# PROPOSED RESIDENTIAL DEVELOPMENT
# SINAH LANE, HAYLING ISLAND
# HAVANT

# FLOOD RISK ASSESSMENT

## MARCH 2020

## Document Control Sheet

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# 1.0 Executive Summary

Rogers Cory Partnership Limited has prepared this Flood Risk Assessment (FRA) in accordance with the guidance set out in the Department for Communities and Local Government National Planning Policy Framework (NPPF).

This report summarises the methodology and results of the FRA in relation to the planning application for the residential proposal for the erection of 195 dwellings, associated open space, pumping station, sub-station with vehicular access via Sinah Lane and change of use of land from agricultural to a Wader and Brent Geese refuge.

According to data supplied by the Environment Agency (EA), the site lies wholly within Flood Zone 1 considered the lowest risk of flooding from fluvial or tidal sources. This report therefore focuses on the site-specific flood risk assessment and surface water management in line with the requirements of the Environment Agency and Hampshire County Council.

The study will also examine the effects of the development on adjacent parcels of land.

A surface water drainage strategy has been developed and hydraulically modelled incorporating sustainable urban drainage systems (SuDS) in line with the NPPF and EA standing advice. The strategy is based on a reduction in the surface water run-off rates thus ensuring that the development does not increase the risk of flooding from the site during peak storm events.

This report has therefore been prepared in support of a planning application for the residential proposal for the erection of 195 dwellings, associated open space, pumping station, sub-station with vehicular access via Sinah Lane and change of use of land from agricultural to a Wader and Brent Geese refuge

The report also aims to assess potential flood risk sources to and from the site and detail the drainage strategy for implementation on the scheme.

## 2.0 Introduction

Rogers Cory Partnership Limited have been instructed on behalf of Barratt David Wilson to prepare a Flood Risk Assessment (FRA) and surface water drainage strategy in support of a planning application for the proposed residential development in Hayling Island.

The development site seeks planning permission from the Havant Borough Council for the residential proposal for the erection of 195 dwellings, associated open space, pumping station, sub-station with vehicular access via Sinah Lane and change of use of land from agricultural to a Wader and Brent Geese refuge.

The National Planning Policy Framework (NPPF) was published in March 2012 by the Department of Communities and Local Government and replaced all planning policy statements including Planning Policy Statement 25 (PPS 25): Development and Flood Risk. The NPPF set out the Government's planning policy for England and how these are expected to be applied. The Planning Practice Guidance (PPG), published in March 2014, provides additional guidance and retains key elements of the now superseded PPS 25.

Initial searches into the Environment Agency's (EA) website has identified the development site to lie wholly within flood zone 1, considered to be the lowest risk of flooding from rivers or sea. In this respect requirements in the NPPF (foot note 20) states the following:

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

The EA Guidance Note 3 (April 2012) highlights that a FRA is required to ensure flood risk to the proposed development is considered as well as the impact the development will have elsewhere on people and property. In addition the FRA should consider the risk of flooding from other sources (groundwater, overland flow, sewers).

The PPG sets out the objectives of a site specific FRA as to establish the following:

- *"Whether the proposed development is likely to be affected by current or future flooding from any source;*
- *Whether it will increase flood risk elsewhere;*
- *Whether the measures proposed to deal with these effects and risks are appropriate;*
- *The evidence for the local planning authority to apply (if necessary) the Sequential Test, and;*

- *Whether the development will be safe and pass the Exception Test, if applicable."*

As such this report has been prepared in accordance with the requirements of the NPPF, PPG and EA Guidance.

# 3.0 Proposed Development Site

## 3.1 Site Location

The site is located off Sinah Lane within the south western part of Hayling Island. The site is bounded by residential properties to the west and south, open fields and a nature reserve to the north, Hayling Billy Trail and open fields to the east with National Grid reference 470733, 99841 (See **Appendix A**).

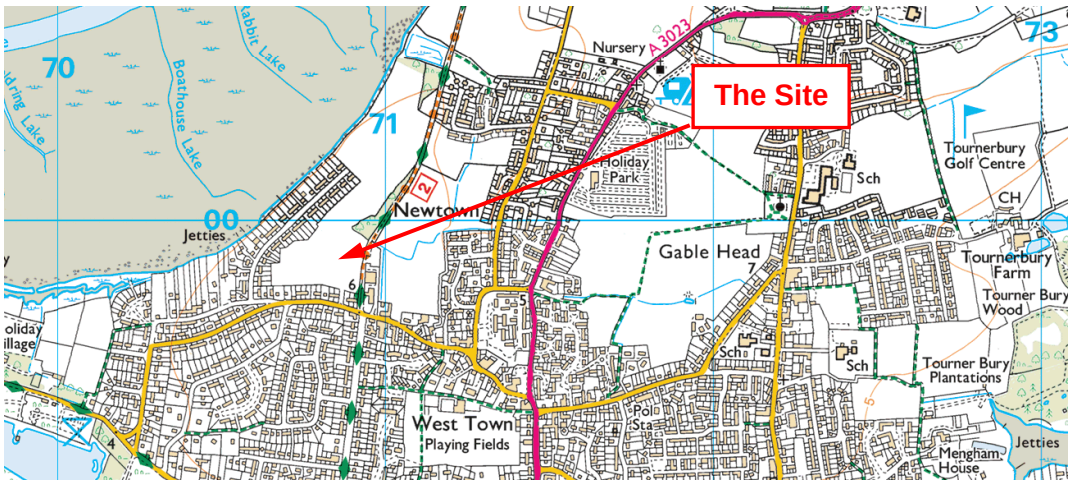



**Figure 1- Site Location and Extent**

## 3.2 Existing Topography

A topographical survey was carried out by Siteline in June 2016 and subsequently in April 2017 and May 2018 and is related to Ordinance Survey Datum.

The survey generally shows the site to be relatively flat levels ranging from approximately 5.90mAOD in the south, falling gently northwards to 5.10mAOD (See **Appendix B**).

## 3.3 Development Proposals

The proposed development comprises of the erection of 195 dwellings, associated open space, pumping station, sub-station with vehicular access via Sinah Lane and change of use of land from agricultural to a Wader and Brent Geese refuge.

## 3.4 Existing Geological Information

According to existing British Geological Survey (BGS) maps the site is located over the London Clay Formation with a superficial Head deposit consisting of River Terrace Deposits of Sand, Silt and Clay

Intrusive ground investigations carried out by Wilson Bailey in 2015 indicate the in-situ ground as comprising of Topsoil to 0.4-0.65mbgl over a soft brickearth type silty CLAY beneath which a generally medium to coarse sand with variable gravel content to depths of less than 4mbgl and onto stiff grey clay soils of the

London Clay was encountered. Groundwater was encountered at depths of approximately 1.5mbgl and found that the groundwater rest level was at 1.0mbgl with further tidal monitoring indicating that the groundwater is tidally influenced with a variation of between 0.05m to 0.12m. Due to the depth of the groundwater and extent of soft silty Clay, infiltration drainage is deemed inappropriate for this site.

## 3.5 National Policy Context

National policy regarding flood risk is contained within the National Planning Policy Framework and Technical guidance which was issued by the Department of Communities and Local Government in March 2012.

The Environment Agency's latest revision of their Flood Risk Standing Advised (FRSA) (version 3.1) was released in April 2012.

The Department for Environment, Food and Rural Affairs (DEFRA) released the Non-statutory technical standards for sustainable drainage systems in March 2015. The document sets out non-statutory technical standards for SuDS to be read in conjunction with the NPPF and PPG.

As of the 15th April 2015 the Lead Local Flood Authority (LLFA) has now become a statutory consultee on all major planning applications and as such will assess planning applications in respect of surface water drainage and sustainable drainage systems which was previously the responsibility of the Environment Agency. The LLFA's primary duties will be to ensure that flood risks from surface water run-off, groundwater and ordinary watercourses are identified and managed properly. The use of SuDS will be a material consideration in planning conditions and as such the proposed use of SuDS will need to be demonstrated on all major developments unless it can be demonstrated otherwise.

## 3.6 Local Planning Policies

As the site is located within Havant any future development would need to accord with the policies set out in the Havant Borough Council Core Strategy (adopted in 2011). The policies most relevant to flooding are CS15

***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.*

*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.*

*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.*

## 3.7 Existing Flood Defences

The site does not benefit from any existing flood defences.

## 3.8 NPPF Flood Zone and Vulnerability

The National Planning Policy Framework Table 1 confirms the flood zone Classification based upon the probability of flooding. The site is shown to lie wholly within Flood Zone 1 (low risk of tidal flooding).

Table 2 of the National Planning Policy Framework confirms the 'Flood Risk Vulnerability Classification' of a site, depending on its proposed use. The classification is then applied to Table 3 to determine whether:

- The proposed development is suitable for the flood zone in which it is located
- An Exception Test is required for the proposed development.

The proposed development is classified as 'More Vulnerable' according to the NPPF and suited for the flood zone in which it is located.

# 4 Flood Risk to the Site

The degree of detail appropriate to an FRA depends upon the scale and potential impact of the proposed development to and from the surrounding boundaries. In this case, the applicant has the intention of re-developing an area of land which is located wholly within Flood Zone 1, considered the lowest risk of flooding from tidal sources.




**Figure 2- Extract from EA Website- Flood Map for Planning (Rivers and Sea)**

## 4.1 Strategic Flood Risk Assessment

The National Planning Policy Framework confirms that Regional Planning Bodies (RPBs) or local planning authorities (LPAs) should prepare strategic Flood Risk Assessments (SFRAs) in consultation with the EA. The SFRA is then used to refine information on areas liable to flooding by taking into account other sources of flooding and the impacts associated with climate change in addition to the EA flood map data.

The document informs the Council's policies in the emerging Local Development framework and a strategic approach to the allocation of sites for development and the future management of flood risk, in line with the National Planning Policy Framework.

The Partnership for Urban South Hampshire (PUSH) is made up of 10 local planning authorities within Hampshire. Atkins were commissioned in 2006 to undertake a Strategic Flood Risk Assessment (SFRA), which was divided into two stages.

The first stage of the SFRA included for the collation of data and production of scoping appraisal. This stage also provided a high-level analysis of flood risk within each sub-region. This stage was developed to assist in assessing the feasibility of the PUSH housing allocation.

The second stage of the SFRA involved the production of detailed mapping outputs to assist the Planners and Flood Risk Managers.

## 4.2 Existing Information on Flooding

### Tidal Flood Risk

According to the EA Flood Map, see figure 2, the site appears to be located wholly within Flood Zone 1. As such the site is considered to be at low risk from tidal flooding.

Whist the site lies wholly within Flood Zone 1, it is recognised that vehicular access on and off Hayling Island is only via Langstone Road, located further north of the site (see figure 3). Part of Langstone Road lies within Flood Zone 3 considered a high risk of Tidal Flooding. As a result, early consultation has been carried out with the Environment Agency, East Solent Coastal Partnership, Hampshire County Council and Havant Borough Council regarding flood risk and drainage matters relating to the development. As a result, a Flood Emergency Plan, describing early flood warning and procedures for the development in the event of a peak tidal surge event has been included as part of **Appendix K** which is proposed to be implement to inform and assist future residents in the event of a peak tidal flood event.




**Figure 3- Extract from EA Website- Flood Map for Planning (Rivers and Sea)**

### Fluvial Flood Risk

The site is located within Flood Zone 1, considered lowest risk of flooding from fluvial sources.

## Sewer Flood Risk

There are no recorded incidences of sewer flooding within the vicinity of the site. Any potential future risk to the proposed development from sewer flooding events is considered low in the context that the finished levels on the site will be designed to ensure that any overland flow is directed away from the buildings and not pose a risk to people or property.

## Surface Water Flood Risk

Searches of the EA Risk of Flooding from Surface Water flood map confirm that the site lies mainly outside the of any risk of flooding from surface water with exception of areas within the south eastern part which indicate to be a low risk of flooding from surface water (between 0.1% to 1% probability). The areas are reflective of localised low points within the site and the risk to the future development can be mitigated thorough the detailed design of the finished ground levels of the development.

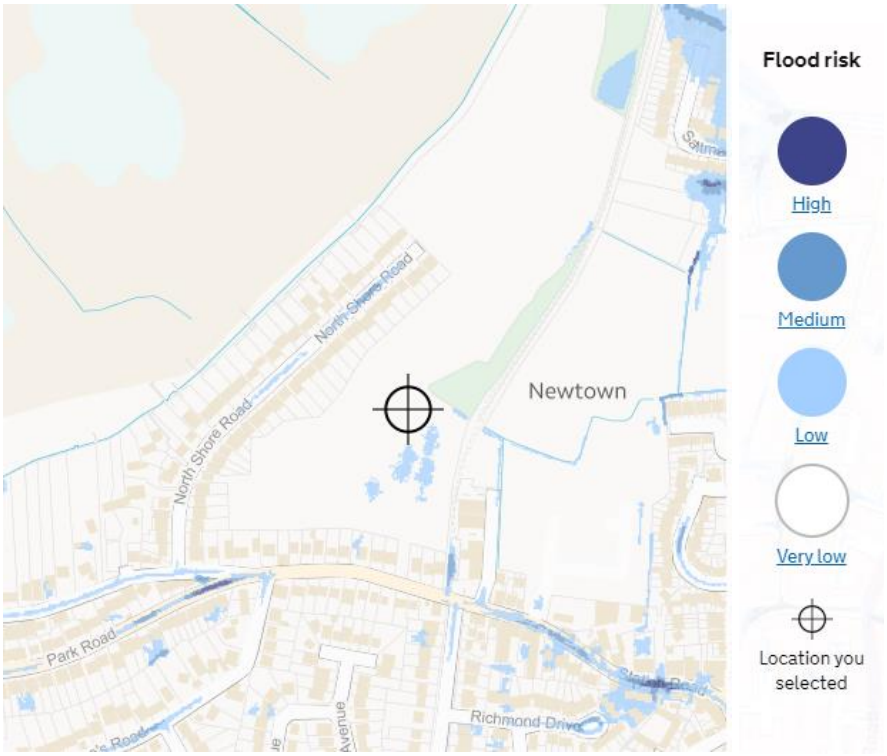



**Figure 4 Extract: – Extract from Environment Agency Risk of Surface Water Flood Risk Maps**

## Groundwater Flood Risk

A review of the groundwater levels indicates that the risk of groundwater flooding to the development is low.

Any potential residual risk to the new development will be mitigated through the detailed design of the finished ground levels which will seek to have building floor levels above the existing ground levels and ensure adequate falls away from the building to protect both building and people.

### Flood Warning

The EA's Flood Warning service is aimed to mitigate the impact of flooding for people who live in areas subject to flooding and is available for the areas within the floodplain of the main rivers in England and Wales.

## 4.3 Climate Change

As of the 19th February 2016, the EA has updated guidance on the application of climate changes allowances for the following:

- peak river flow by river basin district
- peak rainfall intensity
- sea level rise
- offshore wind speed and extreme wave height

Peak river flow allowances are now to be based on River Basin areas thus making them more geographically relevant, based on the range of predicted allowances.

Rainfall – increases in peak rainfall over time is to be assessed on two scenarios to assess the sensitivity of the areas as per table 1 below

| Applies across all of England | Total potential change anticipated for 2010 to 2039 | Total potential change anticipated for 2040 to 2059 | Total potential change anticipated for 2060 to 2115 |
|---|---|---|---|
| **Upper end** | +10% | +20% | +40% |
| **Central** | +5% | +10% | +20% |

**Table 1: Extract from www.gov.uk website- Table 2 – peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline)**

As a conservative approach, a lifetime of the development should be considered of up to 100 years (i.e. up to 2118) when assessing flood risk for residential developments. According to Table 1 above, an increase of 20% to 40% on the peak rainfall intensity should be expected. To mitigate any residual risk at the site as a result of climate change, an appropriate climate change allowance (i.e. 40% increase in rainfall intensity) will therefore be considered and accommodated within the design strategy for managing surface water run-off.

## 4.4 The Sequential Test

The sequential test approach is aimed to steer new development to areas of lowest probability of flooding. In this regard to determine the suitability and classification of the development, as a check of the proposed scheme, consultation has been made to tables 2 and 3 of the NPPF.

Table 2 of the NPPF technical guidance determines that the proposed development is considered to be a 'more vulnerable' land class usage, in terms of flood risk, as illustrated in Figure 4.

**More vulnerable**

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste[6].
- Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*[7]

**Figure 5: Extract of Table 2: Flood Risk Vulnerability Classification**

Table 3 of the NPPF considers sites providing a 'more vulnerable' land-class usage in a Flood Risk Zone 3 area to require the application of the Exception Test, (see Figure 4):

**Table 3: Flood risk vulnerability and flood zone 'compatibility'**

| Flood risk vulnerability classification (see table 2) | | Essential infrastructure | Water compatible | Highly vulnerable | More vulnerable | Less vulnerable |
|---|---|---|---|---|---|---|
| Flood zone (see table 1) | Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Zone 2 | ✓ | ✓ | Exception Test required | ✓ | ✓ |
| | Zone 3a | Exception Test required | ✓ | × | Exception Test required | ✓ |
| | Zone 3b functional floodplain | Exception Test required | ✓ | × | × | × |

**Key:** ✓ Development is appropriate.
× Development should not be permitted.

**Figure 6: Table 3 - Flood Risk Vulnerability and Flood Zone 'Compatibility'**

As the site lies wholly within Flood Zone 1, it is deemed suitable for residential development in terms of flood risk vulnerability.

# 5 Surface Water Management

Hampshire County Council (HCC) are the Lead local flood Authority for Havant Borough Council and statutory consultee on surface water management on all planning applications within the County.

The surface water management section should ensure that there is no adverse impact on flood risk elsewhere as a result of a change in the surface water runoff regime from the re-development.

A meeting was held with the LLFA on the 7th June 2017 as part of their pre-application process. Details of the key elements of the constraints and opportunities discussed at the meeting are noted below:

- HCC are not averse to the strategy using pumping provided we can demonstrate that this is the only alternative and content that pumping was being proposed, efforts have been made to bring in SuDS to manage the water quality and quantity;
- HCC would expect to see the site discharge to the greenfield run-off rates.

A site meeting and walkover was also carried out with the Havant Borough Council Drainage Engineer on the 14th June 2017, where the route of the existing ditch and outfall was reviewed and recommendations for CCTV drainage surveys to be undertaken on the sections of ordinary watercourse once it entered culverted sections. A copy of the meeting note summarising the key items of the meeting is provided in **Appendix F**. It should be noted that since this meeting, the scheme proposals have developed and the proposed point of discharge from the SuDS scheme is now being taken to another ditch system further north, which drains into a pond and ultimately to a watercourse which discharges into the Sinah Lake.

