PROPOSED RESIDENTIAL DEVELOPMENT
LAND AT FORTY ACRES FARM
HAVANT

FLOOD RISK ASSESSMENT

APRIL 2018

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Contents

1. Executive Summary 2

2. Introduction 3

3. Proposed Development Site 5

3.1 Site Location 5
3.2 Existing Topography 5
3.3 Development Proposal..... 5
3.4 Existing geological information 6
3.5 National Policy Context 6
3.6 Local Planning Policies 6
3.7 Existing Flood Defences 7
3.8 NPPF Flood Zone & Vulnerability 7

4. Flood Risk to the Site 7
4.1 Strategic Flood Risk Assessment 7
4.2 Existing information on Flooding 9
4.3 Climate Change 11
4.4 The Sequential Test 12

5. Surface Water Management 13

6. Foul Water Drainage Strategy..... 22

7. Conclusions 23

Appendices

Appendix A Site Location Plan
Appendix B Topographical Survey
Appendix C Feasibility Study – Site Layout Plan
Appendix D Geotechnical Information
Appendix E Environment Agency Correspondence
Appendix F Lead Local Flood Authority Correspondence
Appendix G Flooding Risk Mitigation Proposals
Appendix H Existing Drainage Regime
Appendix I Proposed Surface Water Strategy
Appendix J MicroDrainage Calculations
Appendix K Exceedance Flow Paths

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 320 new homes (30% affordable housing), 66 bed care home, allotments, habitat mitigation zone, provision of public open space and associated infrastructure.

According to data supplied by the Environment Agency (EA), the site lies partly within Flood Zone 1, 2 and 3 considered a low, medium and high risk of flooding from tidal sources respectively 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 320 new homes (30% affordable housing), 66 bed care home, allotments, habitat mitigation zone, provision of public open space and associated infrastructure.

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 Portchester.

The development site seeks planning permission from the Havant Borough Council for the residential proposal for 320 new homes (30% affordable housing), 66 bed care home, allotments, habitat mitigation zone, provision of public open space and associated infrastructure.

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 mainly within flood zone 1, considered to be at low risk of flooding from rivers or sea, whilst the southern and south western parts lie within Flood zones 2 and 3 considered to have a medium to high risk of flooding from the 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 Havant Road approximately 1.5km south west of the centre of Bedhampton. The site is bounded by residential properties to the west, Havant Road to the north and agricultural fields to the east and south. with National Grid reference 469055, 105726 (See **Appendix A**).

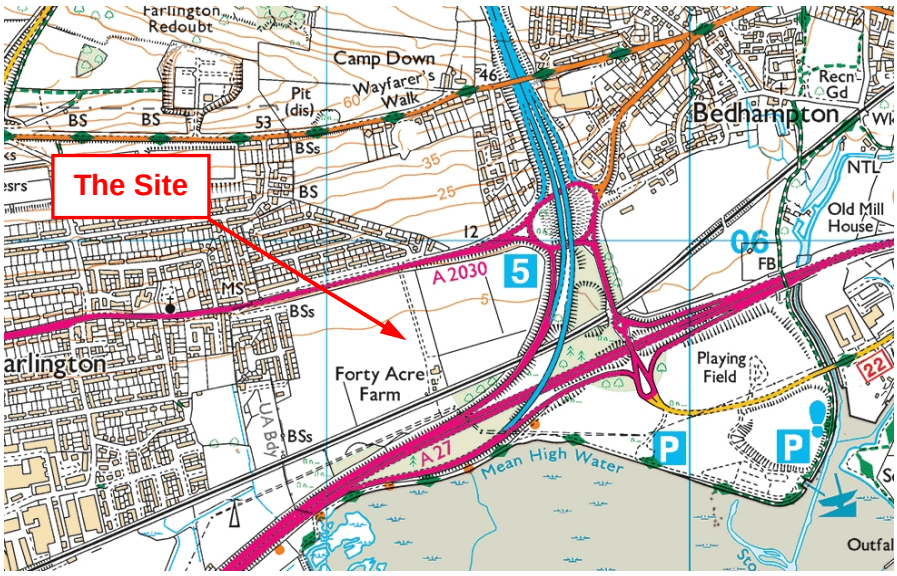


Figure 1- Site Location and Extent

3.2 Existing Topography

A topographical survey was carried out by Siteline in August 2016 and is related to Ordinance Survey Datum.

