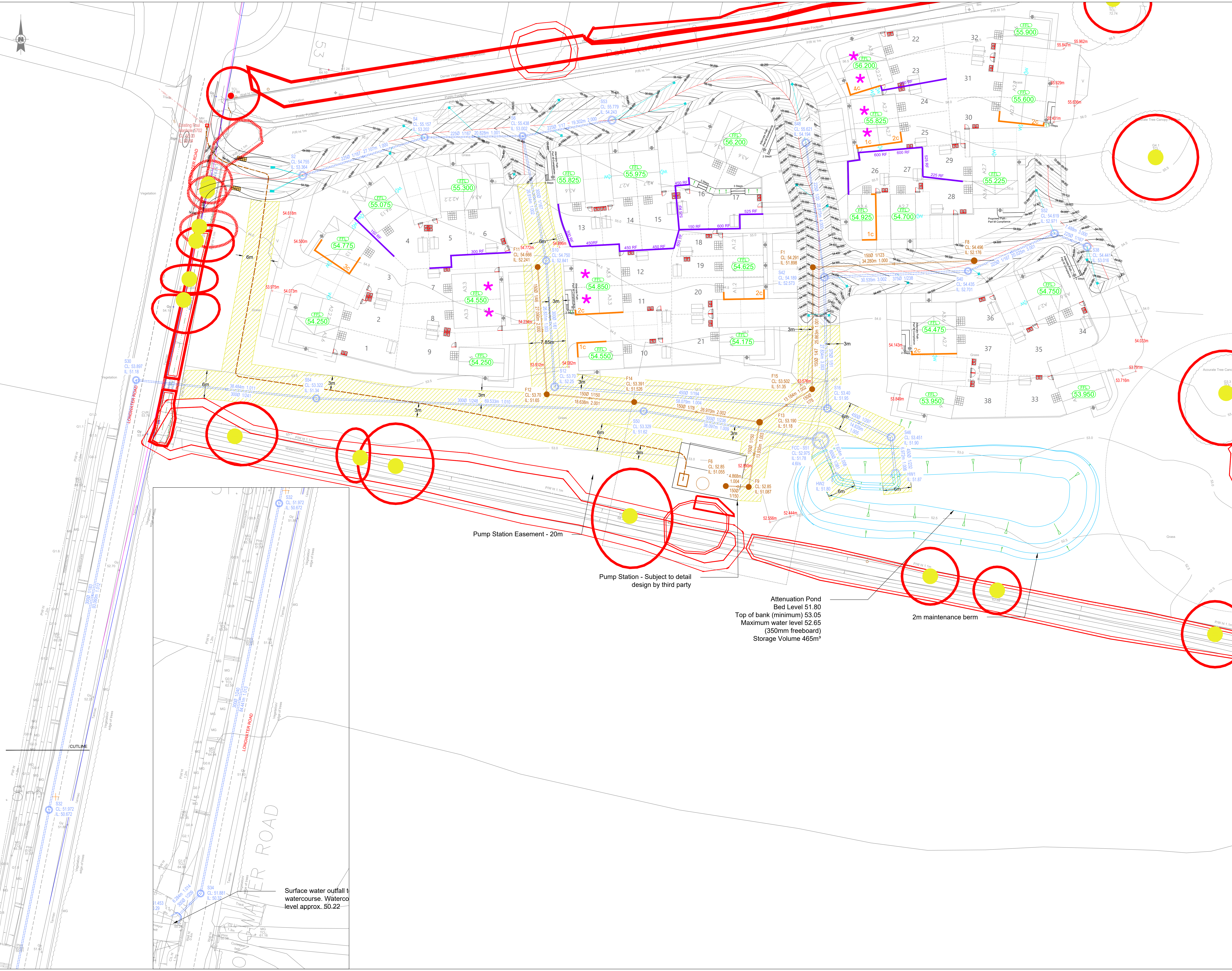
Default

Edited

Q_{BAR} (l/s):	6.29	6.29
1 in 1 year (l/s):	5.35	5.35
1 in 30 years (l/s):	14.48	14.48
1 in 100 year (l/s):	20.08	20.08
1 in 200 years (l/s):	23.54	23.54

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 E -Drainage Strategy



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Notes

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- If received electronically it is the recipient's responsibility to print to correct scale. Only written dimensions should be used.
- This drawing should be read in conjunction with all other relevant drawings and specifications.