The drainage strategy has been developed with the above key items in consideration. Infiltration has not been deemed suitable based on the intrusive investigations carried out onsite which indicate a highly silty CLAY geology in conjunction with the high groundwater table.

## 5.1 Existing Surface Water Drainage Regime

A base line hydrology plan has been produced to review the current surface water run-off from this Greenfield site and into the existing ordinary watercourses along its eastern and northern boundary. This plan is presented as **Appendix G.**

## 5.2 Pre-Development Run Off

The historic Greenfield run-off rate is based on the IH Report 124 ‘Flood estimation for small catchments’ (Marshall and Bayliss, 1994).

Using the Micro drainage source control suite ICP SuDS methodology the following baseline parameters where used to determine the sites historic Greenfield run off rates:

SAAR (mm): 700

Soil: 0.40

Region 7

Area: 2.913ha (impermeable area of proposed site)

Return Period: 100 Year

The historic Greenfield run-off rates have been summarised in Table 2 below:

| Area (Ha) | QBar Urban (L/sec) | Q1 Year (L/Sec) | Q30 Year (L/Sec) | Q100 Year (L/Sec) | Greenfield Run-off Volume (m3) |
|---|---|---|---|---|---|
| **2.913** | **9.9** | 8.4 | 22.5 | 31.6 | 661.756 |

**Table 2: Summary of Greenfield runoff rates and volumes**

## 5.3 Design Principles

Key design principles in the following guidance documents steer the approach to managing surface water runoff at sites:

- Building Regulations hierarchy of drainage (H3);
- Interim Code of Practice for SuDS; and
- CIRIA best practice guidance, including the use of the 'SUDS management train'

Building Regulations hierarchy of drainage outlines the preferred methods for the disposal of surface water with infiltration methods being the preferred option. If this is not possible the next favoured option is to drain to an existing watercourse. If neither of these options are feasible, the regulations state that rainwater discharge should be directed to a sewer.

The Interim Code of Practice for SUDS provides guidance about the hydraulic design criteria for Sustainable drainage systems. This in general refers to both peak rate of runoff and the volume of runoff, post development. Prior to mitigation measures such as the use of SuDS attenuation features, both the volume and peak rate of runoff may increase post development.

The design principles for surface water management extend beyond simple hydraulic criteria. CIRIA guidance promotes the use of the SUDS management train, a concept where SUDS techniques are used to treat, convey and store surface water runoff. This approach is considered as part of the SUDS selection methodology.

## Sustainable Drainage Systems

To drain the development in a sustainable manner whilst complying with the requirements of the NPPF, the scheme should seek to adopt an appropriate form(s) of sustainable urban drainage systems (SuDS).

SuDS techniques comprise of implementation of infiltration drainage devices to discharge surface water to the underlying soil stratum (where ground conditions permit). These may be in the form of conventional soakaways, infiltration basins and ponds, filter strips, bio-retention areas, swales, permeable surfaces, green roofs, over-sized pipes/tanks or geo-cellular attenuation units.

An additional 40% storage provision should be provided as an allowance for any potential climate change impact (as stated in Table 1: Peak rainfall intensity allowance in small and urban catchment associated with a residential scheme).

The SuDS philosophy is steered to maximize the benefits and minimise the negative impacts of surface water runoff from developed areas. CIRIA C753 The SuDS Manual determines the design criteria for SuDS to be based upon water quantity, water quality, amenity and biodiversity. Table 7.1 of The SuDS Manual assesses each SuDS component to the delivery of the design criteria. Where broadly ranking the SuDS, components depicted in Table 7.2 by applying a score for the deliverance of the design criteria, a theoretical SuDS hierarchy can be determined for the selection of SuDS against the design criteria as represented in Table 3 below.

SuDS in the form of an attenuation ponds, basins and bio-retention areas have been incorporated within the scheme. It has therefore been concluded that the SuDS design criteria as described in the SuDS Manual has been met and accords with current best practice.

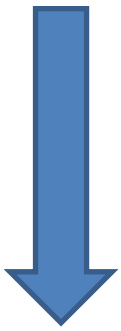
| SuDS Component | Potential of delivering SuDS Design Criteria |
|---|---|
| Infiltration Systems<br>Swales<br>Bioretention systems<br>Pervious Pavements<br>Detention Basins<br>Trees<br>Green Roofs<br>Ponds and Wetlands<br>Filter Drains<br>Filter Strips<br>Rainwater Harvesting Systems<br>Proprietary Treatment Systems<br>Attenuation Storage Tanks | High<br>  <br>Low |

**Table 3: Theoretical SuDS Hierarchy**

### Infiltration Drainage

Intrusive ground investigations carried out indicate that the underlying strata consists of firm clay and silt with low permeability in conjunction with relatively shallow groundwater. As such full infiltration drainage has not been deemed suitable for this site.

### Existing Watercourses

There is an existing ditch system located on the eastern boundary of the site, which in turn flows northwards into an existing ordinary watercourse and a final outfall into Sinah Lake.

## 5.4 Surface Water Drainage Strategy

In view of the requirements of the NPPF, PPG, HCC the design parameters and constraints associated with redeveloping this site, a surface water drainage strategy design has been devised and hydraulically modeled to demonstrate that the scheme can be suitably implemented without increasing the level of flood risk, when the

surface water drainage system experiences a 1:100 year rainfall event (including climate change).

The surface water drainage scheme has been designed to ensure:

- A reduction in the pre-development site discharge for peak storm events.
- Sustainable Urban Drainage systems are wholly incorporated within the scheme.
- Consideration is given for the improvement of water quality within the design.
- The designed drainage scheme can satisfactorily retain a critical 1 in 100 Year storm event with climate change.

Having taken into consideration the above points, a scheme has been devised and hydraulically modelled based on attenuation techniques with a restricted discharge to the existing watercourse at the predevelopment Greenfield run-off rates. A copy of the proposed surface water strategy can be found in **Appendix I**.

### 5.4.1 Access Roads, Shared Surfaces, Private Drives and Roof Drainage

The proposed run-off from the access roads, drives and parking bays will be conveyed to the new below ground surface water network via trapped gullies. Rainfall run-off from the roofs of the new properties will discharge directly into the below ground surface water network

The surface water network will convey the flows, under gravity, north eastwards towards a new attenuation basin and SuDS swales which will provide attenuation of the restricted flow prior to discharging to an existing ditch system located on the eastern boundary of the site, which in turn flows northwards into an existing ordinary watercourse and a final outfall into Sinah Lake.

Due to the very limited fall available on the site, (approximately 800mm over the entire site) and depth of the proposed outfall ditch, consideration of how to achieve a gravity connection to the existing watercourse system was undertaken whilst still ensuring a sufficient depth of attenuation could be achieved. The following options were considered:

- Raising ground levels to achieve a gravity connection to the ditch in the north- This option was discounted due to the need to raise the ground levels across the site and most significantly along the southern and western boundaries of the site, which was not permitted due to the sensitivities of the ground levels interface with the neighboring properties;
- The use of shallow SuDS drainage techniques, such as swales and lined permeable paving. This option was considered but discounted as the use of shallow SuDS alone would not mitigate the need for a surface water pumping solution, without land raising as well. Furthermore, the proposed roads and

sewers are to be put forward for adoption by HCC and a Local Sewerage Authority, who would not permit the use of a line permeable paving for the conveyance of surface water drainage within the main access roads.

As a result, a surface water pumping solution has been proposed to overcome the limited fall available on the site and a positive gravity connection from the main attenuation basin to the existing watercourse system.

The proposed onsite surface water pumping station is to be offered for adoption as part of an adoptable surface water drainage scheme and thus will become the responsibility of a Local Sewerage Authority.

In addition to the provision of emergency storage, the pumping station has been located in the north eastern part of the site adjacent to the proposed swales and attenuation basin and includes for a provision for exceedance overflow into the basin in the event of a pump failure, thus ensuring flows would continue into the SuDS attenuation systems.

### 5.4.3 Flow Control

A maximum overall development discharge is proposed to be limited to the greenfield equivalent run-off rates.

The hydraulic calculations have been simulated under various scenarios up to and included the critical 1 in 100 Year storm event with additional 40% allowance for climate change. The simulations confirm that the storm can be managed and maintained within the site without flooding.

The hydraulic model of the proposed surface water network, incorporating the SuDS attenuation systems can be found in **Appendix I**.

| **Impermeable Development Area (Ha)** | **Q1 Year (L/sec)** | **Q30 Year (L/Sec)** | **Q100 Year Plus Climate (L/Sec)** | **Discharge Volume (m3)** (360min Winter) |
|---|---|---|---|---|
| 2.913 | 9.6 | 9.9 | 9.9 | 346.424 |

**Table 5: Summary of Post Development Runoff with mitigation measures**

### 5.4.4 Water Quality

It is important to address issues with regards to quality when considering surface water management. As the surface water is proposed to be discharge to the existing downstream watercourses, treatment is proposed as part of a SuDS Management Train in accordance with the recommendations of the SuDS Manual (CIRIA 753) and as required by the LLFA.

Chapter 26 of the CIRIA SuDS Manual (2015) provides guidance on methods that should be used to design SuDS to meet the water quality design criteria and good

practice design standards. Diffuse urban pollution is a significant factor in compromising groundwater and receiving water standards that are required under the EA Water Framework Directive. Chapter 4 of the SuDs Manual summarises factors, which influence pollution levels in urban run-off. This summary is presented in **Table 6 below:**

| **Factors influencing pollution levels in urban run-off** |
|---|
| The amount and type of pollution washed off a surface will depend on many things including:<br>• Planning activities on, above and adjacent to the surface that affect the deposition of pollutants, their retention on the surface and the extent to which they are mixed with runoff (including pollution prevention strategies)<br>• Unplanned activities (accidents and spillages) that can cause temporary unexpected high pollution concentrations<br>• The surface location and type, affecting wash-off rates and contaminant movement mechanisms<br>• The drainage path<br>• The length of the dry weather period before the rainfall event<br>• The intensity and the duration of the rainfall, and the associated flow velocities<br>Any further pollutant transformations occurring during residence and conveyance within gullies, chambers, pipe or channel networks, gravels, soils and vegetation and quiescent bodies of water. |

**Table 6: Extract of Box 4.1 of the SuDS Manual (CIRIA 753)**

Table 4.3 of the SuDS Manual classifies the pollution hazard level for residential sites, including residential car parks, low traffic roads as being “low” and thus only requiring a “Simple index approach” in terms of the requirements for the discharge to surface waters, including coasts and estuaries.

The SuDS Manual summarises the steps for the simple index approach:

**Step 1** – *Allocated suitable pollution hazard indices for the proposed land use*

**Step 2** – *Select SuDS with a total pollution mitigation index that equals or exceeds the pollution index*

**Step 3** – *Where the discharge to a protected surface waters or groundwater, consider the need for a more precautionary approach*

The SuDS Manual describes “protected surface waters” as protected surface water resources, which include those designated for drinking water abstraction or for other environmental protection reasons

Table 26.2 of the SuDS manual notes the following pollution hazard indices for residential land use development:

| Land Use | Pollution Hazard Level | Total suspended solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|---|
| Individual property driveways, residential car parks, low traffic roads (eg. cul-de sacs, home zones and general access roads) and non-residential car parking with infrequent change (eg schools, offices )ie. Less than 300 vehicle movements/day | Low | 0.5 | 0.4 | 0.4 |

**Figure 7: Extract of Table 26.2 of SuDS Manual (2015)**

Table 26.3 of the SuDS Manual provides details of the SuDS pollution mitigation indices for various types of SuDS components

| | Mitigation indices | | |
|---|---|---|---|
| Type of SuDS component | TSS | Metals | Hydrocarbons |
| Filter Strip | 0.4 | 0.4 | 0.5 |
| Filter Drain | 0.4 | 0.4 | 0.4 |
| Swale | 0.5 | 0.6 | 0.6 |
| Bioretention system | 0.8 | 0.8 | 0.8 |
| Permeable Paving | 0.7 | 0.6 | 0.7 |
| Detention Basin | 0.5 | 0.5 | 0.6 |
| Pond | 0.7 | 0.7 | 0.5 |
| Wetland | 0.8 | 0.8 | 0.8 |

**Figure 8: Extract of Table 26.3 of SuDS Manual (2015)**

As such the total SuDS mitigation index (figure 8) must be greater than the pollution hazard index (figure 6), furthermore when used in combination of two or more SuDS components, a factor of 0.5 is used to account for the reduced performance of the secondary or tertiary components associated with the already reduced inflow of concentration, therefore:

**Total SuDS mitigation index = mitigation index$_1$ + 0.5(mitigation index$_2$)**

As such all the run-off from the development site is proposed to be conveyed through attenuation basins, bioretention areas and swales thus providing a far greater SuDS mitigation index than what is required to meet the minimum standards.

### 5.4.5 Long Term Maintenance

Consideration has been given to the long-term maintenance of the proposed drainage structures. SuDS attenuation basins, bio retention areas, granular filter drainage and all associated external pipework, chambers and manholes will be the responsibility of a management company.

A detailed maintenance schedule will be provided by the designers during the detailed design stage of the surface water proposals.

### 5.4.6 Exceedance

Whilst the drainage system has been designed to a very high standard (1 in 100 Year storm event including climate change), it is possible that a more extreme event will occur and that the design standard for the system will be exceeded. It is best practice to design the drainage system to shed water, primarily into landscaped and other areas, therefore reducing the risk of flooding areas of built development during extreme events.

A strategy for directing overland flows for the site will be confirmed using overland flow modeling as part of the detailed design once key ground levels or development levels across the site have been finalized. Based on the strategic finished floor levels and topographical survey it has however been possible to demonstrate the anticipated exceedance flow routes which can be found in **Appendix J**.

### 5.4.7 Safe means of access and egress.

A safe means of emergency dry access and egress is proposed from the development site through the proposed access roads to Sinah Lane. A Flood Plan is provided in **Appendix K** which outlines options and procedures for future occupants to consider in the event of a peak tidal surge event should they wish to leave Hayling Island during such occurrence.

# 6 Foul Water Drainage Strategy

Southern Water Services Limited (SWSL) are the Local Sewerage Authority in this area. The development proposals will seek to discharge to the existing Southern Water public sewer network.

The proposed foul water discharge generated by the site has been calculated at 9.02l/s (based on 195 dwellings at 4000l/dwelling/day) in accordance with Sewers for Adoption 7th Edition.

It should be noted that as of April 2018, under the new Charging Rules for New Connection Services (English Undertakers) published by Ofwat, SWSL has introduced a new Charging Arrangement which includes methods for calculating charges and any Income Offsets and Asset Payments that will apply in relation to the provision of new mains and sewers; provisions of service connections, lateral drawings and waste connections, adoption agreements and diversions.

Under the new Charging Arrangements that SWSL will limit the charge for a New Sewer to the cost of connecting to the nearest reasonably practicable point on the network where the existing sewer is at least the same diameter as the New Sewer that is required to provide the capacity of the development.

The new development parcel will seek to connect to nearest existing Southern Water foul sewer via an onsite adoptable pumping station to the existing 200mm diameter sewer located just north west of the development site, subject to agreement with Southern Water.

Connections to the existing foul sewer can be made under Section 106 of the Water Industry Act 1991. Therefore, an application will need to be made to SWSL to connect to the public sewers. Should any of the onsite foul water networks be offered for adoption, then this will be carried out under Section 104 of the Water Industry Act 1991.

All domestic foul drainage will be designed in accordance with Part H of the Building Regulations.

# 7 Conclusion

This site-specific flood risk assessment has demonstrated that the development proposals is appropriate in terms of flood risk and the provision of flood mitigation measures.

A preliminary design surface water drainage strategy has been prepared and hydraulically modelled which demonstrates that the redevelopment proposals can be successfully implemented and designed to withstand the impact of a 1:100 year rainfall event (including climate change), in accordance with the NPPF. PPG and HCC requirements

The development's surface water discharge is proposed to be attenuated to the pre-development Greenfield run-off rates through the use of SuDS techniques and re-use of existing resources.

In view of this assessment, the report concludes that:

i. The site is located wholly within Flood Zones 1 considered lowest risk of flooding from Rivers or Sea;

ii. The Development and its occupants are not at an increased risk of flooding;

iii. The Development does not increase the risk of flooding elsewhere;

iv. The Development can be drained in a sustainable manner utilizing SuDS techniques;

v. The Development will satisfactorily manage and maintain a 1 in 100 Year storm event with allowance for climate change

The findings of this report identify the opportunity to promote the sustainable re-use of existing resources and potential to implement an appropriate SUDS strategy.

# Appendix (A)

# Site Location Plan

NOTES




| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|

Client:-

BARRATT HOMES

Site:-
Sinah Lane
Hayling Island

Drawing Title:-
Site Location Plan

Date: June 2018 | Scales: NTS
Drawn: TRS | Checked: TRS | Approved: TRS

Drawing No.
BSO/E4513/006

FOR INFORMATION ONLY

RCP ARCHITECTURE & CIVIL ENGINEERING
Rogers Cory Partnership
Architectural and Civil Consultants
The Old School Old School Road
Hook Hampshire RG27 9NJ
T: 01256 769269 E: mail@rcpconsultants.co.uk W: rcpconsultants.co.uk

# Appendix (B)

# Topographical Survey

TREES

| | |
|---|---|
| A | Ash |
| AL | Alder |
| AP | Apple |
| B | Beech |
| C | Cedar |
| CB | Copper Beech |
| CH | Cherry |
| CY | Cypress |
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| WN | Walnut |
| Y | Yew |

Species / Dia / Spread (max) / Ht
e.g. OK / 0.6 / 8 / 15

KEY

| | |
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| CB | Control Box |
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| EP | Electricity Pole |
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| GSV | Gas Stop Valve |
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| S□R□EY ST□TIO□S | | | | |
|---|---|---|---|---|
| □a□e | Easting | □orthing | Height | Ty□e |
| S1 | 4□0□6□43□ | □□□3□□4□ | 6.150 | □ail |
| S□ | 4□0□66.5□□ | □□□63□□5 | 6.04□ | □ail |
| S3 | 4□0□6□□□□ | □□□1□□□□ | 6.0□□ | □ail |
| S4 | 4□0□□4□5□ | □□□4□□□5 | 5□41 | Peg |
| S5 | 4□0□□□5□□ | □□□4 830 | 5□15□ | Peg |
| S6 | 4□0□□15□0 | □□□□□5□□ | 5.4□□ | Peg |
| S□ | 4□06□1.840 | □□□64.643 | 5□5□ | Peg |
| S10 | 4□10□4□4□ | 1001□□9□□ | 5.01□ | Peg |
| S11 | 4□0□61.□□ | 100□□5□.40 | 4□□□9 | Peg |
| S13 | 4□1103.00□ | 1001□□40□ | 4□□□9 | Peg |
| EP1 | 4□0□□4.06□ | □□□□4 8□□□ | □505 | □ail |
| EP□ | 4□0□65.□□□ | □□□□5□36□ | □□□4 | □ail |
| EP3 | 4□065.□□01 | □□□13□340 | □□□□ | □ail |

Revision B - May 2018
Survey extended to north outfall

Revision A - April 2017
Survey extended to the north

NOTES:

The survey grid has been related to a local determination of OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station S1. Levels are related to OS datum determined from the National GPS Network using OSGM02.

