

Flood Risk Assessment & Drainage Strategy Report

Cabbagefield Row, Swanmore Road, Havant

Date: June 2022
Project No.: 303795
Revision: 00

	Structural Engineering
	Civil Engineering
	CDM Consultants
	Sustainability and BREEAM
	Traffic and Transport
	Flood Risk Assessments
	Highway Engineering
	Event Engineering

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Revision	Comment/Amendment	Prepared	Reviewed	Approved	Date
00	First Issue	MJH	TK	TK	28.06.22

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1.0 Introduction

- 1.1** Scott White and Hookins have been instructed by Portsmouth City Council to undertake a flood risk assessment of a proposed development at Cabbagefield Row, Swanmore Road, Havant, Hampshire. This flood risk assessment has been produced as a supporting document for a planning application and takes the form of a desk study.
- 1.2** The proposed development comprises a total of 150 dwellings (mixture of apartments and houses), 257 car parking spaces and associated landscaping. The existing site is currently consists of woodland and scrub grassland. A location plan is provided in **Appendix A**. Proposed site plans are given in **Appendix C**.
- 1.3** On the basis of the proposed development the scheme is classed as 'More Vulnerable' under table 2 of the NPPF. On this basis development is considered appropriate for flood zone 1 and 2 only. This site meets the sequential test criteria, and an exception test is not required.

	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
FZ1					
FZ2		ETR			
FZ3a	ETR		ETR		
FZ3b	ETR				

Green – Development appropriate.

Red- Development not permitted.

ETR – Exception test required to allow development.

- 1.4** This report considers the flood risk to the proposed development and the impact that the development will have in relation to flooding of adjacent areas and watercourses. It also considers any limits relating to flooding that are likely to be imposed to allow the development to be undertaken and recommends Sustainable Urban Drainage systems (SUDS) to control surface water runoff.
- 1.5** This report takes into account the requirements of NPPF and local policies and is based on information received from the Environment Agency web site and Southern Water.
- 1.5** Local planning policy is included within the Havant Borough Council Core Strategy document Dated March 2011. Policy CS15 "Flood and Coastal Erosion Risk states "all development will be required to ensure that there is no net increase in surface water runoff. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless proven that SuDS are not appropriate". See **Appendix L**.
- 1.6** This report is for the private and confidential use of the client and its agents and may not

be copied in whole or in part without the written permission of Scott White and Hookins.

2.0 Existing Site Conditions

- 2.1 The site is located on land referred to as Cabbagefield Row, north of Swanmore Road PO9 4EU, centred on grid reference SU 70676 09521, and is approximately 7.5ha in size. A location plan is given in **Appendix A**.
- 2.2 The site currently comprises unmanaged woodland in the south and scrub grassland in the north. The site is bound to the east, west and north by woodland. An aerial view of the site is also given in **Appendix A**.
- 2.3 A topographic survey was carried out by pdp architecture on behalf of Portsmouth City Council dated June 2019, see drawing enclosed in **Appendix B**. Site levels range between 27.2m AOD at the north-west corner to 41.1m AOD at the central eastern boundary. Generally site levels fall from east to west. To the east, ground levels on surrounding land fall in an easterly direction away from the site.
- 2.4 It is considered that rainfall would drain via natural infiltration into the ground, be intercepted by trees/vegetation or drain via overland flow following topography in more extreme rainfall events. The site is situated within the surface water catchment of Park Lane Stream, a tributary of Hermitage Stream. Park Lane Stream, which is defined as an ordinary watercourse, is located approximately 60m west of the site and flows in a southerly direction before discharging to the Hermitage Stream via a culverted outlet in north west Havant. OS mapping indicates there are no water bodies within the site boundary. A field drain flows north to south adjacent to a path to the east of the eastern site boundary.
- 2.5 Southern Water asset plans in **Appendix D** show there are no surface water or foul sewers within the site. There are two 225mm surface water sewers which convey runoff southwards close to the southern boundary of the site. The nearest foul sewer is a 150mm foul sewer located between Stanmore Road and Crabwood Court.
- 2.6 The British Geological Survey (BGS) records for the site indicate that the site is likely to be underlain by Head superficial deposits comprising Clay, Silt, Sand and Gravel in the north-west part of the site. The remainder of the site is not likely to be underlain by superficial deposits. A large part of the site is underlain by Sand bedrock of the Bognor Sand Member. London Clay Formation comprising Clay, Silt and Sand is likely to be present in the north part of the site. BGS Maps are enclosed in **Appendix E**.
- 2.7 A site investigation undertaken by Socotec dated August 2021 (Report No: STH1016/2) indicates local ground conditions comprising slightly clayey sandy Silt to a typical depth of 0.25m underlain slightly sand Silt/Clay of the London Clay Formation to a depth of 4m below ground level (bgl). No groundwater was encountered in the window samples. See borehole logs and location plan in **Appendix F**. Based on the site investigation it is unlikely the site supports the use of soakaways or any other form of infiltration device, however this will need to be confirmed at the detailed design stage. The SI states that “no potentially significant contamination was noted within the site soils or groundwater during

the fieldwork by visual or olfactory means”.

- 2.8** The site is underlain by a principal bedrock aquifer and is in Zone 1 of a Source Protection Zone. This is defined as the 50 day travel time from any point below the water table to the source. This zone has 50 metre minimum radius. As such a hydrogeological risk assessment is required which identifies any unacceptable risks to groundwater if infiltrating into the ground. If the assessment identifies risks, then the developer must provide appropriate mitigation.

3.0 Potential Flood Risk Affecting the site

3.1 Fluvial Flooding (overtopping of watercourses)

- 3.1.1** Park Lane Stream becomes a Main River approximately 350m south-west of the site. Floodplain mapping provided by the Environment Agency (EA) indicates that the site lies in Flood Zone 1. Flood zone 1 is defined as comprising 'land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%)'. On this basis the site is considered to have a very low risk of flooding. See extract of flood maps in **Appendix G**.

3.2 Surface Water Flooding

- 3.2.1** The EA Surface Water flood map indicates the site is at very low risk of surface water flooding. Very low risk is defined as land as having less than 0.1% annual probability of flooding. High and medium surface water flood areas are restricted to the Park Lane Stream west of the of the site and local resident roads including Stanmore Road south of the site. See map in **Appendix G**.

3.3 Groundwater Flooding

- 3.3.1** No groundwater was recorded in any of the window samples as part of the site investigation. The site is underlain by silt/clay soils which will restrict the rate and quantity of any groundwater recharge and therefore the groundwater level will respond slowly to any rainfall. No groundwater incidents have been recorded according to the Partnership for Urban South Hampshire (PUSH) Strategic Flood Risk Assessment 2016 Update (see map enclosed in **Appendix H**). The risk of groundwater flooding is therefore considered to be low.

3.4 Reservoir Flooding

- 3.4.1** EA flood maps show the site is not at risk of flooding from reservoir failure.

3.5 Sewer Flooding

- 3.5.1** There are no public sewers which cross the site. The nearest public sewers are located within the existing residential development to the south of the site. Should the capacity of the sewers be exceeded, it is anticipated that excess water will flow along the internal roads and in a south westerly direction, away from the Site. The SFRA indicates no sewer flood incidents have been recorded on site (see map enclosed in **Appendix H**). It is concluded the proposed development is at low risk from sewer flooding.

3.6 Our assessment of the above indicates that there is a low risk of flooding from all sources.

4.0 Flood Mitigation and Outline Drainage Proposals

4.1 Flood Mitigation

- 4.1.1** The proposed works are assessed to be in an area at low risk from all sources of flooding. Due to the development of the site flood mitigation measures are required to reduce downstream flood risks. Flood mitigation measures are required to address the issues associated with overland surface water flows.
- 4.1.2** It is recommended that ground floor levels are set a suitable freeboard above surrounding ground (minimum 150mm) to mitigate the residual flood risk associated with excess surface water runoff in an extreme rainfall event. Similarly, exterior ground levels across the site should also be appropriately contoured to direct surface water away from buildings in such a scenario.

4.2 Surface Water Drainage

- 4.2.1** Based on the drainage hierarchy stated in paragraph 2.3 of **Appendix M**, the preferred method for disposal of surface water from the new development is via infiltration drainage. Based on Ground Investigation findings, the site is unlikely to support infiltration drainage, therefore this option has been discounted at this stage. This assumption will need to be confirmed at the detailed design stage to demonstrate the drainage hierarchy has been followed.
- 4.2.2** The next preferred option is discharge to a watercourse. Park Lane Stream is located in close proximity to the site to the west and therefore a discharge to a watercourse is proposed. This mimics the existing drainage arrangement. The land owner also owns the land between the watercourse and the western site boundary so no third party agreement is necessary to discharge to the watercourse.
- 4.2.3** For developments on greenfield sites, surface water run-off it is to be kept at greenfield runoff rates. Due to the large site area, the development is proposed to have two outfalls to the watercourse. Approximately 58% of the development area (1.07ha) is proposed to discharge to the northern outfall with the remaining development area (0.77ha) discharging to the southern outfall
- 4.2.4** The greenfield flows for the northern area are as follows:-
 1 in 1 year flow = 5.3 l/s
 1 in 30 year flow = 14.2 l/s
 1 in 100 year flows = 20.0 l/s
- The greenfield flows for the southern area are as follows:-
 1 in 1 year flow = 4.0 l/s
 1 in 30 year flow = 10.7 l/s

1 in 100 year flows = 15.1 l/s

4.2.5 Existing/Greenfield run-off rates can be found in **Appendix I**.

4.2.6 On the basis of the above the following drainage options are considered to be appropriate for this site:

Device	Description
Green roofs	Soft landscaping at roof level which slows surface water runoff.
Rain Gardens	Elements of landscaping designed to accommodate small areas of discharge close to source.
Permeable surfaces	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate into permeable soils or discharge to sewers.
Rainwater harvesting	Reduces the annual average rate of runoff from the site by reusing water for non-potable uses e.g. toilet flushing.
Swales	Broad shallow channels that convey / store runoff, and may allow infiltration subject to ground conditions.
Filter drains & perforated pipes	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration.
Filter Strips	Wide gently sloping areas of grass or dense vegetation that slow surface water flows and remove pollutants from run-off from adjacent hardstanding areas.
Wet ponds & constructed wetlands	Provide water quality treatment & temporary storage above the permanent water level.
Attenuation Underground	Oversized pipes or geo-cellular tanks designed to store water below ground level.
Proprietary Treatment Systems	Petrol interceptors, silt traps and similar devices used as part of an overall SUDS scheme to provide pollution control prior to discharge.

- For the northern part of the development, stormwater storage is provided by a retention basin and geocellular tanks to attenuate the development discharge flows to 20l/s. Part of the basin is proposed to be wet all time to provide biodiversity benefits. For the southern part of the development a series of geocellular tanks are proposed to restrict the discharge flow to 15.1l/s. Other forms of attenuation features such as permeable paving in the parking bays, swales and rain gardens will be explored at the detailed design stage. Design Drainage Calculations are saved in **Appendix J**.

- 4.2.7** A copy of the drainage layout, manhole schedules and cross sections of the proposed basin serving the northern development area are saved in **Appendix K**.
- 4.2.8** Protection of groundwater from pollution is covered in Chapter 26 of CIRIA SuDS Manual C753. Due to the proposed development use i.e. residential and a lack of known contamination on site, we can utilise the “simple qualitative method” described in this chapter (cl. 26.7.1) where we may select **“SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index”**, Table 26.2 & 26.3 CIRIA refers.

Pollution Hazard (Indices method)				
Whole Site	Pollution Hazard	TSS	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Low traffic roads and parking	Low	0.5	0.4	0.4

Note – Please see CIRIA SUDS manual for full descriptions.

Pollution Mitigation (Indices method)				
Northern Area				
Component	TSS	Metals	Hydro-carbons	
Permeable Pavement	0.7	0.6	0.7	
Retention Basin	0.7	0.7	0.5	
Total	1.05	0.95	0.95	
Southern Area				
Permeable Pavement	0.7	0.6	0.7	

Note – Please see CIRIA SUDS manual for full descriptions.

- 4.2.7** Driveways and low traffic roads have a low risk of pollution. For the northern part of the development a retention basin alone offers sufficient pollution mitigation and is considered acceptable (Table 26.3 and 26.4 CIRIA). No such retention basin is proposed for the southern development area however the incorporation of SuDS features such as swales, filter strips and rainwater gardens will be explored at the detailed design stage so a robust SuDS management treatment train is provided. Permeable Paving in the car parking bays are proposed.
- 4.2.8** To ensure drainage elements function correctly, maintenance of drainage should be covered by a suitable management company and subject to a regular maintenance regime. Maintenance of SuDS to be in accordance with CIRIA SuDS manual C753 where specific intervals are advised within the document as per element type. A summary of these are present in **Appendix K**.

5.0 Summary and Recommendations

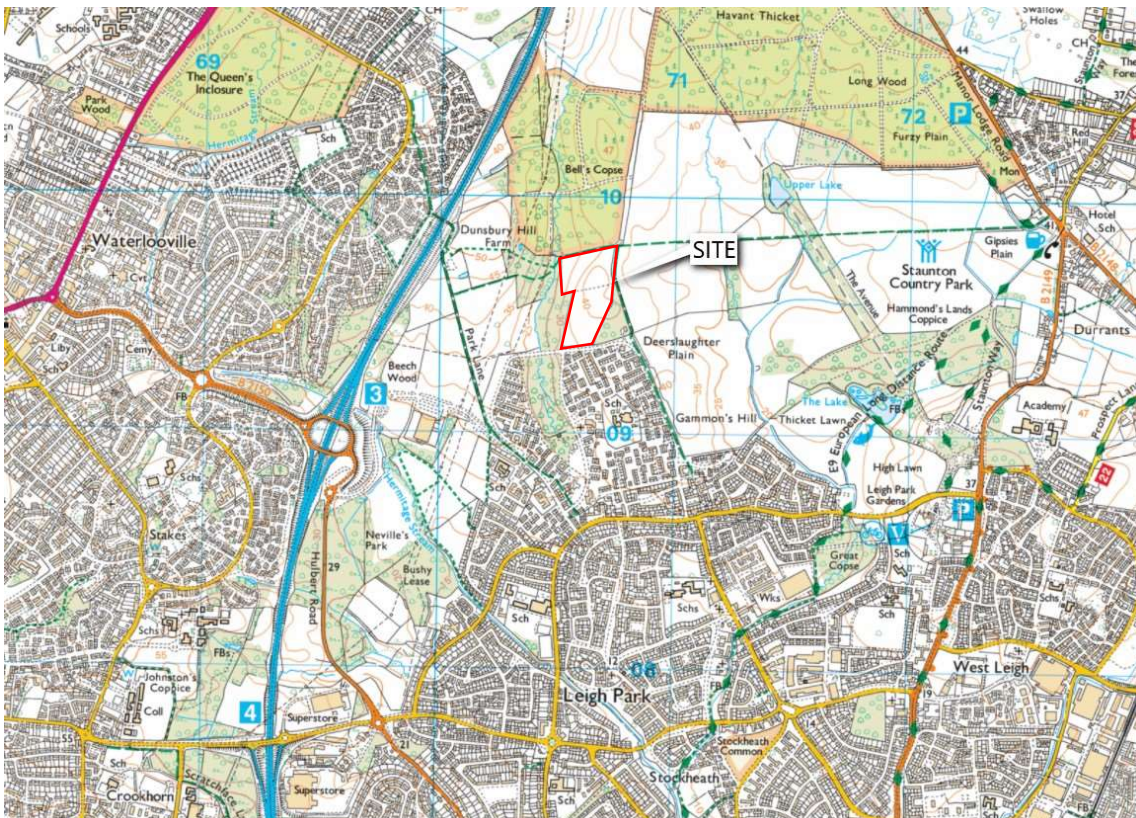
- 5.1** The proposed development lies within Flood Risk Zone 1: Low probability of flooding from rivers as indicated on the Environment Agency flood map. The site is assessed to be at low risk from other forms of flooding including from groundwater, sewers and from overland flow.
- 5.2** The drainage strategy is to restrict discharge to the greenfield rate to a watercourse named Park Lane Stream west of the site following topography, mimicking the existing drainage characteristics of the site. Attenuation will be provided through a retention basin and a series of geocellular tanks. Permeable Paving is proposed in the parking areas. Further SuDS features such as swales, filter strips and rain gardens will be explored at the detailed design stage to provide a robust SuDS management treatment train.
- 5.3** This report confirms that developing the Site would not increase the risk of flooding within the site, or elsewhere, and that there is a satisfactory strategy, incorporating sustainable drainage techniques, for the disposal of surface water runoff from the proposed development.