For guidance only. Do not scale off this drawing

1:250 0 250m 500m 1000m 1500m 2000m

1:50 0 50m 100m 150m 200m

1:25 0 25m 50m 75m 100m

PRELIMINARY
SUBJECT TO DETAILED DESIGN

This drawing illustrates a sketch proposal only and is not to be used for construction. It is subject to detailed site investigation including ground conditions and contaminants, drainage, design and planning/conservation regulations. The layout may be based upon an enlargement of an O.S. sheet or other small scale plans and its accuracy will need to be verified by survey. Full risk analysis under the C.D.M. Regulations has not been undertaken.

KEY

FOUL WATER
Manhole
Pipe line

SURFACE WATER
Manhole
Pipe line

OTHER
Existing foul sewer

Rising Main

FINISHED FLOOR LEVEL
C.F.F.L. 12.45

RETAINING FEATURES

EXPOSED BRICKWORK & NO. COURSES
2c

EASEMENT

PRIVATE DRIVE SPOT LEVELS
+ 12.450m

Site Impermeable Area estimation (inc. 10% allowance for urban creep on plots & garages) = 0.7ha
Greenfield run-off rate 6.29/s/ha
Proposed discharge rate 4.6/s
Storage required for 1 in 100 + 40% return period = 465m³
1:20 garden gradients were assumed for retaining features

P07	Latest planning layout added: Plots 18-20 parking bays amended	CW	AG	29.11.24
P06	Layer properties updated to ensure drawing clarity	RM	CW	20.11.24
P05	Updated to include latest architectural layout	RM	CW	20.11.24
P04	Shops added to rear gardens to reduce retaining features. Spot levels added to private drives	RM	CW	19.11.24
P03	Updated to show latest layout	RM	CW	19.11.24
P02	Formal Issue	RM	CW	06.06.24
P01	Issue	RM	CW	04.06.24
Rev	Description	By	Ckd	Date

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Client
Catesby Strategic Land and Stonebond Properties (Guildford) Ltd.

Project
Land off Longwater Road Finchampstead

Title
Levels and Drainage Strategy

Status	Scale	Date Created
Preliminary	1:250 @A0	24.02.2024
Task Team Manager	Information Author	Task Information Manager
AG	CW	AG
Document Number		
30429-RPS-xx-xx-DR-C-001		
Project Code - Originator - Zone - Level - Type - Role - Drawing Number		
RPS Project Number	Suitability	Revision
794-DES-ARC-30429	S4	P07
rpsgroup.com		

Appendix F – Causeway Calculations



Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	1.000
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S2	0.061	5.00	54.755	1350	479549.397	162720.660	1.391
S4	0.027	5.00	55.157	1200	479575.271	162728.745	1.955
S53	0.072	5.00	55.779	1350	479615.103	162732.411	1.536
S6	0.005	5.00	55.438	1200	479596.097	162729.039	2.436
S10	0.031	5.00	54.750	1200	479601.082	162702.591	1.909
S12	0.047	5.00	53.700	1350	479602.919	162675.823	1.450
S38	0.023	5.00	54.441	1350	479715.967	162705.531	1.425
S52	0.020	5.00	54.619	1350	479709.030	162708.352	1.648
S40	0.162	5.00	54.435	1200	479690.662	162700.376	1.734
S48	0.064	5.00	55.621	1350	479656.217	162727.597	1.427
S42	0.052	5.00	54.189	1350	479660.156	162699.053	1.616
S16	0.047	5.00	53.400	1350	479660.816	162671.227	1.450
S46			53.451	1350	479674.347	162665.144	1.551
HW1			53.050		479675.174	162658.221	1.180
HW2			53.050		479662.305	162657.417	1.250
S51			52.975	3000	479659.372	162664.454	1.195
S50			53.329	1200	479621.783	162670.657	1.709
S54			53.322	1200	479552.303	162673.350	1.982
S30			53.897	1200	479514.016	162677.242	2.717
S32			51.972	1350	479495.536	162586.035	1.300
S34			51.881	1350	479478.864	162503.256	1.561
HW3			51.453		479474.400	162498.833	1.163

