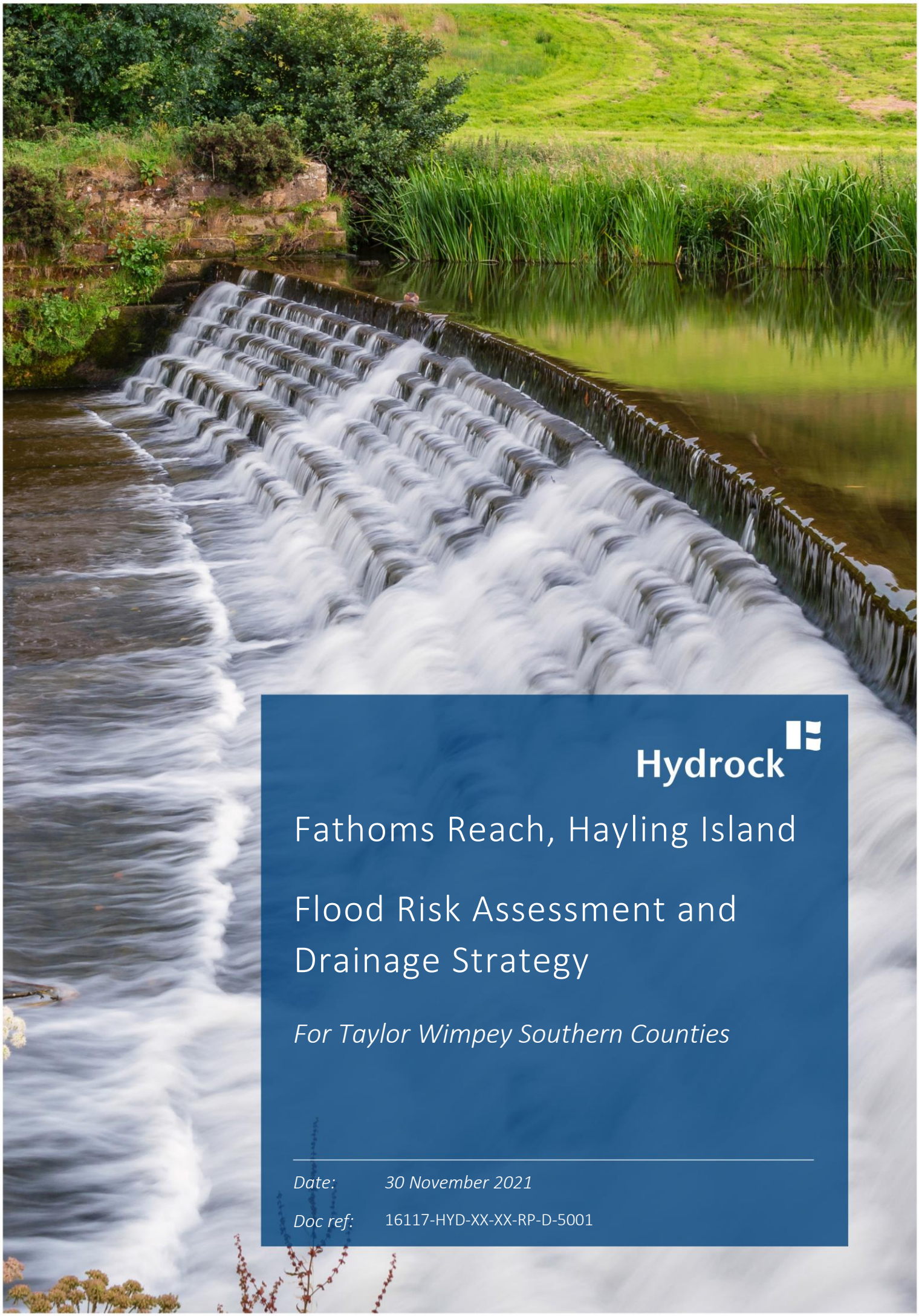

Hydrock

Fathoms Reach, Hayling Island

Flood Risk Assessment and Drainage Strategy

For Taylor Wimpey Southern Counties

Date: *30 November 2021*

Doc ref: 16117-HYD-XX-XX-RP-D-5001

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1. INTRODUCTION

This Flood Risk Assessment (FRA) and Drainage Strategy (DS) report has been prepared by Hydrock Consultants Limited to support a Planning Application to Hampshire County Council for the development of a site to provide a total of 51 residential units at Fathom's Reach, Hayling Island. The site has an area of 1.762Ha.

This FRA and DS report addresses the requirements of the National Planning Policy Framework (NPPF) and associated National Planning Practice Guidance for Flood Risk and Coastal Change (NPPG). The main objectives of the report are as follows:

- Assessing whether the site is likely to be affected by flooding.
- Assessing whether the proposed development is appropriate in the suggested location.
- Presenting any flood risk mitigation measures necessary to ensure that the proposed development and occupants will be safe, whilst ensuring flood risk is not increased elsewhere.
- Demonstrating that the proposed development can be adequately drained through the provision of a suitable Drainage Strategy.

The report considers the requirements for undertaking a Flood Risk Assessment as detailed in the NPPF.

The report also includes a drainage strategy addressing the requirements identified by the FRA.

2. SITE INFORMATION

2.1 Location and Description

The site is located immediately to the east of Fathoms Reach, Newtown, Hayling Island and is bound to the north and east by green fields, and south and west by existing residential development.

With the exception of three residential dwellings on the western boundary the site is currently undeveloped and a combination of dense vegetation or areas of open grass. As such, it is considered as being Greenfield with respect to surface water drainage.

Vehicular Access is currently provided via Fathoms Reach to the west and Southleigh Grove to the south with a number of pedestrian access routes around the site boundary.

Table 1 provides an exact location reference of the site and Figure 1 shows the site location and approximate redline boundary.

Table 1. Site Referencing Information

Address	Land East of Fathoms Reach, Newtown, Hayling Island, PO11 0SH
Grid Reference	SZ716996
Easting, Northing	471654 , 099641