The survey generally shows levels ranging from approximately 10.80mAOD at the northern part of the site to the lowest point of 2.08mAOD at the southern boundary. There is an approximate 1.5m bank along the northern boundary. (See **Appendix B**).

3.3 Development Proposals

The proposed development comprises of the residential proposal for 320 new homes (30% affordable housing), 64 bed care home, allotments, habitat mitigation zone, provision of public open space and associated infrastructure.

3.4 Existing Geological Information

According to existing British Geological Survey (BGS) maps the site is located over the Lewes Nodular Chalk Formation with a superficial Head deposit consisting of Clay, Silts, Sands and Gravels.

Intrusive ground investigations carried out by Wilson Bailey in August 2016 indicate the in-situ ground as comprising of Topsoil to 0.2-0.3mbgl over firm dark orange-brown silty sandy CLAY, firm brown silty sand CLAY, pale yellowish brown clayey SILT, pale yellowish brown silty sandy chalk derived GRAVEL in various parts of the site over weathered CHALK. Groundwater was not encountered in all boreholes, but where this was it varied in depth from 1.5m to 2.8mbgl during the investigations. Infiltration testing has not been carried out as the existing geology of the superficial deposits of SILT and CLAY are deemed unsuitable for infiltration drainage techniques.

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 mainly within Flood Zone 1 (low risk of tidal flooding) with the southern portion partly within Flood Zones 2 and 3, considered medium to high risk of flooding from tidal sources respectively. At this location the risk of flooding is from tidal sources rather than fluvial and thus indicates that the southern part of the site could be susceptible to tidal flooding with an annual probability of 0.5%-0.1% for Flood Zone 2 and greater than 0.5% for parts within Flood Zone 3. It should be noted that the residential portion of the development is wholly within Flood Zone 1

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 mainly within Flood Zone 1, considered the lowest risk of flooding from tidal sources, with the southern parts of the development within Flood Zones 2 and 3.

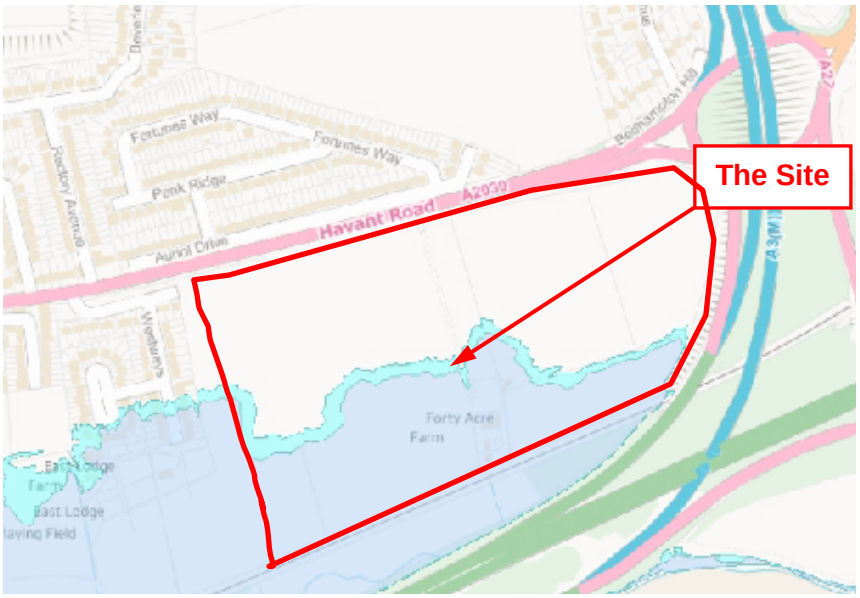


Figure 2- Extract from EA Website- Flood Map for Planning (Rivers and Sea)

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 partly within Flood Zone 1, 2 and 3. The latest modelled tide levels provided by the EA give the 1 in 200-year tide level as **4.40mAOD**, for the year 2115 which will need to be used to assess the level of flood risk to any future residential development at the site. As such the minimum finished floor levels for the new dwellings will be set at least **4.7mAOD** which provides a 300mm freeboard above the 1 in 200 year plus climate change flood level.