6.0 Appendices

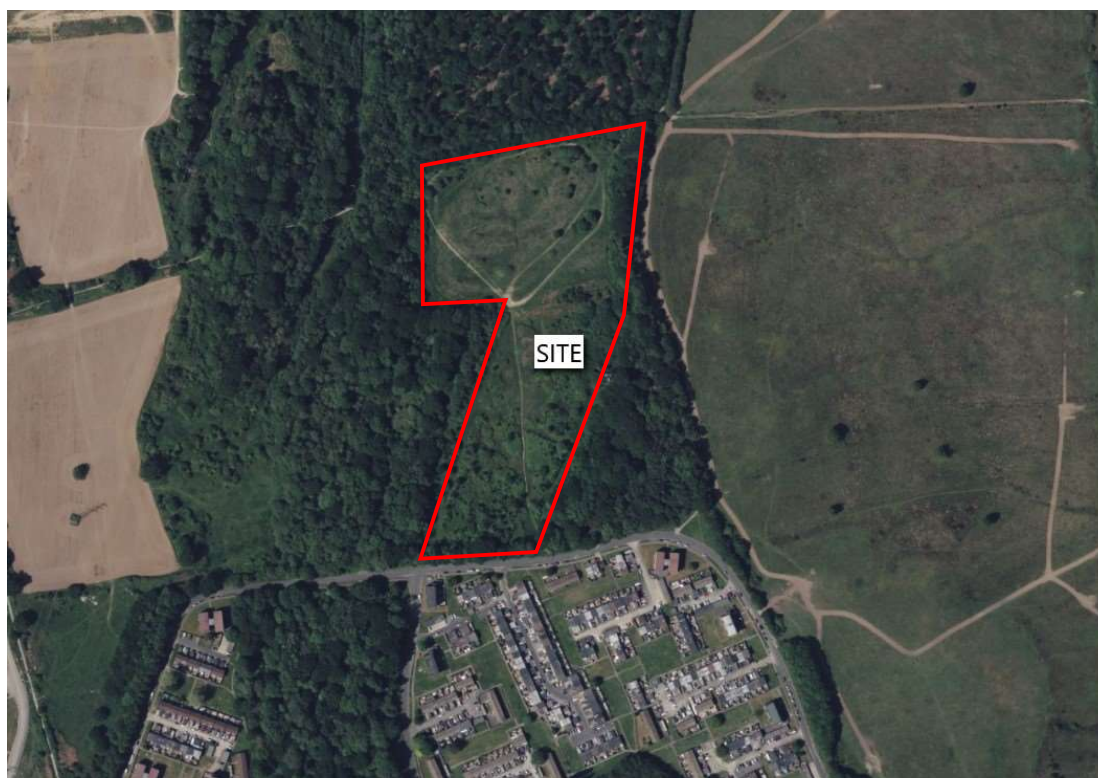
- A. Site Location Plan**
- B. Existing Topographic Survey**
- C. Proposed Site Plan**
- D. Existing Sewer Records Drawings**
- E. British Geological Survey Records**
- F. Site Investigation Report Extracts**
- G. Flood Map Extracts**
- H. SFRA Map Extracts**
- I. Greenfield Calculations**
- J. Drainage Design Calculations**
- K. Proposed Drainage Drawings**
- L. SW Drainage Maintenance Schedule**
- M. Local Planning Policy applicable to the development**

Appendix A

Site Location Plan



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Aerial photograph of existing site

Appendix B

Existing Topographic Survey

Appendix C

Proposed Site Plan



Schedule of Accommodation	
Dwelling Houses (102nr):	Apartments (48nr):
● Type 3A.1: 10 nr 3-bed 6 person (M4(1)) (119sqm)	○ Type 1F.1: 7 nr 1-bed 2 person (M4(1)) (57m²)
■ Type 3A.2: 15 nr 3-bed 6 person (M4(2)) (119sqm)	□ Type 1F.2: 4 nr 1-bed 2 person (M4(2)) (57m²)
★ Type 3B.1: 45 nr 3-bed 6 person (M4(1)) (111sqm)	△ Type 1F.3: 1 nr 1-bed 2 person (M4(3)) (64m²)
▲ Type 3D.3: 2 nr 3-bed 6 person (M4(3)) (136sqm)	○ Type 2F.1: 16 nr 2-bed 4 person (M4(1)) (72m²)
● Type 4A.1: 17 nr 4-bed 8 person (M4(1)) (141sqm)	□ Type 2F.2: 17 nr 2-bed 4 person (M4(2)) (72m²)
■ Type 4A.2: 8 nr 4-bed 8 person (M4(2)) (144sqm)	△ Type 2F.3: 3 nr 2-bed 4 person (M4(3)) (80m²)
▲ Type 4D.3: 2 nr 4-bed 8 person (M4(3)) (160sqm)	
● Type 5A.1: 2 nr 5-bed 10 person (M4(1)) (144sqm)	
■ Type 5A.2: 1 nr 5-bed 10 person (M4(2)) (165sqm)	
Total Units:	
12nr 1-bed 2 person apartments	
36nr 2-bed 4 person apartments	
72nr 3-bed 6 person houses	
27nr 4-bed 8 person houses	
3nr 5-bed 10 person houses	
Total: 150 Dwellings	
257 car parking spaces	

notes

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all dimensions to be checked on site prior to commencement of construction works and the architect notified of any discrepancy.

figured dimensions are to be used in preference to scaled dimensions.

no deviation from this drawing will be permitted without prior consent of the architect.

all drawings are prepared subject to a full measured and structural survey of the buildings and site.

all structural work is subject to the appointment of a structural engineer to confirm and agree the structural proposals.

os promap licence no. 100020449.

health & safety:
exceptional risks involving specific methods of construction or exceptional maintenance issues can be found within the designers risk assessment.

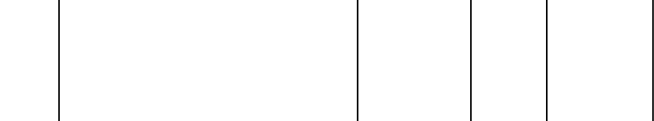
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revision	notes	date	drawn	checked
A	Amends to site layout to client reqs	21.06.21	MAS	IR
B	Planning Issue	26.07.21	MAS	IR
C	Plan amended to revised layout	26.01.22	MAS	IR
D	Resubmission to planners	14.03.22	MAS	IR

client



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project Proposed Development
Cabbagefield Row
Swanmore Road, Leigh Park

detail Site Context Plan

drawn MAS checked IR

date May 2021 status Planning

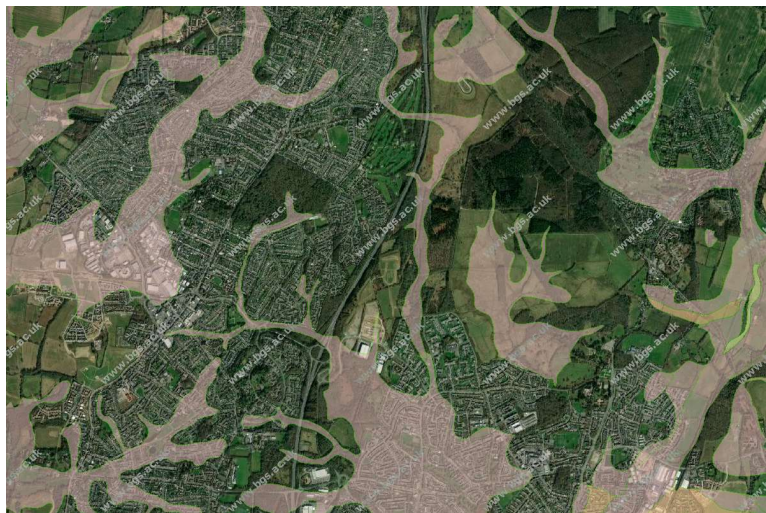
a1 scale a3 scale 1:1250 1:2500

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Appendix D

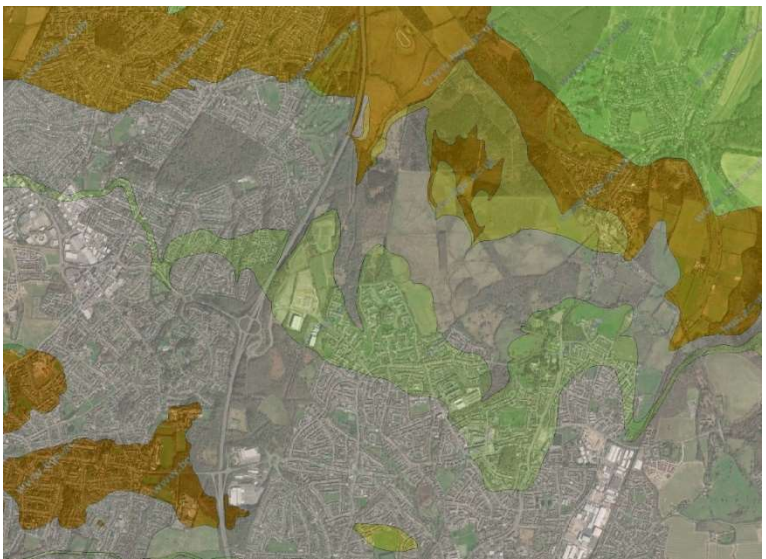
Existing Sewer Record Drawings

Appendix E
British Geological Survey Records



Superficial deposits

- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL
- RAISED STORM BEACH DEPOSITS, 2 - GRAVEL
- RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND, SILT AND CLAY
- CLAY-WITH-FLINTS FORMATION - CLAY, SILT, SAND AND GRAVEL



Bedrock geology

- LONDON CLAY FORMATION - SAND
- LONDON CLAY FORMATION - CLAY, SILT AND SAND
- WITTERING FORMATION - SAND
- WITTERING FORMATION - SAND, SILT AND CLAY
- BOGNOR SAND MEMBER - SAND
- LAMBETH GROUP - SAND
- LAMBETH GROUP - CLAY, SILT AND SAND
- WHITECLIFF SAND MEMBER - SAND
- PORTSDOWN CHALK FORMATION - CHALK
- SPETISBURY CHALK MEMBER - CHALK
- TARRANT CHALK MEMBER - CHALK
- NEWHAVEN CHALK FORMATION - CHALK
- LEWES NODULAR CHALK FORMATION, SEAFORD CHALK FORMATION, NEWHAVEN

Extract of British Geological Survey

Appendix F

Site Investigation Report Extracts



- Legend to symbols:
-  Window sample borehole location
 -  Site boundary
 -  Site entrance gate

Not to Scale
Aerial photo courtesy of Google

Title
Exploratory Hole Location Plan

Project
Cabbagefield Row, Havant



Project No
STH1016/002

Figure No
2

Borehole Log



Drilled	GC	Start	Equipment, Methods and Remarks			Depth from	to	Diameter	Casing Depth	Ground Level
Logged	AC	26/05/2021	Insulated hand tools. Hand dug inspection pit to 1.3 m.			(m)	(m)	(mm)	(m)	Coordinates (m)
Checked	MG	End								National Grid
Approved	SM	26/05/2021								
Samples and Tests					Strata Description					
Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill	
0.05 - 0.25	ES 1				Dark brown slightly clayey sandy SILT with frequent roots and rootlets. (TOPSOIL)		(0.25)			
0.25 - 0.50	ES 2				Stiff brownish grey slightly sandy silty CLAY with occasional partings of fine orange sand. (LONDON CLAY FORMATION)		(1.05)			
					END OF EXPLORATORY HOLE		1.30			
Groundwater Entries					Depth Related Remarks			Hard Boring		
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used	
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project			Borehole		
Scale 1:50 © Copyright SOCOTEC UK Limited 17/06/2021 10:10:30					Project			WS1		
AGS					Cabbagefield Row, Havant			Sheet 1 of 1		
					Project No.					
					Carried out for					
					STH1016					
					Portsmouth City Council					

[illegible]

Borehole Log



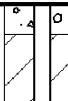
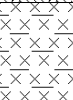
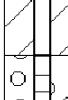
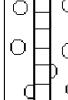
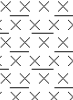
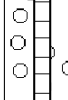
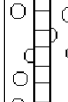
Drilled	GC	Start	Equipment, Methods and Remarks			Depth from	to	Diameter	Casing Depth	Ground Level		
Logged	AC	26/05/2021	Archway Competitor 130. Hand dug inspection pit to 1.2 m followed by dynamic sampling with a competitor rig.			(m)	(m)	(mm)	(m)	Coordinates (m)		
Checked	MG	End								National Grid		
Approved	SM	26/05/2021										
Samples and Tests					Strata Description							
Depth	Type & No.	Records	Date Casing	Time Water	Main	Detail	Depth, Level (Thickness)	Legend	Backfill			
0.10 - 0.30	ES 1				Dark brown slightly clayey sandy SILT with frequent roots and rootlets. (TOPSOIL)		(0.30)					
0.30 - 1.00	ES 2				Firm orangish brown slightly sandy SILT / CLAY with partings of fine orange sand. (LONDON CLAY FORMATION)		0.30					
1.20 - 1.65	SPT S	N=12 (2,2/2,3,3,4)										
2.00 - 2.45	SPT S	N=14 (2,2/4,3,4,3)										
3.00 - 3.45	SPT S	N=13 (3,3/2,4,3,4)										
					END OF EXPLORATORY HOLE		4.00					
Groundwater Entries					Depth Related Remarks			Hard Boring				
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used			
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project			Borehole				
Scale 1:50					Cabbagefield Row, Havant			WS3				
© Copyright SOCOTEC UK Limited					Project No.			Sheet 1 of 1				
17/06/2021 10:10:31					Carried out for							
					STH1016							
					Portsmouth City Council							