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S2	S4	27.107	0.600	53.364	53.202	0.162	167.3	225	5.45	50.0
1.001	S4	S6	20.828	0.600	53.202	53.077	0.125	166.6	225	5.79	50.0
2.000	S53	S6	19.302	0.600	54.243	53.077	1.166	16.6	225	5.10	50.0
1.002	S6	S10	26.914	0.600	53.002	52.841	0.161	167.2	300	6.16	50.0
1.003	S10	S12	26.831	0.600	52.841	52.400	0.441	60.8	300	6.38	49.7

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.008	40.1	11.0	1.166	1.730	0.061	0.0	80	0.862
1.001	1.010	40.2	15.9	1.730	2.136	0.088	0.0	98	0.951
2.000	3.231	128.5	13.0	1.311	2.136	0.072	0.0	48	2.088
1.002	1.213	85.7	29.8	2.136	1.609	0.165	0.0	122	1.105
1.003	2.019	142.7	35.2	1.609	1.000	0.196	0.0	101	1.681



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	S12	S16	58.079	0.600	52.250	51.950	0.300	193.6	450	7.05	47.2
3.000	S38	S52	7.488	0.600	53.016	52.971	0.045	166.4	225	5.12	50.0
3.001	S52	S40	20.025	0.600	52.971	52.851	0.120	166.9	225	5.45	50.0
3.002	S40	S42	30.535	0.600	52.701	52.573	0.128	238.6	375	5.89	50.0
4.000	S48	S42	28.815	0.600	54.194	52.723	1.471	19.6	225	5.16	50.0
3.003	S42	S16	27.834	0.600	52.573	52.025	0.548	50.8	375	6.07	50.0
1.005	S16	S46	14.835	0.600	51.950	51.900	0.050	296.7	450	7.26	46.5
1.006	S46	HW1	6.972	0.600	51.900	51.870	0.030	232.4	450	7.35	46.2
1.007	HW1	HW2	12.894	0.600	51.870	51.800	0.070	184.2	600	7.47	45.8
1.008	HW2	S51	7.624	0.600	51.800	51.780	0.020	381.2	600	7.57	45.5
1.009	S51	S50	38.097	0.600	51.780	51.620	0.160	238.1	300	8.19	43.6
1.010	S50	S54	69.533	0.600	51.620	51.340	0.280	248.3	300	9.36	40.6
1.011	S54	S30	38.484	0.600	51.340	51.180	0.160	240.5	300	10.00	39.1
1.012	S30	S32	93.060	0.600	51.180	50.672	0.508	183.2	300	11.34	36.4
1.013	S32	S34	84.441	0.600	50.672	50.320	0.352	239.9	300	12.73	34.0
1.014	S34	HW3	6.284	0.600	50.320	50.290	0.030	209.5	300	12.83	33.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	1.457	231.8	41.4	1.000	1.000	0.243	0.0	128	1.112
3.000	1.011	40.2	4.2	1.200	1.423	0.023	0.0	49	0.657
3.001	1.009	40.1	7.8	1.423	1.359	0.043	0.0	67	0.786
3.002	1.168	129.1	37.0	1.359	1.241	0.205	0.0	137	1.015
4.000	2.970	118.1	11.6	1.202	1.241	0.064	0.0	47	1.898
3.003	2.547	281.3	58.0	1.241	1.000	0.321	0.0	115	2.020
1.005	1.175	186.8	102.7	1.000	1.101	0.611	0.0	239	1.202
1.006	1.329	211.4	102.0	1.101	0.730	0.611	0.0	220	1.317
1.007	1.791	506.3	101.2	0.580	0.650	0.611	0.0	181	1.413
1.008	1.241	350.9	100.5	0.650	0.595	0.611	0.0	219	1.077
1.009	1.014	71.7	96.3	0.895	1.409	0.611	0.0	300	1.027
1.010	0.993	70.2	89.6	1.409	1.682	0.611	0.0	300	1.006
1.011	1.009	71.3	86.3	1.682	2.417	0.611	0.0	300	1.022
1.012	1.158	81.9	80.3	2.417	1.000	0.611	0.0	242	1.313
1.013	1.011	71.4	75.1	1.000	1.261	0.611	0.0	265	1.136
1.014	1.082	76.5	74.7	1.261	0.863	0.611	0.0	241	1.227