Consultation was carried out with the EA at a meeting on the 19th August 2016 regarding the development proposals and the provisions of extending the development further south from the Flood Zone 1 area into Flood Zone 2 and 3. This was deemed acceptable by the EA on the basis that the existing risk of flooding was from Tidal Sources and the development proposals could provide mitigation through the provision of the finished floor and ground levels being above the 1 in 200 year plus CC tidal flood level. As the risk of flooding was from Tidal sources then compensatory flood volume storage would not be required to offset areas of the raised land and development within the tidal flood extent.

Refer to **Appendix E** of the report for correspondence with the EA.

Fluvial Flood Risk

The site is not deemed to be at risk from fluvial flooding.

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. There are parts of the site along the southern boundary considered to have low to medium risk of flooding from surface water as well as a potential low risk flow path within the centre of the site. The areas of surface water flood risk on site generally correspond with the lower lying areas and localised low spots across the site. The potential surface water flow path within the central part of the site follows the general lower lying topography in this area originating from the low point on Havant Road. This potential surface water flow route has been preserved within the development site layout by

retaining this area as open green space and roads to ensure any potential existing surface water flow routes are not impeded.

Where the southern parts of the development proposals encroach into the area designated as low risk from surface water flooding, this area of encroachment has been offset and compensated through the provision of open space storage in the south eastern parts of the site, to ensure that the development proposals do not increase the risk of surface water flooding downstream. Details are presented in **Appendix G**.

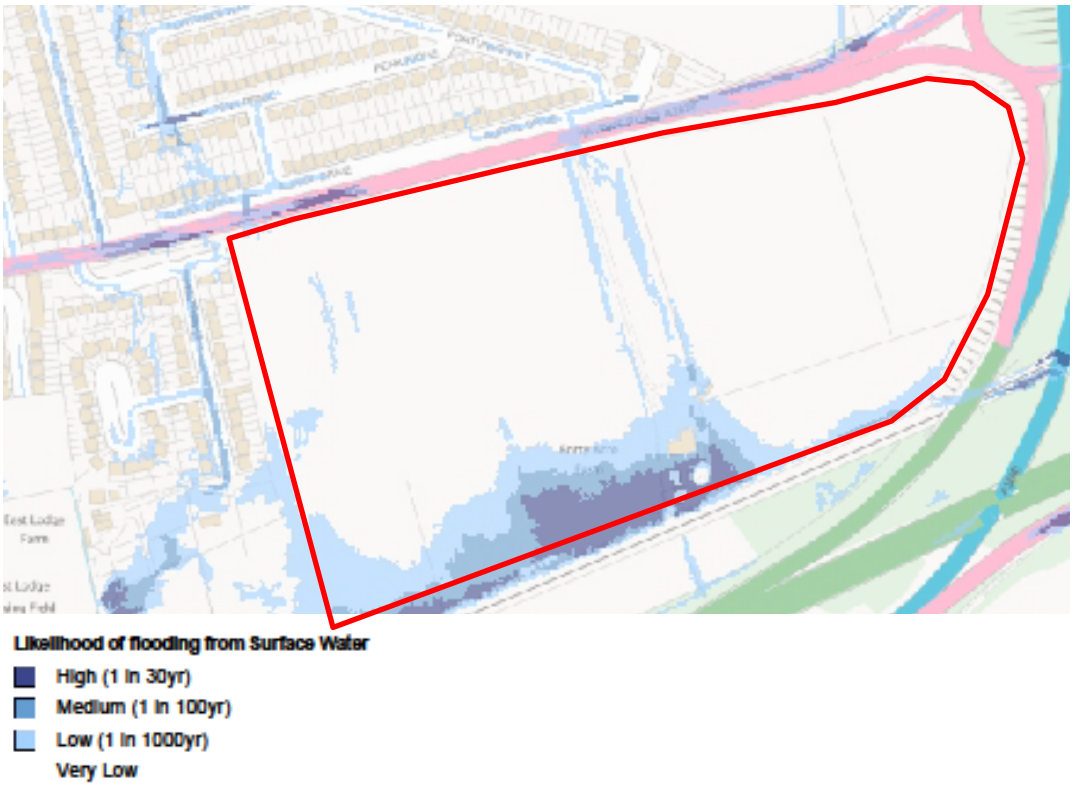


Figure 3 Extract: – Extract from Environment Agency Risk of Surface Water Flood Risk Maps