Borehole Log



Drilled	GC	Start	Equipment, Methods and Remarks			Depth from	to	Diameter	Casing Depth	Ground Level		
Logged	AC	25/05/2021	Archway Competitor 130. Hand dug inspection pit to 1.2 m followed by dynamic sampling with a competitor rig.			(m)	(m)	(mm)	(m)	Coordinates (m)		
Checked	MG	End							National Grid			
Approved	SM	25/05/2021										
Samples and Tests					Strata Description							
Depth	Type & No.	Records	Date	Time	Main	Detail	Depth, Level (Thickness)	Legend	Backfill			
			Casing	Water								
0.10 - 0.25	ES 1				Dark brown slightly clayey sandy SILT with frequent roots and rootlets. (TOPSOIL)		(0.25)					
0.25 - 1.00	ES 2											
					Firm orangish brown slightly sandy SILT / CLAY with partings of fine orange sand. (LONDON CLAY FORMATION)							
1.20 - 1.65	SPT S	N=14 (0,2/3,3,4,4)										
2.00 - 2.45	SPT S	N=11 (2,2/3,3,3,3)										
3.00 - 3.45	SPT S	N=13 (2,2/3,3,4,3)										
					END OF EXPLORATORY HOLE		4.00					
Groundwater Entries					Depth Related Remarks				Hard Boring			
No.	Depth	Strike (m)	Remarks	Depth Sealed (m)	Depths (m)	Remarks	Depths (m)	Duration (mins)	Tools used			
Notes: For explanation of symbols and abbreviations see Key to Exploratory Hole Records. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.					Project				Borehole			
Scale 1:50					Cabbagefield Row, Havant				WS4			
© Copyright SOCOTEC UK Limited					Project No.				Sheet 1 of 1			
17/06/2021 10:10:31					Carried out for							
					STH1016							
					Portsmouth City Council							

[illegible]

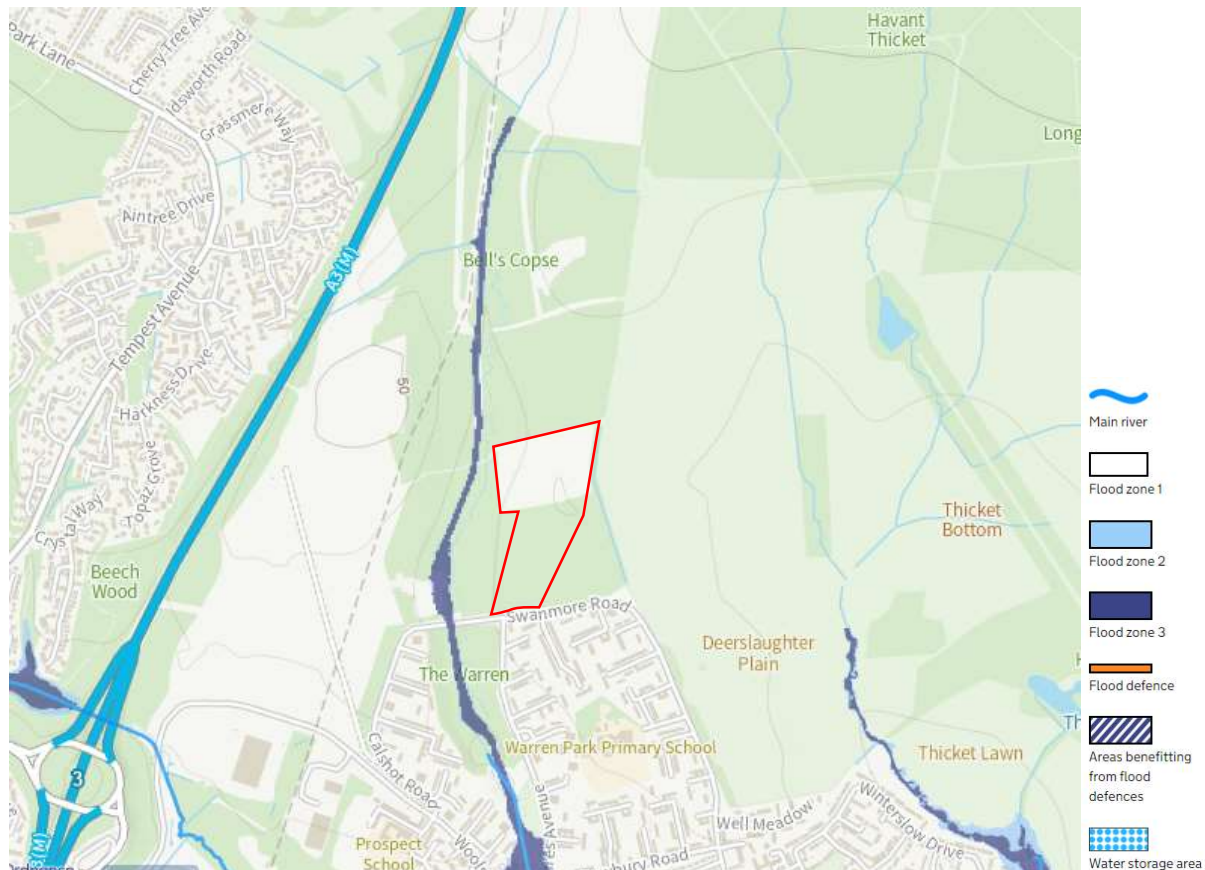
Drilled	GC	Start	Equipment, Methods and Remarks				Depth from (m)	to (m)	Diameter (mm)	Casing Depth (m)	Ground Level						
Logged	AC	25/05/2021	Archway Competitor 130. Hand dug inspection pit to 1.2 m followed by dynamic sampling with a competitor rig.							Coordinates (m)							
Checked	MG	End								National Grid							
Approved	SM	25/05/2021															
Samples and Tests							Strata Description										
Depth		Type & No.		Records		Date Casing	Time Water	Main		Detail		Depth, Level (Thickness)		Legend		Backfill	
0.10 - 0.65		ES 1						Dark brown slightly clayey slightly gravelly sandy SILT with frequent roots and rootlets. Gravel is sub-rounded fine to medium of quartzite. (TOPSOIL)				(0.65)					
0.65 - 1.00		ES 2						Firm orangish brown slightly sandy SILT / CLAY with partings of fine orange sand. (LONDON CLAY FORMATION)				0.65					
1.20 - 1.65		SPT S		N=11 (0,1/2,2,3,4)													
2.00 - 2.45		SPT S		N=20 (12,12/5,6,2,7)								(2.95)					
3.00 - 3.45		SPT S		N=24 (6,6/7,6,4,7)													
4.00 - 4.45		SPT S		N=38 (6,7/8,9,11,10)				Stiff dark grey silty CLAY. (LONDON CLAY FORMATION)				3.60 (0.40)					
								END OF EXPLORATORY HOLE				4.00					

[illegible]

[illegible]

Appendix G Flood Map Extracts

River and Sea Flooding



Flood Map For Planning

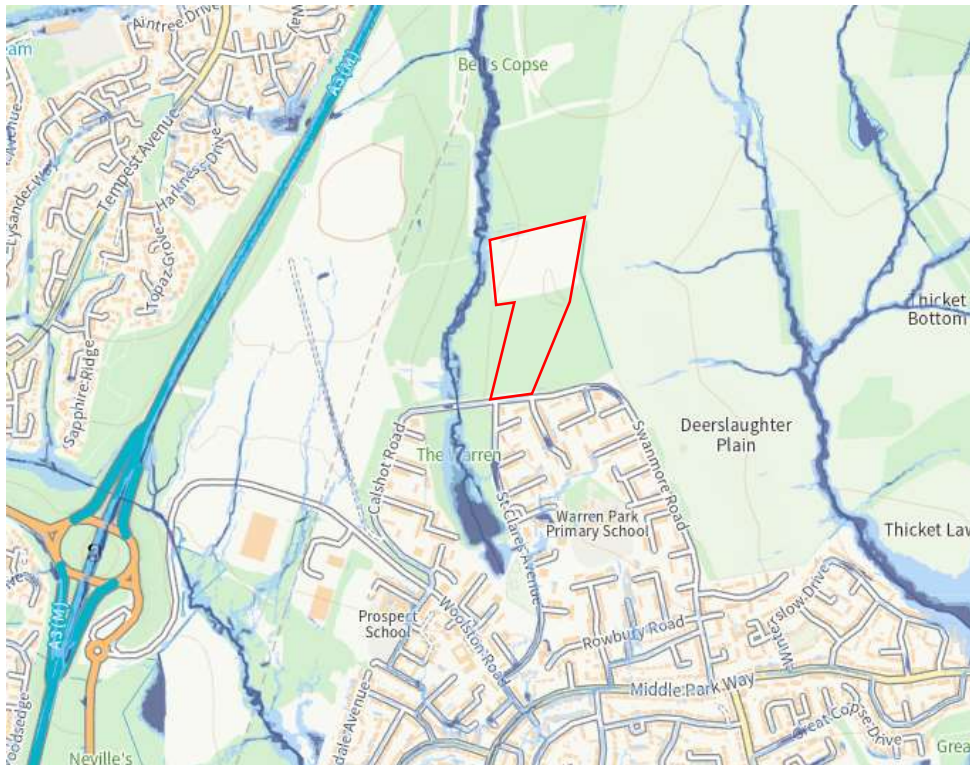
Flood risk from rivers or the sea

Low Probability (Flood Zone 1) means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Medium Probability (Flood Zone 2) means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

High Probability (Flood Zone 3) means that each year this area has a chance of flooding of greater than 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Surface Water Flooding

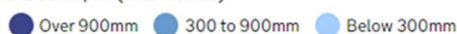


Flood Map – Surface Water

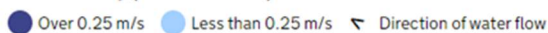
Extent of flooding from surface water



Flood depth (millimetres)



Flood velocity (metres/second)



Flood risk from surface water

Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

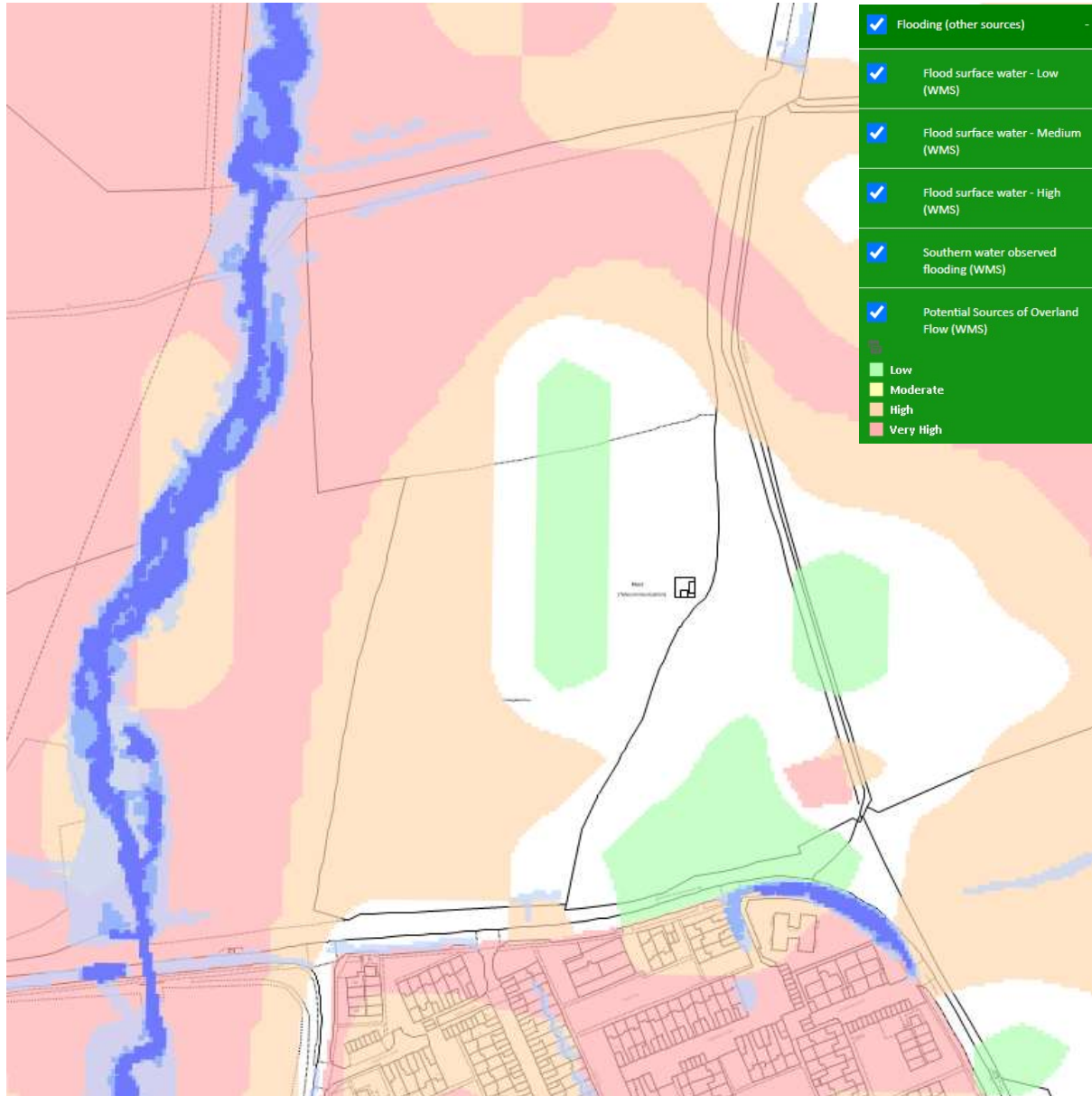
High risk means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