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| | |
|---|---|
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| BARRATT DAVID WILSON | Client |
| LAND AT SINAH LANE<br>HAYLING ISLAND<br>HAMPSHIRE | Contract |
| SITE SURVEY | Title |
| 36HX001B - Sheet 1 of 7 | Drawing No. |
| JUNE 2016 | Date |
| 1:250 (A0) | Scale |
| MJR/ST/MJU | Surveyor |

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Species / Dia / Spread (max) / Ht
e.g. OK / 0.6 / 8 / 15

KEY

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NORTH SHORE ROAD

S:::R::EY ST::TIO::S

| ::a::e | Easting | ::orthing | Height | Ty::e |
|---|---|---|---|---|
| S1 | 4::0::6::43:: | ::::3::::4:: | 6:150 | ::ail |
| S:: | 4::0::66.5:: | ::::63::::5 | 6:04:: | ::ail |
| S3 | 4::0::6:::::: | ::::1::::0:: | 6:0:: | ::ail |
| S4 | 4::0::4::6:: | ::::4::::5 | 5::41 | Peg |
| S5 | 4::0::::::5:: | ::::4:630 | 5::5:: | Peg |
| S6 | 4::0::1:5::0 | ::::::5::: | 5:4:: | Peg |
| S:: | 4::06::1:440 | :::64:643 | 5::5:: | Peg |
| S10 | 4::10::4::4:: | 1001::::0:: | 5:01:: | Peg |
| S1:: | 4::0::61::0:: | 100::::5::40 | 4::::3 | Peg |
| S13 | 4::1103:00:: | 1001::::40:: | 4::::5 | Peg |
| EP1 | 4::0::::4:06:: | ::::::4:6:: | ::505 | ::ail |
| EP:: | 4::0::65:::::: | ::::::1:36:: | :::::4 | ::ail |
| EP3 | 4::065::::01 | ::::13:340 | :::::1 | ::ail |

Revision B - May 2018
Survey extended to north outfall

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| ::a::e | Easting | ::orthing | Height | Ty::e |
|---|---|---|---|---|
| S1 | 4::0::6.::43:: | ::::3::::4:: | 6:150 | ::ail |
| S:: | 4::0::66.5::: | ::::63:::5 | 6:04:: | ::ail |
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| EP3 | 4::065::::01 | ::::::9:340 | :::::: | ::ail |

Revision B - May 2018
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Draft




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S□R□EY ST□TIO□S

| □a□e | Easting | □orthing | Height | Ty□e |
|---|---|---|---|---|
| S1 | 4□0□6□43□ | □□□3□□□4□ | 6□150 | □ail |
| S□ | 4□0□66□5□□ | □□□63□□□5 | 6□04□ | □ail |
| S3 | 4□0□6□□□□ | □□□1□□□0□ | 6□0□□ | □ail |
| S4 | 4□0□□4□6□ | □□□□4□□□5 | 5□□41 | Peg |
| S5 | 4□0□□□□5□ | □□□□4□630 | 5□□5□ | Peg |
| S6 | 4□0□□1□5□0 | □□□□□□5□□ | 5□4□□ | Peg |
| S□ | 4□06□1□440 | □□□64□643 | 5□□5□ | Peg |
| S10 | 4□10□4□4□ | 1001□□□0□□ | 5□01□ | Peg |
| S1□ | 4□0□61□□0□ | 100□□5□□40 | 4□□□3 | Peg |
| S13 | 4□1103□00□ | 1001□□□40□ | 4□□□5 | Peg |
| EP1 | 4□0□□4□06□ | □□□□4□6□□ | □505 | □ail |
| EP□ | 4□0□65□□□□ | □□□□1□36□ | □□□□4 | □ail |
| EP3 | 4□065□□□01 | □□□13□340 | □□□□□ | □ail |

Revision B - May 2018
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| 36HX001B - Sheet 4 of 7 | Drawing No. |
| JUNE 2016 | Date |
| 1:250 (A0) | Scale |
| MJR/ST/MU | Surveyor |

TREES

| | |
|---|---|
| A | Ash |
| AL | Alder |
| AP | Apple |
| B | Beech |
| C | Cedar |
| CB | Copper Beech |
| CH | Cherry |
| CY | Cypress |
| E | Elm |
| EL | Elder |
| EU | Eucalyptus |
| F | Fir |
| FM | Field Maple |
| FR | Fruit |
| HZ | Hazel |
| HC | Horse Chestnut |
| HO | Holm Oak |
| HW | Hawthorn |
| HY | Holly |
| JM | Japanese Maple |
| LB | Laburnum |
| LM | Lime |
| LO | Locust Tree |
| LR | Laurel |
| M | Maple |
| MG | Magnolia |
| OK | Oak |
| P | Pine |
| PA | Palm |
| PL | Plane |
| PM | Plum |
| PO | Poplar |
| PP | Pissardii Plum |
| PR | Pear |
| R | Redwood |
| RD | Red Oak |
| RH | Rhododendron |
| RO | Rowan |
| SB | Silver Birch |
| SC | Sweet Chestnut |
| SP | Scots Pine |
| SU | Spruce |
| SY | Sycamore |
| U | Unidentified |
| W | Willow |
| WN | Walnut |
| Y | Yew |

Species / Dia / Spread (max) / Ht
e.g. OK / 0.6 / 8 / 15

KEY

| | |
|---|---|
| BT | British Telecom |
| BOL | Bollard |
| CB | Control Box |
| CL | Cover Level |
| CTV | Cable Television |
| EL | Electric |
| EP | Electricity Pole |
| FH | Fire Hydrant |
| GSV | Gas Stop Valve |
| HT | Height |
| HVC | High Voltage Cable |
| IC | Inspection Cover |
| IL | Invert Level |
| LP | Lamp Post |
| MH | Man-Hole |
| MKR | Marker |
| MW | Monitoring Well |
| O/H | Overhead |
| G | Road Gully |
| PB | Post Box |
| PC | Pram Crossing |
| RNP | Road Name Plate |
| RS | Road Sign |
| S/A | Soakaway |
| ST | Stay / Strut |
| SV | Stop Valve (Unidentified) |
| TB | Telephone Box |
| TC | Telecom |
| TH | Trial Hole |
| TL | Traffic Light |
| TP | Telegraph Pole |
| UTL | Unable to Lift |
| VP | Vent pipe |
| WM | Water Meter |
| WSV | Water Stop Valve |

FENCES

| | |
|---|---|
| BWF | Barbed Wire Fence |
| CBF | Closed Board Fence |
| CF | Concrete Post |
| CPF | Chestnut Paling Fence |
| CWF | Chicken Wire Fence |
| IRF | Iron Railing Fence |
| PKF | Picket Fence |
| PRF | Post & Rail Fence |
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| SP | Steel Post |
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S::R::EY ST::TIO::S

| □a□e | Easting | □orthing | Height | Ty□e |
|---|---|---|---|---|
| S1 | 4□0□8□43□ | □□□3□□4□ | 6□150 | □ail |
| S□ | 4□0□66 5□□ | □□□63□□5 | 6 04□ | □ail |
| S3 | 4□0□8□ | □□□1□□0□ | 6 0□ | □ail |
| S4 | 4□0□□4□6□ | □□□□4□□5 | 5□141 | Peg |
| S5 | 4□0□□□□5□ | □□□□4 630 | 5□25□ | Peg |
| S6 | 4□0□□1 5□0 | □□□□□5□□ | 5 4□□ | Peg |
| S□ | 4□06□1 440 | □□64 843 | 5□25□ | Peg |
| S10 | 4□10□4□4□ | 1001□□0□□ | 5 01□ | Peg |
| S1□ | 4□0□81□0□ | 100□□5□40 | 4□□3 | Peg |
| S13 | 4□1103 00□ | 1001□□40□ | 4□□5 | Peg |
| EP1 | 4□0□□4 06□ | □□□□4 6□□ | □505 | □ail |
| EP□ | 4□0□55□□□ | □□□□136□ | □□□4 | □ail |
| EP3 | 4□065□□01 | □□□1□340 | □□□□ | □ail |

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| W | Willow |
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Species / Dia / Spread (max) / Ht
e.g. OK / 0.6 / 8 / 15

KEY

| | |
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| EP | Electricity Pole |
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| GSV | Gas Stop Valve |
| HT | Height |
| HVC | High Voltage Cable |
| IC | Inspection Cover |
| IL | Invert Level |
| LP | Lamp Post |
| MH | Man-Hole |
| MKR | Marker |
| MW | Monitoring Well |
| O/H | Overhead |
| G | Road Gully |
| PB | Post Box |
| PC | Pram Crossing |
| RNP | Road Name Plate |
| RS | Road Sign |
| S/A | Soakaway |
| ST | Stay / Strut |
| SV | Stop Valve (Unidentified) |
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| MJR/ST/MU | Surveyor |

# Appendix (C)

# Feasibility Study – Site Layout Plan

# Sinah Lane, Hayling Island

**BDW SOUTHAMPTON**

| | | ha | acres |
|---|---|---|---|
| GROSS SITE AREA | | 12.64 | 31.23 |
| NETT SITE AREA | | 4.77 | 11.79 |

12-Feb-2020

| HOUSE TYPE | BED/ROOM/PERSON | DESCRIPTION | STOREYS | NO | MIX | SQ FT | SQ M | TOTAL SQ FT | TOTAL SQ M |
|---|---|---|---|---|---|---|---|---|---|
| **Private Mix** | | | | | | | | | |
| Kenley | 2B/4P | Terr/semi | 2 | 29 | 21 | 615 | 57.1 | 17835 | 1655.9 |
| Maidstone | 3B/5P | Terr / semi | 2 | 45 | 33 | 830 | 77.1 | 37350 | 3469.5 |
| Moresby | 3B/5P | Semi / Detached | 2 | 23 | 17 | 855 | 79.4 | 19665 | 1826.2 |
| Kingsville | 3B/5P | Terr / semi | 2.5 | 14 | 10 | 1072 | 99.6 | 15008 | 1394.4 |
| Chester | 4B/6P | Detached | 2 | 17 | 12 | 1032 | 95.9 | 17544 | 1630.30 |
| Kingsley | 4B/7P | Detached | 2 | 9 | 7 | 1085 | 100.8 | 9765 | 907.20 |
| | | | **TOTAL** | **137** | **100** | | | **117167** | **10883.50** |
| **Affordable Mix** | | | | | | | | | |
| HT1 | 2B/3P | Maisonette | 2 | 2 | 3 | 722 | 67.1 | 1444 | 134.2 |
| HT2 | 2B/3P | Maisonette | 2 | 2 | 3 | 825 | 76.6 | 1650 | 153.2 |
| Ambersham | 2B/3P | Maisonette | 3 | 9 | 16 | 584 | 54.3 | 5256 | 488.7 |
| Maldon | 2B/4P | Maisonette | 3 | 9 | 16 | 676 | 62.8 | 6084 | 565.2 |
| Alverton | 2B/4P | Coach House | 2 | 3 | 5 | 687 | 63.8 | 2061 | 191.4 |
| TS1 | 2B/4P | Terr/semi | 2 | 14 | 24 | 842 | 78.3 | 11788 | 1096.2 |
| TS2 | 3B/5P | Terr/semi | 2 | 13 | 22 | 926 | 86.0 | 12038 | 1118 |
| TS5 | 3B/5P | Terr/semi | 2 | 9 | 9 | 958 | 89.0 | 4790 | 445 |
| TS4 | 4B/6P | Terr/semi | 2 | 1 | 2 | 1104 | 102.6 | 1104 | 102.6 |
| | | | **TOTAL** | **58** | **100** | | | **46215** | **4294.5** |
| | | **OVERALL TOTALS** | | **195** | | | | **163382** | **15178.00** |

| OVERALL DENSITY | |
|---|---|
| UNITS / ha | 40.88 |
| UNITS / ACRE | 16.54 |
| SQ M / ha | 3182 |
| SQ FT / ACRE | 13858 |

| PRIVATE MIX | | TOTAL | % |
|---|---|---|---|
| 2 BED HOUSE/APT | | 29 | 21 |
| 3 BED HOUSE | | 82 | 60 |
| 4 BED HOUSE | | 26 | 19 |
| | | 137 | 100 |

| AFFORDABLE MIX | | |
|---|---|---|
| BEDS | TOTAL | SOCIAL (%) |
| 2 BED | 39 | 67 |
| 3 BED | 19 | 31 |
| 4 BED | 1 | 2 |
| | **58** | **100** |

**NOTE:** Nett area and gross area excludes all public open space and associated structural landscaping / buffer planting

**KEY**

- SITE BOUNDARY — This boundary is subject to confirmation by Client
- SALES AREA
- AFFORDABLE RENT
- SHARED OWNERSHIP
- PROPOSED TREES
- REMOVED TREES
- EXISTING TREES
- 6m EASEMENT
- BLOCK PAVED RAISED TABLE
- HEAVY DUTY CONSTRUCTION FOOTPATH OR DRIVE - CONSTRUCTION TO BE CAPABLE OF ALLOWING EMERGENCY VEHICLE ACCESS

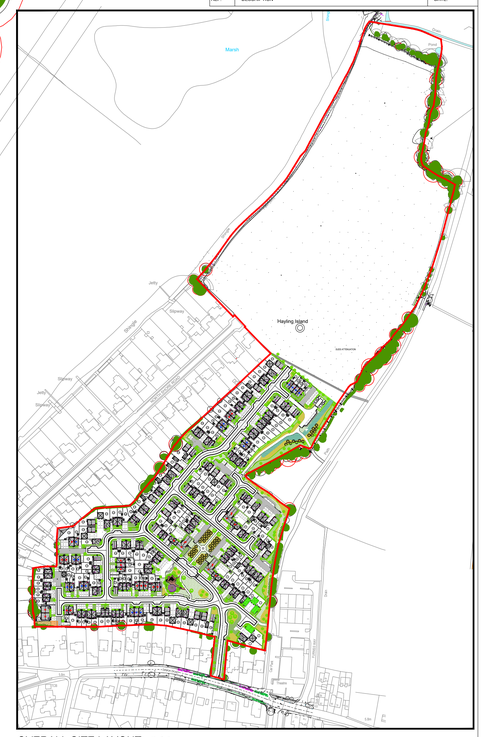
SUDS ATTENUATION

N

DO NOT SCALE
All dimensions to be checked on site and Architect to be notified of any discrepancies prior to commencement

DESIGNER'S RISK ASSESSMENT
Construction (Design and Management) Regulations 2015
RESIDUAL RISKS:

| REF: | DESCRIPTION | DATE: |
|---|---|---|




OVERALL SITE LAYOUT - n.t.s

0 5 10 20 50 metres

Scale 1:500 @ A0

| REVISION | DATE | DESCRIPTION | CHECKED |
|---|---|---|---|
| D27 | 28/02/20 | 2no VP's removed from north of play lap and relocated south of play lap.MF | |
| D26 | 12/02/20 | Plot 129 changed from TS2 to TS1. Plot 149 changed from TS1 to TS5. Schedule updated to correspond.KT | |
| D25 | 12/02/20 | Plots 101-102 & 150-153 changed from TS2's to TS1's and plot 149 changed from TS5 to TS1 all at client request. Schedule updated to correspond.KT | |
| D24 | 11/02/20 | Parking to plots 150-156 reconfigured following comments received from planners. Plots 149-156 repositioned accordingly.KT | |
| D23 | 10/02/20 | Parking to plots 150-156 reconfigured. Visitor parking spaces added adjacent to plot 146 and opposite plots 149 & 194.KT | |
| D22 | 07/02/20 | Fences to plots 147-152 reconfigured to allow for larger gardens to plots 150-152 following comments received from client.KT | |
| D21 | 07/02/20 | Area of land to plots 142-156 redesigned to omit apartments and replace with housing at planners request. Housing schedule updated to correspond. Plots 101-102 amended from Maidstone's to Type 52's. Plot 128 amended from shared ownership to affordable rent at client request.KT | |
| P6 | 18/12/19 | Boundary walls to plots 105, 110, 135-136, 139, 143, 157-158 omitted and replaced with fencing at client request. Maldon and Alverton bedroom/person corrected on schedule. Latest landscaping added.KT | |
| P5 | 13/12/19 | D20 issued for planning.KT | |
| D20 | 05/12/19 | Cycle storage indicated to all for sale plots without a garage at client request. Bollards at to road stub to northern field access. Footpath behind plots 72-83 repositioned to allow for wider buffer planting.KT | |
| P4 | 20/09/19 | Cycle storage indicated to all for sale plots without a garage at client request.KT | |
| D19 | 14/11/19 | Brickwork wall forming plot 1 boundary amended to 1.8m high close boarded timber fence and repositioned. 3m link footpath serving plots 72-75 omitted and parking repositioned. Bollards indicated to footpaths adjacent to plots 3, 72 & 87.KT | |
| P3 | 11/09/19 | D18 issued for planning.KT | |
| D18 | 10/09/19 | Plot 128 amended to Type 54 in lieu of Type 52. Plots 131-132 amended from affordable rent to shared ownership. Schedule updated to correspond. All amendments carried out following comments received from LA Housing Officer.KT | |
| P2 | 16/07/19 | Plot 6 amended to Kingsville V1 type. Plot 112-113 amended to Kingsley V2 house type. Plots 119-120 & 180-181 amended to Kingsville V2 type. Plot 126 amended to Kingsley V1 house type.KT | |
| P1 | 28/06/19 | Latest landscaping added. Issued for planning.KT | |
| D17 | 26/06/19 | LEAP changed to LAP. Raised table added adjacent to plots 11-22 and block paving removed. Service margins increased to 2m in width. Footpath and service strip in front of plots 1&2 amended. All amendments carried out as client request.KT | |
| D16 | 26/06/19 | VP adjacent to plot 84 repositioned adjacent to plot 75. Plots 72-75 repositioned. Shared drive opposite plot 68 amended to fire tender. All amendments carried out following RCP highways review.KT | |
| D15 | 25/06/19 | Kingsley gable projection increased in width at client request. Schedule updated to correspond.KT | |
| D14 | 21/06/19 | Shed and bins to plot 127 repositioned. Boundary walls added to plots 1, 26, 29, 33-34, 55, 60, 61, 65-66, 75, 84, 105, 110, 120, 135-136, 139, 144, 157-158 & 195.KT | |
| D13 | 14/06/19 | VP's opposite plot 195 and adjacent to plots 60 & 105 repositioned out of visibility splays. All raised tables and vertical deflection omitted. Footpath adjacent to plots 72-75 increased to 3m wide. Corner adjacent to plot 26 reconfigured to be speed control bend. Plot 195 repositioned out of visibility splay & associated parking reconfigured. All side road reduced in width to 4.8m with the exception of side road serving plots 1-6. Plots 1-2, 36-87 & 158-173 repositioned to suit new road pattern. All amendments carried out following receipt of RCP comments dated 13/06/19.KT | |
| D12 | 23/05/19 | Roads serving plots 34-48, 56-59, 120-141 & 144-192 amended to be shared surface. 3no vp's adjacent to site entrance repositioned opposite plot 10. 5no 'end on' vp bays opposite plot 195 redistributed to be 2no parallel bays opposite plot 195, 2no parallel bays opposite plots 68-70 and 1no parallel bay opposite plot 87. Additional footpaths added opposite plots 10, 192-195 and adjacent to plots 48 and 55 & 65.KT | |
| D11 | 04/04/19 | Block paving indicated to shared drives serving plots 1-6, 61-64, 67-71, 144-147. Railings indicated adjacent to plots 11-22, 49-54 & 148-153. Substation repositioned adjacent to plot 163. Parking to plots 128-130 amended. Land adjacent to plot 128 indicated to be conveyed to neighbouring dwellings. Plots 174-175 moved forward and plot 174 parking repositioned.KT | |