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	27.107	167.3	225	Circular	54.755	53.364	1.166	55.157	53.202	1.730
1.001	20.828	166.6	225	Circular	55.157	53.202	1.730	55.438	53.077	2.136
2.000	19.302	16.6	225	Circular	55.779	54.243	1.311	55.438	53.077	2.136
1.002	26.914	167.2	300	Circular	55.438	53.002	2.136	54.750	52.841	1.609

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S2	1350	Manhole	Adoptable	S4	1200	Manhole	Adoptable
1.001	S4	1200	Manhole	Adoptable	S6	1200	Manhole	Adoptable
2.000	S53	1350	Manhole	Adoptable	S6	1200	Manhole	Adoptable
1.002	S6	1200	Manhole	Adoptable	S10	1200	Manhole	Adoptable



Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.003	26.831	60.8	300	Circular	54.750	52.841	1.609	53.700	52.400	1.000
1.004	58.079	193.6	450	Circular	53.700	52.250	1.000	53.400	51.950	1.000
3.000	7.488	166.4	225	Circular	54.441	53.016	1.200	54.619	52.971	1.423
3.001	20.025	166.9	225	Circular	54.619	52.971	1.423	54.435	52.851	1.359
3.002	30.535	238.6	375	Circular	54.435	52.701	1.359	54.189	52.573	1.241
4.000	28.815	19.6	225	Circular	55.621	54.194	1.202	54.189	52.723	1.241
3.003	27.834	50.8	375	Circular	54.189	52.573	1.241	53.400	52.025	1.000
1.005	14.835	296.7	450	Circular	53.400	51.950	1.000	53.451	51.900	1.101
1.006	6.972	232.4	450	Circular	53.451	51.900	1.101	53.050	51.870	0.730
1.007	12.894	184.2	600	Circular	53.050	51.870	0.580	53.050	51.800	0.650
1.008	7.624	381.2	600	Circular	53.050	51.800	0.650	52.975	51.780	0.595
1.009	38.097	238.1	300	Circular	52.975	51.780	0.895	53.329	51.620	1.409
1.010	69.533	248.3	300	Circular	53.329	51.620	1.409	53.322	51.340	1.682
1.011	38.484	240.5	300	Circular	53.322	51.340	1.682	53.897	51.180	2.417
1.012	93.060	183.2	300	Circular	53.897	51.180	2.417	51.972	50.672	1.000
1.013	84.441	239.9	300	Circular	51.972	50.672	1.000	51.881	50.320	1.261
1.014	6.284	209.5	300	Circular	51.881	50.320	1.261	51.453	50.290	0.863