Appendix H

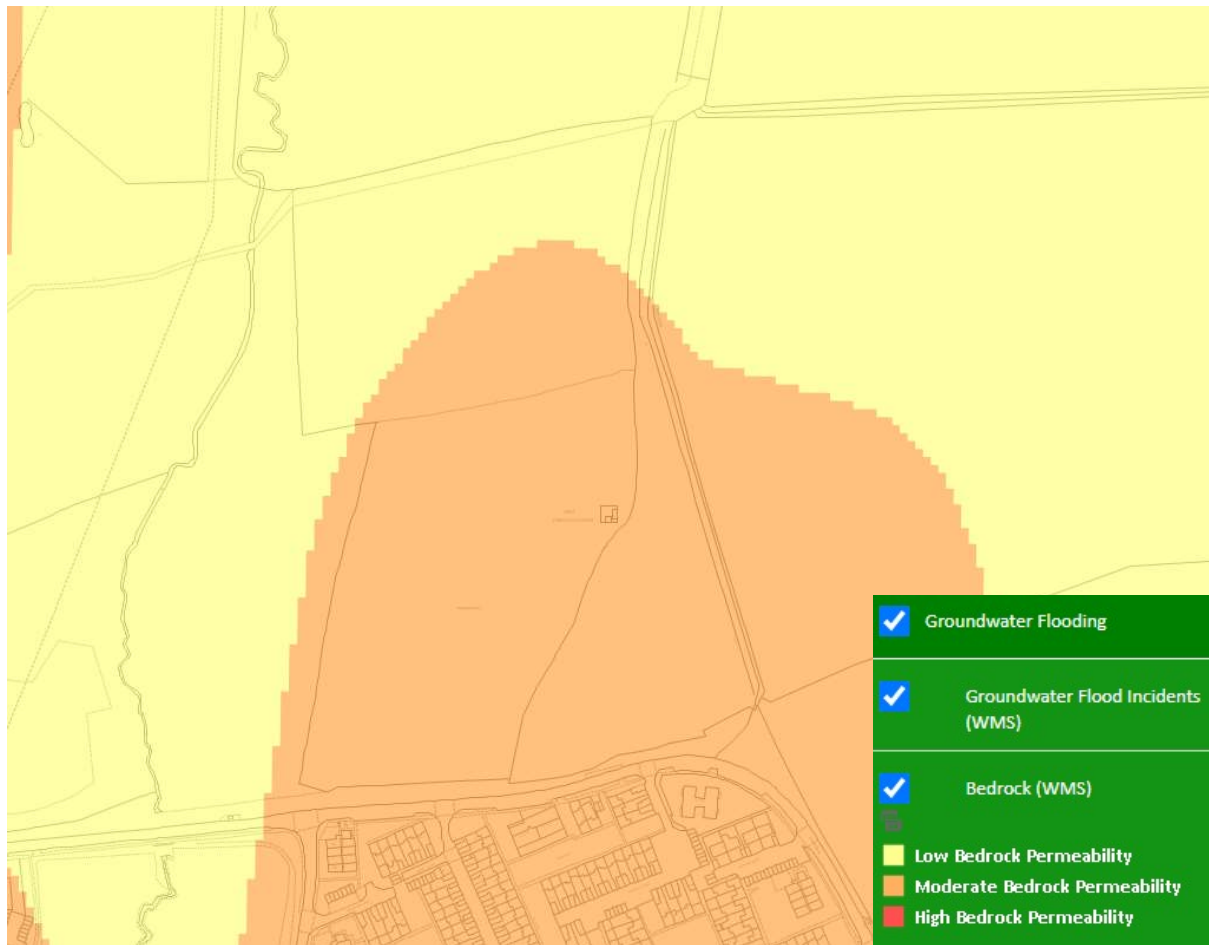
SFRA Map Extracts

PUSH SFRA 2016 Update Map Extracts

Surface Water Flood Map



Groundwater Flood Map



Source: <https://pcc.dynamicmaps.co.uk/MapThatPublic/Default.aspx>

Appendix I

Greenfield Calculations

Scott White and Hookins		Page 1
St Nicholas House St Nicholas Road Sutton SM1 1EL		
Date 23/06/2022 17:33 File	Designed by tkillingback Checked by	
Micro Drainage Source Control 2020.1.3		

IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.066	Urban	0.000
SAAR (mm)	779	Region Number	Region 7

Results l/s

QBAR Rural	6.3
QBAR Urban	6.3
Q100 years	20.0
Q1 year	5.3
Q2 years	5.5
Q5 years	8.0
Q10 years	10.2
Q20 years	12.6
Q25 years	13.5
Q30 years	14.2
Q50 years	16.4
Q100 years	20.0
Q200 years	23.5
Q250 years	24.7
Q1000 years	32.4

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

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Scott White and Hookins		Page 1
St Nicholas House St Nicholas Road Sutton SM1 1EL		
Date 23/06/2022 17:35 File	Designed by tkillingback Checked by	
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IH 124 Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.777	Urban	0.000
SAAR (mm)	779	Region Number	Region 7

Results l/s

QBAR Rural	4.7
QBAR Urban	4.7
Q100 years	15.1
Q1 year	4.0
Q2 years	4.2
Q5 years	6.1
Q10 years	7.7
Q20 years	9.5
Q25 years	10.2
Q30 years	10.7
Q50 years	12.4
Q100 years	15.1
Q200 years	17.8
Q250 years	18.6
Q1000 years	24.4

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

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Appendix J

Drainage Design Calculations

Scott White and Hookins		Page 1
St Nicholas House St Nicholas Road Sutton SM1 1EL		
Date 24/06/2022 14:12 File SW - Northern network -...	Designed by tkillingback Checked by	
Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	76.531	1.255	61.0	0.062	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	7.520	0.235	32.0	0.164	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	64.127	1.515	42.3	0.122	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	39.872	1.250	31.9	0.122	5.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	14.067	1.125	12.5	0.020	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.001	51.888	0.825	62.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	31.960	0.630	50.7	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	25.520	0.865	29.5	0.082	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	27.470	0.930	29.5	0.062	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.63	37.500	0.062	0.0	0.0	0.0	2.02	142.5	8.4
S2.000	50.00	5.04	38.000	0.164	0.0	0.0	0.0	2.79	197.2	22.2
S2.001	50.00	5.49	37.765	0.286	0.0	0.0	0.0	2.42	171.3	38.7
S3.000	50.00	5.24	37.500	0.122	0.0	0.0	0.0	2.79	197.5	16.5
S4.000	50.00	5.05	37.375	0.020	0.0	0.0	0.0	4.47	316.0	2.7
S1.001	50.00	6.07	36.250	0.490	0.0	0.0	0.0	1.99	140.4	66.4
S1.002	50.00	6.31	35.425	0.512	0.0	0.0	0.0	2.21	156.4	69.3
S1.003	50.00	6.46	34.795	0.594	0.0	0.0	0.0	2.91	205.3	80.4
S1.004	50.00	6.61	33.930	0.656	0.0	0.0	0.0	2.90	205.3	88.8

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St Nicholas House St Nicholas Road Sutton SM1 1EL		
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	40.500	3.000	Open Manhole	1200	S1.000	37.500	300				
SAT2	40.000	2.000	Open Manhole	1200	S2.000	38.000	300				
S2	40.000	2.235	Open Manhole	1200	S2.001	37.765	300	S2.000	37.765	300	
S3	40.500	3.000	Open Manhole	1200	S3.000	37.500	300				
SAT 1	40.375	3.000	Open Manhole	1200	S4.000	37.375	300				
S4	40.250	4.005	Open Manhole	1200	S1.001	36.250	300	S1.000	36.245	300	
								S2.001	36.250	300	
								S3.000	36.250	300	
								S4.000	36.250	300	
S5	38.000	2.575	Open Manhole	1200	S1.002	35.425	300	S1.001	35.425	300	
S6	39.000	4.205	Open Manhole	1200	S1.003	34.795	300	S1.002	34.795	300	
S7	39.000	5.070	Open Manhole	1200	S1.004	33.930	300	S1.003	33.930	300	
S8	41.000	3.000	Open Manhole	1200	S5.000	38.000	300				
S9	40.750	4.253	Open Manhole	1200	S5.001	36.497	300	S5.000	36.497	300	
S10	40.500	5.506	Open Manhole	1200	S5.002	34.994	300	S5.001	34.994	300	
S11	40.500	5.858	Open Manhole	1200	S5.003	34.642	300	S5.002	34.642	300	
S12	39.000	5.154	Open Manhole	1200	S6.000	33.846	300				
S13	39.000	6.000	Open Manhole	1500	S1.005	33.000	300	S1.004	33.000	300	
								S5.003	33.000	300	
								S6.000	33.000	300	
SPOND1	32.576	3.000	Open Manhole	1200	S1.006	29.576	300	S1.005	32.000	300	2424
S14	31.250	3.501	Open Manhole	1500	S1.007	27.749	300	S1.006	27.749	300	
S	24.000	0.530	Open Manhole	0		OUTFALL		S1.007	23.470	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	470698.146	109561.470	470698.146	109561.470	Required	
SAT2	470642.907	109481.759	470642.907	109481.759	Required	
S2	470635.408	109481.182	470635.408	109481.182	Required	
S3	470615.662	109583.287	470615.662	109583.287	Required	

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Date 24/06/2022 14:12
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MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SAT 1	470630.200	109556.626	470630.200	109556.626	Required	
S4	470623.587	109544.210	470623.587	109544.210	Required	
S5	470572.576	109534.708	470572.576	109534.708	Required	
S6	470567.044	109566.185	470567.044	109566.185	Required	
S7	470573.000	109591.000	470573.000	109591.000	Required	
S8	470705.282	109638.435	470705.282	109638.435	Required	
S9	470661.848	109626.359	470661.848	109626.359	Required	
S10	470618.413	109614.283	470618.413	109614.283	Required	
S11	470611.437	109606.373	470611.437	109606.373	Required	
S12	470586.678	109594.020	470586.678	109594.020	Required	
S13	470575.739	109618.333	470575.739	109618.333	Required	
SPOND1	470550.662	109628.618	470550.662	109628.618	Required	
S14	470522.963	109614.562	470522.963	109614.562	Required	
S	470451.717	109578.461			No Entry	

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St Nicholas House St Nicholas Road Sutton SM1 1EL		
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Micro Drainage Network 2020.1.3		

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	S	24.000	23.470	23.500	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	30
Ratio R	0.350		

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Micro Drainage		Network 2020.1.3

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S14, DS/PN: S1.007, Volume (m³): 8.3

Unit Reference	MD-SHE-0173-2000-2766-2000
Design Head (m)	2.766
Design Flow (l/s)	20.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	173
Invert Level (m)	27.749
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.766	20.0
Flush-Flo™	0.744	19.3
Kick-Flo®	1.539	15.1
Mean Flow over Head Range	-	17.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	18.3	3.000	20.8	7.000	31.2
0.200	14.9	1.400	16.8	3.500	22.4	7.500	32.3
0.300	16.9	1.600	15.4	4.000	23.8	8.000	33.3
0.400	18.1	1.800	16.3	4.500	25.2	8.500	34.3
0.500	18.8	2.000	17.1	5.000	26.5	9.000	35.2
0.600	19.2	2.200	17.9	5.500	27.8	9.500	36.2
0.800	19.3	2.400	18.7	6.000	29.0		
1.000	19.0	2.600	19.4	6.500	30.1		

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St Nicholas House St Nicholas Road Sutton SM1 1EL		
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Storage Structures for Storm

Tank or Pond Manhole: SAT2, DS/PN: S2.000

Invert Level (m) 38.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	198.0	0.800	198.0	0.801	0.0

Tank or Pond Manhole: SAT 1, DS/PN: S4.000

Invert Level (m) 37.375

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	30.0	0.800	30.0	0.801	0.0

Tank or Pond Manhole: SPOND1, DS/PN: S1.006

Invert Level (m) 29.576

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	74.0	1.000	557.0	3.000	1241.0

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St Nicholas House St Nicholas Road Sutton SM1 1EL								
Date 24/06/2022 14:12 File SW - Northern network -...	Designed by tkillingback Checked by							
Micro Drainage Network 2020.1.3								
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Simulation Criteria Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000 Number of Input Hydrographs 0 Number of Storage Structures 3 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Ratio R 0.350 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.000 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 40								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	1	+0%				
S2.000	SAT2	60 Winter	1	+0%				
S2.001	S2	30 Winter	1	+0%	100/15 Winter			
S3.000	S3	15 Winter	1	+0%	100/15 Winter			
S4.000	SAT 1	15 Winter	1	+0%				
S1.001	S4	15 Winter	1	+0%	100/15 Summer			
S1.002	S5	15 Winter	1	+0%	100/15 Summer			
S1.003	S6	15 Winter	1	+0%	100/15 Summer			
S1.004	S7	15 Winter	1	+0%	30/15 Summer			
S5.000	S8	15 Winter	1	+0%				
S5.001	S9	15 Winter	1	+0%				
S5.002	S10	15 Winter	1	+0%	100/15 Summer			
S5.003	S11	15 Winter	1	+0%	100/15 Summer			
S6.000	S12	15 Winter	1	+0%	100/15 Summer			
S1.005	S13	15 Winter	1	+0%	30/15 Summer			
S1.006	SPOND1	60 Winter	1	+0%	1/30 Winter			
S1.007	S14	180 Winter	1	+0%	1/15 Summer	30/480 Summer		

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Scott White and Hookins							Page 9		
St Nicholas House St Nicholas Road Sutton SM1 1EL									
Date 24/06/2022 14:12		Designed by tkillingback							
File SW - Northern network -...		Checked by							
Micro Drainage				Network 2020.1.3					
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm									
		Water	Surcharged	Flooded		Half Drain	Pipe		
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status
S1.000	S1	37.546	-0.254	0.000	0.06			7.6	OK
S2.000	SAT2	38.044	-0.256	0.000	0.05			6.3	OK
S2.001	S2	37.826	-0.239	0.000	0.09			14.9	OK
S3.000	S3	37.558	-0.242	0.000	0.08			15.4	OK
S4.000	SAT 1	37.386	-0.289	0.000	0.01			2.0	OK
S1.001	S4	36.362	-0.188	0.000	0.30			39.3	OK
S1.002	S5	35.535	-0.190	0.000	0.29			41.3	OK
S1.003	S6	34.902	-0.193	0.000	0.27			49.5	OK
S1.004	S7	34.044	-0.186	0.000	0.30			55.7	OK
S5.000	S8	38.045	-0.255	0.000	0.05			10.3	OK
S5.001	S9	36.561	-0.236	0.000	0.10			19.0	OK
S5.002	S10	35.082	-0.212	0.000	0.19			27.7	OK
S5.003	S11	34.725	-0.217	0.000	0.17			36.5	OK
S6.000	S12	33.893	-0.253	0.000	0.06			10.4	OK
S1.005	S13	33.156	-0.144	0.000	0.53			101.7	OK
S1.006	SPOND1	29.930	0.054	0.000	0.16			38.8	SURCHARGED
S1.007	S14	30.080	2.031	0.000	0.08			19.1	SURCHARGED
	PN	US/MH Name	Level Exceeded						
	S1.000	S1							
	S2.000	SAT2							
	S2.001	S2							
	S3.000	S3							
	S4.000	SAT 1							
	S1.001	S4							
	S1.002	S5							
	S1.003	S6							
	S1.004	S7							
	S5.000	S8							
	S5.001	S9							
	S5.002	S10							
	S5.003	S11							
	S6.000	S12							
	S1.005	S13							
	S1.006	SPOND1							
	S1.007	S14	4						
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 3
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%				
S2.000	SAT2	30 Winter	30	+0%				
S2.001	S2	15 Winter	30	+0%	100/15 Winter			
S3.000	S3	15 Winter	30	+0%	100/15 Winter			
S4.000	SAT 1	15 Winter	30	+0%				
S1.001	S4	15 Winter	30	+0%	100/15 Summer			
S1.002	S5	15 Winter	30	+0%	100/15 Summer			
S1.003	S6	15 Winter	30	+0%	100/15 Summer			
S1.004	S7	15 Winter	30	+0%	30/15 Summer			
S5.000	S8	15 Winter	30	+0%				
S5.001	S9	15 Winter	30	+0%				
S5.002	S10	15 Winter	30	+0%	100/15 Summer			
S5.003	S11	15 Winter	30	+0%	100/15 Summer			
S6.000	S12	15 Winter	30	+0%	100/15 Summer			
S1.005	S13	15 Winter	30	+0%	30/15 Summer			
S1.006	SPOND1	120 Winter	30	+0%	1/30 Winter			
S1.007	S14	180 Winter	30	+0%	1/15 Summer	30/480 Summer		