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PROJECT / CLIENT
Sinah Lane, Hayling Island
for BDW Southampton

DRAWING TITLE
Proposed Site Layout

| | | | |
|---|---|---|---|
| PROJECT ARCHITECT | KD | PROJECT NO. N81:2517 | DRAWING REVISION D27 |
| DRAWN BY | KT | | |
| CHECKED | IDP | DRAWING NO. PL-02 | |
| SCALE | 1: 500 @ A0 | DRAWING STATUS DRAFT | |
| DATE | January 2019 | | |

BARRATT HOMES


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# Appendix (D)

# Geotechnical Information

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH1**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale yellowish brown and brown very silty CLAY |
| | | 1.00 | D | | | | | |
| | | 1.50 | D | | 1.55 | | | |
| | | | | | 1.70 | | | Pale yellowish brown silty very sandy fine to medium flint GRAVEL |
| | | | | | 1.85 | | | |
| | | 2.00 | D | | | | | Pale yellowish brown and orange-brown silty SAND |
| | | 2.50 | D | | | | | Yellowish orange-brown and yellowish brown silty SAND with scattered fine to medium flint gravel |
| | ▽ | 3.00 | D | | | | | |
| | | 3.50 | D | | 3.50 | | | Stiff bluish grey silty sandy CLAY |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 2.90m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH2**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.50 | D | | 0.50 | | | TOPSOIL |
| | | 1.00 | D | | | | | Pale yellowish grey brown silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.50 | D | | 1.40 | | | Pale orange-brown and yellowish brown sandy locally silty clayey SILT |
| | | 2.00 | D | | | | | |
| | | 2.50 | D | | 2.60 | | | Stiff dark bluish grey fissured CLAY |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 1.80m. Standpipe installed with a response zone from 1.00m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH3**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing Depth (m) | Type | Results | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | 0.25 | D | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale yellowish brown silty sandy CLAY with scattered fine flint gravel |
| | | 0.75 | D | | | | | |
| | | 1.00 | SPT | N=39 | | | | |
| | | 1.00 | D | (4,10/ 12,11,8,8) | 1.10 | | | Pale grey silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.50 | D | | 1.40 | | | Pale grey becoming orange-brown silty SAND with occasional fine flint gravel |
| | | 2.00 | SPT | N=21 | | | | |
| | | 2.00 | D | (3,6/ 5,6,5,5) | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | SPT | N=45 | 2.80 | | | Stiff dark bluish grey silty CLAY with claystone at 3.20m. |
| | | 3.00 | D | (1,2/ 2,1,13,29) | | | | |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 1.70m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH4**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.40 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale brow silty sandy CLAY |
| | | 1.00 | D | | | | | |
| | | 1.50 | D | | 1.60 | | | |
| | ▽ | | | | 1.70 | | | Firm pale grey mottled pale brown silty CLAY |
| | | 2.00 | D | | | | | Pale orange-brown silty sandy fine to medium flint GRAVEL |
| | | | | | 2.10 | | | Pale orange-brown silty SAND with abundant fine flint gravel |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | 3.60 | | | Stiff dark bluish grey locally silty CLAY |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | | Type | Results | | | |

Remarks: Groundwater encountered at 1.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH5**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.25 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm orange-brown silty sandy CLAY with occasional fine flint gravel |
| | | 1.00 | D | | | | | |
| | | | | | 1.30 | | | Orange-brown silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.50 | D | | | | | |
| | | | | | 1.90 | | | Pale yellowish brown silty SAND |
| | | 2.00 | D | | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | 3.50 | | | Firm pale brown and brown silty sandy CLAY |
| | | | | | 3.90 | | | |
| | | 4.00 | D | | 4.00 | | | Stiff dark bluish grey silty CLAY |
| | | | | | | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 1.70m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH6**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.50 | D | | 0.50 | | | TOPSOIL with abundant fine to medium flint gravel |
| | | 1.00 | D | | | | | "Stiff" pale grey and orange-brown silty sandy CLAY - desiccated |
| | | 1.50 | D | | 1.50 | | | Pale grey and brown silty sandy locally clayey fine to medium flint GRAVEL |
| | ▽ | 2.00 | D | | 2.10 | | | Orange-brown and brown silty locally clayey SAND |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | 3.00 | | | End of Borehole at 3.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwate encountered at 1.90m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH7**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing Depth (m) | Type | Results | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | 0.25 | D | | 0.25 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale yellowish brown and brown silty sandy CLAY |
| | | 0.75 | D | | | | | |
| | | 1.00 | SPT | N=28 | 0.95 | | | Pale brown and pale grey silty sandy fine to medium flint GRAVEL |
| | | 1.00 | D | (5,9/ 7,7,7,7) | | | | |
| | ▽ | 1.50 | D | | 1.40 | | | Pale grey locally clayey fine silty SAND with occasional fine rounded flint gravel |
| | | 2.00 | SPT | N=7 | | | | |
| | | 2.00 | D | (4,4/ 4,2,1,0) | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | SPT | N=7 | 2.85 3.00 | | | Stiff dark bluish grey silty CLAY |
| | | 3.00 | D | (1,1/ 1,2,2,2) | | | | End of Borehole at 3.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 1.70m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH8**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.20 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm brown silty sandy CLAY |
| | | 0.75 | D | | | | | |
| | | 1.00 | SPT | N=22 | 0.90 | | | Pale grey silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.00 | D | (6,9/ 5,5,5,7) | 1.20 | | | Orange-brown silty fine SAND with occasional fine flint gravel |
| | | 1.50 | D | | | | | |
| | | 2.00 | SPT | N=0 | | | | |
| | | 2.00 | D | (2,1/ -,-,-,-) | | | | |
| | | 2.50 | D | | 2.60 | | | Stiff dark bluish grey silty CLAY |
| | | 3.00 | SPT | N=8 | 3.00 | | | End of Borehole at 3.00 m |
| | | 3.00 | D | (1,1/ 2,2,2,2) | | | | |
| | | | Type | Results | | | | |

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encounterd at 1.30m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH9**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 22/09/2014 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.30 | | | MADE GROUND (reworked topsoil) |
| | | 0.50 | D | | | | | Firm orange-brown and brown silty sandy CLAY |
| | | 1.00 | D | | | | | |
| | | | | | 1.20 | | | Orange-brown, pale grey and brown silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.50 | D | | | | | |
| | | | | | 1.80 | | | Pale orange-brown silty fine SAND with scattered fine flint gravel |
| | | 2.00 | D | | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | | | | 3.40 | | | Stiff dark bluish grey fissured CLAY |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | | Type / Results | | | | |

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encountered at 1.70m. Standpipe installed with a response ezone from 0.50m to 2.5m. Borehole backfilled on completion.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH10**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.20 | | | TOPSOIL |
| | | 0.50 | D | | | | | "Stiff" brown silty sandy CLAY - desiccated with roothairs |
| | | | | | 0.60 | | | Firm brown becoming pale brown silty locally sandy CLAY |
| | | 1.00 | D | | | | | |
| | ▽ | 1.50 | D | | | | | |
| | | | | | 1.70 | | | Yellowish bronw silty sandy fine to medium flint GRAVEL |
| | | 2.00 | D | | 1.90 | | | Brown and pale brown silty fine SAND with soft clay layers |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | | | | 3.70 | | | Stiff dark grey very silty CLAY |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | | Type | Results | | | |

Remarks: Groundwater encountered at 1.70m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH11**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | 0.60 | | | "Stiff" brown silty sandy CLAY with rootlets - desiccated |
| | | 1.00 | D | | | | | Pale brown and yellowish brown silty sandy fine to medium flint GRAVEL |
| | ▽ | 1.50 | D | | | | | |
| | | 2.00 | D | | 1.85 | | | Pale brown silty SAND with abundant fine flint gravel |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 3.85<br>4.00 | | | Stiff dark bluish grey CLAY<br>End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Gorundwater encounterd at 1.30m. Standpipe installed with a response zone from 0.50m to 3.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH12**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.25 | D | | 0.25 | | | TOPSOIL |
| | | 0.50 | D | | | | | Soft pale grey and brown mottled sandy CLAY |
| | | 1.00 | D | | | | | |
| | | | | | 1.30 | | | |
| | ▽ | 1.50 | D | | 1.40 | | | Pale grey silty fine SAND |
| | | | | | 1.70 | | | Pale grey very silty very sandy scattered fine to medium flint GRAVEL |
| | | 2.00 | D | | | | | Orange-brown and yellowish brown silty fine SAND with scattered fine flint gravel |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | | | | 3.90 | | | |
| | | 4.00 | D | | 4.00 | | | Stiff dark grey very silty CLAY |
| | | | | | | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encountered at 1.70m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH13**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.20 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale brown silty sandy CLAY |
| | | 1.00 | D | | 0.90 | | | Pale brown and grey silty sandy clayey fine tto medium flint GRAVEL |
| | ▽ | 1.50 | D | | 1.50 | | | Pale brown and greyish brown silty fine SAND with scatterd fine flint gravel and occasional pockets of clayey sand |
| | | 2.00 | D | | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | | | | 3.70 | | | Dark orange-brown very sandy CLAY |
| | | | | | 3.80 | | | |
| | | 4.00 | D | | 3.90 | | | Dark orange-brown very sandy CLAY |
| | | | | | 4.00 | | | Stiff dark grey CLAY |
| | | | | | | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encountered at 1.60m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH14**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm pale brown silty sandy CLAY |
| | | | | | 0.80 | | | |
| | | 1.00 | SPT | N=60 (10,15/ 13,15,15,17) | | | | Dense brown silty sandy locally clayey fine to medium flint GRAVEL |
| | | 1.80 | SPT | 50 (17,18/ 21,29) | 1.80 | | | End of Borehole at 1.80 m |
| | | | Type | Results | | | | |

Remarks: Sampler terminated in dense gravel at 1.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH15**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing | | | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm brown silty sandy CLAY |
| | | 1.00 | D | | | | | |
| | ▽ | 1.50 | D | | 1.40 | | | Pale grey and brown mottled silty sandy fine to medium flint GRAVEL |
| | | 2.00 | D | | 2.10 | | | Orange-brown silty fine SAND withscattered fine flint gravel and layers of soft very sandy clay |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 3.90 | | | Stiff dark grey sandy silty CLAY |
| | | | | | 4.00 | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

Remarks: Groundwater encountered at 1.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
**BH16**
Sheet 1 of 1

| Project Name | Project No. | Co-ords: - | Hole Type |
|---|---|---|---|
| Sinah Lane Development Site | J16123 | | WLS |
| Location: Hayling Island, Hampshire | | Level: - | Scale 1:50 |
| Client: BDW Southampton | | Dates: 23/09/2016 | Logged By DPB |

| Well | Water Strikes | Samples & In Situ Testing Depth (m) | Type | Results | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.30 | | | TOPSOIL |
| | | 0.50 | D | | | | | Firm orange-brown and brown silty sandy CLAY |
| | | 1.00 | D | | | | | |
| | ▽ | 1.50 | D | | 1.60 | | | Orange-brown silty SAND with fine flint gravel |
| | | 2.00 | D | | | | | |
| | | 2.50 | D | | | | | |
| | | 3.00 | D | | | | | |
| | | 3.50 | D | | | | | |
| | | 4.00 | D | | 4.00 | | | End of Borehole at 4.00 m |
| | | | Type | Results | | | | |

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encounterd at 1.60m. Standpipe installed with a response zone from 1.00m to 3.00m. Borehole collapsed to 3.00m.

AGS

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GEOTECHNICAL & ENVIRONMENTAL

Carters Barn
Sherrington
Wiltshire
BA12 0SN

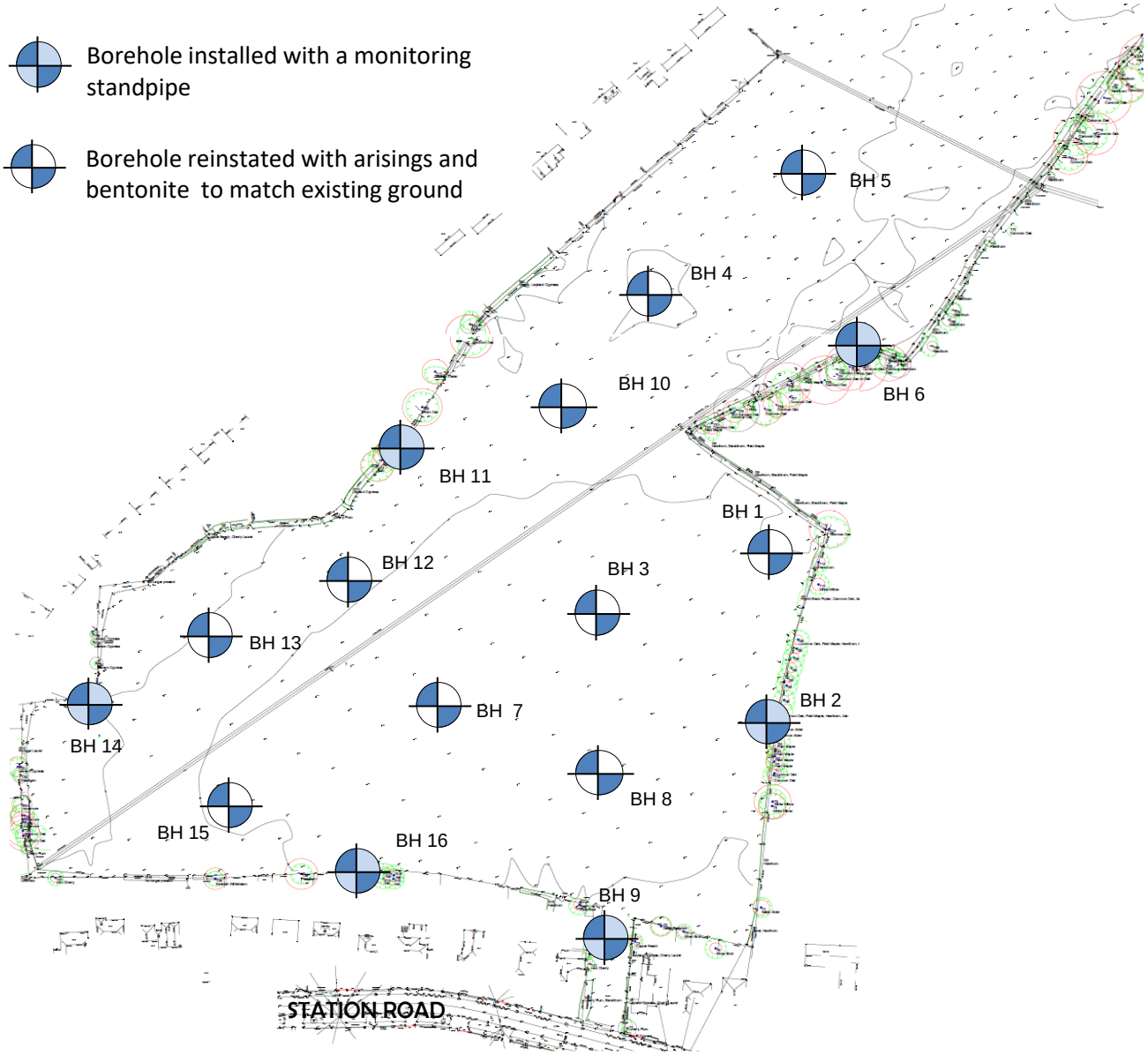
# Site Plan

**Site** Sinah Lane Site, Hayling Island, Hampshire

**Client** BDW Southampton

Borehole installed with a monitoring standpipe

Borehole reinstated with arisings and bentonite to match existing ground




## Winter Water Level Monitoring Records 2017/2018

| | BH 2 | BH 6 | BH 9 | BH 11 | BH 14 | BH 16 |
|---|---|---|---|---|---|---|
| 09/10/2017 | 1.79 | 2.52 | 1.62 | 1.66 | 1.35 | 0.89 |
| 03/11/2017 | 1.62 | 2.41 | 1.62 | 1.66 | 1.21 | 0.92 |
| 07/12/2017 | 1.59 | 2.23 | 1.62 | 1.67 | 1.11 | 1.10 |
| 10/01/2018 | 0.48 | 1.13 | 1.16 | 1.00 | 0.82 | 0.40 |
| 06/02/2018 | 0.52 | 1.13 | 1.22 | 1.00 | 0.89 | 0.52 |
| 05/03/2018 | 0.45 | 1.13 | 1.18 | 1.09 | 0.91 | 0.43 |




Approximate Scale in metres

Sinah Lane Site Plan

# Appendix (E)

# Environment Agency Correspondence

| | |
|---|---|
| **From:** | Karren Johnston |
| **To:** | "Maskell, Jon" |
| **Subject:** | RE: Sinah Lane, Hayling Island, PO11 0EY - Flooding |
| **Date:** | 11 May 2017 19:55:38 |
| **Attachments:** | image001.jpg<br>image002.png<br>image003.jpg |

Jon

Thank you for your response.

I have been in touch with the LLFA, but I just wanted to check that there were no special issues relating to Hayling Island that the EA were interested parties to. From your response I note that I should continue to liaise with the LLFA.

Thank you again for your time.