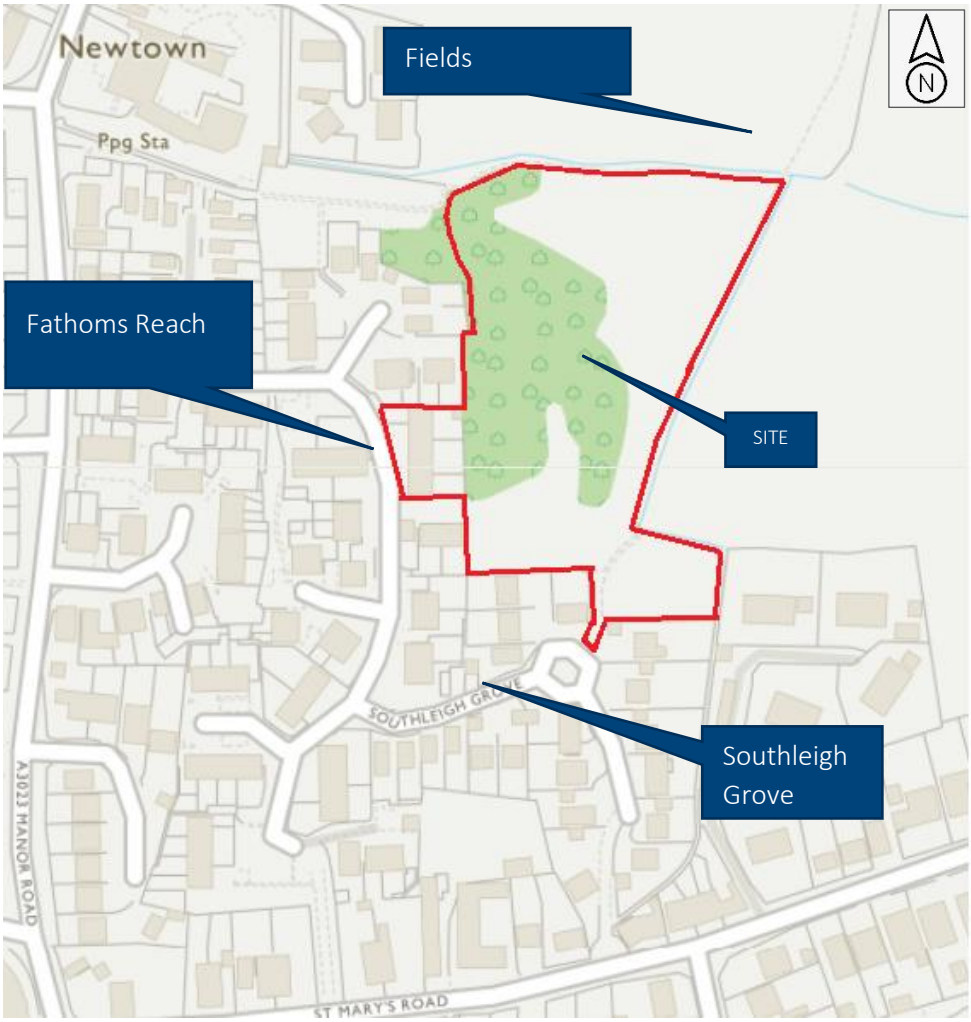

Figure 1 Site Location

2.2 Existing Topography

A Topographical Survey has been undertaken and is included at Appendix A. This shows the site to fall northwards with a fall of approximately 1:140 with ground levels ranging between 6.43m AOD at the northern boundary and 7.5m AOD at the southern boundary. The existing buildings to the west of the site is shown to have a ground level of 7m AOD, while the adjacent land to the north and east have levels of 7.5m AOD.

2.3 Proposed Development

The proposal is for the construction of 51 residential units, along with associated access roads, parking/driveways, domestic gardens and areas of public open space. An illustrative proposed scheme layout is included in Appendix A.

3. ASSESSMENT OF FLOOD RISK

3.1 Flood Zone Mapping

Based upon the Environment Agency (EA) 'Flood Map for Planning', the entirety of the site and surrounding area is shown to be within Flood Zone 1 (land having a less than 1 in 1,000 annual probability of fluvial or tidal flooding).

A copy of the Flood Zone mapping for the area is provided in Figure 2.

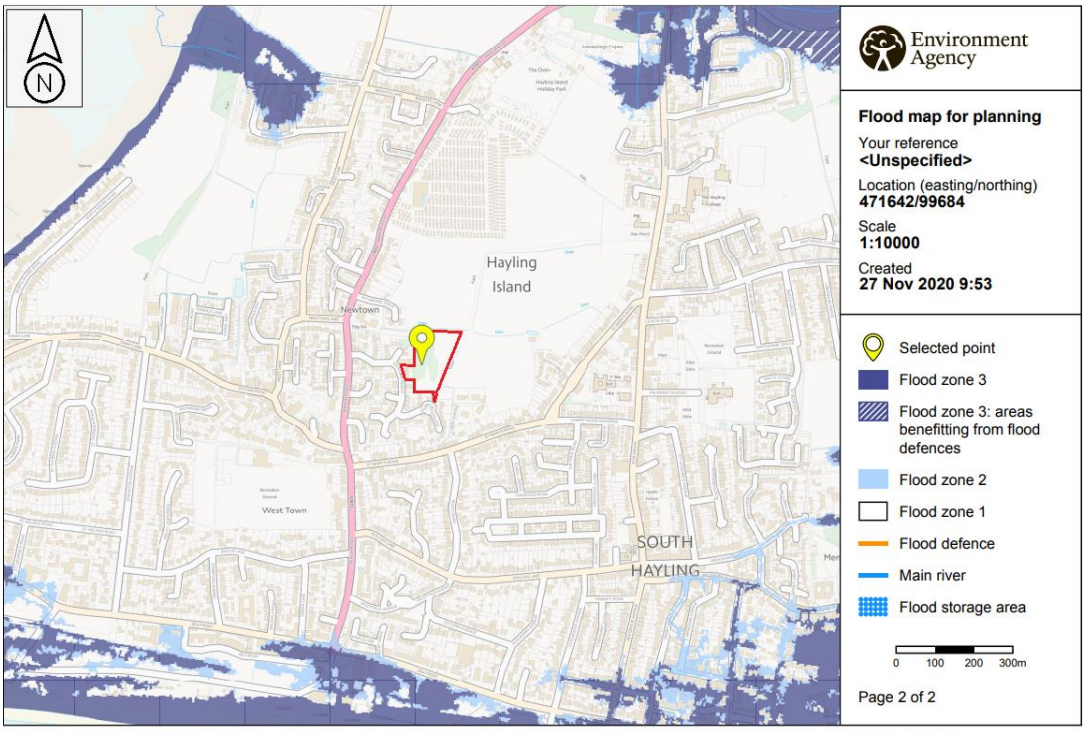

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Figure 1 Flood Map for Planning

3.2 Fluvial & Tidal Flooding

The closest watercourses to the site are ditches to the north and east of the site. Both of these ditches bifurcate a short distance to the north east of the site where they flow in a generally easterly direction before discharging into the Chichester Harbour around 2km to the west of the site

A review of available information has confirmed that at the site the ditches are at an elevation and location above/beyond the tidal limits and are therefore not shown as being tidally influenced in this area.

It is noted that the Portsmouth Council Strategic Flood Risk Assessment (SFRA) does record flooding from the sea, due to extreme tides at the coastal frontage of Hayling Island caused by wave overtopping. However, there are protective measures in place and Hayling Island is defended to a higher level than other frontages in the sub-region.

Based on the above the site is concluded as being at low risk from fluvial and tidal sources of flooding.

3.3 Surface Water Flooding

The EA's 'Flood Risk from Surface Water' map (Figure 3) shows the site to be predominantly at 'very low' risk of surface water flooding.