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 4: 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 5: Table 3 - Flood Risk Vulnerability and Flood Zone 'Compatibility'

As the development lies partly within Flood Zone 2 and 3 and based on the proposed development's vulnerability it will need to pass the Exception Test in order to satisfy the requirements of the PPG.

For the Exception Test to be passed a development proposal:

- Must demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA;
- The development should be on developable brownfield land or, if not, it must be demonstrated that there is no such alternative land available; and
- A FRA must demonstrate that the development will be safe for its lifetime taking into account the vulnerability of its users, without increasing flood risk elsewhere, and where possible, reducing flood risk overall.

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 July as part of their pre-application process. Details of the key elements of the constraints and opportunities discussed at the meeting relating to the surface water drainage strategy and flood risk are summarised in their correspondence as presented in **Appendix F**.

Some of the key elements of the meeting which have been considered in the development of the surface water drainage strategy are as follows:

- Consideration of infiltration drainage, if feasible;
- Using green corridors where possible to take exceedance flows;
- Surface level SuDS features such as wet pond would be considered highly beneficial;
- Attenuation basins to be located outside of the flood zones and consideration to the effect of tide lock should be undertaken to assess impact to onsite attenuation

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 over a weathered chalk stratum. The use of both attenuation basins and ponds are proposed within the surface water drainage scheme and whilst part of the basins

are located within Flood Zone 3 (tidal flood zone), the levels of the basin have been raised and the impact of tide lock considered as part of the attenuation scheme, this mitigates the potential impact of placing the basins within the designated flood zone. The principles of placing the attenuation basin and features within Flood Zone 3 and mitigating this through raising the levels above the tidal peak flood level were agreed in principle with the EA during the meeting of 19th August 2016.

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 southern boundary. This plan is presented as **Appendix H.**

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): 735

Soil: 0.40

Region 7

Area: 6.56ha (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)
6.56	**23.6**	20.1	53.6	75.4	1539

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.

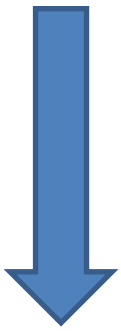
SuDS Component	Potential of delivering SuDS Design Criteria
Infiltration Systems Swales Bioretention systems Pervious Pavements Detention Basins Trees Green Roofs Ponds and Wetlands Filter Drains Filter Strips Rainwater Harvesting Systems Proprietary Treatment Systems Attenuation Storage Tanks	High  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. As such full infiltration drainage has not been deemed suitable for this site.

Existing Watercourses

There is an existing ditch which runs along the southern boundary of the site which connects into a watercourse which discharges beneath the existing railway and the A27 and out into Langstone Harbour.

In reviewing the hierarchy for a proposed outfall and constraints associated with the re-development we have determined the proposed discharge from the residential portion of the site would continue to Langstone Harbour, via the existing watercourse and Southern Water surface water outfall.

5.4 Post Development Run Off

Using the Micro drainage simulation suite, an assessment of the proposed peak discharge rates prior to mitigation measures has been made. A 360min storm duration was then applied to ascertain the discharge volume.

The following parameters were used for the initial assessment and findings tabled below.

M5-60 (mm): 19.40

Ratio: 0.350

Time of Entry: 5 minutes

Impermeable Development Area (Ha)	**Q1 Year (L/sec)**	**Q30 Year (L/Sec)**	**Q100 Year Plus Climate (L/Sec)**	**Discharge Volume (m3)** (360min Winter)
6.474	397	1069	1419	4833

Table 4: Summary of Post Development Runoff prior to mitigation

5.5 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**.