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	37.575	-0.225	0.000	0.14			18.7	OK
S2.000	SAT2	38.087	-0.213	0.000	0.18			22.4	OK
S2.001	S2	37.878	-0.187	0.000	0.29			47.4	OK
S3.000	S3	37.592	-0.208	0.000	0.21			37.8	OK
S4.000	SAT 1	37.402	-0.273	0.000	0.02			5.0	OK
S1.001	S4	36.458	-0.092	0.000	0.81			107.3	OK
S1.002	S5	35.627	-0.098	0.000	0.79			113.2	OK
S1.003	S6	35.022	-0.073	0.000	0.73			134.7	OK
S1.004	S7	34.586	0.356	0.000	0.78			144.9	SURCHARGED
S5.000	S8	38.073	-0.227	0.000	0.13			25.2	OK
S5.001	S9	36.604	-0.193	0.000	0.27			52.1	OK
S5.002	S10	35.151	-0.143	0.000	0.53			78.9	OK
S5.003	S11	34.792	-0.150	0.000	0.49			105.7	OK
S6.000	S12	34.036	-0.110	0.000	0.14			25.4	OK
S1.005	S13	34.010	0.710	0.000	1.31			252.8	SURCHARGED
S1.006	SPOND1	30.402	0.526	0.000	0.11			26.4	SURCHARGED
S1.007	S14	30.713	2.664	0.000	0.08			19.3	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S2.000	SAT2	
S2.001	S2	
S3.000	S3	
S4.000	SAT 1	
S1.001	S4	
S1.002	S5	
S1.003	S6	
S1.004	S7	
S5.000	S8	
S5.001	S9	
S5.002	S10	
S5.003	S11	
S6.000	S12	
S1.005	S13	
S1.006	SPOND1	
S1.007	S14	

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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>		
<u>Simulation Criteria</u>		
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow 0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm)	0	Inlet Coefficient 0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s)	0.000	
Number of Input Hydrographs 0 Number of Storage Structures 3 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0		
<u>Synthetic Rainfall Details</u>		
Rainfall Model	FSR	Ratio R 0.350
Region	England and Wales	Cv (Summer) 0.750
M5-60 (mm)	19.000	Cv (Winter) 0.840
Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON		
Profile(s) Summer and Winter		
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080	
Return Period(s) (years)	1, 30, 100	
Climate Change (%)	0, 0, 40	

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	100	+40%				
S2.000	SAT2	30 Winter	100	+40%				
S2.001	S2	15 Winter	100	+40%	100/15 Winter			
S3.000	S3	15 Winter	100	+40%	100/15 Winter			
S4.000	SAT 1	15 Winter	100	+40%				
S1.001	S4	15 Winter	100	+40%	100/15 Summer			
S1.002	S5	15 Winter	100	+40%	100/15 Summer			
S1.003	S6	15 Winter	100	+40%	100/15 Summer			
S1.004	S7	15 Winter	100	+40%	30/15 Summer			
S5.000	S8	15 Winter	100	+40%				
S5.001	S9	15 Winter	100	+40%				
S5.002	S10	15 Winter	100	+40%	100/15 Summer			
S5.003	S11	15 Winter	100	+40%	100/15 Summer			
S6.000	S12	15 Winter	100	+40%	100/15 Summer			
S1.005	S13	15 Winter	100	+40%	30/15 Summer			
S1.006	SPOND1	180 Winter	100	+40%	1/30 Winter			
S1.007	S14	2160 Winter	100	+40%	1/15 Summer	30/480 Summer		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	37.795	-0.005	0.000	0.24		33.2	OK
S2.000	SAT2	38.134	-0.166	0.000	0.41		49.9	OK
S2.001	S2	38.116	0.051	0.000	0.57		93.5	SURCHARGED
S3.000	S3	37.851	0.051	0.000	0.37		68.4	SURCHARGED
S4.000	SAT 1	37.662	-0.013	0.000	0.21		55.8	OK
S1.001	S4	37.745	1.195	0.000	1.12		148.1	SURCHARGED
S1.002	S5	37.223	1.498	0.000	1.13		160.8	SURCHARGED
S1.003	S6	36.820	1.725	0.000	0.96		176.4	SURCHARGED
S1.004	S7	36.277	2.047	0.000	1.01		187.1	SURCHARGED
S5.000	S8	38.100	-0.200	0.000	0.24		45.6	OK
S5.001	S9	36.699	-0.098	0.000	0.49		94.3	OK
S5.002	S10	36.454	1.160	0.000	0.77		114.2	SURCHARGED
S5.003	S11	36.262	1.320	0.000	0.69		149.5	SURCHARGED
S6.000	S12	35.546	1.400	0.000	0.20		36.3	SURCHARGED
S1.005	S13	35.504	2.204	0.000	1.79		345.2	SURCHARGED
S1.006	SPOND1	30.873	0.997	0.000	0.12		30.5	SURCHARGED
S1.007	S14	31.251	3.202	0.746	0.08		19.7	FLOOD

PN	US/MH Name	Level Exceeded
S1.000	S1	
S2.000	SAT2	
S2.001	S2	
S3.000	S3	
S4.000	SAT 1	
S1.001	S4	
S1.002	S5	
S1.003	S6	
S1.004	S7	
S5.000	S8	
S5.001	S9	
S5.002	S10	
S5.003	S11	
S6.000	S12	
S1.005	S13	
S1.006	SPOND1	
S1.007	S14	4

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S7.000	17.627	0.176	100.2	0.091	5.00	0.0	0.600	o	375	Pipe/Conduit	
S8.000	9.056	0.176	51.5	0.091	5.00	0.0	0.600	o	375	Pipe/Conduit	
S7.001	31.288	0.232	135.2	0.090	0.00	0.0	0.600	o	375	Pipe/Conduit	
S9.000	10.187	0.500	20.4	0.180	5.00	0.0	0.600	o	375	Pipe/Conduit	
S9.001	9.384	2.407	3.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.002	14.694	0.232	63.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.003	30.438	1.165	26.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.004	45.409	1.774	25.6	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.005	58.452	1.347	43.4	0.160	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.000	50.00	5.16	34.925	0.091	0.0	0.0	0.0	1.81	200.0	12.3
S8.000	50.00	5.06	34.925	0.091	0.0	0.0	0.0	2.53	279.5	12.3
S7.001	50.00	5.50	34.749	0.272	0.0	0.0	0.0	1.56	171.9	36.8
S9.000	50.00	5.04	37.425	0.180	0.0	0.0	0.0	4.03	445.1	24.4
S9.001	50.00	5.06	36.925	0.180	0.0	0.0	0.0	9.23	1019.4	24.4
S7.002	50.00	5.60	34.518	0.452	0.0	0.0	0.0	2.28	251.8	61.2
S7.003	50.00	5.75	34.286	0.452	0.0	0.0	0.0	3.56	392.9	61.2
S7.004	50.00	5.96	33.121	0.452	0.0	0.0	0.0	3.59	396.9	61.2
S7.005	50.00	6.31	31.347	0.612	0.0	0.0	0.0	2.76	304.5	82.9

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SAT1	37.000	2.075	Open Manhole	1350	S7.000	34.925	375				
SAT2	37.000	2.075	Open Manhole	1350	S8.000	34.925	375				
S1	38.000	3.251	Open Manhole	1350	S7.001	34.749	375	S7.000	34.749	375	
								S8.000	34.749	375	
S2	39.000	1.575	Open Manhole	1350	S9.000	37.425	375				
SAT3	39.500	2.575	Open Manhole	1350	S9.001	36.925	375	S9.000	36.925	375	
S3	39.425	4.907	Open Manhole	1350	S7.002	34.518	375	S7.001	34.518	375	
								S9.001	34.518	375	
S4	39.350	5.064	Open Manhole	1350	S7.003	34.286	375	S7.002	34.286	375	
S5	38.850	5.729	Open Manhole	1350	S7.004	33.121	375	S7.003	33.121	375	
S6	37.000	5.653	Open Manhole	1350	S7.005	31.347	375	S7.004	31.347	375	
SAT4	36.250	6.000	Open Manhole	1350	S10.000	30.250	375				
S7	36.000	6.000	Open Manhole	1350	S7.006	30.000	375	S7.005	30.000	375	
								S10.000	30.000	375	
S8	33.000	6.000	Open Manhole	1350	S7.007	27.000	375	S7.006	27.000	375	
S9	30.000	4.865	Open Manhole	1350	S7.008	25.135	375	S7.007	25.135	375	
S	24.000	0.500	Open Manhole	0		OUTFALL		S7.008	23.500	375	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SAT1	470579.629	109468.364	470579.629	109468.364	Required	
SAT2	470582.759	109453.926	470582.759	109453.926	Required	
S1	470591.678	109455.498	470591.678	109455.498	Required	
S2	470611.818	109474.530	470611.818	109474.530	Required	
SAT3	470617.904	109466.361	470617.904	109466.361	Required	
S3	470622.833	109458.376	470622.833	109458.376	Required	



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<u>Simulation Criteria for Storm</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Profile Type</td> <td>Summer</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.100</td> <td>Storm Duration (mins)</td> <td>30</td> </tr> <tr> <td>Ratio R</td> <td>0.350</td> <td></td> <td></td> </tr> </table>			Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.100	Storm Duration (mins)	30	Ratio R	0.350		
Rainfall Model	FSR	Profile Type	Summer																			
Return Period (years)	100	Cv (Summer)	0.750																			
Region	England and Wales	Cv (Winter)	0.840																			
M5-60 (mm)	19.100	Storm Duration (mins)	30																			
Ratio R	0.350																					
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S7, DS/PN: S7.006, Volume (m³): 15.3

Unit Reference	MD-SHE-0163-1500-1800-1500
Design Head (m)	1.800
Design Flow (l/s)	15.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	163
Invert Level (m)	30.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	15.0
Flush-Flo™	0.523	15.0
Kick-Flo®	1.111	11.9
Mean Flow over Head Range	-	13.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.8	1.200	12.4	3.000	19.1	7.000	28.7
0.200	12.9	1.400	13.3	3.500	20.6	7.500	29.7
0.300	14.2	1.600	14.2	4.000	21.9	8.000	30.6
0.400	14.8	1.800	15.0	4.500	23.2	8.500	31.5
0.500	15.0	2.000	15.8	5.000	24.4	9.000	32.4
0.600	15.0	2.200	16.5	5.500	25.6	9.500	33.3
0.800	14.5	2.400	17.2	6.000	26.7		
1.000	13.3	2.600	17.9	6.500	27.7		

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Storage Structures for Storm

Tank or Pond Manhole: SAT1, DS/PN: S7.000

Invert Level (m) 34.925

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	174.0	0.800	174.0	0.801	0.0

Tank or Pond Manhole: SAT2, DS/PN: S8.000

Invert Level (m) 34.925

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	180.0	0.800	180.0	0.801	0.0

Tank or Pond Manhole: SAT3, DS/PN: S9.001

Invert Level (m) 36.925

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	68.0	1.200	68.0	1.201	0.0

Tank or Pond Manhole: SAT4, DS/PN: S10.000

Invert Level (m) 30.250

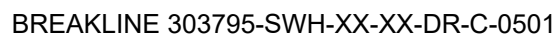
Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	414.0	2.000	414.0	2.001	0.0

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Micro Drainage Network 2020.1.3																																																																																																																																														
1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm Simulation Criteria Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000 Number of Input Hydrographs 0 Number of Storage Structures 4 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FSR Ratio R 0.350 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.000 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 40 <table><thead><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surcharge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th></tr></thead><tbody><tr><td>S7.000</td><td>SAT1</td><td>60 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>34.954</td></tr><tr><td>S8.000</td><td>SAT2</td><td>60 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>34.953</td></tr><tr><td>S7.001</td><td>S1</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>34.821</td></tr><tr><td>S9.000</td><td>S2</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>37.497</td></tr><tr><td>S9.001</td><td>SAT3</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>36.970</td></tr><tr><td>S7.002</td><td>S3</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>34.623</td></tr><tr><td>S7.003</td><td>S4</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>34.363</td></tr><tr><td>S7.004</td><td>S5</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>33.197</td></tr><tr><td>S7.005</td><td>S6</td><td>15 Winter</td><td>1</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>31.450</td></tr><tr><td>S10.000</td><td>SAT4</td><td>60 Winter</td><td>1</td><td>+0%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>30.319</td></tr><tr><td>S7.006</td><td>S7</td><td>15 Winter</td><td>1</td><td>+0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>30.566</td></tr><tr><td>S7.007</td><td>S8</td><td>30 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>27.051</td></tr><tr><td>S7.008</td><td>S9</td><td>15 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>25.184</td></tr></tbody></table> ©1982-2020 Innovyze			PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	S7.000	SAT1	60 Winter	1	+0%					34.954	S8.000	SAT2	60 Winter	1	+0%					34.953	S7.001	S1	15 Winter	1	+0%					34.821	S9.000	S2	15 Winter	1	+0%					37.497	S9.001	SAT3	15 Winter	1	+0%					36.970	S7.002	S3	15 Winter	1	+0%					34.623	S7.003	S4	15 Winter	1	+0%					34.363	S7.004	S5	15 Winter	1	+0%					33.197	S7.005	S6	15 Winter	1	+0%	100/15 Summer				31.450	S10.000	SAT4	60 Winter	1	+0%	100/15 Winter				30.319	S7.006	S7	15 Winter	1	+0%	1/15 Summer				30.566	S7.007	S8	30 Winter	1	+0%					27.051	S7.008	S9	15 Summer	1	+0%					25.184
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S10.000	SAT4	60 Winter	1	+0%	100/15 Winter				30.319																																																																																																																																					
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Appendix K