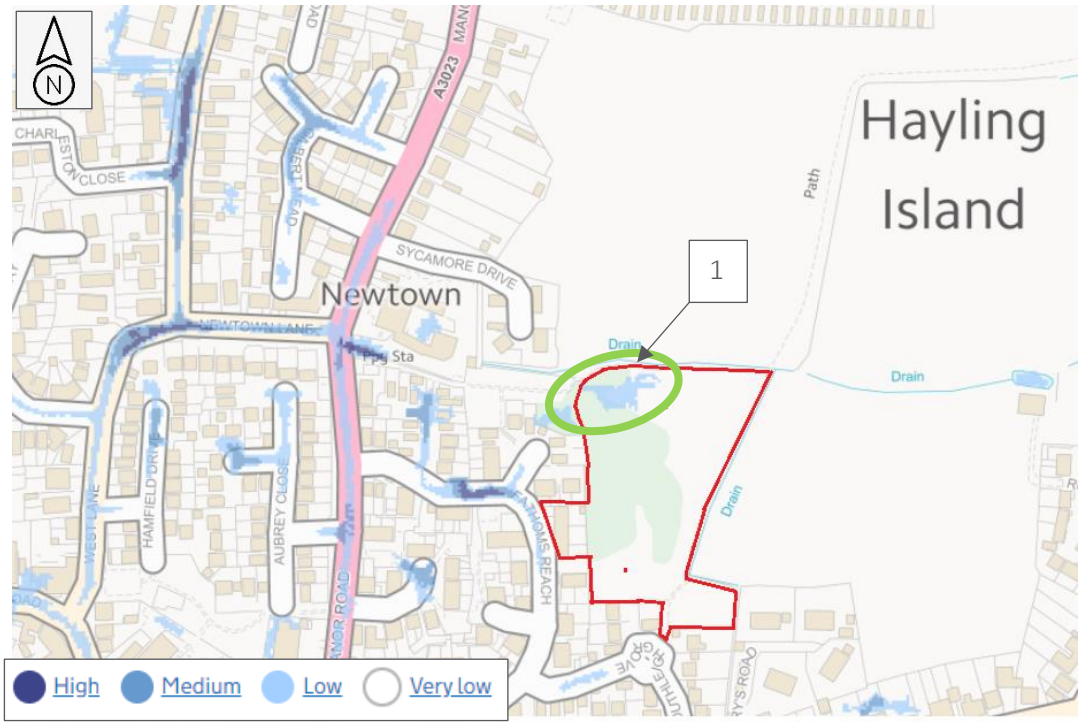

Figure 2: EA Flood Risk from Surface Water Map

There is, however, an area of localised surface water flooding predicted along the northern site boundary and this is marked as area '1' within Figure 3. This area provides no connectivity to the wider area and is therefore considered to be representative of a localised low point where ponding/ exceedance flows would occur if not drained. The available mapping indicates that the isolated area of flooding is predicted to be predominantly of shallow depth (<300mm).

It should be noted that the EA's flooding from surface water mapping does not make any allowance for existing sewer networks or road drainage and therefore provides a 'worst case' prediction of risk from this source.

As such, and owing to the developed area catchment of the site and its anticipated sewer network, the site is concluded as being at low risk from this source of flooding under normal operating conditions. A residual risk would however remain along the northern site boundary.

Based upon the above, the site is concluded to be at low risk of surface water flooding.

3.4 Groundwater Flooding

The British Geological Survey mapping (Figure 4) indicates that there are River Terrace Deposits underlaying the site, which refers to sand, silt and clay deposits in environments previously dominated by rivers. The bedrock underlaying the site is made up of the London Clay Formation. Such a geological succession is considered impermeable and having limited drainage potential.

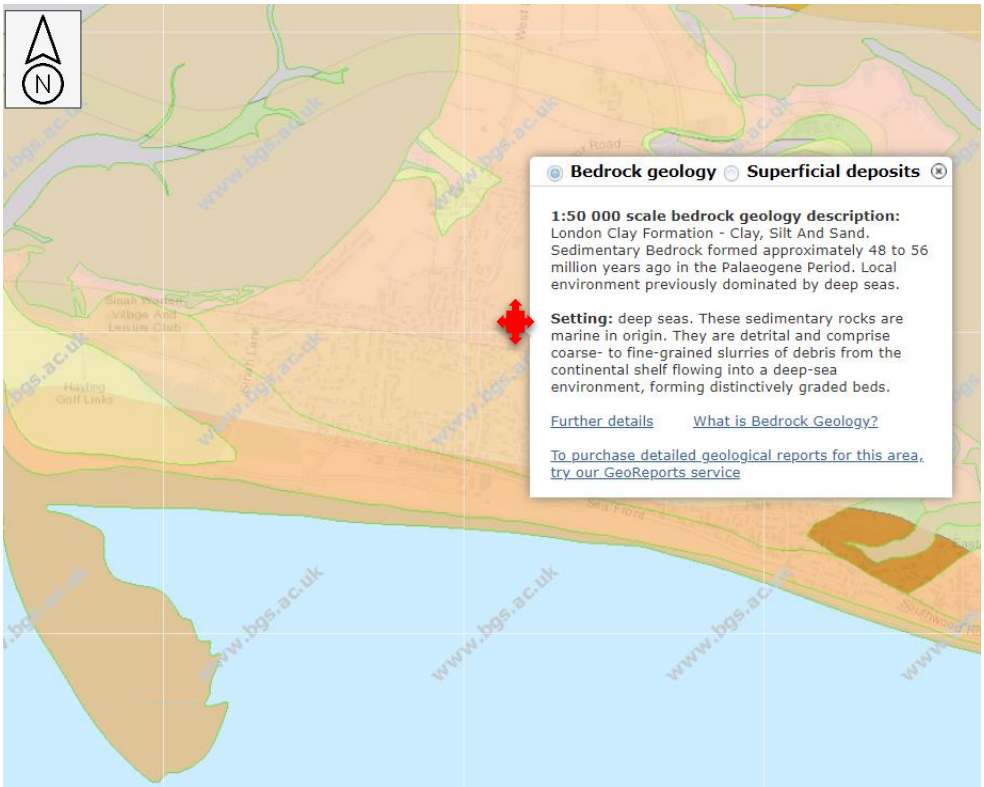

Figure 4: British Geological Survey Mapping

Owing to the low-lying nature of the surrounding area and the presence of tidal waterbodies (English Channel, Chichester Harbour etc) groundwater levels are expected to be in hydraulic connectivity with these levels. However, the reported geology suggests the ground is of a relatively low permeability and therefore the potential for storing and yielding significant quantities of groundwater is relatively low. In addition, the groundwater is influenced by tidal levels and there are no low-lying areas within the site where groundwater would have a higher risk of emergence, as demonstrated by the surface water mapping.

On the basis of the above, the site is therefore concluded to be at low risk of groundwater flooding.

On this basis, the site is therefore concluded to be at low risk of groundwater flooding.

3.5 Infrastructure Failure Flooding

Sewer asset mapping has been made available for the site and it's included in Appendix B. According to the map no known reservoirs or elevated water storage features are evident upstream. And therefore, the risk posed to the site from reservoir failure flooding is considered as being negligible.

Sewer asset mapping also shows an extensive sewer network serving the adjacent residential area. According to the strategic flood risk assessment there have been no recorded incidents of flooding, a ‘residual’ risk could remain in the unlikely event of a blockage or failure of existing infrastructure.

As with the assessment of surface water flood risk (section 3.3), if these sewers were to surcharge, any overland flows will likely preferentially flow towards the existing ditches and likely be convey around, rather than through the site. If any exceedance flows were to be directed onto the site these would either flow northwards and towards the ditches, or would 'pond' in the area towards the north-westerly corner of the site.

As such, whilst the site is concluded to be at potential 'residual' risk of sewer flooding (i.e. in the scenario that the existing sewers were to surcharge / fail), given existing site gradients, any such flows will likely comprise relatively shallow 'sheet flows' as opposed to 'ponding' within the site itself.

On this basis the site is concluded as being at low risk from infrastructure failure flooding.

4. SITE SUITABILITY AND PROPOSED MITIGATION

4.1 Sequential Test

Paragraph 033 of the Flood Risk and Coastal Change National Planning Practice Guidance (NPPG) states that “Nor should it normally be necessary to apply the Sequential Test to development proposals in Flood Zone 1”.

The site is indicated to be within Flood Zone 1 and accordingly the application of the Sequential Test is concluded to not be required in this instance.

4.2 Exception Test

This assessment has demonstrated that the site is on land designated as Flood Zone 1 by the EA’s Flood Zone mapping.

The NPPF Flood Risk Vulnerability and Flood Zone Compatibility matrix (Table 3) indicates that all forms of development are "appropriate" in Flood Zone 1 without application of the Exception Test, and accordingly the application of the Exception Test is concluded to not be required in this instance.