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.003	S10	1200	Manhole	Adoptable	S12	1350	Manhole	Adoptable
1.004	S12	1350	Manhole	Adoptable	S16	1350	Manhole	Adoptable
3.000	S38	1350	Manhole	Adoptable	S52	1350	Manhole	Adoptable
3.001	S52	1350	Manhole	Adoptable	S40	1200	Manhole	Adoptable
3.002	S40	1200	Manhole	Adoptable	S42	1350	Manhole	Adoptable
4.000	S48	1350	Manhole	Adoptable	S42	1350	Manhole	Adoptable
3.003	S42	1350	Manhole	Adoptable	S16	1350	Manhole	Adoptable
1.005	S16	1350	Manhole	Adoptable	S46	1350	Manhole	Adoptable
1.006	S46	1350	Manhole	Adoptable	HW1		Junction	
1.007	HW1		Junction		HW2		Junction	
1.008	HW2		Junction		S51	3000	Manhole	Adoptable
1.009	S51	3000	Manhole	Adoptable	S50	1200	Manhole	Adoptable
1.010	S50	1200	Manhole	Adoptable	S54	1200	Manhole	Adoptable
1.011	S54	1200	Manhole	Adoptable	S30	1200	Manhole	Adoptable
1.012	S30	1200	Manhole	Adoptable	S32	1350	Manhole	Adoptable
1.013	S32	1350	Manhole	Adoptable	S34	1350	Manhole	Adoptable
1.014	S34	1350	Manhole	Adoptable	HW3		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S2	479549.397	162720.660	54.755	1.391	1350					
						0	1.000	53.364	225	
S4	479575.271	162728.745	55.157	1.955	1200		1	1.000	53.202	225
						0	1.001	53.202	225	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S53	479615.103	162732.411	55.779	1.536	1350		0	2.000	54.243	225
S6	479596.097	162729.039	55.438	2.436	1200		1	2.000	53.077	225
							2	1.001	53.077	225
							0	1.002	53.002	300
S10	479601.082	162702.591	54.750	1.909	1200		1	1.002	52.841	300
							0	1.003	52.841	300
S12	479602.919	162675.823	53.700	1.450	1350		1	1.003	52.400	300
							0	1.004	52.250	450
S38	479715.967	162705.531	54.441	1.425	1350		0	3.000	53.016	225
S52	479709.030	162708.352	54.619	1.648	1350		1	3.000	52.971	225
							0	3.001	52.971	225
S40	479690.662	162700.376	54.435	1.734	1200		1	3.001	52.851	225
							0	3.002	52.701	375
S48	479656.217	162727.597	55.621	1.427	1350		0	4.000	54.194	225
S42	479660.156	162699.053	54.189	1.616	1350		1	4.000	52.723	225
							2	3.002	52.573	375
							0	3.003	52.573	375
S16	479660.816	162671.227	53.400	1.450	1350		1	3.003	52.025	375
							2	1.004	51.950	450
							0	1.005	51.950	450
S46	479674.347	162665.144	53.451	1.551	1350		1	1.005	51.900	450
							0	1.006	51.900	450
HW1	479675.174	162658.221	53.050	1.180			1	1.006	51.870	450
							0	1.007	51.870	600
HW2	479662.305	162657.417	53.050	1.250			1	1.007	51.800	600
							0	1.008	51.800	600

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S51	479659.372	162664.454	52.975	1.195	3000	 1	1.008	51.780	600
S50	479621.783	162670.657	53.329	1.709	1200	 0	1.009	51.780	300
						 1	1.009	51.620	300
S54	479552.303	162673.350	53.322	1.982	1200	 0	1.010	51.620	300
						 1	1.010	51.340	300
S30	479514.016	162677.242	53.897	2.717	1200	 0	1.011	51.340	300
						 1	1.011	51.180	300
S32	479495.536	162586.035	51.972	1.300	1350	 0	1.012	51.180	300
						 1	1.012	50.672	300
S34	479478.864	162503.256	51.881	1.561	1350	 0	1.013	50.672	300
						 1	1.013	50.320	300
HW3	479474.400	162498.833	51.453	1.163		 0	1.014	50.320	300
						 1	1.014	50.290	300

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Additional Storage (m³/ha)	0.0
Summer CV	1.000	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	1.000	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

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

Node S51 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	51.780	Product Number	CTL-SHE-0102-4600-0960-4600
Design Depth (m)	0.960	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	4.6	Min Node Diameter (mm)	1200