Proposed Drainage Drawings

- Drainage Strategy Layout
- Manhole Schedule
- Detention Layout and Sections
- Attenuation and Ecology Pond Layout and Profile

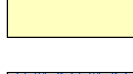
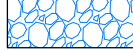


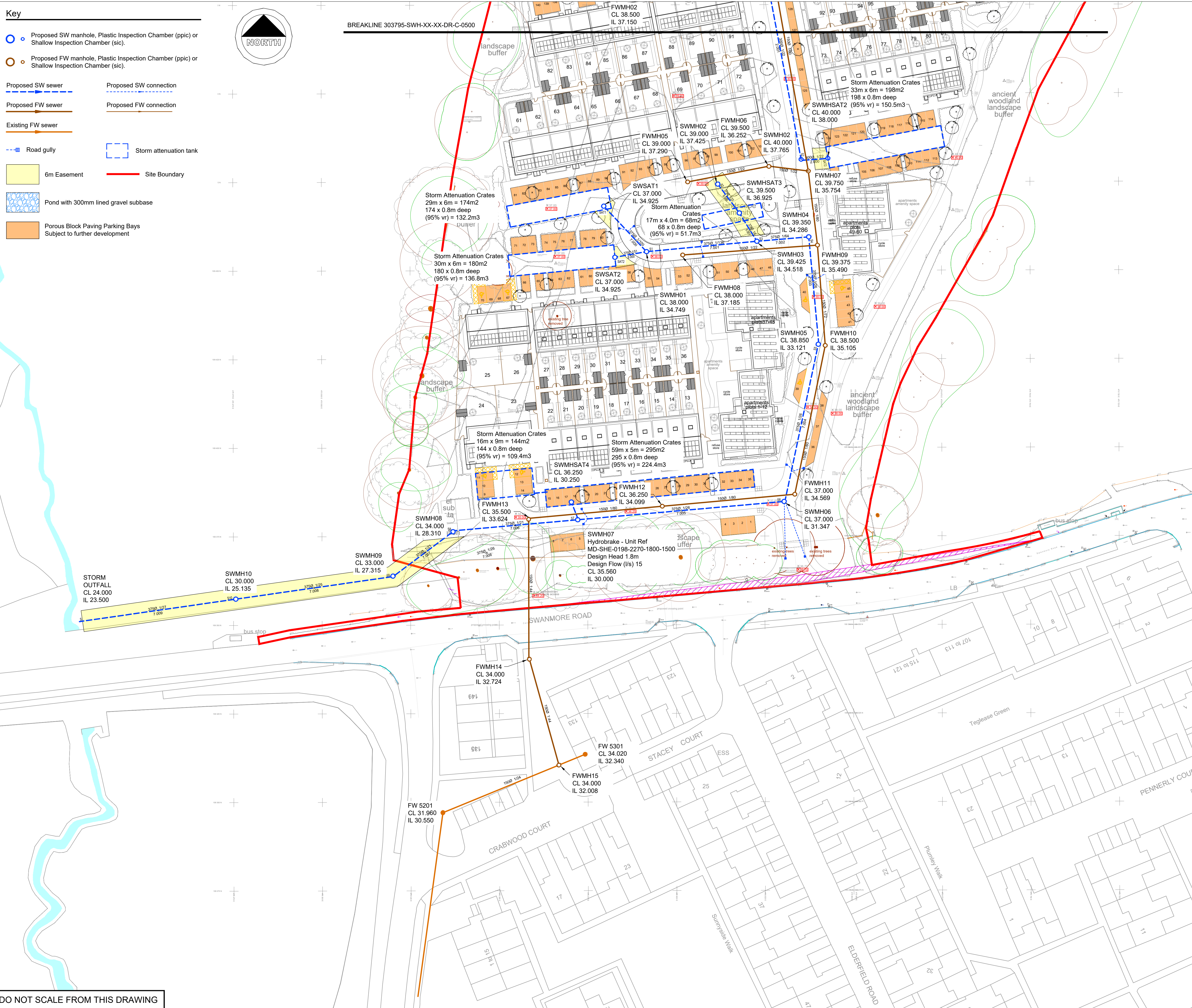
Project	Originator	Zone	Level	Type	Role	Number	Rev
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CP004-01 FM ST 008



BREAKLINE 303795-SWH-XX-XX-DR-C-0500

-  Proposed SW manhole, Plastic Inspection Chamber (ppic) or Shallow Inspection Chamber (sic).
 Proposed FW manhole, Plastic Inspection Chamber (ppic) or Shallow Inspection Chamber (sic).
-  Road gully
  Storm attenuation tank
-  6m Easement
  Site Boundary
-  Pond with 300mm lined gravel subbase
-  Porous Block Paving Parking Bays Subject to further development



Notes

GENERAL

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- For setting out refer to Architects drawings.
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- Contractor to check/scan for services prior to construction to avoid any damage during works.
- This drawing is based on PDP Architects plan dated May 2022

DRAINAGE

- Any information given on this drawing regarding existing services is believed to be correct. The contractor must check this information and determine the nature and location of other existing services from the various statutory authorities before commencing excavation works.
- Drainage works to be constructed in accordance with BS EN 752 and Approved Document H
- All soft spots and unacceptable material encountered in drainage excavations is to be removed and replaced with granular material to the requirements of the building control officer.
- Pipes to be installed to manufacturers recommendations.
- Pipes under buildings to be laid to a fall of 1:60 minimum unless noted otherwise. Internal level of pipes to be 4.20m (50mm below blinding + 90° bend). Refer to structural detail drawings for detailed slab construction make-up layers and levels.
- Plastic plain wall pipes to be PVC-U to BS EN 1401-1, class SN4, with flexible joints, Kitemark certified. Structured wall plastic pipes to be to WIS 04-35-01, Kitemark certified
- Clay pipes to be vitrified clay to BS EN 295-1, with flexible joints, Kitemark certified. Clayware pipes must be extra strength classification protected in accordance with the specified details.
- Concrete pipes to be precast concrete to BS 5911-1 and BS EN 1916, with flexible joints.
- Bedding of pipes to be in accordance with approved document H1
- Rocker pipes with flexible joints are to be provided at a distance of 150mm and 750mm from the face of construction to manholes, where pipes pass above, below or through ground beams or foundations; at gully connections and soil stack ends.
- Manhole access covers are to be located at the outgoing side of manholes.
- Cover levels are to be fixed on site to suit finished levels. Covers and frames to BS EN124, Grade D to be used in areas subject to heavy vehicular loading, Grade C in areas subject to light vehicular loading and Grade B to be used elsewhere.
- All pipes to be 100Ø unless noted otherwise.
- Manhole positions are indicative only to be confirmed by Architect
- Access points to be located at base of all nwp and svps.
- All gullies to be trapped
- Positions of SVPs and RWP's are indicative only and should be read in conjunction with Architects drawings.

PRELIMINARY - NOT FOR CONSTRUCTION

P04	Preliminary Issue	TK	TK	IL	29.06.22
P03	Preliminary Issue	RD	TK	IL	14.06.22
P02	Preliminary Issue	RD	TK	IL	06.06.22
P01	Preliminary Issue	RD	TK	IL	26.05.22
Rev.	Amendment	Drn.	Chkd.	Appd.	Date

Project

Cabbagefield Row
Leigh Park

Drawing

Drainage Strategy
Sheet 2 of 2

Client _____

Portsmouth City Council

Scott White and Hookins

Structural Engineering Civil Engineering Sustainability and BREEAM CDM Consultancy

Harman House, Andover Road, Winchester, Hampshire SO23 7BS

T: +44 (0)1962 844855 W: www.swh.co.uk E: info@swh.co.uk

Scale at A1 - 1:500

303795-SWH-XX-XX-DR-C-0501-P04

Project	Originator	Zone	Level	Type	Role	Number	Rev.
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CP004-01_FM_ST_008_D

Notes

GENERAL

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SURFACE WATER MANHOLE SCHEDULE (CL to be confirmed by architect / contractor) Manhole / Inspection Chambers located in (H) Hard Landscaping (S) Soft Landscaping								
MANHOLE REF.	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH (m)	CHAMBER SIZE (mm)	CONSTRUCTION	COVER SIZE (mm)	COVER TYPE	NOTES
SWMH01	40.500	37.500	2.500	1200	Type 2 (H)	600x600	D400	Attenuation Crate Catchpit Manhole
SWSAT02	40.000	38.000	2.000	1200	Type 2 (H)	600x600	D400	
SWMH02	40.000	37.765	2.235	1200	Type 2 (H)	600x600	D400	
SWMH03	40.500	37.500	2.500	1200	Type 2 (H)	600x600	D400	Attenuation Crate Catchpit Manhole
SWSAT01	40.375	37.375	2.625	1200	Type 2 (S)	600x600	D400	
SWMH04	40.250	36.250	3.750	1200	Type 2 (H)	600x600	D400	
SWMH05	38.000	35.425	2.675	1200	Type 2 (H)	600x600	D400	
SWMH06	39.000	34.795	4.205	1200	Type 2 (H)	600x600	D400	
SWMH07	39.000	33.930	5.070	1200	Type 2 (S)	600x600	D400	
SWMH08	41.000	38.000	3.000	1200	Type 2 (H)	600x600	D400	
SWMH09	40.750	36.497	4.253	1200	Type 2 (H)	600x600	D400	
SWMH10	40.500	34.994	5.506	1200	RE	600x600	D400	
SWMH11	40.500	34.642	5.858	1200	Type 2 (H)	600x600	D400	
SWMH12	39.000	33.846	5.154	1200	Type 2 (S)	600x600	D400	
SWMH13	39.000	33.000	6.000	1500	Type 2 (S)	600x600	D400	
SWSPOND1	32.576	30.576	2.000	1200	Type 2 (S)	600x600	D400	Stormwater Pond chamber
SWMH14	31.250	28.749	2.501	1500	Type 2 (S)	600x600	D400	Hydrobrake Chamber
S OUTFALL	24.000	23.470	0.530			750x675	D400	Stormwater Outfall
SWSAT01	37.000	34.925	2.075	1350	Type 2 (H)	600x600	D400	Attenuation Crate Catchpit Manhole
SWSAT02	37.000	34.925	2.075	1350	Type 2 (H)	600x600	D400	Attenuation Crate Catchpit Manhole
SWMH01	38.000	34.749	3.251	1350	Type 2 (H)	600x600	D400	
SWMH02	39.000	37.425	1.575	1350	Type 2 (H)	1200x675	D400	
SWSAT03	39.500	36.925	2.575	1350	Type 2 (S)	600x600	D400	
SWMH03	39.425	34.518	4.907	1350	Type 2 (H)	600x600	D400	
SWMH04	39.350	34.286	5.064	1350	Type 2 (H)	600x600	D400	
SWMH05	38.850	33.121	5.729	1350	Type 2 (H)	600x600	D400	
SWMH06	37.000	31.347	5.653	1350	Type 2 (H)	600x600	D400	Hydrobrake Chamber
SWMH07	35.560	30.000	5.560	1350	Type 2 (H)	600x600	D400	
SWMH08	34.000	28.310	5.690	1350	Type 2 (S)	600x600	D400	
SWMH09	33.000	27.315	5.685	1350	Type 2 (S)	600x600	D400	
SWMH10	30.000	25.135	4.865	1350	Type 2 (S)	600x600	D400	
S OUTFALL	24.000	23.500	0.500			750x675	D400	

FOUL WATER MANHOLE SCHEDULE (CL to be confirmed by architect / contractor) Manhole / Inspection Chambers located in (H) Hard Landscaping (S) Soft Landscaping								
MANHOLE REF.	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH (m)	CHAMBER SIZE (mm)	CONSTRUCTION	COVER SIZE (mm)	COVER TYPE	NOTES
FWIC01	40.500	39.150	1.350	1200	Type 2 (H)	600x600	D400	
FWIC02	38.500	37.150	1.350	1200	Type 2 (H)	600x600	D400	
FWIC03	40.375	36.904	3.471	1200	Type 2 (H)	600x600	D400	
FWIC04	40.250	36.565	3.685	1200	Type 2 (H)	600x600	D400	
FWIC05	39.000	37.290	1.710	1200	Type 2 (H)	600x600	D400	
FWIC06	39.500	36.252	3.248	1200	Type 2 (H)	600x600	D400	
FWIC07	39.750	35.754	3.996	1200	Type 2 (H)	600x600	D400	
FWIC08	38.000	37.185	0.815	750x675	Type 3 (H)	600x600	D400	
FWIC09	39.375	35.490	3.885	1200	Type 2 (H)	600x600	D400	
FWIC10	38.500	35.105	3.395	1200	Type 2 (H)	600x600	D400	
FWIC11	37.000	34.569	2.431	1200	Type 2 (H)	600x600	D400	
FWIC12	36.250	34.099	2.151	1200	Type 2 (H)	600x600	D400	
FWIC13	35.500	33.624	1.876	750x675	Type 3 (S)	600x600	D400	
FWIC14	34.000	32.724	1.276	1200	Type 2 (S)	600x600	D400	
FWIC15	34.000	32.008	1.992	1200	Type 2 (S)	600x600	D400	

Co ORDINATE TABLE FOR FOUL DRAINAGE MANHOLES SOUTHERN SECTION		
REF.	EASTING	NORTHING
F1	470613.723	109598.870
F2	470579.919	109534.620
F3	470630.517	109548.376
F4	470626.151	109542.113
F5	470603.331	109475.152
F6	470626.275	109479.558
F7	470637.386	109478.188
F8	470601.890	109454.541
F9	470639.934	109457.254
F10	470642.071	109428.934
F11	470633.405	109386.948
F12	470596.005	109383.629
F13	470558.275	109379.982
F14	470558.408	109340.519
F15	470566.693	109310.604

Co ORDINATE TABLE FOR STORM DRAINAGE MANHOLES NORTHERN SECTION		
REF.	EASTING	NORTHING
S1	470698.146	109561.470
SAT2	470642.907	109481.759
S2	470635.408	109481.182
S3	470615.662	109583.287
SAT1	470630.200	109544.210
S4	470623.587	109544.210
S5	470572.576	109534.708
S6	470567.044	109566.185
S7	470573.000	109591.000
S8	470705.282	109638.435
S9	470661.848	109626.369
S10	470618.413	109614.283
S11	470611.437	109606.373
S12	470586.678	109594.020
S13	470575.739	109618.333
SPOND1	470550.662	109628.618
S14	470528.184	109631.817
S	470451.717	109578.461