Whilst an Exception Test is not explicitly required under the NPPF, the following section details any measures necessary to mitigate 'residual' flood risks, to ensure that the proposed development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, akin to the requirements of section 'b' of the Exception Test, as outlined in the NPPF.

4.2.1 *Resistance and Resilience Measures*

Whilst no significant flood risks have been identified, in order to afford the site additional protection from any potential ‘residual’ flood risks, finished floor levels will be set a minimum 'standard' 0.15m above adjacent infrastructure thoroughfare levels.

A comprehensive Drainage Strategy (outlined in Section 5), to be constructed as part of the proposed development, will be designed to intercept and manage rainfall. Furthermore, the proposed highway and building layout has been designed to create a preferential overland flow route through the site, to allow any overland flows (should the proposed or surrounding drainage system fail or surcharge) to pass through the site, away from existing or proposed buildings, and continue away from the site (although it is noted that the proposed drainage system will be designed to intercept and therefore mitigate the risk of such overland flows being directed off-site). This flow route is also considered to provide a conveyance route for (i.e manage) the potential surface water flooding identified on the available mapping at the western edge of the site.

4.2.2 *Safe Access and Egress*

Access to the site will be via the existing surrounding highway network which is indicated to be at low risk of flooding based on the EA’s Flood Zone mapping. Whilst an area to the west of the site is shown as being at an increased risk of surface water flooding, safe access can be achieved by heading south onto Fathoms Reach. As such, safe / dry access and egress is considered to be possible to and from the site in accordance with standard guidance.

4.2.3 *Flood Risk within Catchment*

The proposed development is not considered to increase flood risk within the catchment through a loss of floodplain storage (as the site has been demonstrated as being outside a functioning floodplain).

The proposed preferential overland flow route through the site also means that the proposed development should not redirect any surface water overland flows onto adjacent land / properties.

5. DRAINAGE STRATEGY

5.1 Surface Water Pre-development

The site is currently undeveloped and expected to have a natural drainage regime where rainfall run-off infiltrates to ground up to the infiltration / saturation capacity of the soil before running overland following the ground topography.

The existing greenfield runoff rates have been calculated using the industry standard MicroDrainage software using the ICP SuDS methodology (as appropriate for a site of less than 50ha) which uses linear interpolation of IH124. Calculations are included in Appendix B.

The adjacent western and southern areas are developed and served by public sewers. Records have been requested from Southern Water and are included at Appendix B.

5.2 Surface Water Post-development

In accordance with the Sustainable Drainage Systems (SuDS) hierarchy, rainfall run-off should be managed in the following preferential order:

1. Infiltrated to ground.
2. Discharged to local watercourse.
3. Discharged to a local surface water sewer network.
4. Discharged to a local combined water sewer network.

As described in Section 3.3, the site is underlain by low permeability geology that is foreseen to be unaccepting to infiltration. This, coupled with the ground investigation that has been submitted as part of this application, demonstrates that the site is not suitable for surface water discharge through means of infiltration.

The watercourse adjacent the site is separated by an area of third-party land and resides outside of the redline boundary in its entirety. Preliminary discussions have indicated an inability to achieve riparian consent to discharge. As such, discharge of surface waters to the watercourse is not possible.

Therefore, given the close proximity of the site to existing public sewers serving the wider area, it is anticipated that surface water flows will be discharged to the public sewer at Fathoms Reach.

Adopting the hierarchical approach, and noting that options 1 and 2 cannot been considered, option 3 appears to offer a viable means of surface water disposal from the site.

In line with NPPF requirements (i.e. to ensure no detrimental effect downstream of the proposed development), all proposed surface water networks have been designed and simulated for the 1 in 100 year storm plus 40% climate change event in accordance with the 'Upper End' UKCP18 climate change allowance scenario. An allowance of 10% increase on private parking and residential units, known as "Urban Creep" in accordance to the non-statutory guidance CIRIA report C753, "The SuDS Manual" has been made for the potential future increase of impermeable area within the site.

Due to the site topography, site levels need to be raised between 0m to 1.5m along the entire site.

The proposed drainage network is to outfall to an existing surface water sewer through a flow control restricting the flow to a pre-development greenfield Q-bar rate of 2.7l/sec.

In accordance with the requirements as set out under the NPPF, surplus flows generated by the flow restriction will be stored onsite for storm events up to and including the 1 in 100 year event plus and allowance of 40% for climate change. Storage is to be provided in the form of oversized pipes and cellular crates in accordance with the Sewerage Sector Guidance as published by Water UK.

The proposed drainage strategy layout and supporting hydraulic calculations are included at Appendix C.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 *Permeable Paving*

Permeable paving is located on private driveways. The permeable paving is to be constructed using purpose made blockwork underlain by a layer of sand, geotextiles and subbase of 4/20 crushed rock. Please refer to the hatched locations of permeable paving at the attached drainage strategy drawings. The system including storage is to be proposed for adoption and the permeable paving will be under the responsibility of the plot owners and conveyed to them at the point of sale.

5.3.2 *Swales & Basins*

Due to the numerous tree protection zones coupled with the ground raising, retention will be a necessity to avoid detrimental impact. As such, open attenuation features (i.e. swales and basins) would be non-compliant with the rapid changes in ground levels they are likely to not conform the SSG given the complex nature. Further to this it would be seen that due to the ground raising aspects aforementioned, the complex nature of any open attenuation structure would make them non-adoptable and therefore a maintenance liability for the proposed residents and potentially the local water authority who would adopt a system reliant on their upkeep.

Maintenance Schedule	Responsibility	Required Action	Typical Frequency*
Regular Maintenance	Maintenance Company	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency, based on site specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional Maintenance	Maintenance Company	Stabilise and mow contributing and adjacent areas	As required
		Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements.
Remedial Actions	Maintenance Company	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 works to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or hazard to users, and replace lost jointing material.	As required
		Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10-15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Maintenance Company	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, 48hr after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
* Frequency of maintenance is dependent upon site specific circumstance and activities should be undertaken as necessary to ensure continued performance of the infiltration.			

5.4 Foul Water Pre-development

Given the undeveloped nature of the site, there is currently no foul discharge from the site. However, the Southern Water sewer map included in Appendix B identifies a 225mm diameter foul sewer flowing northwards along Fathoms Reach.

5.5 Foul Water Post-development

The proposed drainage strategy includes the conveyance of foul effluence from the dwellings through means of gravity network prior to discharge into the existing Southern Water public foul sewer.

As described in Section 2.3, the proposed development consists of 51 residential dwellings. As stipulated within the Sewerage Sector Guidance, peak foul effluent discharge from the proposed development has been calculated based on 4000l/dwelling/day, equating to 2.4l/s.

This indicates that there will be an increase of foul flows from the site post-development. Under the OFWAT charging regulations it is anticipated that the water authority will be responsible for any reinforcement works on the public network.

The proposed foul water drainage strategy plan is included in Appendix C.

6. SUMMARY AND CONCLUSIONS

This report has considered the flood risk posed to the proposal site from a variety of sources of flooding.

The entirety of the site is confirmed to be within Flood Zone 1 in respect of fluvial and tidal flooding, and at low risk of flooding from all other potential sources assessed.

The use of the site for residential use is concluded to meet the requirements of the Sequential and Exception Tests.

Whilst no significant flood risks have been identified, in order to afford the site additional protection from any potential 'residual' flood risks, finished floor levels will be set a minimum 150mm above adjacent infrastructure thoroughfare levels. The proposed building layout has also been designed to create a preferential overland flow route through the site.