Node HW2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	51.800
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	396.5	0.0	0.400	536.9	0.0	0.800	687.0	0.0	1.200	846.1	0.0
0.100	430.2	0.0	0.500	573.5	0.0	0.900	725.9	0.0			
0.200	465.2	0.0	0.600	610.8	0.0	1.000	765.4	0.0			
0.300	500.8	0.0	0.700	648.6	0.0	1.100	805.4	0.0			

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	10	53.443	0.079	10.8	0.1132	0.0000	OK
15 minute summer	S4	11	53.302	0.100	15.5	0.1130	0.0000	OK
15 minute summer	S53	10	54.292	0.049	12.8	0.0702	0.0000	OK
15 minute summer	S6	11	53.126	0.124	28.6	0.1401	0.0000	OK
15 minute summer	S10	11	52.945	0.104	33.9	0.1173	0.0000	OK
15 minute summer	S12	11	52.377	0.127	42.1	0.1820	0.0000	OK
15 minute summer	S38	10	53.066	0.050	4.1	0.0712	0.0000	OK
15 minute summer	S52	11	53.039	0.068	7.7	0.0967	0.0000	OK
15 minute summer	S40	10	52.840	0.139	36.2	0.1571	0.0000	OK
15 minute summer	S48	10	54.242	0.048	11.4	0.0683	0.0000	OK
15 minute summer	S42	10	52.685	0.112	56.3	0.1604	0.0000	OK
15 minute summer	S16	11	52.204	0.254	105.4	0.3630	0.0000	OK
15 minute summer	S46	11	52.118	0.218	104.2	0.3118	0.0000	OK
15 minute summer	HW1	11	52.050	0.180	103.7	0.0000	0.0000	OK
360 minute summer	HW2	264	52.020	0.220	27.2	95.3874	0.0000	OK
360 minute summer	S51	264	52.020	0.240	4.8	1.6948	0.0000	OK
360 minute summer	S50	264	51.672	0.052	4.6	0.0585	0.0000	OK
360 minute summer	S54	264	51.392	0.052	4.6	0.0589	0.0000	OK
360 minute summer	S30	264	51.228	0.048	4.6	0.0540	0.0000	OK
360 minute summer	S32	264	50.723	0.051	4.6	0.0735	0.0000	OK
360 minute summer	S34	264	50.371	0.051	4.6	0.0726	0.0000	OK
360 minute summer	HW3	264	50.339	0.049	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	10.7	0.733	0.267	0.3972	
15 minute summer	S4	1.001	S6	15.3	0.926	0.381	0.3440	
15 minute summer	S53	2.000	S6	12.8	2.022	0.099	0.1219	
15 minute summer	S6	1.002	S10	28.6	1.170	0.334	0.6598	
15 minute summer	S10	1.003	S12	34.1	1.630	0.239	0.5612	
15 minute summer	S12	1.004	S16	41.8	0.656	0.180	3.7402	
15 minute summer	S38	3.000	S52	4.1	0.495	0.101	0.0617	
15 minute summer	S52	3.001	S40	7.5	0.767	0.187	0.1961	
15 minute summer	S40	3.002	S42	35.8	1.111	0.277	0.9877	
15 minute summer	S48	4.000	S42	11.3	1.865	0.096	0.1743	
15 minute summer	S42	3.003	S16	56.0	1.650	0.199	1.1024	
15 minute summer	S16	1.005	S46	104.2	1.239	0.558	1.2468	
15 minute summer	S46	1.006	HW1	103.7	1.536	0.491	0.4710	
15 minute summer	HW1	1.007	HW2	103.3	3.037	0.204	0.5414	
360 minute summer	HW2	1.008	S51	4.8	0.185	0.014	0.7567	
360 minute summer	S51	Hydro-Brake®	S50	4.6				
360 minute summer	S50	1.010	S54	4.6	0.563	0.065	0.5645	
360 minute summer	S54	1.011	S30	4.6	0.596	0.064	0.2954	