Co ORDINATE TABLE FOR STORM DRAINAGE MANHOLES SOUTHERN SECTION		
REF.	EASTING	NORTHING
SAT1	470579.629	109468.364
SAT2	470582.759	109453.926
S1	470591.678	109455.498
S2	470611.080	109475.612
SAT3	470617.904	109466.361
S3	470622.972	109475.874
S4	470637.870	109459.005
S5	470640.116	109429.266
S6	470630.382	109384.913
SAT4	470572.158	109379.754
S7	470572.124	109379.849
S8	470536.910	109376.528
S9	470519.952	109364.038
S10	470519.613	109363.769
S12	470475.522	109357.562
S	470431.432	109351.355

PRELIMINARY - NOT FOR CONSTRUCTION

P03	Preliminary Issue	RD	TK	IL	14.06.22
P02	Preliminary Issue	RD	TK	IL	06.06.22
P01	Preliminary Issue	RD	TK	IL	26.05.22
Rev.	Amendment	Drm.	Chkd.	Appd.	Date

Project

Cabbagefield Row
Leigh Park

Drawing

Manhole Schedule

Client

Portsmouth City Council

Scott White and Hookins
Structural Engineering Civil Engineering Sustainability and BREEM CDM Consultancy

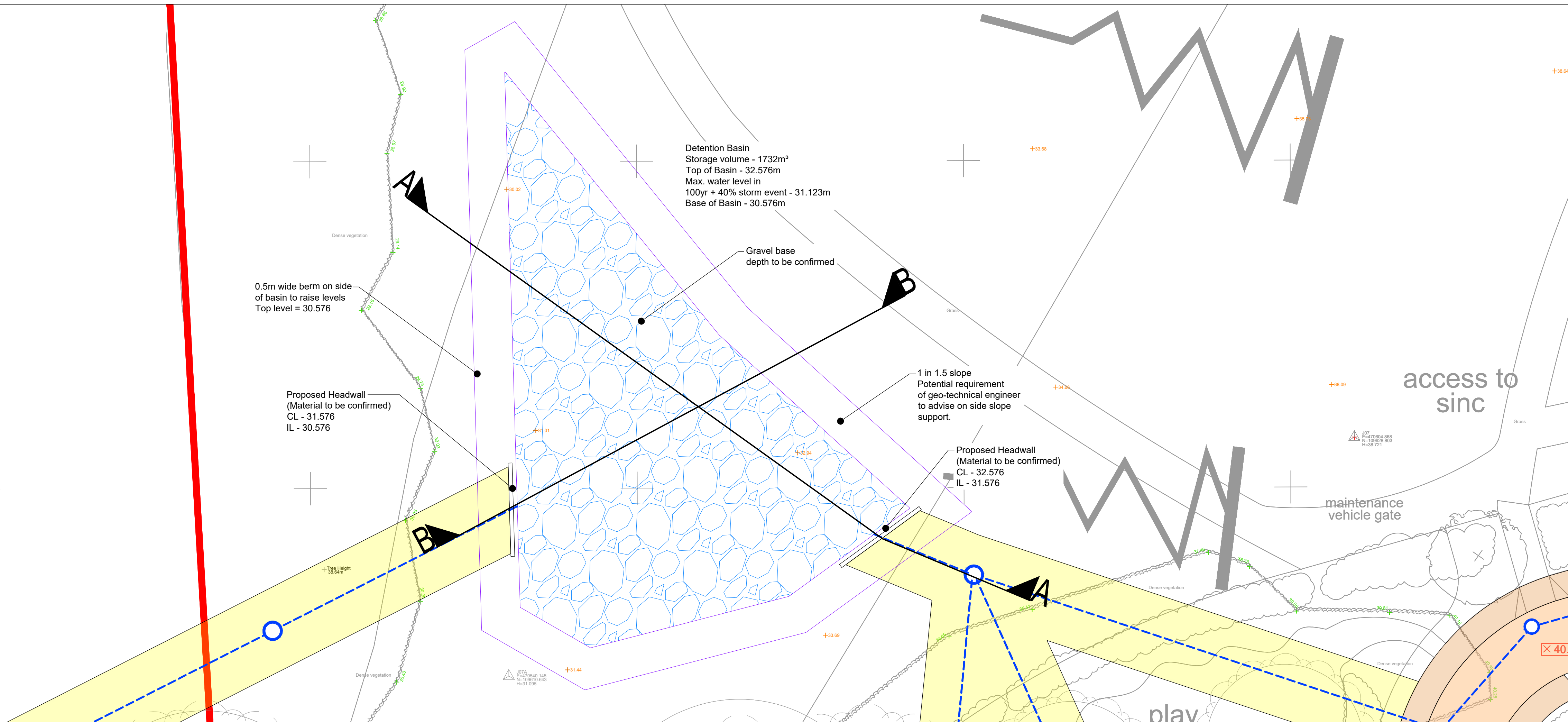
Harman House, Andover Road, Winchester, Hampshire SO23 7BS
T: +44 (0)1962 844855 W: www.swh.co.uk E: info@swh.co.uk

Scale at A1 - NTS

303795-SWH-XX-XX-DR-C-0502-P03

Project | Originator | Zone | Level | Type | Role | Number | Rev.

DO NOT SCALE FROM THIS DRAWING



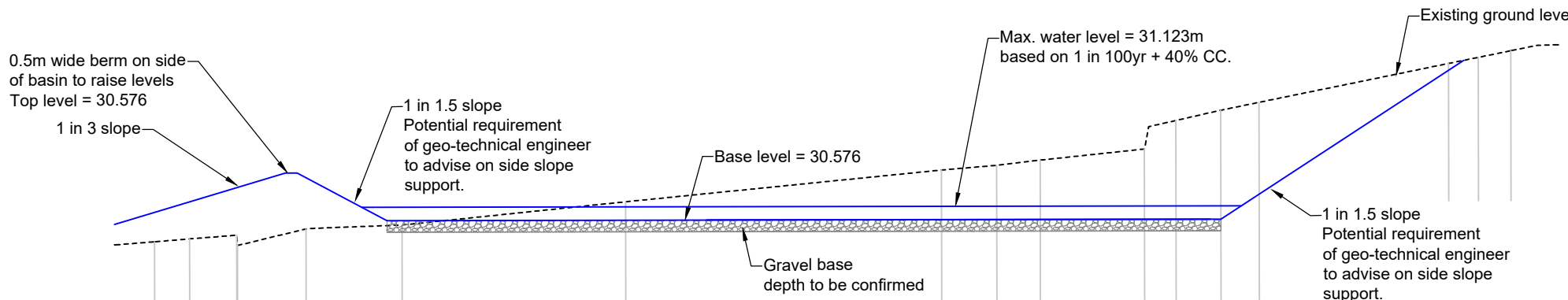
- Notes**
- GENERAL**
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 - This drawing is based on PDP Architects plan dated May 2022

A-A

Datum: 25.000M AOD

EXISTING CHAINAGE (m)

EXISTING LEVELS (m)



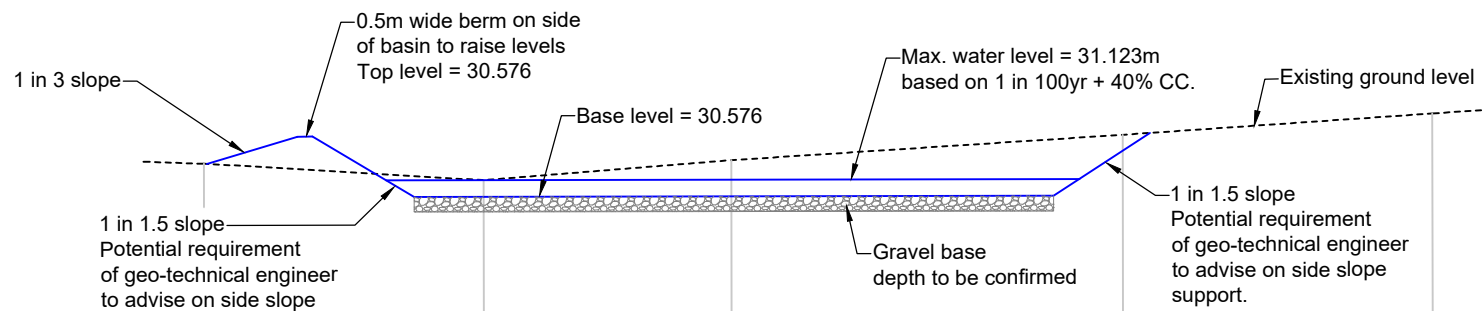
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29.697	29.811	29.966	29.533	30.224	30.380	31.338	32.647	32.841	33.056	33.514	34.710	35.138	35.464	37.084	37.338	37.614

B-B

Datum: 25.000M AOD

EXISTING CHAINAGE (m)

EXISTING LEVELS (m)



0.000	9.254	17.442	30.392	40.631
31.675	31.117	31.763	32.580	33.205

PRELIMINARY - NOT FOR CONSTRUCTION

P01	Preliminary Issue	TK	TK	IL	01.06.22
Rev.	Amendment	Drm.	Chkd.	Appd.	Date

Project
Cabbagefield Row
Leigh Park

Drawing
Drainage Strategy
Detention Basin Layout and Profiles

Client
Portsmouth City Council

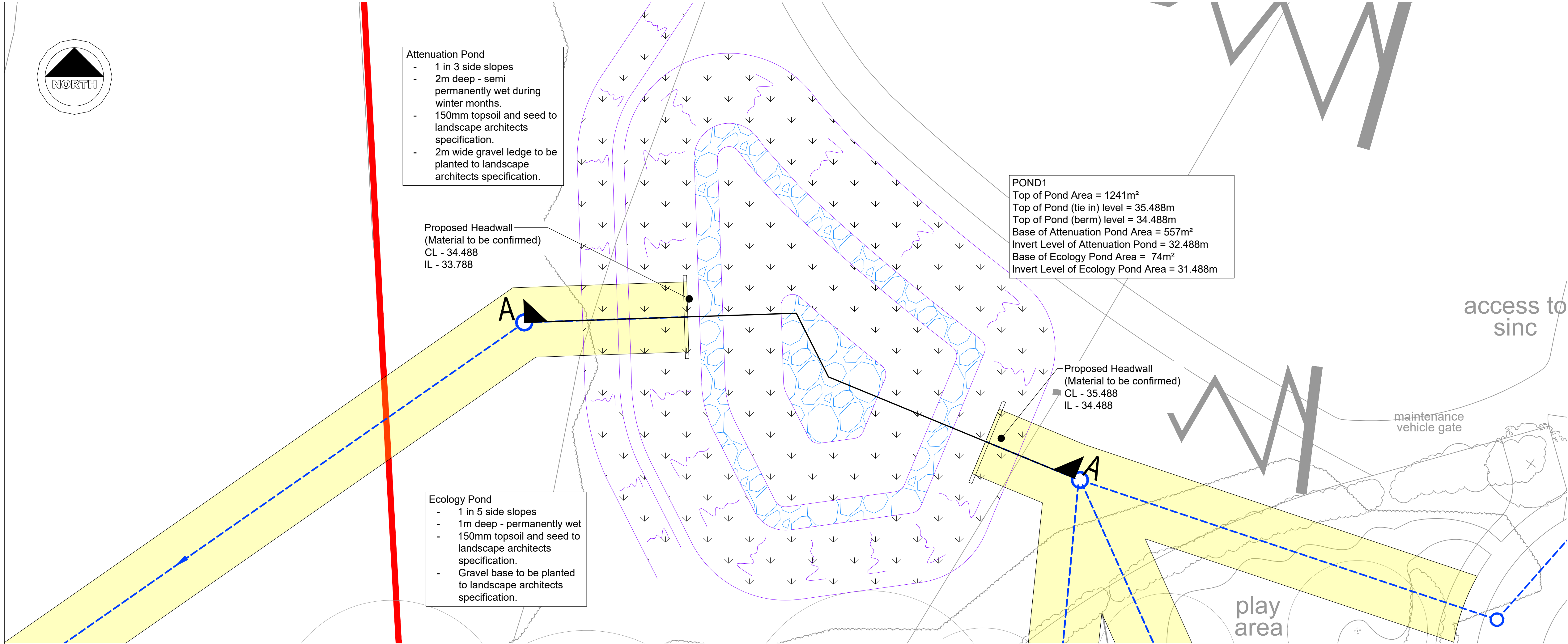
Scott White and Hookins
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Harman House, Andover Road, Winchester, Hampshire SO23 7BS
T: +44 (0)1902 844855 W: www.swh.co.uk E: info@swh.co.uk

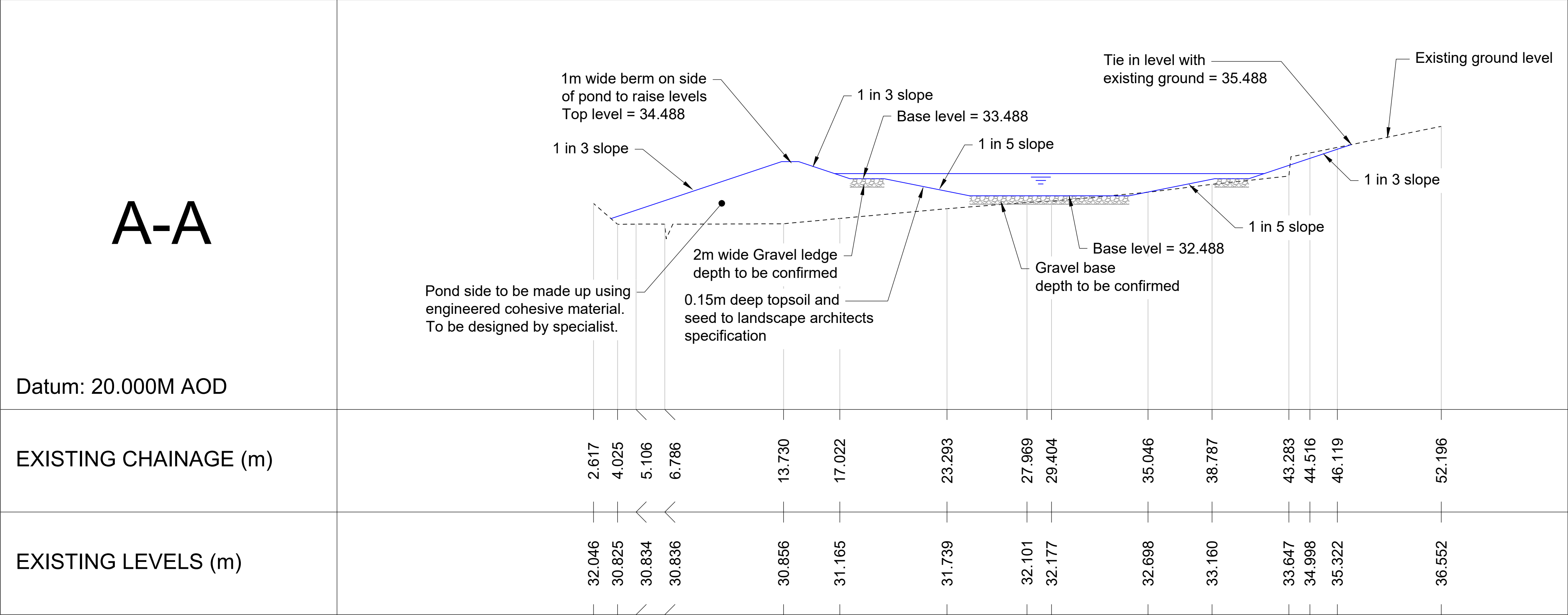
Scale at A1 - 1:500
303795-SWH-XX-XX-DR-C-0505-P01
Project | Originator | Zone | Level | Type | Role | Number | Rev.