Safe access and egress has been demonstrated to and from the site, and the proposed scheme will not result in a loss of floodplain storage or redirect any surface water overland flows onto adjacent land / properties.

Preliminary surface and foul water drainage strategies have been prepared which demonstrate that the site can be satisfactorily drained without detrimental effects to third party land.

This report therefore demonstrates that the use of the site for residential uses:

- Is suitable in the location proposed.
- Will be adequately flood resistant and resilient.
- Will not place additional persons at risk of flooding, and will offer a safe means of access and egress.
- Will not increase flood risk elsewhere as a result of the proposed development through the loss of floodplain storage or impedance of flood flows.
- Will put in place measures to ensure surface and foul water is appropriately managed.

As such, the proposal is concluded to meet the flood risk requirements of the NPPF.

Hydrock Consultants Limited

Appendix A - Site

	Name/Title/Description	Ref	Originator
A.1	Site Layout Plan		SDA DESIGN GROUP
A.2	Topographical Survey		Digital Terrain Surveys LLP

Site Area = 1.779 Hectares

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- Car parking bay and allocation
- Visitor parking bay
- Plot boundary fence
- Decorative boundary wall
- Existing trees and undergrowth to be removed for development
- Indicative new landscaping / trees
- Affordable Unit Location (30%)
- Ecology Zone
- Concrete block surface finish
- Site Sections
- Street Scenes

Fathom's Reach
Hayling Island

Taylor Wimpey Southern Counties

+(44) 1962 589 030
designs@sdadesigngroup.com
Ground Floor Studio, Unit 2,
East Horton Business Park,
Knowle Lane, Fair Oak,
Hampshire, SO50 7HN

SDA DESIGN GROUP

DRAWING TITLE
Site Plan Planning Layout

In Progress

SCALE	SHEET SIZE	DRAWN	CHKD	DATE
1:500	A1	ML		05/10/2021

DETAIL PLANNING

19-1105-005-1ST

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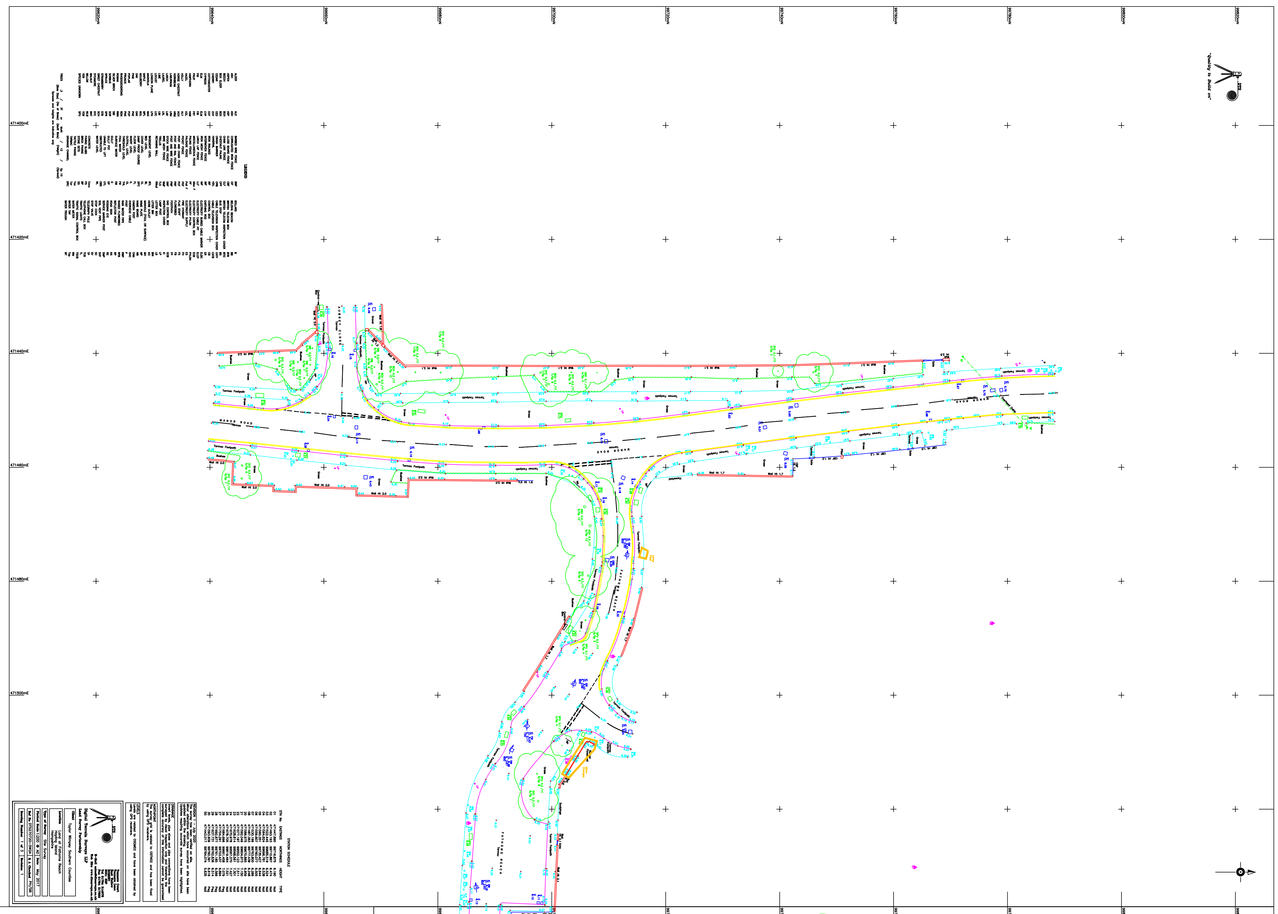