360 minute summer	S30	1.012	S32	4.6	0.602	0.056	0.7064	
360 minute summer	S32	1.013	S34	4.6	0.577	0.064	0.6696	
360 minute summer	S34	1.014	HW3	4.6	0.594	0.060	0.0484	121.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	11	53.518	0.154	31.4	0.2209	0.0000	OK
15 minute summer	S4	11	53.435	0.233	44.8	0.2633	0.0000	SURCHARGED
15 minute summer	S53	10	54.325	0.082	37.0	0.1176	0.0000	OK
15 minute summer	S6	11	53.246	0.244	82.0	0.2764	0.0000	OK
15 minute summer	S10	11	53.038	0.197	97.3	0.2229	0.0000	OK
15 minute summer	S12	11	52.592	0.342	120.9	0.4899	0.0000	OK
15 minute summer	S38	10	53.114	0.097	11.8	0.1395	0.0000	OK
15 minute summer	S52	10	53.095	0.124	22.0	0.1770	0.0000	OK
15 minute summer	S40	10	52.962	0.261	104.8	0.2947	0.0000	OK
15 minute summer	S48	10	54.278	0.084	32.9	0.1195	0.0000	OK
15 minute summer	S42	11	52.795	0.222	162.7	0.3179	0.0000	OK
15 minute summer	S16	11	52.524	0.574	298.6	0.8208	0.0000	SURCHARGED
240 minute winter	S46	240	52.312	0.412	54.7	0.5893	0.0000	OK
240 minute winter	HW1	240	52.312	0.442	54.3	0.0000	0.0000	OK
240 minute winter	HW2	240	52.312	0.512	53.6	248.6613	0.0000	OK
240 minute winter	S51	240	52.312	0.532	5.5	3.7599	0.0000	SURCHARGED
15 minute summer	S50	13	51.673	0.053	4.6	0.0602	0.0000	OK
15 minute summer	S54	16	51.393	0.053	4.7	0.0595	0.0000	OK
15 minute summer	S30	17	51.230	0.050	4.7	0.0562	0.0000	OK
15 minute summer	S32	22	50.724	0.052	4.8	0.0741	0.0000	OK
15 minute summer	S34	26	50.371	0.051	4.6	0.0729	0.0000	OK
15 minute summer	HW3	26	50.339	0.049	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	30.9	0.904	0.771	0.9326	
15 minute summer	S4	1.001	S6	43.7	1.167	1.088	0.7590	
15 minute summer	S53	2.000	S6	36.9	2.148	0.287	0.4325	
15 minute summer	S6	1.002	S10	82.1	1.478	0.958	1.4873	
15 minute summer	S10	1.003	S12	97.9	2.071	0.686	1.2983	
15 minute summer	S12	1.004	S16	121.1	0.864	0.522	8.3590	
15 minute summer	S38	3.000	S52	11.7	0.603	0.290	0.1454	
15 minute summer	S52	3.001	S40	21.6	1.006	0.538	0.4305	
15 minute summer	S40	3.002	S42	103.4	1.405	0.801	2.2799	
15 minute summer	S48	4.000	S42	32.6	2.497	0.276	0.3766	
15 minute summer	S42	3.003	S16	159.9	1.665	0.568	2.4811	
15 minute summer	S16	1.005	S46	297.6	1.881	1.593	2.2728	
240 minute winter	S46	1.006	HW1	54.3	1.134	0.257	1.0800	
240 minute winter	HW1	1.007	HW2	53.6	1.410	0.106	3.0853	
240 minute winter	HW2	1.008	S51	5.5	0.289	0.016	1.9831	
240 minute winter	S51	Hydro-Brake®	S50	4.6				
15 minute summer	S50	1.010	S54	4.7	0.699	0.067	0.5708	
15 minute summer	S54	1.011	S30	4.7	0.674	0.065	0.3048	
15 minute summer	S30	1.012	S32	4.8	0.746	0.058	0.7125	
15 minute summer	S32	1.013	S34	4.6	0.608	0.065	0.6735	
15 minute summer	S34	1.014	HW3	4.6	0.595	0.060	0.0487	64.5