5.5.1 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, southwards towards a new attenuation basins and SuDS ponds which will provide attenuation of the restricted flow prior to discharging to a series of ponds and scrape creation areas/ bio retention areas which will provide multiple levels of SuDS treatment to the surface water flows prior to final discharge to the Langstone Harbour via the surface water outfall and existing watercourses

5.5.3 Flow Control

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

The hydraulic models of the proposed surface water networks, incorporating the SUDs attenuation basins and flow control devices can be found in **Appendix J.**

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 J**.

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.

Impermeable Development Area (Ha)	**Q1 Year (L/sec)**	**Q30 Year (L/Sec)**	**Q100 Year Plus Climate (L/Sec)**	**Discharge Volume (m3)** (360min Winter)
6.474	20.5	51.3	59.5	2027

Table 5: Summary of Post Development Runoff with mitigation measures

In addition to this the impact of a joint probability event of the peak tidal surcharge event has been assessment in relation to a 1-year rainfall event. Theses calculations are presented in Appendix J. It should be noted that the volumes of “flooding” indicated on the results of the calculations related to the areas downstream of the attenuation and flow controls and relate to the tidal flooding only. These calculations indicate that the proposed system can operate with adequate attenuation during a peak 1-year rainfall event with a corresponding peak 1 in 200-year tidal surcharge event.

5.5.4 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: • 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) • Unplanned activities (accidents and spillages) that can cause temporary unexpected high pollution concentrations • The surface location and type, affecting wash-off rates and contaminant movement mechanisms • The drainage path • The length of the dry weather period before the rainfall event • The intensity and the duration of the rainfall, and the associated flow velocities 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 6: 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 7: Extract of Table 26.3 of SuDS Manual (2015)

As such the total SuDS mitigation index (figure 7) 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, ponds and scrape creation/bioretention areas thus providing a far greater SuDS mitigation index than what is required to meet the minimum standards.

5.5.5 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.

5.5.6 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 K**.

5.5.7 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 Havant Road.

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 17.87l/s (based on 386 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 225mm diameter sewer within Havant Road, 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. That whilst the site is located partly within Flood Zones 2 and 3, the residential portion of the development is situated wholly within the Flood Risk Zone 1 area;

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;

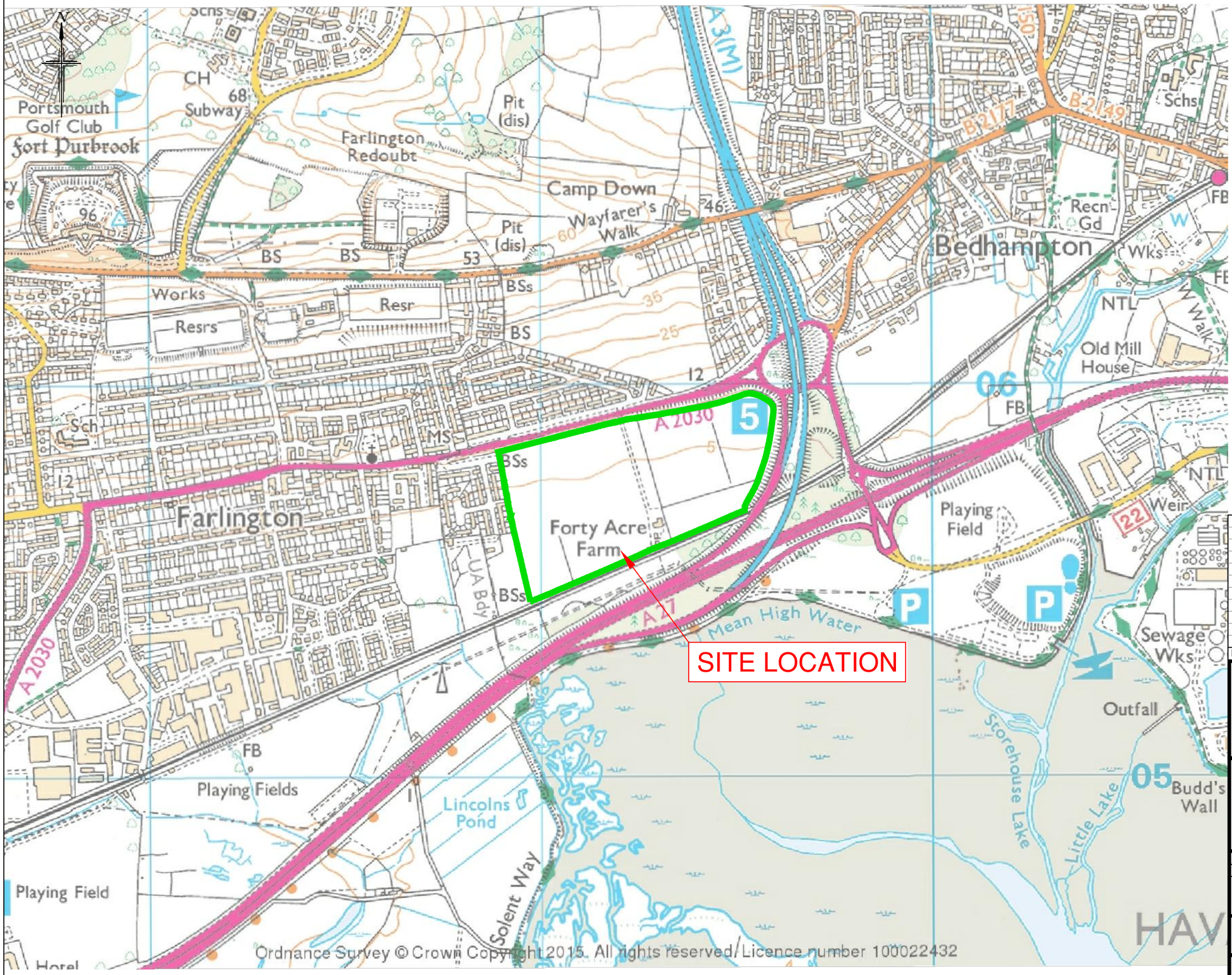
iv. The Development can be drained in a sustainable manner utilizing SuDS techniques;