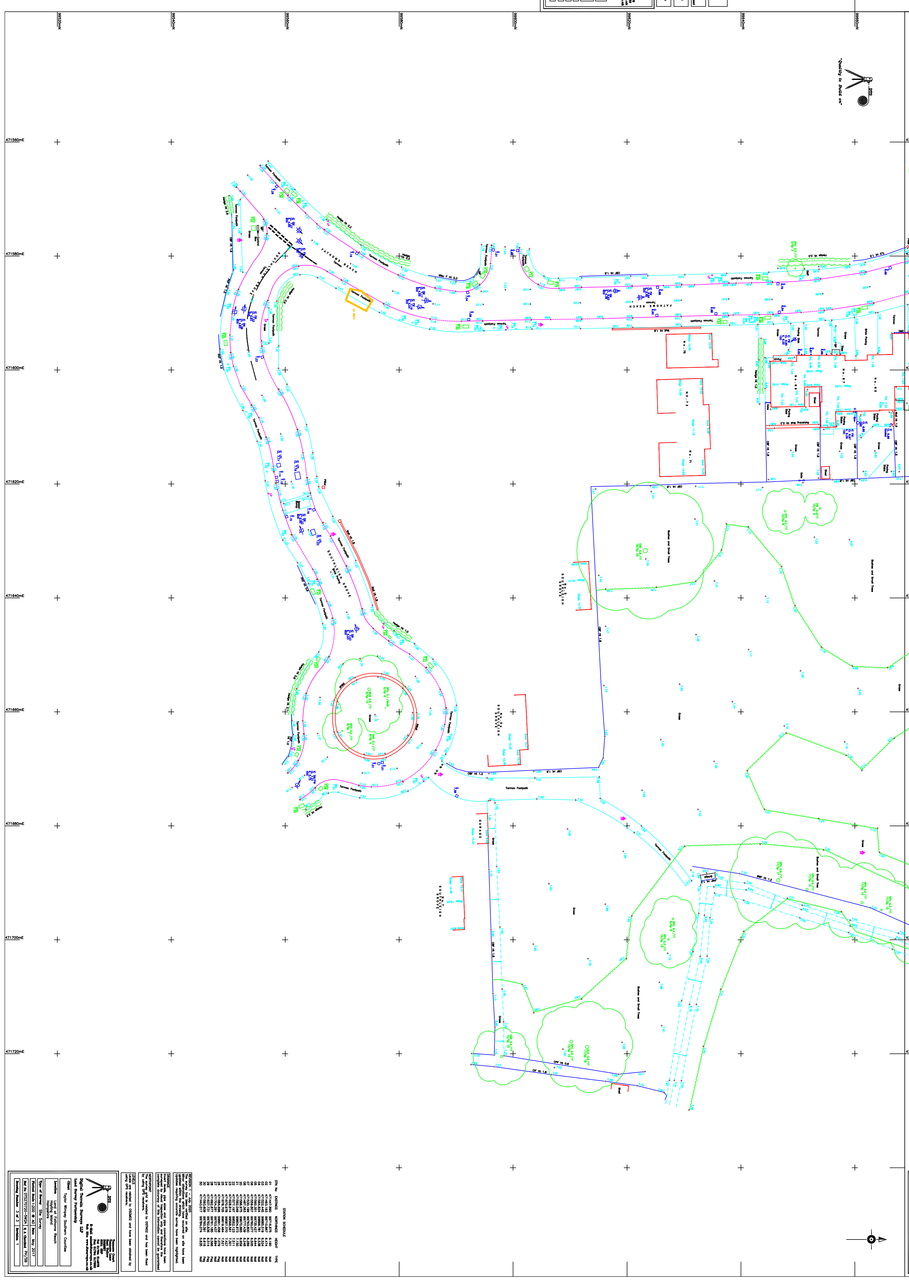

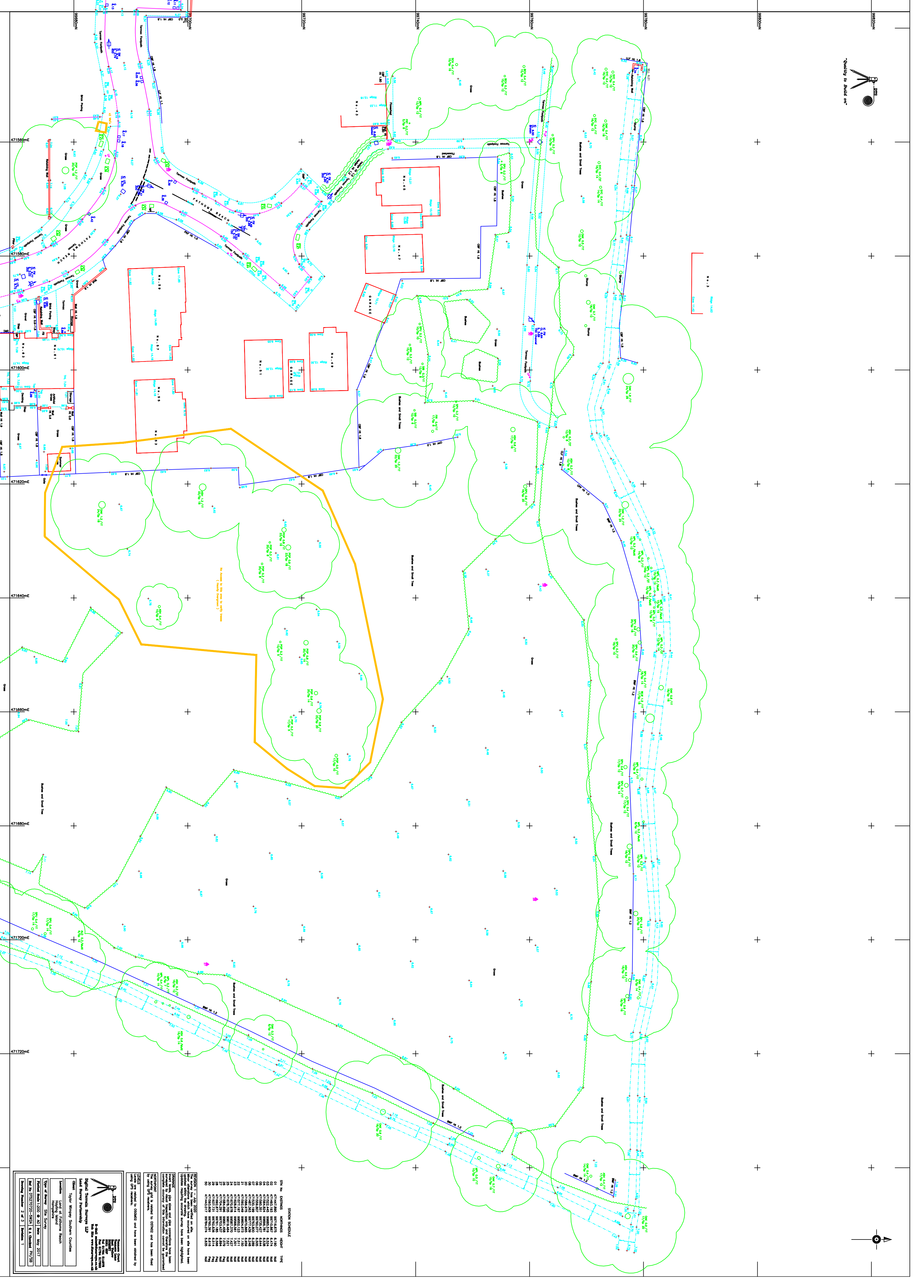

Appendix B - Existing Drainage

	Name/Title/Description	Ref	Originator
B.1	Sewer Asset Mapping		Southern Water

(c) Crown copyright and database rights 2020 Ordnance Survey 100031673

Date: 22/10/20

Scale: 1:1250

Map Centre: 471658,99723

Data updated: 19/10/20

Our Ref: 450665 - 1

Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
WWTW Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

sophiedauksta@hydrock.com

C16117

WATER for LIFE from Southern Water.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
4601	F	6.48	4.83	
4602	F	6.14	4.34	
4603	F	6.43	0.00	
4604	F	6.64	0.00	
4605	F	6.46	4.80	
4606	F	6.33	4.60	
4702	F	5.97	4.32	
4703	F	6.27	4.31	
4704	F	0.00	0.00	
4705	F	5.71	4.41	
4706	F	6.14	4.51	
4707	F	5.99	4.10	
4708	F	6.10	4.25	
4709	F	6.24	4.75	
4710	F	6.12	4.74	
4711	F	6.16	4.28	
4804	F	5.79	2.49	
5601	F	6.35	5.02	
5602	F	6.76	5.18	
5603	F	6.92	5.43	
5604	F	0.00	5.20	
5605	F	0.00	0.00	
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5705	F	6.74	4.92	
5706	F	6.47	4.95	
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6602	F	0.00	0.00	
660D	F	0.00	0.00	
6801	F	6.45	3.91	
4651	S	6.39	3.98	
4652	S	6.13	4.96	
4653	S	6.38	4.17	
4654	S	6.64	4.28	
4655	S	6.73	4.39	
4751	S	5.77	4.47	
4752	S	5.72	4.57	
4753	S	5.96	0.00	
4755	S	6.06	3.38	
4756	S	5.91	4.66	
4757	S	6.17	3.44	
4758	S	6.31	3.49	
4759	S	6.40	3.51	
4761	S	6.15	3.59	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
4762	S	6.09	3.50	
4763	S	6.05	3.24	
4764	S	5.97	3.23	
4765	S	5.91	3.22	
4850	S	5.82	4.64	
4853	S	5.67	4.53	
5650	S	6.46	3.58	
5651	S	6.18	3.60	
5652	S	6.36	4.58	
5653	S	6.15	3.67	
5654	S	6.33	4.19	
5655	S	6.71	4.21	
5656	S	6.92	4.36	
5750	S	6.01	4.95	
5751	S	6.22	4.30	
5752	S	6.50	5.11	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	1.000	Urban	0.000
SAAR (mm)	700	Region Number	Region 7