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.39%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S2	11	54.755	1.391	56.1	1.9905	1.9543	FLOOD
15 minute summer	S4	11	54.644	1.442	67.1	1.6313	0.0000	SURCHARGED
15 minute summer	S53	11	54.696	0.453	66.2	0.6480	0.0000	SURCHARGED
15 minute summer	S6	11	54.365	1.363	123.6	1.5413	0.0000	SURCHARGED
15 minute summer	S10	11	53.983	1.142	143.9	1.2918	0.0000	SURCHARGED
15 minute summer	S12	11	53.419	1.169	183.3	1.6724	0.0000	FLOOD RISK
15 minute summer	S38	11	54.262	1.246	27.1	1.7835	0.0000	FLOOD RISK
15 minute summer	S52	11	54.249	1.278	36.4	1.8287	0.0000	SURCHARGED
15 minute summer	S40	11	54.153	1.452	172.6	1.6425	0.0000	FLOOD RISK
15 minute summer	S48	11	54.341	0.147	58.8	0.2104	0.0000	OK
15 minute summer	S42	11	53.862	1.289	272.2	1.8449	0.0000	SURCHARGED
15 minute summer	S16	11	53.195	1.245	491.3	1.7818	0.0000	FLOOD RISK
480 minute winter	S46	472	52.678	0.778	53.1	1.1132	0.0000	SURCHARGED
480 minute winter	HW1	472	52.678	0.808	52.8	0.0000	0.0000	SURCHARGED
480 minute winter	HW2	472	52.678	0.878	52.4	485.5772	0.0000	SURCHARGED
480 minute winter	S51	472	52.678	0.898	5.2	6.3482	0.0000	FLOOD RISK
15 minute winter	S50	11	51.674	0.054	4.6	0.0608	0.0000	OK
15 minute summer	S54	14	51.393	0.053	4.7	0.0597	0.0000	OK
15 minute summer	S30	16	51.230	0.050	4.6	0.0561	0.0000	OK
1440 minute summer	S32	660	50.723	0.051	4.6	0.0737	0.0000	OK
1440 minute winter	S34	630	50.371	0.051	4.6	0.0728	0.0000	OK
1440 minute winter	HW3	630	50.339	0.049	4.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S2	1.000	S4	42.4	1.065	1.057	1.0781	
15 minute summer	S4	1.001	S6	60.3	1.515	1.501	0.8284	
15 minute summer	S53	2.000	S6	61.9	2.085	0.482	0.7677	
15 minute summer	S6	1.002	S10	119.2	1.692	1.390	1.8953	
15 minute summer	S10	1.003	S12	143.5	2.052	1.005	1.8894	
15 minute summer	S12	1.004	S16	181.7	1.147	0.784	9.2022	
15 minute summer	S38	3.000	S52	26.2	0.660	0.653	0.2978	
15 minute summer	S52	3.001	S40	51.2	1.289	1.277	0.7964	
15 minute summer	S40	3.002	S42	170.8	1.548	1.323	3.3679	
15 minute summer	S48	4.000	S42	56.2	2.526	0.476	0.9689	
15 minute summer	S42	3.003	S16	268.4	2.434	0.954	3.0700	
15 minute summer	S16	1.005	S46	489.8	3.092	2.622	2.3505	
480 minute winter	S46	1.006	HW1	52.8	0.956	0.250	1.1047	
480 minute winter	HW1	1.007	HW2	52.4	1.287	0.104	3.6319	
480 minute winter	HW2	1.008	S51	5.2	0.283	0.015	2.1475	
480 minute winter	S51	Hydro-Brake®	S50	4.6				
15 minute winter	S50	1.010	S54	4.7	0.695	0.067	0.5712	
15 minute summer	S54	1.011	S30	4.6	0.677	0.065	0.3022	
15 minute summer	S30	1.012	S32	4.7	0.750	0.058	0.7023	
1440 minute summer	S32	1.013	S34	4.6	0.577	0.064	0.6719	
1440 minute winter	S34	1.014	HW3	4.6	0.595	0.060	0.0486	359.2