Kind regards,

Karren

**Karren Johnston** BEng (Hons) CEng MICE
**Engineering Associate**

**Rogers Cory Partnership Ltd**
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**t** 01256 769269 **e** karren@rcpconsultants.co.uk
**m** 07484060847 **w** rcpconsultants.co.uk

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**From:** Maskell, Jon [mailto:jon.maskell@environment-agency.gov.uk]
**Sent:** 09 May 2017 16:34
**To:** Karren Johnston <Karren@rcpconsultants.co.uk>
**Subject:** RE: Sinah Lane, Hayling Island, PO11 0EY - Flooding

Hello Karren,

Thanks for your email regarding the above site in Havant.

As you have pointed out, the site you are proposing to develop falls within Flood Zone 1 (areas with a low probability of river or sea flooding). In line with Development Management Procedure Order the Environment Agency is not a statutory consultee for development in flood zone 1 and therefore we would not be consulted at the planning stage and therefore not provide any comment to the Local Planning Authority (LPA).

Legally we are only allowed to recover costs for work that we would be statutory on at the planning

stage and therefore I am afraid that we will not be able to provide you with any detailed advice with regards to the site in this instance.

I have however, provided some generic advice that may be of help below:

Access & Egress

Whilst the site itself is not in a high flood risk area (flood zone 2 or 3) it is pertinent to highlight the potentially significant flood risk facing the primary access and egress routes from Hayling Island. This is especially important given the lack of services, such as a hospital available on Hayling. It is for the council to assess the sustainability of development (now and in the future) in this location and ensure that flood risk is a significant part of this. This should include consideration of the flood risk management hierarchy including your preference for either safe access and egress, flood warning and evacuation and / or safe refuge in an extreme flood event. We would recommend that you liaise with Havant Borough Council and their Emergency Planners on this issue.

It is a requirement of the NPPF that any planning application submitted for development that is over 1 hectare in size in Flood Zone 1 is accompanied by a Flood Risk Assessment (FRA). Guidance on the requirements for undertaking a FRA can be found online at:

https://www.gov.uk/guidance/flood-risk-assessment-in-flood-zone-1-and-critical-drainage-areas; and

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311502/LIT_9193.pdf

Surface Water:

-

Amendments to the Development Management Procedure Order (DMPO) came into effect on 15 April 2015. As a result we are no longer a statutory consultee on 'development of land over 1 hectare' (Para zf of DMPO 2010, Schedule 5) and will therefore no long provide comment on the surface water aspects of these proposals. Please be aware that we are still statutory consultee on any development (other than minor development) in Flood Zones 2 and 3.

Hampshire County Council, as the Lead Local Flood Authority is now statutory consultee for 'Major development with Surface Water Drainage', we therefore recommend that you consult them on this issue.

Kind Regards

Jon

Jon Maskell | Sustainable Places Advisor | Solent and South Downs Area | Environment Planning and Engagement
Environment Agency | Romsey District Office | Canal Walk | Romsey | Hampshire | SO51 7LP

Tel: 020 8474 5888

jon.maskell@environment-agency.gov.uk

**We offer a cost recovery service for bespoke pre-application advice**. For more information go to: gov.uk or email us

**Flood Risk Standing Advice was updated on 15 April 2015. For more information please follow the links below:**

For developers: FRSA developers page
For councils: FRSA council's page

Our **climate change allowances** for planning were updated on 19 February 2016. The guidance is accessible here: Flood risk assessment: Climate change allowances

---

**From:** Karren Johnston [mailto:Karren@rcpconsultants.co.uk]
**Sent:** 08 May 2017 16:39
**To:** Maskell, Jon <jon.maskell@environment-agency.gov.uk>
**Subject:** Sinah Lane, Hayling Island, PO11 0EY - Flooding

Jon,

I've been given your contact details by Terry Seymour.

Our Client is looking to develop the above site with circa 150 residential houses. I have attached a location plan to show where the site is. We are currently undertaking to support the planning application and would like to meet with you to discuss the site and any issues that we may need to deal with from the Environment Agencies point of view. In particular with respect to flood risk and coastal flood risk especially as we are on Hayling Island. The site is shown as being in Flood Zone 1 by the EA flood maps. EA maps also currently show no issue with coastal flooding, although there do seem to be some pockets of surface water flooding on the maps within the site.

Are there any particular issues with regard to the main road access to the island that we need to be aware of?

Is it possible to give me some dates when you are available in the coming weeks so that we can meet with you to discuss the site. Any information that you feel relevant in the meantime regarding the site would be gratefully received. If you need any further information regarding the site then please let me know.

Kind regards,

Karren

**Karren Johnston** BEng (Hons) CEng MICE
**Engineering Associate**

**Rogers Cory Partnership Ltd**
Architectural & Civil Consultants
The Old School Old School Road
Hook Hampshire RG27 9NJ
**t** 01256 769269 **e** karren@rcpconsultants.co.uk
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# Appendix (F)

# Local Authority Correspondence

# Sinah Lane, Hayling Island
# Meeting / Site Visit Notes

**Location:** Site off Sinah Lane, Hayling Island

**Date:** 14th June

**Time:** 10am

**Present:** Steve Mountain - Havant Borough council (SM)

Karren Johnston – RCP (KJ)

---

**Purpose:** To walk the downstream ditches to establish condition given that this site will discharge at greenfield rate to the existing ditch network.

**Notes of Meeting / Walkround:**

1. We discussed the lay of the land. RCP to clarify topographical survey levels and include in submission reasons why part of the site cannot fall to the existing sewer in Sinah Lane.

2. Steve Mountain queried the lack of SuDS features amongst the residential units. RCP to include in submission technical note explaining how strategy is arrived at and why on site SuDS features cannot be utilised. Steve also confirmed given his locally knowledge that the ground water was high and had tidal fluctuations.

3. The surface water drainage strategy was discussed. RCP will put together a comprehensive technical note on how the strategy has been arrived at given the lack of SuDS on the development site, but with the use of a pond adjacent the site.

4. SM had a plan from Southern Water showing the wider area from that obtained for the site specific asset search. This has the ditch network, which eventually outfalls to the Southern Water Network.

5. SM suggested that we contact Southern Water to discuss capacity in their piped system to the north of the island. KJ agreed noting item 6 below.

6. It was noted that the greenfield runoff had been calculated and that the site discharge from the pond would be restricted at this rate. This would mean that the runoff from the site would mimic the existing situation. Therefore the discharge in the ditches would not increase and therefore no more capacity required in the Southern Water network.

7. The ditch runs first in a westerly direction under the Hayling Billy Coastal Path before turning North. SM pointed out areas where the existing ditch network floods. These were areas of open common land and did not affect any local residents.

8. SM asked that the developer assess the condition of any piped sections for the downstream ditch system especially that as it leaves the site to cross the Hayling Billy Coastal Path.

9. The ditch runs mainly through open farmed fields, but in the north runs under a property not shown on the plan. The owner of the property confronted us as we were standing in the field looking at the headwall to the rear of his property as he knew the owner of the field. The owner was able to give interesting local knowledge and was comforted when SM told him we were walking the ditches to check they were clear before winter.

10. The owner said that he had recently cleared the ditch at the rear of his property (we could see the matt of grass cutting that he had cleared on the bank) as it was backing up and was in danger of flooding his property which was at a lower level than the field at the rear. SM was encouraged to see that the resident had taken responsibility to clear the ditch. The owner had no objection to a cctv survey of the pipe under his house being carried out with notice being given.

11. The ditch in the front garden was well maintained with gabion walling as it was quite deep. The incoming pipe (under the house) was about 600mm diameter. The outgoing pipe running under the road was also about 600mm diameter.

12. Generally the ditches were 900mm to 1200mm deep, well defined and in good condition. They were overgrown as expected at this time of year, but not overly impeding volume or flow.

---

**Southern Water Asset Plan – Showing Ditch Locations**



# Appendix (G)

# Existing Drainage Regime

## ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 SAAR (mm) 700 Urban 0.000
Area (ha) 2.913 Soil 0.400 Region Number Region 7

**Results l/s**

QBAR Rural 9.9
QBAR Urban 9.9

Q1 year 8.4

Q1 year 8.4
Q30 years 22.5
Q100 years 31.6

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## Greenfield Runoff Volume

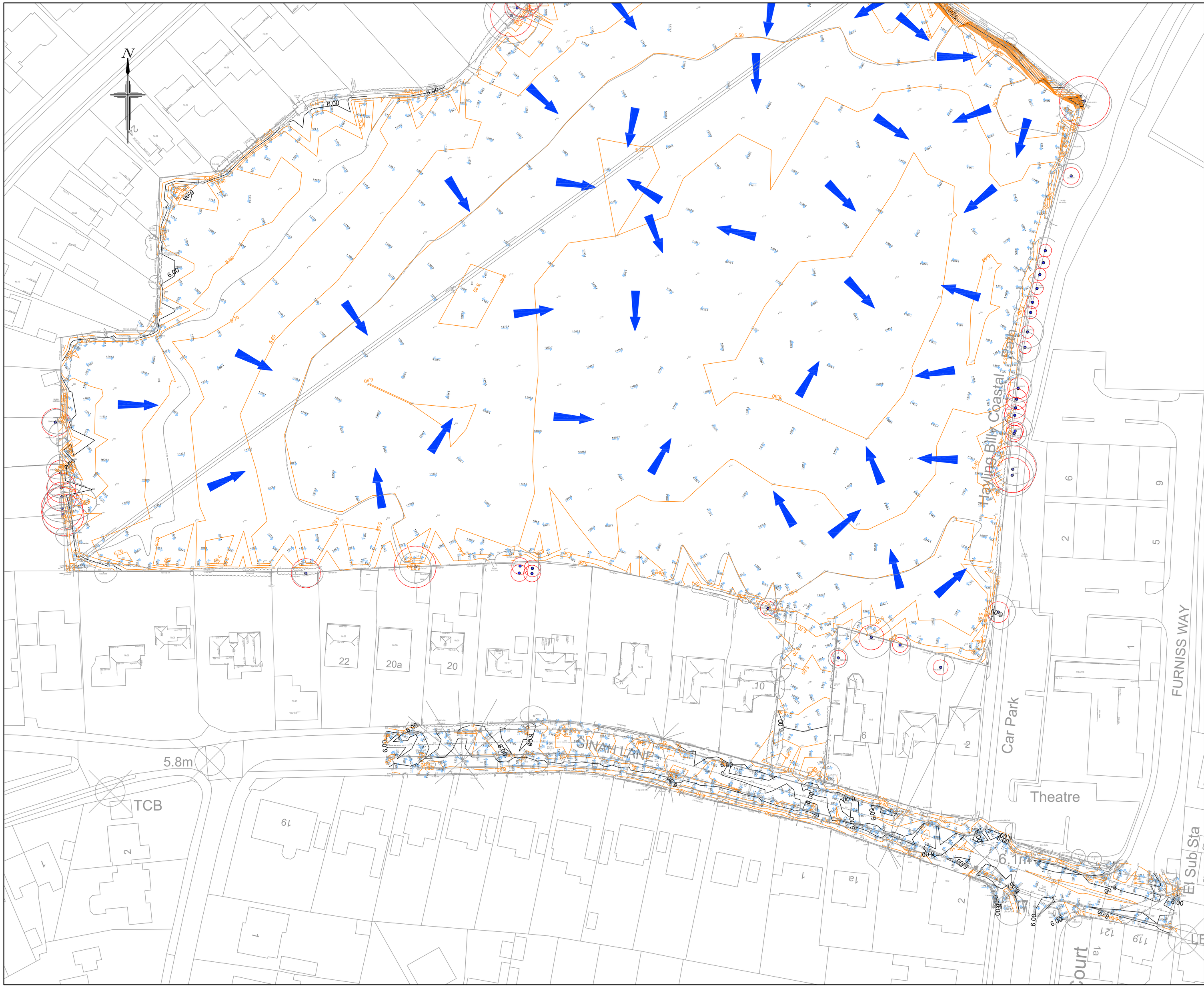
FSR Data

| | |
|---|---|
| Return Period (years) | 100 |
| Storm Duration (mins) | 360 |
| Region | England and Wales |
| M5-60 (mm) | 19.000 |
| Ratio R | 0.350 |
| Areal Reduction Factor | 1.00 |
| Area (ha) | 2.913 |
| SAAR (mm) | 700 |
| CWI | 105.000 |
| Urban | 0.000 |
| SPR | 37.000 |

Results

| | |
|---|---|
| Percentage Runoff (%) | 36.04 |
| Greenfield Runoff Volume ($m^3$) | 661.756 |

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## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D17 dated dated 26/06/2019.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Layout review is subject to receipt of finalised layout proposal and the final highway layout design will be subject to the outcome of consultation with Hampshire County Council.
6. Red indicates vehicle moving forward, blue indicates vehicle reversing.

## KEY:

Existing flow routes

Existing Ground Level

Existing Ground Fall Arrow and gradient 181.6

Primary Ground Contour 6.000

Secondary Ground Contour 5.850

Root Protection Area (RPA) for Retained Trees
***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

0m 5m 10m 20m 30m 40m 50m

SCALE BAR 1:500 at A1

| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| A | 28.06.19 | Note 2 updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |

Client:-

BARRATT HOMES

Site:-
Sinah Lane
Hayling Island

Drawing Title:-
BASELINE HYDROLOGY

SHEET 1 OF 2

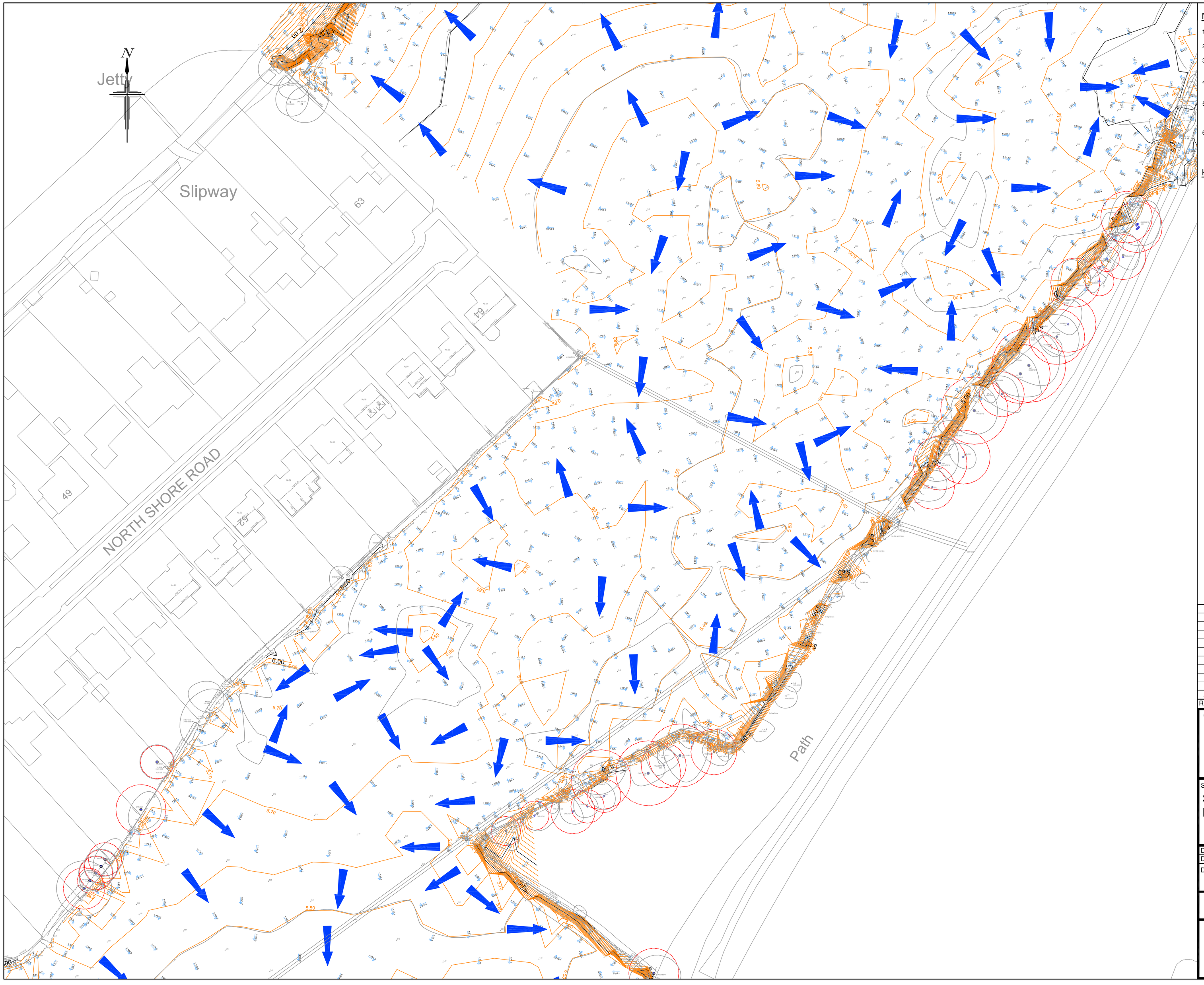
Date: June 2018 | Scales: 1:500 at A1

Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No.
BSO/E4513/024 A

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## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D17 dated dated 26/06/2019.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Layout review is subject to receipt of finalised layout proposal and the final highway layout design will be subject to the outcome of consultation with Hampshire County Council.
6. Red indicates vehicle moving forward, blue indicates vehicle reversing.

## KEY:

Existing flow routes

Existing Ground Level

Existing Ground Fall Arrow and gradient

Primary Ground Contour — 6.000

Secondary Ground Contour — 5.850

Root Protection Area (RPA) for Retained Trees
***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

0m 5m 10m 20m 30m 40m 50m

SCALE BAR 1:500 at A1

| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| A | 28.06.19 | Note 2 updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |

Client:-

BARRATT HOMES

Site:-
Sinah Lane
Hayling Island

Drawing Title:-
BASELINE HYDROLOGY

SHEET 2 OF 2

Date: June 2018 | Scales: 1:500 at A1

Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No.
BSO/E4513/025 A

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# Appendix (H)

# Proposed Surface Water Strategy

## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D27 dated dated 28/02/2020.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Level strategy is subject to further design development. Extent of any retaining shown is indicative only and subject to a further detailed review.
6. ***ANY VARIANCE OR DISCREPANCY MUST BE REPORTED BACK TO RCP ENGINEERING BEFORE WORK BEGINS.***

## KEY

- Site Boundary
- Proposed Surface Water Sewer (S5)
- Proposed Foul Water Sewer (F5)
- Existing Southern Water Foul Sewer (S5)
- Proposed Foul Water Rising Main
- Area of Public Open Space to be used as localised storage in peak storm events
- Cellular storage tank
- Wehohlte (or similar) large diameter storage pipes
- Proposed Headwall
- Proposed Surface Water Swale
- 3.0m Maintenance Easement
- Root Protection Area (RPA) for Retained Trees ***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

***Any proposed works within Root Protection Areas are subject to supervision and approval by the Arboriculturist.***

## CDM NOTES

1. EXISTING SERVICES. Depth of existing services must be determined prior to works commencing. The contractor is responsible for establishing underground services in accordance with HSE Guidance note HS (G) 47. Any services which would be within the proposed construction layers must be lowered to below the sub-base.