Results	**l/s**
QBAR Rural	3.4
QBAR Urban	3.4
Q100 years	10.9
Q1 year	2.9
Q30 years	7.7
Q100 years	10.9

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Appendix C - Drainage

	Name/Title/Description	Ref	Originator
C.1	Drainage Strategy Drawing	16117-HYD-XX-XX-DR-D-2200	Hydrock
C.2	Potential Ground Levels	16117-HYD-XX-XX-DR-D-2400	Hydrock
C.3	Surface Water Calculations	16117-HYD-XX-XX-CA-D-5500	Hydrock
C.4	SUDS Mitigation	16117-HYD-XX-XX-CA-D-5501	Hydrock

General Drainage Notes:

1. Use of this drawing does not absolve the client from his responsibilities under the Health and Safety: The Construction Design and Management Regulations 2015. The Principal Designer is required to contact Hydrock Consultants prior to permitting this drawing to be used in connection with any construction works.
2. All private drainage to comply with current Building Regulations, BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
3. All sewers to be laid soffit to soffit unless otherwise shown.
4. It is the Contractors responsibility to locate existing services on site accurately.
5. This drawing is for planning and information purposes only and NOT SUITABLE FOR CONSTRUCTION.
6. Compliance with Health & Safety matters on any trench/manhole is obligatory and a permit to enter a confined space is required.

REVISIONS

Rev	Date	Description	By	Ckd	App
P02	26/11/21	Layout updated.	VL	JAC	JAC
P01	30/11/20	First Issue.	VL	JAC	RJH

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CLIENT
TAYLOR WIMPEY
SOUTHERN COUNTIES

PROJECT
FATHOMS REACH, HAYLING ISLAND

TITLE
DRAINAGE STRATEGY

HYDROCK PROJECT NO.	SCALE @ A0
16117-IOCB	1:250

STATUS DESCRIPTION	STATUS
INFORMATION	S2

DRAWING NO. [PROJECT-CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER]	REVISION
16117-HYD-XX-XX-DR-D-2200	P02

General Drainage Notes:

1. Use of this drawing does not absolve the client from his responsibilities under the Health and Safety: The Construction Design and Management Regulations 2015. The Principal Designer is required to contact Hydrock Consultants prior to permitting this drawing to be used in connection with any construction works.
2. All private drainage to comply with current Building Regulations. BS EN-752 Drain and Sewer systems outside Buildings and other relevant British Standards and Codes of Practices.
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4. It is the Contractors responsibility to locate existing services on site accurately.
5. This drawing is for planning and information purposes only and NOT SUITABLE FOR CONSTRUCTION.
6. Compliance with Health & Safety matters on any trench/manhole is obligatory and a permit to enter a confined space is required.

REVISIONS

Rev	Date	Description	By	Ckd	App
P02	30/11/21	Updated to revised Architectural Layout	JAC	JAC	RJH
P01	30/11/20	First Issue.	VL	JAC	RJH

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PROJECT
FATHOMS REACH, HAYLING ISLAND

TITLE
POTENTIAL GROUND LEVELS

HYDROCK PROJECT NO.	SCALE @ A0	
16117-IOCB	1:250	
STATUS DESCRIPTION		STATUS
INFORMATION		S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)		REVISION
16117-HYD-XX-XX-DR-D-2400		P02

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)	19.000	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

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.118	4-8	0.581	8-12	0.048

Total Area Contributing (ha) = 0.747

Total Pipe Volume (m^3) = 47.122

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.030	0.030	0.030
1.001	-	-	100	0.030	0.030	0.030
2.000	-	-	100	0.068	0.068	0.068
2.001	-	-	100	0.041	0.041	0.041
2.002	-	-	100	0.022	0.022	0.022
2.003	-	-	100	0.018	0.018	0.018
1.002	-	-	100	0.013	0.013	0.013
1.003	-	-	100	0.047	0.047	0.047
3.000	-	-	100	0.011	0.011	0.011
3.001	-	-	100	0.018	0.018	0.018
1.004	-	-	100	0.046	0.046	0.046
1.005	-	-	100	0.053	0.053	0.053
1.006	-	-	100	0.011	0.011	0.011
1.007	-	-	100	0.011	0.011	0.011
1.008	-	-	100	0.011	0.011	0.011
1.009	-	-	100	0.018	0.018	0.018
4.000	-	-	100	0.054	0.054	0.054
4.001	-	-	100	0.011	0.011	0.011
1.010	-	-	100	0.021	0.021	0.021
1.011	-	-	100	0.025	0.025	0.025
5.000	-	-	100	0.083	0.083	0.083
1.012	-	-	100	0.018	0.018	0.018
6.000	-	-	100	0.029	0.029	0.029
6.001	-	-	100	0.008	0.008	0.008
6.002	-	-	100	0.025	0.025	0.025
6.003	-	-	100	0.025	0.025	0.025
6.004	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.747	0.747	0.747

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)
1.017		6.000	4.422	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	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	12
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)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 14, DS/PN: 1.013, Volume (m³): 3.8

Unit Reference	MD-SHE-0070-2700-1600-2700
Design Head (m)	1.600
Design Flow (l/s)	2.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	70
Invert Level (m)	5.199
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.600	2.7
Flush-Flo™	0.307	2.2
Kick-Flo®	0.626	1.8
Mean Flow over Head Range	-	2.1

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	1.8	1.200	2.4	3.000	3.6	7.000	5.4
0.200	2.1	1.400	2.5	3.500	3.9	7.500	5.5
0.300	2.2	1.600	2.7	4.000	4.1	8.000	5.7
0.400	2.2	1.800	2.8	4.500	4.4	8.500	5.9
0.500	2.1	2.000	3.0	5.000	4.6	9.000	6.0
0.600	1.9	2.200	3.1	5.500	4.8	9.500	6.2
0.800	2.0	2.400	3.3	6.000	5.0		
1.000	2.2	2.600	3.4	6.500	5.2		

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Storage Structures for Storm

Cellular Storage Manhole: 1, DS/PN: 1.000

Invert Level (m) 6.520 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 2, DS/PN: 1.001

Invert Level (m) 6.455 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 4, DS/PN: 1.003

Invert Level (m) 5.995 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 10, DS/PN: 3.001

Invert Level (m) 6.185 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	30.0	30.0	1.100	0.0	56.0
1.000	30.0	56.0			

Cellular Storage Manhole: 5, DS/PN: 1.004

Invert Level (m) 5.831 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

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Cellular Storage Manhole: 5, DS/PN: 1.004

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 6, DS/PN: 1.005

Invert Level (m) 5.730 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 18, DS/PN: 4.001

Invert Level (m) 5.718 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	100.0	1.100	0.0	140.0
1.000	100.0	140.0			

Cellular Storage Manhole: 21, DS/PN: 5.000

Invert Level (m) 5.614 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	100.0	100.0	1.100	0.0	140.0
1.000	100.0	140.0			