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



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NOTES

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Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Site boundary added.	NW	AC	TRS

Client:-

BARRATT HOMES

DAVID WILSON HOMES
WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm, Havant Road, Havant

Drawing Title:-
SITE LOCATION PLAN

Date: June 2016 | Scales: 1:10,000 at A3
Drawn: PJ | Checked: KJ | Approved: TS

Drawing No.
BSO/E4519/001 A

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
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
IBT	Indian Bean Tree
LB	Laburnum
LM	Lime
LO	Locust Tree
LR	Laurel
M	Maple
MG	Magnolia 5950mN
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

AV	Air Valve
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
IC	Inspection Cover
KC	Kerb Chord
KD	Kerb Drop
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
CP	Concrete Post
CPF	Chestnut Paling Fence
CWF	Chicken Wire Fence
IRF	Iron Railing Fence
PKF	Picket Fence
PRF	Post & Rail Fence
PWF	Post & Wire Fence
SF	Security Fence
STF	Steel Post
WMF	Wire Mesh Fence
WPF	Wood Panel Fence

SURVEY STATION INFORMATION

Name	Easting	Northing	Height	Type
FT	489164.700	106003.654	10.466	Valid
FU	489125.960	105971.996	9.889	REFL
FV	489123.861	105972.788	9.883	REFL
FW	489123.504	105972.629	9.887	REFL
FX	489126.447	105971.235	9.764	REFL
FY	489126.715	105970.930	9.764	REFL
FZ	489126.715	105970.930	9.629	REFL
F2	489279.210	105825.206	2.443	REFL
F3	489279.210	105825.206	2.443	REFL
F4	489287.540	105899.766	9.462	Valid
F5	489328.972	105744.366	4.459	Valid
F6	489328.972	105744.366	4.459	REFL
F7	489401.196	105886.647	10.016	Valid
F8	489402.036	105874.132	10.004	Valid
F9	489402.036	105874.132	10.004	REFL
F10	489403.648	105886.766	10.142	Valid
F11	489562.575	105998.867	3.104	REFL
F12	489562.575	105998.867	3.104	REFL
F13	489564.067	105791.911	9.268	REFL
F14	489562.343	105998.862	2.954	REFL
F15	489562.343	105998.862	2.954	REFL
F16	489514.447	106012.675	10.047	REFL
F17	489562.602	106012.556	7.983	Valid
F18	489562.602	106012.556	7.983	REFL
F19	489581.926	106027.748	8.451	Valid
F20	489585.056	106033.016	2.451	Valid
F21	489585.056	106033.016	2.451	REFL
F22	489513.164	106063.490	2.439	REFL
F23	489513.782	106063.791	2.439	Valid
F24	489513.782	106063.791	2.439	REFL
F25	489577.599	106061.713	2.618	REFL
F26	489577.599	106061.713	2.618	Valid
F27	489601.165	106083.482	10.187	Valid
F28	489611.715	106080.783	10.217	Valid
F29	489626.396	106092.626	10.047	Valid
F30	489626.396	106092.626	10.047	REFL
F31	489666.063	106061.433	9.139	Valid
F32	489666.061	106060.966	11.051	Valid
F33	489627.436	106027.966	11.057	Valid