SCALE BAR 1:500 at A1

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| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| C | 02.03.20 | Updated in accordance with rev. D23 of IDP Site Layout. | TRS | TRS | TRS |
| B | 27.06.19 | Updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |
| A | 04.07.18 | Updated in accordance with latest IDP Site Layout PL-02A | SRV | VPI | TRS |

Client:- BARRATT HOMES

Site:- Sinah Lane, Hayling Island

Drawing Title:- DRAINAGE STRATEGY

SHEET 1 OF 2

Date: June 2018 | Scales: 1:500 at A1

Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No. BSO/E4513/012 C

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1:500 KEYPLAN

N

Jetty

Slipway

Shingle

NORTH SHORE ROAD

Hayling Island

New Foul Water Manhole to be Constructed Online of Existing Southern Water Sewer

Foul Water Proposed Rising Main Outfall Chamber

Foul Water Rising Main. Rising Main Diameter is Subject to Detailed Design by Specialist.

Existing Water Course

Outfall into Existing Water Course

SWMH S2 - Control Chamber
Hydro-Brake details:
Design Head=0.90m
Design Flow: 9.9 l/s

Outfall Headwall

Outfall Headwall

Conveyance Swale

3.0m Maintenance Easement

Low flow channel

SUDS ATTENUATION
ATTENUATION BASIN
BASE LEVEL - 4.450m

FARM ACCESS

Surface Water Storage Tank
127m x 2.0m Dia (400m³)
BL 1.600

Conveyance Swale

FWMH F1 - Foul Water Pumping Station

SWMH S4 - Surface Water Pumping Station
Pump Rate: 100 l/s

SWMH S5 - Control Chamber
Hydro-Brake details:
Design Head=1.500m
Design Flow: 250.0 l/s

Surface Water Rising Main

SWMH S3 Rising Main Outfall Chamber

Outfall Headwall

Swale

Path

## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D27 dated dated 28/02/2020.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Level strategy is subject to further design development. Extent of any retaining shown is indicative only and subject to a further detailed review.
6. ***ANY VARIANCE OR DISCREPANCY MUST BE REPORTED BACK TO RCP ENGINEERING BEFORE WORK BEGINS.***

## KEY

- Site Boundary
- Proposed Surface Water Sewer (S5)
- Proposed Foul Water Sewer (F5)
- Existing Southern Water Foul Sewer (S5)
- Proposed Foul Water Rising Main
- Area of Public Open Space to be used as localised storage in peak storm events
- Cellular storage tank
- Wehobite (or similar) large diameter storage pipes
- Proposed Headwall
- Proposed Surface Water Swale
- 3.0m Maintenance Easement
- Root Protection Area (RPA) for Retained Trees ***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

***Any proposed works within Root Protection Areas are subject to supervision and approval by the Arboriculturist.***

## CDM NOTES

1. EXISTING SERVICES. Depth of existing services must be determined prior to works commencing. The contractor is responsible for establishing underground services in accordance with HSE Guidance note HS (G) 47. Any services which would be within the proposed construction layers must be lowered to below the sub-base.

0m 5m 10m 20m 30m 40m 50m

SCALE BAR 1:500 at A1

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| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| D | 02.03.20 | Updated in accordance with rev. D23 of IDP Site Layout. | TRS | TRS | TRS |
| C | 27.06.19 | Updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |
| B | 27.07.18 | Foul water RM and Outfall added | KK | SV | TRS |
| A | 04.07.18 | Updated in accordance with latest IDP Site Layout PL-02A | SRV | VPI | TRS |

Client:- BARRATT HOMES

Site:- Sinah Lane, Hayling Island

Drawing Title:- DRAINAGE STRATEGY

SHEET 2 OF 2

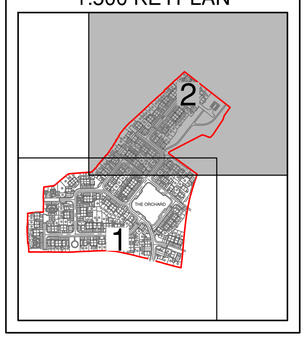
Date: June 2018 | Scales: 1:500 at A1

Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No. BSO/E4513/013 D

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1:500 KEYPLAN




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# Appendix (I)

# MicroDrainage Calculations

## STORM SEWER DESIGN by the Modified Rational Method

### Design Criteria for SW1.SWS

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) | 1.000 |
| Maximum Rainfall (mm/hr) | 50 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 1.350 |
| 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 SW1.SWS

| 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 | 57.895 | 0.236 | 245.0 | 0.067 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.001 | 11.519 | 0.490 | 23.5 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S2.000 | 16.094 | 0.198 | 81.3 | 0.092 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S2.001 | 11.568 | 0.082 | 141.1 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.002 | 16.825 | 0.105 | 160.2 | 0.047 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.000 | 22.770 | 0.255 | 89.3 | 0.050 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.001 | 18.026 | 0.192 | 93.9 | 0.064 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S3.002 | 13.827 | 0.056 | 245.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.003 | 13.761 | 0.056 | 245.7 | 0.051 | 0.00 | 0.0 | 0.600 | o | 600 | Pipe/Conduit | |
| S1.004 | 42.555 | 0.174 | 244.6 | 0.104 | 0.00 | 0.0 | 0.600 | o | 600 | Pipe/Conduit | |
| S1.005 | 49.813 | 0.203 | 245.4 | 0.067 | 0.00 | 0.0 | 0.600 | o | 600 | 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 | 5.96 | 4.089 | 0.067 | 0.0 | 0.0 | 0.0 | 1.00 | 70.7 | 9.1 |
| S1.001 | 50.00 | 6.02 | 3.853 | 0.067 | 0.0 | 0.0 | 0.0 | 3.26 | 230.1 | 9.1 |
| S2.000 | 50.00 | 5.15 | 3.643 | 0.092 | 0.0 | 0.0 | 0.0 | 1.75 | 123.4 | 12.5 |
| S2.001 | 50.00 | 5.30 | 3.445 | 0.092 | 0.0 | 0.0 | 0.0 | 1.32 | 93.4 | 12.5 |
| S1.002 | 50.00 | 6.25 | 3.363 | 0.206 | 0.0 | 0.0 | 0.0 | 1.24 | 87.6 | 27.9 |
| S3.000 | 50.00 | 5.23 | 3.761 | 0.050 | 0.0 | 0.0 | 0.0 | 1.66 | 117.7 | 6.8 |
| S3.001 | 50.00 | 5.41 | 3.506 | 0.114 | 0.0 | 0.0 | 0.0 | 1.62 | 114.7 | 15.4 |
| S3.002 | 50.00 | 5.64 | 3.314 | 0.114 | 0.0 | 0.0 | 0.0 | 1.00 | 70.7 | 15.4 |
| S1.003 | 50.00 | 6.40 | 2.958 | 0.371 | 0.0 | 0.0 | 0.0 | 1.55 | 438.0 | 50.2 |
| S1.004 | 50.00 | 6.85 | 2.902 | 0.475 | 0.0 | 0.0 | 0.0 | 1.55 | 439.0 | 64.3 |
| S1.005 | 50.00 | 7.39 | 2.728 | 0.542 | 0.0 | 0.0 | 0.0 | 1.55 | 438.3 | 73.4 |

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## Network Design Table for SW1.SWS

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S1.006 | 10.976 | 0.045 | 243.9 | 0.035 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S4.000 | 47.472 | 0.279 | 170.2 | 0.233 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S4.001 | 8.018 | 0.891 | 9.0 | 0.063 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S5.000 | 55.875 | 0.821 | 68.1 | 0.194 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.007 | 50.146 | 0.205 | 244.6 | 0.057 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S6.000 | 54.542 | 0.585 | 93.2 | 0.165 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S7.000 | 34.712 | 0.142 | 244.5 | 0.058 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S7.001 | 26.954 | 0.110 | 245.0 | 0.093 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S6.001 | 29.602 | 0.121 | 244.6 | 0.118 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S6.002 | 27.626 | 0.113 | 244.5 | 0.143 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S8.000 | 19.293 | 0.615 | 31.4 | 0.082 | 5.00 | 0.0 | 0.600 | o | 375 | Pipe/Conduit | |
| S6.003 | 12.339 | 0.050 | 246.8 | 0.000 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S6.004 | 10.335 | 0.042 | 246.1 | 0.099 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S6.005 | 21.806 | 0.089 | 245.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S6.006 | 12.753 | 0.052 | 245.3 | 0.089 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S9.000 | 48.325 | 0.197 | 245.3 | 0.088 | 5.00 | 0.0 | 0.600 | o | 450 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S1.006 | 50.00 | 7.48 | 2.224 | 0.577 | 0.0 | 0.0 | 0.0 | 2.00 | 1273.5 | 78.1 |
| S4.000 | 50.00 | 5.66 | 3.949 | 0.233 | 0.0 | 0.0 | 0.0 | 1.20 | 85.0 | 31.6 |
| S4.001 | 50.00 | 5.68 | 3.670 | 0.296 | 0.0 | 0.0 | 0.0 | 5.27 | 372.6 | 40.1 |
| S5.000 | 50.00 | 5.49 | 3.600 | 0.194 | 0.0 | 0.0 | 0.0 | 1.91 | 134.9 | 26.3 |
| S1.007 | 50.00 | 7.90 | 2.179 | 1.124 | 0.0 | 0.0 | 0.0 | 2.00 | 1271.7 | 152.2 |
| S6.000 | 50.00 | 5.56 | 4.260 | 0.165 | 0.0 | 0.0 | 0.0 | 1.63 | 115.1 | 22.3 |
| S7.000 | 50.00 | 5.58 | 3.927 | 0.058 | 0.0 | 0.0 | 0.0 | 1.00 | 70.8 | 7.9 |
| S7.001 | 50.00 | 6.03 | 3.785 | 0.151 | 0.0 | 0.0 | 0.0 | 1.00 | 70.7 | 20.4 |
| S6.001 | 50.00 | 6.41 | 3.525 | 0.434 | 0.0 | 0.0 | 0.0 | 1.30 | 206.0 | 58.8 |
| S6.002 | 50.00 | 6.76 | 3.404 | 0.577 | 0.0 | 0.0 | 0.0 | 1.30 | 206.1 | 78.1 |
| S8.000 | 50.00 | 5.10 | 3.981 | 0.082 | 0.0 | 0.0 | 0.0 | 3.25 | 358.4 | 11.1 |
| S6.003 | 50.00 | 6.92 | 3.291 | 0.659 | 0.0 | 0.0 | 0.0 | 1.29 | 205.1 | 89.2 |
| S6.004 | 50.00 | 7.06 | 3.241 | 0.758 | 0.0 | 0.0 | 0.0 | 1.29 | 205.4 | 102.6 |
| S6.005 | 50.00 | 7.34 | 3.199 | 0.758 | 0.0 | 0.0 | 0.0 | 1.29 | 205.9 | 102.6 |
| S6.006 | 50.00 | 7.50 | 3.110 | 0.847 | 0.0 | 0.0 | 0.0 | 1.29 | 205.8 | 114.7 |
| S9.000 | 50.00 | 5.62 | 3.255 | 0.088 | 0.0 | 0.0 | 0.0 | 1.29 | 205.7 | 11.9 |

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## Network Design Table for SW1.SWS

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| S6.007 | 58.994 | 0.633 | 93.2 | 0.089 | 0.00 | 0.0 | 0.600 | o | 450 | Pipe/Conduit | |
| S1.008 | 53.706 | 0.134 | 400.0 | 0.214 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.009 | 16.147 | 0.040 | 400.0 | 0.065 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.010 | 34.243 | 0.086 | 400.0 | 0.070 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.011 | 64.235 | 0.161 | 399.0 | 0.110 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S10.000 | 16.970 | 1.697 | 10.0 | 0.045 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| S1.012 | 56.443 | 0.141 | 400.0 | 0.168 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.013 | 14.441 | 0.036 | 400.0 | 0.098 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.014 | 9.961 | 0.026 | 383.1 | 0.000 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.015 | 9.999 | 0.020 | 495.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 900 | Pipe/Conduit | |
| S1.016 | 10.001 | 0.020 | 495.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 900 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| S6.007 | 50.00 | 7.97 | 3.058 | 1.024 | 0.0 | 0.0 | 0.0 | 2.11 | 335.0 | 138.7 |
| S1.008 | 50.00 | 8.54 | 1.974 | 2.362 | 0.0 | 0.0 | 0.0 | 1.56 | 992.7 | 319.8 |
| S1.009 | 50.00 | 8.71 | 1.840 | 2.427 | 0.0 | 0.0 | 0.0 | 1.56 | 992.7 | 328.6 |
| S1.010 | 50.00 | 9.08 | 1.799 | 2.497 | 0.0 | 0.0 | 0.0 | 1.56 | 992.7 | 338.1 |
| S1.011 | 50.00 | 9.77 | 1.714 | 2.607 | 0.0 | 0.0 | 0.0 | 1.56 | 994.0 | 353.0 |
| S10.000 | 50.00 | 5.06 | 3.931 | 0.045 | 0.0 | 0.0 | 0.0 | 5.00 | 353.4 | 6.1 |
| S1.012 | 50.00 | 10.37 | 1.553 | 2.820 | 0.0 | 0.0 | 0.0 | 1.56 | 992.7 | 381.9 |
| S1.013 | 50.00 | 10.52 | 1.412 | 2.918 | 0.0 | 0.0 | 0.0 | 1.56 | 992.7 | 395.1 |
| S1.014 | 50.00 | 10.63 | 1.376 | 2.918 | 0.0 | 0.0 | 0.0 | 1.59 | 1014.5 | 395.1 |
| S1.015 | 50.00 | 10.75 | 1.350 | 2.918 | 0.0 | 0.0 | 0.0 | 1.40 | 891.6 | 395.1 |
| S1.016 | 50.00 | 10.86 | 1.330 | 2.918 | 0.0 | 0.0 | 0.0 | 1.40 | 891.6 | 395.1 |

## Free Flowing Outfall Details for SW1.SWS

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---|---|---|---|---|---|---|
| S1.016 | S1 | 6.000 | 1.309 | 0.000 | 0 | 0 |

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## Simulation Criteria for SW1.SWS

| | | | |
|---|---|---|---|
| Volumetric Runoff Coeff | 0.750 | Additional Flow - % of Total Flow | 0.000 |
| Areal Reduction Factor | 1.000 | MADD Factor * 10m³/ha Storage | 2.000 |
| 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 Offline Controls 0 | Number of Time/Area Diagrams 0 |
| Number of Online Controls 5 | Number of Storage Structures 4 | 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 SW1.SWS

### Non Return Valve Manhole: S27, DS/PN: S6.007, Volume (m³): 12.1

### Non Return Valve Manhole: S10, DS/PN: S1.008, Volume (m³): 48.6

### Hydro-Brake® Optimum Manhole: S5, DS/PN: S1.013, Volume (m³): 46.4

| | |
|---|---|
| Unit Reference | MD-SHE-0571-2500-1500-2500 |
| Design Head (m) | 1.500 |
| Design Flow (l/s) | 250.0 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 571 |
| Invert Level (m) | 1.412 |
| Minimum Outlet Pipe Diameter (mm) | Site Specific Design (Contact Hydro International) |
| Suggested Manhole Diameter (mm) | Site Specific Design (Contact Hydro International) |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.500 | 249.9 | Kick-Flo® | 1.255 | 229.0 |
| Flush-Flo™ | 0.801 | 249.9 | Mean Flow over Head Range | - | 192.0 |

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 | 13.6 | 1.200 | 234.1 | 3.000 | 351.0 | 7.000 | 532.4 |
| 0.200 | 50.7 | 1.400 | 241.6 | 3.500 | 378.6 | 7.500 | 550.8 |
| 0.300 | 104.9 | 1.600 | 257.9 | 4.000 | 404.2 | 8.000 | 568.6 |
| 0.400 | 167.9 | 1.800 | 273.2 | 4.500 | 428.3 | 8.500 | 585.9 |
| 0.500 | 228.4 | 2.000 | 287.7 | 5.000 | 451.1 | 9.000 | 602.6 |
| 0.600 | 244.7 | 2.200 | 301.4 | 5.500 | 472.8 | 9.500 | 618.9 |
| 0.800 | 249.9 | 2.400 | 314.6 | 6.000 | 493.5 | | |
| 1.000 | 245.9 | 2.600 | 327.2 | 6.500 | 513.3 | | |

### Pump Manhole: S4, DS/PN: S1.014, Volume (m³): 19.8

Invert Level (m) 1.376

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 100.0000 | 0.900 | 100.0000 | 1.700 | 100.0000 | 2.500 | 100.0000 |
| 0.200 | 100.0000 | 1.000 | 100.0000 | 1.800 | 100.0000 | 2.600 | 100.0000 |
| 0.300 | 100.0000 | 1.100 | 100.0000 | 1.900 | 100.0000 | 2.700 | 100.0000 |
| 0.400 | 100.0000 | 1.200 | 100.0000 | 2.000 | 100.0000 | 2.800 | 100.0000 |
| 0.500 | 100.0000 | 1.300 | 100.0000 | 2.100 | 100.0000 | 2.900 | 100.0000 |
| 0.600 | 100.0000 | 1.400 | 100.0000 | 2.200 | 100.0000 | 3.000 | 100.0000 |
| 0.700 | 100.0000 | 1.500 | 100.0000 | 2.300 | 100.0000 | | |
| 0.800 | 100.0000 | 1.600 | 100.0000 | 2.400 | 100.0000 | | |

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## Complex Manhole: S3, DS/PN: S1.015, Volume (m³): 17.0

### Depth/Flow Relationship

Invert Level (m) 1.350

| Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) | Depth (m) | Flow (l/s) |
|---|---|---|---|---|---|---|---|
| 0.100 | 0.0000 | 0.900 | 0.0000 | 1.700 | 0.0000 | 2.500 | 0.0000 |
| 0.200 | 0.0000 | 1.000 | 0.0000 | 1.800 | 0.0000 | 2.600 | 0.0000 |
| 0.300 | 0.0000 | 1.100 | 0.0000 | 1.900 | 0.0000 | 2.700 | 0.0000 |
| 0.400 | 0.0000 | 1.200 | 0.0000 | 2.000 | 0.0000 | 2.800 | 0.0000 |
| 0.500 | 0.0000 | 1.300 | 0.0000 | 2.100 | 0.0000 | 2.900 | 0.0000 |
| 0.600 | 0.0000 | 1.400 | 0.0000 | 2.200 | 0.0000 | 3.000 | 0.0000 |
| 0.700 | 0.0000 | 1.500 | 0.0000 | 2.300 | 0.0000 | | |
| 0.800 | 0.0000 | 1.600 | 0.0000 | 2.400 | 0.0000 | | |