Cellular Storage Manhole: 23, DS/PN: 6.000

Invert Level (m) 5.742 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	70.0	70.0	1.100	0.0	104.0
1.000	70.0	104.0			

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Cellular Storage Manhole: 24, DS/PN: 6.001

Invert Level (m) 5.681 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	40.0	40.0	1.100	0.0	68.0
1.000	40.0	68.0			

Cellular Storage Manhole: 25, DS/PN: 6.002

Invert Level (m) 5.526 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	50.0	1.100	0.0	80.0
1.000	50.0	80.0			

Cellular Storage Manhole: 26, DS/PN: 6.003

Invert Level (m) 5.470 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	50.0	50.0	1.100	0.0	80.0
1.000	50.0	80.0			

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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	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	12
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
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia 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)	30, 100
Climate Change (%)	0, 40

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	1440 Winter	100	+40%					6.701
1.001	2	1440 Winter	100	+40%	100/960 Winter				6.701
2.000	3	60 Winter	100	+40%	100/15 Summer				6.816
2.001	4	60 Winter	100	+40%	100/30 Winter				6.783
2.002	5	60 Winter	100	+40%	100/15 Winter				6.704
2.003	6	1440 Winter	100	+40%	100/15 Winter				6.701
1.002	3	1440 Winter	100	+40%	100/15 Winter				6.701
1.003	4	1440 Winter	100	+40%	100/15 Winter				6.701
3.000	9	1440 Winter	100	+40%	100/30 Winter				6.700
3.001	10	1440 Winter	100	+40%	100/30 Winter				6.700
1.004	5	1440 Winter	100	+40%	30/60 Winter				6.700
1.005	6	1440 Winter	100	+40%	30/30 Winter				6.700
1.006	7	1440 Winter	100	+40%	30/15 Summer				6.700
1.007	8	1440 Winter	100	+40%	30/15 Summer				6.699
1.008	9	1440 Winter	100	+40%	30/15 Summer				6.699

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.044	0.000	0.03		322	0.9	OK	
1.001	2	0.021	0.000	0.05		440	1.8	SURCHARGED	
2.000	3	0.091	0.000	0.57			21.1	SURCHARGED	
2.001	4	0.170	0.000	0.48			33.7	SURCHARGED	
2.002	5	0.180	0.000	0.39			39.1	SURCHARGED	
2.003	6	0.227	0.000	0.04			4.4	SURCHARGED	
1.002	3	0.275	0.000	0.06			6.5	SURCHARGED	
1.003	4	0.331	0.000	0.07		1421	7.6	SURCHARGED	
3.000	9	0.245	0.000	0.01			0.3	SURCHARGED	
3.001	10	0.290	0.000	0.02		1000	0.8	SURCHARGED	
1.004	5	0.495	0.000	0.08			9.0	SURCHARGED	
1.005	6	0.596	0.000	0.07			8.5	SURCHARGED	
1.006	7	0.739	0.000	0.10			8.2	SURCHARGED	
1.007	8	0.754	0.000	0.11			8.4	SURCHARGED	
1.008	9	0.775	0.000	0.10			8.6	SURCHARGED	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.009	10	1440 Winter	100	+40%	30/15 Summer				6.698
4.000	17	1440 Winter	100	+40%	30/120 Winter				6.697
4.001	18	1440 Winter	100	+40%	30/60 Summer				6.697
1.010	11	1440 Winter	100	+40%	30/15 Summer				6.698
1.011	12	1440 Winter	100	+40%	30/15 Summer				6.697
5.000	21	1440 Winter	100	+40%	30/15 Winter				6.696
1.012	13	1440 Winter	100	+40%	30/15 Summer				6.697
6.000	23	1440 Winter	100	+40%	30/120 Summer				6.694
6.001	24	1440 Winter	100	+40%	30/60 Summer				6.694
6.002	25	1440 Winter	100	+40%	30/15 Summer				6.695
6.003	26	1440 Winter	100	+40%	30/15 Summer				6.696
6.004	27	1440 Winter	100	+40%	30/15 Summer				6.696
1.013	14	1440 Winter	100	+40%	30/15 Summer				6.695
1.014	15	1440 Winter	100	+40%					5.023
1.015	16	1440 Winter	100	+40%					4.753
1.016	17	1440 Winter	100	+40%					4.657
1.017	18	1440 Winter	100	+40%					4.574

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	10	0.801	0.000	0.09			9.1	SURCHARGED	
4.000	17	0.626	0.000	0.04			1.6	SURCHARGED	
4.001	18	0.754	0.000	0.04			1.3	SURCHARGED	
1.010	11	0.867	0.000	0.07			7.4	SURCHARGED	
1.011	12	0.933	0.000	0.07			7.9	SURCHARGED	
5.000	21	0.857	0.000	0.03			1.1	SURCHARGED	
1.012	13	1.035	0.000	0.07			7.1	SURCHARGED	
6.000	23	0.727	0.000	0.02			0.7	SURCHARGED	
6.001	24	0.788	0.000	0.03			1.1	SURCHARGED	
6.002	25	0.944	0.000	0.03			1.1	SURCHARGED	
6.003	26	1.002	0.000	0.07			2.6	SURCHARGED	
6.004	27	1.072	0.000	0.13			4.0	SURCHARGED	
1.013	14	1.121	0.000	0.02			2.6	FLOOD RISK	
1.014	15	-0.340	0.000	0.02			2.6	OK	
1.015	16	-0.337	0.000	0.02			2.6	OK	
1.016	17	-0.336	0.000	0.02			2.6	OK	
1.017	18	-0.337	0.000	0.02			2.6	OK	

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Client	Taylor Wimpey Southern Counties	Page 1 of 1	
Project Name	Fathoms Reach, Hayling Island	Prepared	VL
Doc ref	16117-HYD-XX-XX-CA-D-5501		
Project No.	16117-IOCB	Checked	JAC
Status	S2 - Information		
Date	30/11/2020	Approved	RJH
Rev	P01		

Pollutant Sources

	TSS	Heavy Metals	Hydro-carbons
Roofs	0.3	0.2	0.05
Drives	0.5	0.4	0.4
Highways	0.5	0.4	0.4
Critical	**0.5**	**0.4**	**0.4**

Note:
Please refer to The SuDS Manual, CIRIA C753 Paragraph 26.7.1 and Table 26.3 for full calculations and details.

SuDS Features (Mitigation Index)

	TSS	Heavy Metals	Hydro-carbons
Permeable Paving	0.7	0.6	0.7
Cellular Sotrage	0.3	0.2	0.2

Equivalent Index Range for Propriety Systems

Effectiveness	Index Range
N/A	<0.1
Very Low	0.1 - 0.2
Low	0.3 - 0.4
Medium	0.5 - 0.6
High	0.7 - 0.8
Very High	0.9 - 1.0

Proprietary Systems (Mitigation Index Equivalent)

	TSS	Heavy Metals	Hydro-carbons
Trap Gully	0.3	0.2	0.4
Pipe	0.1	0.1	0.1

Treatment Train

Source	Primary ⇨ Secondary ⇨ Tertiary	Mitigation Index			Acceptable
		TSS	Heavy Metals	Hydro-carbons	
Roofs	Cellular Storage	0.3	0.2	0.2	Yes
Drives	Permeable Paving ⇨ Cellular Storage	0.9	0.7	0.8	Yes
Highways	Trap Gully ⇨ Cellular Storage ⇨ Pipes	0.5	0.4	0.6	Yes

Treatment Train Mitigation Index = Primary + (Secondary / 2) + (Trertiary / 2)...