NOTES:
The survey grid has been related to OS National Grid using a flat earth projection and metric scale factor of 1, centred on Station F2.
Levels are related to OS datum determined from the National GPS Network using OSGM02.

The position and height of adjacent buildings have been obtained using higher level reflectorless measurement and may not take account of single storey extensions or conservatories below the line of sight.

No assumptions should be made regarding the interconnection of manholes. Drainage details have been obtained from surface inspection and should be verified if of critical importance.

Geomatic Surveyors

siteline

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34 Parham Drive
Eastleigh
SO50 4NU

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BARRATT DAVID WILSON	Client
FORTY ACRE FARM BEDHAMPTON HAMPSHIRE	Contract
SITE SURVEY	Title
36FA01	Drawing No.
AUGUST 2016	Date
1:200 (OVERSIZE SHEET)	Scale
SB	Surveyor

Appendix (C)

Feasibility Study – Site Layout Plan

FORTY ACRE FARM

idp PARTNERSHIP

BDW SOUTHAMPTON

		ha	acres
GROSS SITE AREA		23.05	56.96
NETT SITE AREA		7.78	19.25

26-Apr-2018

HOUSE TYPE	BEDROOM	CONFIG	STOREYS	NO	MIX	SQFT	SQM	TOTAL SQFT	TOTAL SQM
BARRATT									
AMBERSHAM	2	Apartment	3	6	1.9	584	54.3	3504	325.56
MALSON	2	Apartment	3	6	1.9	676	62.8	4056	376.80
ROSEBERRY	2	Terrisemi	2	25	7.8	679	63.1	16975	1577.50
WASHINGTON	2	Terrisemi	2	24	7.5	615	57.1	14760	1370.40
ALVERTON V1	2	Apartment	2	2	0.6	687	63.8	1374	127.60
MACKSTONE	3	Terrisemi	2	28	8.8	830	77.1	23240	2158.80
MORESBY	3	Terrisemi	2	23	7.2	855	79.4	19665	1826.20
KINGSVILLE	3	Terrisemi	2.5	19	5.9	1073	99.6	20387	1892.40
DWH									
WILFORD P/345-EC7/C7	2	Terrisemi	2	4	1.3	620	57.6	2480	230.40
HADLEY P/341-E-TP/341--D7	3	SemiDetached	2	21	6.6	1001	93.0	21021	1953.00
HADLEY P/341--V6D7	3	Detached	2	6	1.9	1001	93.0	6006	558.00
ARCHFORD P/382-EB7	3	Semi	2	24	7.5	832	77.3	19968	1855.20
KENNETT T/12-E-7	3	Semi	2.5	8	2.5	1089	101.2	8712	809.68
BAYSWATER H406---7	4	Detached	2.5	5	1.6	1342	124.7	6710	623.50
EXETER H418---7	4	Detached	2	10	3.1	1464	137.6	14640	1376.00
CORNELL H433---7	4	Detached	2	9	2.8	1374	127.7	12366	1148.85
HOLDEN H489--X7	4	Detached	2	4	1.3	1536	142.7	6144	570.80
BARRATT AFFORDABLE									
Type 98 - FLAT 1	1	Apartment	3	6	1.9	451	41.9	2706	251.40
Type 98 - FLAT 2	1	Apartment	3	6	1.9	451	41.9	2706	251.40
Type 98 - FLAT 3	2	Apartment	3	6	1.9	558	51.9	3348	311.22
T60	1	Apartment	2	4	1.3	465	43.2	1860	172.80
T61	1	Apartment	2	4	1.3	448	41.6	1792	166.40
T64	3	Terrisemi	2	9	2.8	733	68.1	6597	612.90
T66	3	Terrisemi	2.5	17	5.3	926	86.1	15742	1463.70
T67	2	Terrisemi	2	18	5.6	602	55.9	9632	895.04
T72	2	Apartment	2	1	0.3	704	65.4	704	65.43
T72 V1	2	Apartment	2	2	0.6	704	65.4	1408	130.86
T73	2	Apartment	2	1	0.3	704	65.4	704	65.43
DWH AFFORDABLE									
SH57	2	Terrisemi	2	10	3.1	602	55.9	6020	559.00
SH62	3	Semi	2	3	0.9	705	65.6	2115	196.80
SH74	3	Semi	2	7	2.2	780	72.9	5495	510.30
SH68	3	Semi	2.5	4	1.3	926	86.1	3704	344.40
		TOTAL	**320**	**100**				**266741**	**24780.77**
		OVERALL TOTALS	**320**					**266741**	**24780.77**