### Hydro-Brake® Optimum

| | |
|---|---|
| Unit Reference | MD-SHE-0145-9900-1000-9900 |
| Design Head (m) | 1.000 |
| Design Flow (l/s) | 9.9 |
| Flush-Flo™ | Calculated |
| Objective | Minimise upstream storage |
| Application | Surface |
| Sump Available | Yes |
| Diameter (mm) | 145 |
| Invert Level (m) | 4.350 |
| Minimum Outlet Pipe Diameter (mm) | 225 |
| Suggested Manhole Diameter (mm) | 1200 |

| Control Points | Head (m) | Flow (l/s) | Control Points | Head (m) | Flow (l/s) |
|---|---|---|---|---|---|
| Design Point (Calculated) | 1.000 | 9.9 | Kick-Flo® | 0.675 | 8.2 |
| Flush-Flo™ | 0.305 | 9.9 | Mean Flow over Head Range | - | 8.5 |

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 | 5.2 | 1.200 | 10.8 | 3.000 | 16.7 | 7.000 | 25.0 |
| 0.200 | 9.6 | 1.400 | 11.6 | 3.500 | 17.9 | 7.500 | 25.9 |
| 0.300 | 9.9 | 1.600 | 12.4 | 4.000 | 19.1 | 8.000 | 26.7 |
| 0.400 | 9.8 | 1.800 | 13.1 | 4.500 | 20.2 | 8.500 | 27.5 |
| 0.500 | 9.5 | 2.000 | 13.7 | 5.000 | 21.3 | 9.000 | 28.2 |
| 0.600 | 9.1 | 2.200 | 14.4 | 5.500 | 22.3 | 9.500 | 29.0 |
| 0.800 | 8.9 | 2.400 | 15.0 | 6.000 | 23.2 | | |
| 1.000 | 9.9 | 2.600 | 15.6 | 6.500 | 24.1 | | |

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## Storage Structures for SW1.SWS

### Tank or Pond Manhole: S14, DS/PN: S1.004

Invert Level (m) 4.500

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 200.0 | 0.300 | 225.0 |

### Tank or Pond Manhole: S38, DS/PN: S9.000

Invert Level (m) 3.400

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 150.0 | 0.800 | 150.0 | 0.801 | 0.0 |

### Complex Manhole: S5, DS/PN: S1.013

#### Tank or Pond

Invert Level (m) 1.600

| Depth (m) | Area (m²) | Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 400.0 | 1.000 | 400.0 | 1.001 | 0.0 |

#### Tank or Pond

Invert Level (m) 5.500

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 175.0 | 0.300 | 200.0 |

### Tank or Pond Manhole: S3, DS/PN: S1.015

Invert Level (m) 4.450

| Depth (m) | Area (m²) | Depth (m) | Area (m²) |
|---|---|---|---|
| 0.000 | 2121.0 | 1.000 | 3782.0 |

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## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

### 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0

### Synthetic Rainfall Details

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

| | |
|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 |
| Analysis Timestep | 2.5 Second Increment (Extended) |
| DTS Status | OFF |
| 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) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | 15 Winter | 1 | +0% | 100/60 Summer | | | | 4.160 |
| S1.001 | S17 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.894 |
| S2.000 | S20 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.710 |
| S2.001 | S19 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.526 |
| S1.002 | S16 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.481 |
| S3.000 | S23 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.809 |
| S3.001 | S22 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.579 |
| S3.002 | S21 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.411 |
| S1.003 | S15 | 15 Winter | 1 | +0% | 100/30 Summer | 100/60 Winter | | | 3.108 |
| S1.004 | S14 | 15 Winter | 1 | +0% | 100/30 Summer | 100/60 Winter | | | 3.052 |
| S1.005 | S13 | 15 Winter | 1 | +0% | 100/30 Summer | | | | 2.885 |
| S1.006 | S12 | 15 Winter | 1 | +0% | 100/30 Summer | | | | 2.437 |
| S4.000 | S25 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 4.076 |
| S4.001 | S24 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.747 |
| S5.000 | S26 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.689 |
| S1.007 | S11 | 15 Winter | 1 | +0% | 100/15 Winter | | | | 2.419 |
| S6.000 | S34 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 4.349 |
| S7.000 | S36 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.994 |
| S7.001 | S35 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.890 |
| S6.001 | S33 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.688 |
| S6.002 | S32 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.598 |
| S8.000 | S37 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 4.026 |
| S6.003 | S31 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.518 |
| S6.004 | S30 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.482 |
| S6.005 | S29 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.423 |

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## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | -0.229 | 0.000 | 0.12 | | 8.1 | OK | |
| S1.001 | S17 | -0.259 | 0.000 | 0.05 | | 8.1 | OK | |
| S2.000 | S20 | -0.233 | 0.000 | 0.11 | | 11.6 | OK | |
| S2.001 | S19 | -0.219 | 0.000 | 0.16 | | 11.5 | OK | |
| S1.002 | S16 | -0.182 | 0.000 | 0.33 | | 24.5 | OK | |
| S3.000 | S23 | -0.252 | 0.000 | 0.06 | | 6.3 | OK | |
| S3.001 | S22 | -0.227 | 0.000 | 0.13 | | 13.0 | OK | |
| S3.002 | S21 | -0.203 | 0.000 | 0.23 | | 13.2 | OK | |
| S1.003 | S15 | -0.450 | 0.000 | 0.14 | | 43.0 | OK | 2 |
| S1.004 | S14 | -0.450 | 0.000 | 0.14 | | 53.0 | OK | 2 |
| S1.005 | S13 | -0.443 | 0.000 | 0.15 | | 59.1 | OK | |
| S1.006 | S12 | -0.687 | 0.000 | 0.09 | | 62.4 | OK | |
| S4.000 | S25 | -0.173 | 0.000 | 0.36 | | 28.7 | OK | |
| S4.001 | S24 | -0.223 | 0.000 | 0.15 | | 35.4 | OK | |
| S5.000 | S26 | -0.211 | 0.000 | 0.19 | | 24.3 | OK | |
| S1.007 | S11 | -0.660 | 0.000 | 0.12 | | 120.6 | OK | |
| S6.000 | S34 | -0.211 | 0.000 | 0.19 | | 20.7 | OK | |
| S7.000 | S36 | -0.233 | 0.000 | 0.11 | | 7.2 | OK | |
| S7.001 | S35 | -0.195 | 0.000 | 0.27 | | 16.9 | OK | |
| S6.001 | S33 | -0.287 | 0.000 | 0.28 | | 49.5 | OK | |
| S6.002 | S32 | -0.256 | 0.000 | 0.36 | | 63.0 | OK | |
| S8.000 | S37 | -0.330 | 0.000 | 0.03 | | 10.3 | OK | |
| S6.003 | S31 | -0.223 | 0.000 | 0.47 | | 71.3 | OK | |
| S6.004 | S30 | -0.209 | 0.000 | 0.56 | | 80.2 | OK | |
| S6.005 | S29 | -0.226 | 0.000 | 0.47 | | 80.1 | OK | |

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## 1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 15 Winter | 1 | +0% | 30/15 Summer | | | | 3.355 | -0.205 |
| S9.000 | S38 | 15 Winter | 1 | +0% | 100/30 Winter | | | | 3.326 | -0.379 |
| S6.007 | S27 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 3.236 | -0.272 |
| S1.008 | S10 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 2.343 | -0.531 |
| S1.009 | S9 | 15 Winter | 1 | +0% | 100/15 Summer | | | | 2.239 | -0.500 |
| S1.010 | S8 | 15 Winter | 1 | +0% | 100/15 Winter | | | | 2.148 | -0.551 |
| S1.011 | S7 | 15 Winter | 1 | +0% | 100/15 Winter | | | | 2.046 | -0.568 |
| S10.000 | S39 | 15 Winter | 1 | +0% | 100/30 Summer | | | | 3.958 | -0.273 |
| S1.012 | S6 | 30 Winter | 1 | +0% | 100/15 Summer | | | | 1.886 | -0.567 |
| S1.013 | S5 | 30 Winter | 1 | +0% | 100/15 Summer | | | | 1.810 | -0.502 |
| S1.014 | S4 | 30 Winter | 1 | +0% | 100/15 Winter | | | | 1.519 | -0.757 |
| S1.015 | S3 | 720 Winter | 1 | +0% | 1/15 Summer | | | | 4.637 | 2.387 |
| S1.016 | S2 | 720 Winter | 1 | +0% | | | | | 1.429 | -0.801 |

| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 0.000 | 0.58 | | 87.6 | OK | |
| S9.000 | S38 | 0.000 | 0.06 | | 10.9 | OK | |
| S6.007 | S27 | 0.000 | 0.33 | | 102.3 | OK | |
| S1.008 | S10 | 0.000 | 0.28 | | 226.6 | OK | |
| S1.009 | S9 | 0.000 | 0.41 | | 227.0 | OK | |
| S1.010 | S8 | 0.000 | 0.30 | | 227.2 | OK | |
| S1.011 | S7 | 0.000 | 0.27 | | 227.1 | OK | |
| S10.000 | S39 | 0.000 | 0.02 | | 5.7 | OK | |
| S1.012 | S6 | 0.000 | 0.26 | | 215.6 | OK | |
| S1.013 | S5 | 0.000 | 0.20 | | 101.5 | OK | |
| S1.014 | S4 | 0.000 | 0.21 | | 100.0 | OK | |
| S1.015 | S3 | 0.000 | 0.03 | | 9.6 | SURCHARGED | |
| S1.016 | S2 | 0.000 | 0.03 | | 9.6 | OK | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

### 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0

### Synthetic Rainfall Details

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

| | |
|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 |
| Analysis Timestep | 2.5 Second Increment (Extended) |
| DTS Status | OFF |
| 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) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | 15 Winter | 30 | +0% | 100/60 Summer | | | | 4.204 |
| S1.001 | S17 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.919 |
| S2.000 | S20 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 3.750 |
| S2.001 | S19 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 3.598 |
| S1.002 | S16 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 3.575 |
| S3.000 | S23 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.838 |
| S3.001 | S22 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.633 |
| S3.002 | S21 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 3.487 |
| S1.003 | S15 | 15 Winter | 30 | +0% | 100/30 Summer | 100/60 Winter | | | 3.215 |
| S1.004 | S14 | 15 Winter | 30 | +0% | 100/30 Summer | 100/60 Winter | | | 3.162 |
| S1.005 | S13 | 15 Winter | 30 | +0% | 100/30 Summer | | | | 3.000 |
| S1.006 | S12 | 60 Winter | 30 | +0% | 100/30 Summer | | | | 2.769 |
| S4.000 | S25 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 4.173 |
| S4.001 | S24 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.799 |
| S5.000 | S26 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.745 |
| S1.007 | S11 | 60 Winter | 30 | +0% | 100/15 Winter | | | | 2.765 |
| S6.000 | S34 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 4.405 |
| S7.000 | S36 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 4.177 |
| S7.001 | S35 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 4.158 |
| S6.001 | S33 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 4.094 |
| S6.002 | S32 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 4.010 |
| S8.000 | S37 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 4.055 |
| S6.003 | S31 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 3.910 |
| S6.004 | S30 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 3.812 |
| S6.005 | S29 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 3.710 |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | -0.185 | 0.000 | 0.30 | | 19.8 | OK | |
| S1.001 | S17 | -0.233 | 0.000 | 0.11 | | 19.8 | OK | |
| S2.000 | S20 | -0.193 | 0.000 | 0.27 | | 28.4 | OK | |
| S2.001 | S19 | -0.147 | 0.000 | 0.39 | | 28.0 | OK | |
| S1.002 | S16 | -0.088 | 0.000 | 0.83 | | 61.9 | OK | |
| S3.000 | S23 | -0.223 | 0.000 | 0.15 | | 15.4 | OK | |
| S3.001 | S22 | -0.173 | 0.000 | 0.37 | | 36.4 | OK | |
| S3.002 | S21 | -0.127 | 0.000 | 0.62 | | 36.0 | OK | |
| S1.003 | S15 | -0.343 | 0.000 | 0.37 | | 113.1 | OK | 2 |
| S1.004 | S14 | -0.340 | 0.000 | 0.38 | | 143.8 | OK | 2 |
| S1.005 | S13 | -0.328 | 0.000 | 0.41 | | 158.6 | OK | |
| S1.006 | S12 | -0.355 | 0.000 | 0.14 | | 95.0 | OK | |
| S4.000 | S25 | -0.076 | 0.000 | 0.88 | | 70.4 | OK | |
| S4.001 | S24 | -0.171 | 0.000 | 0.38 | | 89.1 | OK | |
| S5.000 | S26 | -0.155 | 0.000 | 0.46 | | 59.3 | OK | |
| S1.007 | S11 | -0.314 | 0.000 | 0.18 | | 183.7 | OK | |
| S6.000 | S34 | -0.155 | 0.000 | 0.46 | | 50.0 | OK | |
| S7.000 | S36 | -0.050 | 0.000 | 0.26 | | 17.0 | OK | |
| S7.001 | S35 | 0.073 | 0.000 | 0.68 | | 43.1 | SURCHARGED | |
| S6.001 | S33 | 0.119 | 0.000 | 0.57 | | 100.8 | SURCHARGED | |
| S6.002 | S32 | 0.156 | 0.000 | 0.73 | | 127.9 | SURCHARGED | |
| S8.000 | S37 | -0.301 | 0.000 | 0.08 | | 25.3 | OK | |
| S6.003 | S31 | 0.169 | 0.000 | 1.01 | | 152.6 | SURCHARGED | |
| S6.004 | S30 | 0.121 | 0.000 | 1.21 | | 174.6 | SURCHARGED | |
| S6.005 | S29 | 0.061 | 0.000 | 1.02 | | 172.6 | SURCHARGED | |

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## 30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 15 Winter | 30 | +0% | 30/15 Summer | | | | 3.605 | 0.045 |
| S9.000 | S38 | 15 Winter | 30 | +0% | 100/30 Winter | | | | 3.394 | -0.311 |
| S6.007 | S27 | 15 Winter | 30 | +0% | 100/15 Summer | | | | 3.351 | -0.157 |
| S1.008 | S10 | 60 Winter | 30 | +0% | 100/15 Summer | | | | 2.721 | -0.153 |
| S1.009 | S9 | 60 Winter | 30 | +0% | 100/15 Summer | | | | 2.633 | -0.107 |
| S1.010 | S8 | 60 Winter | 30 | +0% | 100/15 Winter | | | | 2.600 | -0.099 |
| S1.011 | S7 | 60 Winter | 30 | +0% | 100/15 Winter | | | | 2.525 | -0.089 |
| S10.000 | S39 | 15 Winter | 30 | +0% | 100/30 Summer | | | | 3.972 | -0.259 |
| S1.012 | S6 | 60 Winter | 30 | +0% | 100/15 Summer | | | | 2.404 | -0.049 |
| S1.013 | S5 | 60 Winter | 30 | +0% | 100/15 Summer | | | | 2.275 | -0.037 |
| S1.014 | S4 | 60 Winter | 30 | +0% | 100/15 Winter | | | | 1.984 | -0.292 |
| S1.015 | S3 | 960 Winter | 30 | +0% | 1/15 Summer | | | | 4.898 | 2.648 |
| S1.016 | S2 | 2880 Summer | 30 | +0% | | | | | 1.429 | -0.800 |

| PN | US/MH Name | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 0.000 | 1.25 | | 190.5 | SURCHARGED | |
| S9.000 | S38 | 0.000 | 0.14 | | 26.3 | OK | |
| S6.007 | S27 | 0.000 | 0.74 | | 229.3 | OK | |
| S1.008 | S10 | 0.000 | 0.46 | | 376.4 | OK | |
| S1.009 | S9 | 0.000 | 0.69 | | 384.1 | OK | |
| S1.010 | S8 | 0.000 | 0.52 | | 390.2 | OK | |
| S1.011 | S7 | 0.000 | 0.47 | | 395.7 | OK | |
| S10.000 | S39 | 0.000 | 0.05 | | 13.9 | OK | |
| S1.012 | S6 | 0.000 | 0.48 | | 395.6 | OK | |
| S1.013 | S5 | 0.000 | 0.21 | | 108.6 | OK | |
| S1.014 | S4 | 0.000 | 0.21 | | 100.0 | OK | |
| S1.015 | S3 | 0.000 | 0.03 | | 9.9 | SURCHARGED | |
| S1.016 | S2 | 0.000 | 0.03 | | 9.9 | OK | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

### 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 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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 5 Number of Storage Structures 4 Number of Real Time Controls 0

### Synthetic Rainfall Details

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

| | |
|---|---|
| Margin for Flood Risk Warning (mm) | 300.0 |
| Analysis Timestep | 2.5 Second Increment (Extended) |
| DTS Status | OFF |
| 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) | 1, 30, 100 |
| Climate Change (%) | 0, 0, 40 |