DO NOT SCALE FROM THIS DRAWING

CP004-01_FM_ST_008_D



Attenuation and Ecology Pond Layout
Scale 1:200



Attenuation and Ecology Pond Profile
Scale 1:200

- Notes**
- GENERAL**
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PRELIMINARY - NOT FOR CONSTRUCTION

P02	Attenuation / ecology pond layout and profile updated.	TK	TK	IL	15.06.22
P01	Preliminary Issue	TK	TK	IL	01.06.22
Rev	Amendment	Drm	Chkd	Appd	Date

Project
Cabbagefield Row
Leigh Park

Drawing
Drainage Strategy
Attenuation and Ecology Pond Layout
and Profile.
Client
Portsmouth City Council

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Appendix L

SW Drainage Maintenance Schedule

This schedule sets out the inspection and maintenance requirements for long term management of the development's surface water drainage system. This work is to be undertaken by the Client.

All those responsible for maintenance should take appropriate health, safety and welfare precautions for all activities including lone working, if relevant, and risk assessments should always be undertaken. The site's infrastructure Health and Safety File should be consulted before carrying out any works either inside or outside of the development's boundary and information regarding the location of existing utilities passed on to operatives.

The requirements of the Health and Safety at Work Act 1974 and The Construction (Design and Management) Regulations 2015 should be adhered to and any residual risks identified in the Health and Safety File should be managed and information passed on to maintenance operatives through task specific risk assessments.

There are three types of maintenance activities associated with surface water drainage systems.

The SuDS Manual, CIRIA C753, defines these as:

- Regular Maintenance – *'basic tasks undertaken on a frequent and predictable schedule' including vegetation management, litter and debris removal, and inspections.'*
- Occasional Maintenance – *'tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example.'*
- Remedial Maintenance – *'intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.'*

SuDS Components Operation and Maintenance Activities

Operation and Maintenance activity	SuDS component (Components shown thus ' <i>Wetland</i> ' are not relevant to the project for which this schedule has been compiled.)												
	Pond	<i>Wetland</i>	Detention basin	Infiltration basin	Soakaway	Infiltration Trench	Filter Drain	Modular Storage	Pervious Pavement	Swale/bioretention/trees	Filter Strip	Green Roofs	Proprietary Treatment Systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter and debris removal	■	■	■	■	□	■	■	□	■	■	■		□
Grass cutting	■	■	■	■	□	■	■	□	□	■	■		
Weed and invasive plant control	□	□	□	□		□	□		□		□	■	
Shrub management (including pruning)	□	□	□	□					□	□	□		
Shoreline vegetation management	■	■	□										
Aquatic vegetation management	■	■	□										
Occasional maintenance													
Sediment management ¹	■	■	■	■	■	■	■	■	■	■	■		■
Vegetation replacement	□	□	□	□						□	□	■	
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation /repair	□	□	□	□	□	□	□	□	□	□	□	□	
Infiltration surface reconditioning				□	□	□	□		□	□	□		

■ Will be required □ May be required

¹ Sediment should be collected and managed in pre-treatment systems, upstream of the main device.

Piped Network / Chambers

Piped Network/Chambers Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action	Monthly for three months, then six monthly
	Debris removal from catchment surface / gratings (where may cause risks to performance)	Monthly (and after large storms)
	Remove sediment from trapped sumps, manholes and catchpits.	Annually or as required
Remedial Maintenance	Repair / rehabilitation of gratings, inlets and outlets	As required
Monitoring	Inspect / check all gratings, trapped sumps, manholes and catchpits to ensure that they are in good condition and operating as designed	Annually and after large storm events
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of features or pipework is required.	As required

Cellular/modular Storage

Cellular Storage Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any features that are not operating correctly. If required take remedial action	Monthly for three months, then annually.
	Remove debris from catchment surface (where may cause risks to performance)	Monthly
	Remove debris from catchment surface (where may cause risks to performance)	Annually or as required
Remedial Maintenance	Repair / rehabilitate inlets, outlets, overflows and vents	As required
Monitoring	Inspect / check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storm events
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
Structure Rehabilitation / Repair	Regular Maintenance and Monitoring to identify if repair and / or replacement of storage units is required.	As required
The SuDS Manual Table 21.3: Operation and maintenance requirements for attenuation storage tanks		

Permeable Pavements

Permeable Pavement Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface). Care should be taken in adjusting vacuuming equipment to avoid removal of jointing material if present. Any lost material should be replaced.	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers' recommendations – pay particular attention to areas where water runs 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 weed or management using glyphosate applied directly to the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavements
Remedial Maintenance	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structured 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 year or as required (if infiltration and filtration 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, forty-eight hours after large rainfall events in the first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually
The SuDS Manual Table 20.15: Operation and maintenance requirements for pervious pavements		

Proprietary Treatment System

Proprietary Treatment System Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Removal of litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by the manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections or immediately following a significant spill.
Remedial actions	Replacement of malfunctioning parts or structures	As required.
Monitoring	Inspection for evidence or poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspection sediment accumulation rates and establish appropriate removal frequencies.	Monthly during first half of operation, then every six months.

Detention Basin

Detention Basin Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter, debris and trash removal.	Monthly.
	Grass cutting – for spillways and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Annually, or as required.
	Tidy all dead growth before start of growing season.	Annually.
	Remove sediment from inlets, outlet and forebay.	Annually, or as required.
	Manage wetland plants in outlet pool – where provided.	Annually.
Occasional Maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	2 years, or as required.
	Remove sediment from forebay, when 50 % full and from micropools if volume reduced by > 25%.	3 – 10 years (or as required).
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required.
	Realignment of rip-rap.	As required.
	Repair/rehabilitation of inlets, outlets and overflows.	As required.
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates.	As required.
	Re-level uneven surfaces and reinstate design levels.	As required.
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/after large storms.
	Inspect banksides, structures, pipework etc for evidence of physical damage.	Monthly/after large storms.
	Inspect inlets and pre-treatment systems for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Check penstocks and other mechanical devices.	Half yearly.
The SuDS Manual Table 22.1: Operation and maintenance requirements for detention basins.		

Filter Strip

Filter Strip Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal	
	Grass cutting – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required	Annually, or if bare soil is exposed over 10% or more of the filter strip area
Remedial actions	Repair erosion or other damage by re-turfing or reseedling	As required.
	Re-level uneven surfaces and reinstate design levels	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required.
	Remove and dispose of oils or petrol residues using safe standard practices	As required.
Monitoring	Inspect filter strip surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination (e.g. oils)	Half yearly
	Check flow spreader and filter strip surface for even gradients	Half yearly
	Inspect gravel diaphragm trench upstream of filter strip for clogging	Half yearly
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
The SuDS Manual Table 15.1: Operation and maintenance requirements for filter strips.		

Green Roof

Green Roof Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly/ Annually or as required.
	During establishment (ie one year), replace dead plants as required.	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plants as required.	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage.	Six monthly or as required.
	Remove nuisance and invasive vegetation, including weeds.	Six monthly or as required.
	Mow grasses (if appropriate) as required. Clippings must be removed and not allowed to accumulate.	Six monthly or as required.
Occasional maintenance	-	-
Remedial Actions	If erosion channels are evident, these should be stabilised with additional soil substrate similar to the original material. Sources of erosion damage must be identified and controlled.	As required.
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate.	As required.
Monitoring	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, and roof structure for proper operation, integrity of waterproofing and structural stability.	Annually/after severe storms.
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources.	Annually/after severe storms.
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system.	Annually/after severe storms.
	Inspect underside of roof for evidence of leakage	Annually/after severe storms.
The SuDS Manual Table 12.5: Operation and maintenance requirements for green roofs.		

Oil Separator

Oil Separator Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Removal of litter and debris	Six monthly
Occasional maintenance	Replacement of any filters.	As required.
	Removal of sediment, oil, grease and floatables	As required.
Remedial actions	Replacement of malfunctioning parts	As required.
Monitoring	Inspection for evidence or poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspection sediment accumulation rates and establish appropriate removal frequencies.	Monthly during first half of operation, then every six months.

Ponds and Wetlands

Pond Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter removal.	As required
	Grass cutting – public areas.	Monthly (during growing season)
	Grass cutting – meadow grass.	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 0.1 m above pond base. Include max 25% of pond surface).	Annually
	Remove 25% of bank vegetation from waters edge to a minimum of 1 m 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.
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.
The SuDS Manual Table 23.1: Operation and maintenance requirements for ponds and wetlands.		

Rainwater Harvesting System

Rainwater Harvesting Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (or following poor performance)
Occasional maintenance	Replacement of any filters.	As required.
Remedial actions	Repair of erosion damage, or damage to tank.	As required.
	Pump repairs.	As required.
Monitoring	Inspection of the tank for debris and sediment build up.	Annually (or following poor performance)
	Inspection of inlets, outlets and withdrawal devices	Annually (or following poor performance)
	Inspection of areas receiving overflow, for evidence of erosion.	Annually (or following poor performance)
	Inspection of any pumps – check function and wiring.	Annually.
	Inspection of roof drain filters.	Annually (or following poor performance)
The SuDS Manual Table 11.6: Operation and maintenance requirements for RWH systems.		

Water Butt

Water Butt Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (or following poor performance)
Occasional maintenance	Replacement of any filters.	As required.
Remedial Actions	Repair of erosion damage, or damage to tank.	As required.
Monitoring	Inspection of the tank for debris and sediment build up.	Annually (or following poor performance)
	Inspection of inlets, outlets and withdrawal devices.	Annually (or following poor performance)
	Inspection of areas receiving overflow, for evidence of erosion.	After extreme storms.
	Inspection of roof drain filters.	Annually (or following poor performance)

Swale

Swale Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal	
	Grass cutting – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required	Annually, or if bare soil is exposed over 10% or more of the filter strip area
Remedial actions	Repair erosion or other damage by re-turfing or reseedling	As required.
	Re-level uneven surfaces and reinstate design levels	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Remove build up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required.
	Remove and dispose of oils or petrol residues using safe standard practices	As required.
Monitoring	Inspect filter strip surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination (eg oils)	Half yearly
	Check flow spreader and filter strip surface for even gradients	Half yearly
	Inspect gravel diaphragm trench upstream of filter strip for clogging	Half yearly
	Inspect silt accumulation rates and establish appropriate removal frequencies	Half yearly
The SuDS Manual Table 17.1: Operation and maintenance requirements for swales.		

Appendix M

Local Planning Policy applicable to the development

National Guidance

- 2.1** The frequency and severity of river flooding is perceived to have increased in recent years and in an attempt to mitigate the flood risk the Government published Planning Policy Statement Note 25: Development and Flood Risk (PPS25) in December 2006. PPS25 detailed the importance of the effective management and reduction of flood risk in the land use planning process and attempted to address the issue of climate change. This has since been superseded by the National Planning Policy Framework and the supporting technical guidance.
- 2.2** Traditionally surface water runoff from developments has been conveyed by pipe systems to the nearest watercourse or sewer. This tends to increase the rate and volume of the run off often leading to flooding downstream of the new development. Latest policy promotes the use of sustainable urban drainage systems (SuDS) whereby the control of run off is to be as close to source as possible. This can be achieved by utilising techniques which mimic the natural drainage processes, the use of direct infiltration for example. The Environment Agency will, in general, seek to restrict the allowable discharge from a new development to that previously expected from the undeveloped land.
- 2.3** The requirements of the revised Building Regulations which came into force on 1st April 2002 are that adequate provision should be made for dealing with rainwater from the roofs of buildings and certain paved areas providing access to the buildings. Run off from such drainage systems are to be discharged to one of the following systems listed in order of priority:-
- A soakaway or other infiltration system
 - A watercourse
 - A sewer or drain
- 2.4** The revised Building Regulations were drafted to reinforce the requirements for SuDS wherever possible.
- 2.5** The Requirements of a Flood Risk Assessment:
- 2.5.1** A Flood Risk Assessment is required in order to ascertain whether a development will exacerbate the risk of flooding elsewhere in the catchment or is at risk of flooding itself.
- 2.5.2** A site specific FRA is required for: -
- Proposals of 1 Hectare or greater situated in Flood Zone 1
 - New development (including minor development and change of use) located in areas of Flood Zone 1 that have critical drainage problems
 - New development (including minor development and change of use) located in areas of Flood Zones 2 & 3.

Local Policies

2.6 The Havant Borough Council Local Plan Core Strategy dated March 2011 outlines the different requirements of new developments. The requirements of the HBC Local Plan relating to flood risk states:

2.6.1 Policy CS15 Flood and Coastal Erosion Risk

Development in areas at risk of flooding now and in the future as identified on the latest Environment Agency flood risk maps and Strategic Flood Risk Assessment climate change maps will only be permitted where:

1. It meets the sequential and exception test (where required) in relation to PPS25.
2. The site is located in a low hazard area as defined in the Strategic Flood Risk Assessment.
3. A site-specific flood risk assessment demonstrates that the development will be safe, including the access, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.
4. The scheme incorporates flood protection, flood resilience and resistance measures appropriate to the character and biodiversity of the area and the specific requirements of the site.
5. Appropriate flood warning and evacuation plans are in place.
6. New site drainage systems are designed taking account of events which exceed the normal design standard.

2.6.2 All development will be required to ensure that there is no net increase in surface water run off. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it is proven that SuDS are not appropriate. Where SuDS are provided arrangements must be put in place for their whole life management and maintenance.

2.6.3 The council will work with partners to implement the Coastal Policy Zones in the North Solent Shoreline Management Plan to ensure that development avoids areas at risk from coastal erosion and coastal flooding and that areas required to offset coastal squeeze and prevent habitat fragmentation, to allow species to adapt to climate change, are identified and protected from development.