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | 120 Winter | 100 | +40% | 100/60 Summer | | | | 4.871 |
| S1.001 | S17 | 60 Winter | 100 | +40% | 100/30 Winter | | | | 4.864 |
| S2.000 | S20 | 120 Winter | 100 | +40% | 100/15 Summer | | | | 4.871 |
| S2.001 | S19 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 4.864 |
| S1.002 | S16 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 4.861 |
| S3.000 | S23 | 120 Winter | 100 | +40% | 100/30 Winter | | | | 4.864 |
| S3.001 | S22 | 60 Winter | 100 | +40% | 100/30 Winter | | | | 4.862 |
| S3.002 | S21 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 4.857 |
| S1.003 | S15 | 60 Winter | 100 | +40% | 100/30 Summer | 100/60 Winter | | | 4.854 |
| S1.004 | S14 | 60 Winter | 100 | +40% | 100/30 Summer | 100/60 Winter | | | 4.872 |
| S1.005 | S13 | 60 Winter | 100 | +40% | 100/30 Summer | | | | 4.918 |
| S1.006 | S12 | 120 Winter | 100 | +40% | 100/30 Summer | | | | 4.986 |
| S4.000 | S25 | 120 Winter | 100 | +40% | 100/15 Summer | | | | 5.060 |
| S4.001 | S24 | 120 Winter | 100 | +40% | 100/30 Winter | | | | 5.003 |
| S5.000 | S26 | 120 Winter | 100 | +40% | 100/30 Winter | | | | 5.007 |
| S1.007 | S11 | 120 Winter | 100 | +40% | 100/15 Winter | | | | 4.998 |
| S6.000 | S34 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 5.412 |
| S7.000 | S36 | 15 Winter | 100 | +40% | 100/15 Summer | | | | 5.308 |
| S7.001 | S35 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 5.241 |
| S6.001 | S33 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 5.143 |
| S6.002 | S32 | 15 Winter | 100 | +40% | 30/15 Summer | | | | 5.016 |
| S8.000 | S37 | 120 Winter | 100 | +40% | 100/15 Summer | | | | 4.885 |
| S6.003 | S31 | 120 Winter | 100 | +40% | 30/15 Summer | | | | 4.884 |
| S6.004 | S30 | 120 Winter | 100 | +40% | 30/15 Summer | | | | 4.877 |
| S6.005 | S29 | 120 Winter | 100 | +40% | 30/15 Summer | | | | 4.871 |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume (m³) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S1.000 | S18 | 0.482 | 0.000 | 0.19 | | 13.0 | SURCHARGED | |
| S1.001 | S17 | 0.711 | 0.000 | 0.12 | | 20.5 | FLOOD RISK | |
| S2.000 | S20 | 0.928 | 0.000 | 0.17 | | 17.9 | SURCHARGED | |
| S2.001 | S19 | 1.119 | 0.000 | 0.39 | | 28.3 | FLOOD RISK | |
| S1.002 | S16 | 1.198 | 0.000 | 0.84 | | 63.0 | FLOOD RISK | |
| S3.000 | S23 | 0.803 | 0.000 | 0.09 | | 9.7 | SURCHARGED | |
| S3.001 | S22 | 1.056 | 0.000 | 0.36 | | 35.2 | FLOOD RISK | |
| S3.002 | S21 | 1.243 | 0.000 | 0.60 | | 35.2 | FLOOD RISK | |
| S1.003 | S15 | 1.296 | 11.227 | 0.38 | | 113.8 | FLOOD | 2 |
| S1.004 | S14 | 1.370 | 12.117 | 0.39 | | 145.3 | FLOOD | 2 |
| S1.005 | S13 | 1.590 | 0.000 | 0.43 | | 163.1 | SURCHARGED | |
| S1.006 | S12 | 1.862 | 0.000 | 0.16 | | 112.5 | SURCHARGED | |
| S4.000 | S25 | 0.811 | 0.000 | 0.57 | | 45.3 | SURCHARGED | |
| S4.001 | S24 | 1.033 | 0.000 | 0.24 | | 57.6 | SURCHARGED | |
| S5.000 | S26 | 1.107 | 0.000 | 0.30 | | 37.8 | FLOOD RISK | |
| S1.007 | S11 | 1.919 | 0.000 | 0.21 | | 212.0 | FLOOD RISK | |
| S6.000 | S34 | 0.852 | 0.000 | 0.68 | | 73.8 | SURCHARGED | |
| S7.000 | S36 | 1.081 | 0.000 | 0.38 | | 24.5 | FLOOD RISK | |
| S7.001 | S35 | 1.156 | 0.000 | 0.93 | | 59.1 | FLOOD RISK | |
| S6.001 | S33 | 1.168 | 0.000 | 1.01 | | 178.1 | FLOOD RISK | |
| S6.002 | S32 | 1.162 | 0.000 | 1.34 | | 234.2 | SURCHARGED | |
| S8.000 | S37 | 0.529 | 0.000 | 0.05 | | 16.0 | SURCHARGED | |
| S6.003 | S31 | 1.143 | 0.000 | 0.84 | | 126.8 | SURCHARGED | |
| S6.004 | S30 | 1.186 | 0.000 | 0.98 | | 141.3 | SURCHARGED | |
| S6.005 | S29 | 1.222 | 0.000 | 0.82 | | 138.7 | SURCHARGED | |

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## 100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surcharge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) |
|---|---|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 120 Winter | 100 | +40% | 30/15 Summer | | | | 4.861 |
| S9.000 | S38 | 120 Winter | 100 | +40% | 100/30 Winter | | | | 4.856 |
| S6.007 | S27 | 120 Winter | 100 | +40% | 100/15 Summer | | | | 4.854 |
| S1.008 | S10 | 120 Winter | 100 | +40% | 100/15 Summer | | | | 5.008 |
| S1.009 | S9 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 5.700 |
| S1.010 | S8 | 60 Winter | 100 | +40% | 100/15 Winter | | | | 5.700 |
| S1.011 | S7 | 60 Winter | 100 | +40% | 100/15 Winter | | | | 5.698 |
| S10.000 | S39 | 60 Winter | 100 | +40% | 100/30 Summer | | | | 5.700 |
| S1.012 | S6 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 5.694 |
| S1.013 | S5 | 60 Winter | 100 | +40% | 100/15 Summer | | | | 5.688 |
| S1.014 | S4 | 60 Winter | 100 | +40% | 100/15 Winter | | | | 5.679 |
| S1.015 | S3 | 1440 Winter | 100 | +40% | 1/15 Summer | | | | 5.284 |
| S1.016 | S2 | 10080 Winter | 100 | +40% | | | | | 1.429 |

| PN | US/MH Name | Surcharged Depth (m) | Flooded Volume ($m^3$) | Flow / Cap. | Overflow (l/s) | Pipe Flow (l/s) | Status | Level Exceeded |
|---|---|---|---|---|---|---|---|---|
| S6.006 | S28 | 1.301 | 0.000 | 1.00 | | 152.0 | FLOOD RISK | |
| S9.000 | S38 | 1.151 | 0.000 | 0.66 | | 122.7 | SURCHARGED | |
| S6.007 | S27 | 1.346 | 0.000 | 0.60 | | 186.4 | FLOOD RISK | |
| S1.008 | S10 | 2.134 | 0.000 | 0.53 | | 433.4 | SURCHARGED | |
| S1.009 | S9 | 2.960 | 0.000 | 1.12 | | 623.4 | FLOOD RISK | |
| S1.010 | S8 | 3.000 | 0.000 | 0.83 | | 629.3 | SURCHARGED | |
| S1.011 | S7 | 3.084 | 0.000 | 0.75 | | 634.4 | SURCHARGED | |
| S10.000 | S39 | 1.469 | 0.000 | 0.05 | | 13.9 | FLOOD RISK | |
| S1.012 | S6 | 3.241 | 0.000 | 0.79 | | 649.9 | FLOOD RISK | |
| S1.013 | S5 | 3.376 | 0.000 | 0.44 | | 227.0 | SURCHARGED | |
| S1.014 | S4 | 3.403 | 0.000 | 0.21 | | 100.0 | SURCHARGED | |
| S1.015 | S3 | 3.035 | 0.000 | 0.03 | | 9.9 | SURCHARGED | |
| S1.016 | S2 | -0.800 | 0.000 | 0.03 | | 9.9 | OK | |

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User Report S:\Clients\BARRATT SOUTHAMPTON\4513 - Sinah Lane, Hayling Island\02 - ENGINEERS\01 - RCP DESIGN\03 - WINDES\20200228\6 hours storm.SPDX for SW1.SWS

| PN | Discharge Volume (m³) | PN | Discharge Volume (m³) | PN | Discharge Volume (m³) |
|---|---|---|---|---|---|
| S1.000 | 49.660 | S4.001 | 219.395 | S9.000 | 65.225 |
| S1.001 | 49.660 | S5.000 | 143.797 | S6.007 | 758.964 |
| S2.000 | 68.190 | S1.007 | 833.065 | S1.008 | 1750.788 |
| S2.001 | 68.190 | S6.000 | 122.298 | S1.009 | 1798.811 |
| S1.002 | 152.687 | S7.000 | 42.990 | S1.010 | 1850.688 |
| S3.000 | 37.060 | S7.001 | 111.921 | S1.011 | 1932.291 |
| S3.001 | 84.497 | S6.001 | 321.680 | S10.000 | 33.353 |
| S3.002 | 84.497 | S6.002 | 427.667 | S1.012 | 2090.233 |
| S1.003 | 274.985 | S8.000 | 60.778 | S1.013 | 2162.903 |
| S1.004 | 352.088 | S6.003 | 488.445 | S1.014 | 2162.892 |
| S1.005 | 401.703 | S6.004 | 561.824 | S1.015 | 346.799 |
| S1.006 | 427.645 | S6.005 | 561.825 | S1.016 | 346.424 |
| S4.000 | 172.700 | S6.006 | 627.791 | | |

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# Appendix (J)

# Exceedance Flow Paths

Cellular storage tank
150m² x 0.80m deep
BL 3.300

PLAY
LAP Provision of overflow arrangement

Area of Public Open Space to be used as localised storage at surface level in peak storm events
(Volume circa. 64m³)

17-22

49-54

11-16

Hayling Billy Coastal Path

Car Park

Theatre

SINAH LANE

FURNESS WAY

5.8m

6.1m

TCB

El Sub Sta

## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D27 dated dated 28/02/2020.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Layout review is subject to receipt of finalised layout proposal and the final highway layout design will be subject to the outcome of consultation with Hampshire County Council.
6. Red indicates vehicle moving forward, blue indicates vehicle reversing.

## KEY

Site Boundary

Existing flow routes

Existing Ground Level

Primary Road Contour 6.000

Secondary Road Contour 5.850

Area of Public Open Space to be used as localised storage in peak storm events

Cellular storage tank

Weholite (or similar) large diameter storage pipes

Root Protection Area (RPA) for Retained Trees
***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

SCALE BAR 1:500 at A1

| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| C | 02.03.20 | Updated in accordance with rev. D27 of IDP Site Layout. | TRS | TRS | TRS |
| B | 27.06.19 | Updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |
| A | 04.07.18 | Updated in accordance with latest IDP Site Layout PL-02A | SRV | VPI | TRS |

Client:-

BARRATT HOMES

Site:-
Sinah Lane
Hayling Island

Drawing Title:-
FLOOD EXCEEDANCE PLAN
SHEET 1 OF 2

Date: June 2018 | Scales: 1:500 at A1
Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No.
BSO/E4513/026 C

FOR INFORMATION ONLY

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N

Jetty

Slipway

Shingle

NORTH SHORE ROAD

49

25

63

79

New Foul Water Manhole to be Constructed Online of Existing Southern Water Sewer

Foul Water Proposed Rising Main Outfall Chamber

Hayling Island

Foul Water Rising Main. Rising Main Diameter is Subject to Detailed Design by Specialist.

Existing Water Course

Outfall into Existing Water Course

SWMH S2 - Control Chamber
Hydro-Brake details:
Design Head=0.90m
Design Flow: 9.9 l/s

Outfall Headwall

Outfall Headwall

Conveyance Swale

3.0m Maintenance Easement

Low flow channel

SUDS ATTENUATION
ATTENUATION BASIN
BASE LEVEL - 4.450m

FARM ACCESS

Surface Water Storage Tank
127m x 2.0m Dia (400m³)
BL 1.600

Conveyance Swale

FWMH F1 - Foul Water Pumping Station

SWMH S4 - Surface Water Pumping Station
Pump Rate: 100 l/s

SWMH S5 - Control Chamber
Hydro-Brake details:
Design Head=1.500m
Design Flow: 250.0 l/s

Surface Water Rising Main

SWMH S3 Rising Main Outfall Chamber

Outfall Headwall

Revision of plot arrangement

Area of Public Open Space to be used as localised storage at surface level in peak storm events (Volume circa. 96m³)

Swale

Path

## NOTES

1. All dimensions are in metres unless stated otherwise.
2. Do not scale from this drawing. Only written dimensions are to be used.
3. Site layout based on ID Partnership Proposed Site Layout, project number N81:2517, drawing number PL-02 Rev.D27 dated dated 28/02/2020.
4. Topographic Survey as per Siteline Ltd. Site Survey drawing number 36HX001B dated May 2018.
5. Layout review is subject to receipt of finalised layout proposal and the final highway layout design will be subject to the outcome of consultation with Hampshire County Council.
6. Red indicates vehicle moving forward, blue indicates vehicle reversing.

## KEY

Site Boundary

Existing flow routes

Existing Ground Level

Primary Road Contour — 6.000

Secondary Road Contour — 5.850

Area of Public Open Space to be used as localised storage in peak storm events

Cellular storage tank

Wehobite (or similar) large diameter storage pipes

Root Protection Area (RPA) for Retained Trees
***(Refer to ACD Tree Reference Plan drawing number BDWS20660 Revision A dated 25/04/17 for Details)***

0m 5m 10m 20m 30m 40m 50m

SCALE BAR 1:500 at A1

| Rev. | Date | Details | By | Chkd | Appd |
|---|---|---|---|---|---|
| C | 02.03.20 | Updated in accordance with rev. D27 of IDP Site Layout. | TRS | TRS | TRS |
| B | 27.06.19 | Updated in accordance with rev. D17 of IDP Site Layout. | SRV | TRS | TRS |
| A | 04.07.18 | Updated in accordance with latest IDP Site Layout PL-02A | SRV | VPI | TRS |

Client:-

BARRATT HOMES

Site:-
Sinah Lane
Hayling Island

Drawing Title:-
FLOOD EXCEEDANCE PLAN
SHEET 2 OF 2

Date: June 2018 | Scales: 1:500 at A1

Drawn: SRV | Checked: TRS | Approved: TRS

Drawing No.
BSO/E4513/027 C

FOR INFORMATION ONLY

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# Appendix (K)

# Flood Plan

# PROPOSED RESIDENTIAL DEVELOPMENT
# SINAH LANE, HAYLING ISLAND
# HAVANT

## FLOOD PLAN

## JUNE 2018

## Document Control Sheet

| | |
|---|---|
| **Project name:** | Chapel Riverside, Southampton |
| **Project ref:** | BSO/E4513 |
| **Report Title** | Flood Plan |
| **Doc. ref:** | TRS/INL/E4513/17138 |
| **Date:** | 22nd June 2018 |

| | Name | Position | Signature | Date |
|---|---|---|---|---|
| **Prepared by:** | Terry Seymour | Director | | 22.06.2018 |
| **Reviewed by:** | Steve Vine | Associate Designate | | 22.06.2018 |
| **Approved by:** | Terry Seymour | Director | | 22.06.2018 |

| Revision | Date | Description | Prepared | Approved |
|---|---|---|---|---|
| | | | | |

# 1.0 Introduction and Objectives

Rogers Cory Partnership Limited have been instructed on behalf of Barratt David Wilson to prepare a Flood Plan in support of the planning application for the proposed residential development at the Sinah Lane, Hayling Island.

The development site seeks planning permission from Havant Borough Council for the erection of 195 dwellings, associated open space, pumping station, sub-station with vehicular access via Sinah Lane and change of use of land from agricultural to a Wader and Brent Geese refuge.

The intention of this flood plan is to provide an initial proposal to highlight the potential flood hazards and provide outline procedures to enable future occupants and users of the site to avoid being directly exposed to the hazard in any future flood events that may affect the site. This flood plan should be regularly reviewed and updated during the life of the development, by the appointed Management Company to ensure it takes into consideration any changes to legislation and the flood hazard to the site,

## Site Location

The site is located off Sinah Lane within the south western part of Hayling Island. The site is bounded by residential properties to the west and south, open fields and a nature reserve to the north, Hayling Billy Trail and open fields to the east with National Grid reference 470733, 99841 (See **Figure 1**).

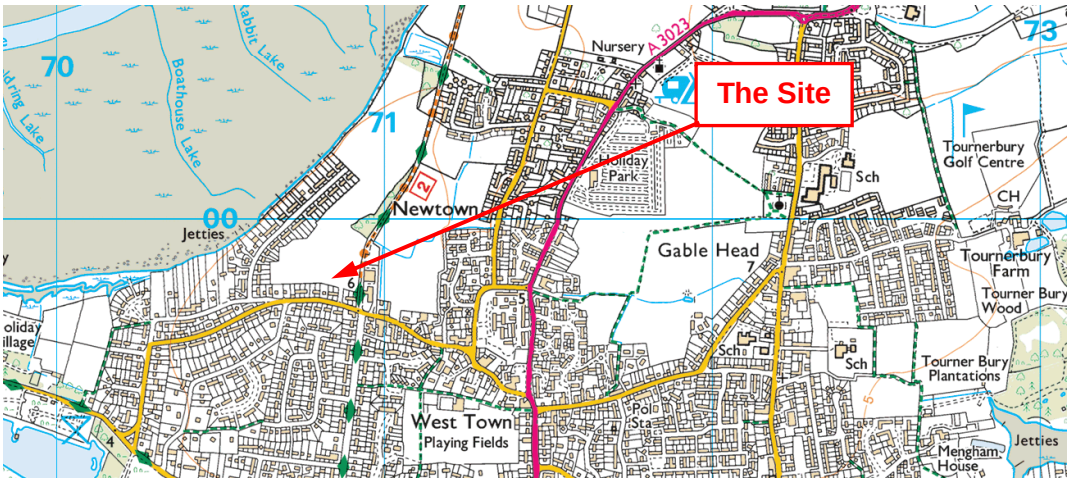



**Figure 1- Site Location and Extent**

## Objectives

Whilst the development site itself is not at risk, Hayling Island could be subject to restricted highway access (on and off the island) in the event of a peak tidal flood event. The objective of the site flood plan is to raise awareness of the risk of flooding from tidal surge events and the potential impact this has on Langstone Road which

could restrict access on and off Hayling Island, thus allowing future occupants to consider options available in such an event.

The site falls within an area where the Environment Agency issue flood warnings. As the risk of flooding is tidal from storm surge events there is an opportunity for an early warning of the potential risk of flooding from the Environment Agency ranging between 6 to 48 hours addition to this the approximate time of arrival of the storm surge can be predicted within an allowance of time.

The flood plan will highlight what mitigation measures should be implemented by the future users of the site.

## 2.0 Flood Risk to the Site

### Tidal Flood Risk

Whist the site lies wholly within Flood Zone 1, it is recognised that vehicular access on and off Hayling Island is only via Langstone Road, located further north of the site (**see figure 2**).




**Figure 2: Extract from EA Flood Map**

Table 1 below outlines the proposed residual flood mitigation measures which will be implemented in the construction of the development:

| Land use | Min Finished Floor Level | Further mitigation requirements |
|---|---|---|
| Residential | 4.70mAOD | None |

**Table 1 – Proposed site wide minimum finished floor levels and further mitigation requirements**

**Table 2** provides residual mitigation measures proposed for the future users and occupants of the site.

| Land use | Further mitigation requirements |
|---|---|
| Residential | Register with the EA flood warning services. In the event of a tidal flood event, propose occupant to remain at property until the tidal surge has passed |

**Table 2 – Proposed site wide residual mitigation measures**

## Safe means of access and egress.

In the event of a peak tidal flood event (1 in 200-year event), there is no risk to the development site itself, thus occupants could choose to stay on site. Should occupants wish to leave Hayling Island ahead of a tidal flood event then sufficient warning will be provided through the EA early warning notification system to allow residents to leave the island temporarily should they so wish to.