OVERALL DENSITY	
UNITS / ha	41.08
UNITS / ACRE	16.62
SQ.M / ha	3181
SQ.FT / ACRE	13857

SHMA PRIVATE MIX	TOTAL	%
1 BED APARTMENT	0	0.00
2 BED HOUSE/APARTMENT	67	29.91
3 BED HOUSE	129	57.59
4 BED HOUSE	28	12.50
	224	100.00

SHMA AFFORDABLE MIX	TOTAL	%
1 BED APARTMENT	20	20.83
2 BED HOUSE/APARTMENT	36	37.50
3 BED HOUSE	40	41.67
4 BED HOUSE	0	0.00
	96	100.00

NOTE: Nett area excludes all public open space and associated structural landscaping / buffer planting / half roads adjacent green etc

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

DESIGNERS RISK ASSESSMENT
Construction (Design and Management) Regulations 2007

RESIDUAL RISKS

REF:	DESCRIPTION	DATE:

CARE HOME DEVELOPMENT SITE

Landscaping and SUDs - indicative only
For landscaping and drainage proposals refer to separate landscape and engineering drawings

PLAY AREA

N
W E
S

KEY

- SITE BOUNDARY
- CARE HOME SITE BOUNDARY
- SALES AREA - DWH
- SALES AREA - BARRATT
- AREA OF TREES TO BE REMOVED
- GRASSCRETE AREAS - CONSTRUCTION TO BE CAPABLE OF ALLOWING EMERGENCY VEHICLE ACCESS
- HEAVY DUTY CONSTRUCTION FOOTPATH OR DRIVE - CONSTRUCTION TO BE CAPABLE OF ALLOWING EMERGENCY VEHICLE ACCESS
- DENOTES TREES TO BE REMOVED
- SHARED OWNERSHIP
- AFFORDABLE RENT

BARRATT HOMES
DAVID WILSON HOMES
WHERE QUALITY LIVES

REVISION	DATE	DESCRIPTION	CHECKED

idp PARTNERSHIP
IAN DARBY PARTNERSHIP
NORTHERN

ST. JUDES, BARKER STREET, SHIELDFIELD, NEWCASTLE UPON TYNE, NE2 1AS
TEL (0191) 261 4442 FAX (0191) 261 1090 e-mail - info@idpartnership-northern.com

JOB / CLIENT: Forty Acre Farm for Barratt Southampton

DRAWING TITLE: Proposed Residential Site Layout

PROJECT ARCHITECT	DRAWN BY	CHECKED
KD	VT/FY	
SCALE: 1:500	PROJECT NO: N81:2393	DRAWING NO: PL06
DATE: April 2018		

DRWG. STATUS: DRAFT | CONSULTATION | TENDER | CONSTRUCTION | RECORD

COPYRIGHT - idpartnership

Appendix (D)

Geotechnical Information

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Carters Barn
Sherrington
Wiltshire
BA12 0SN

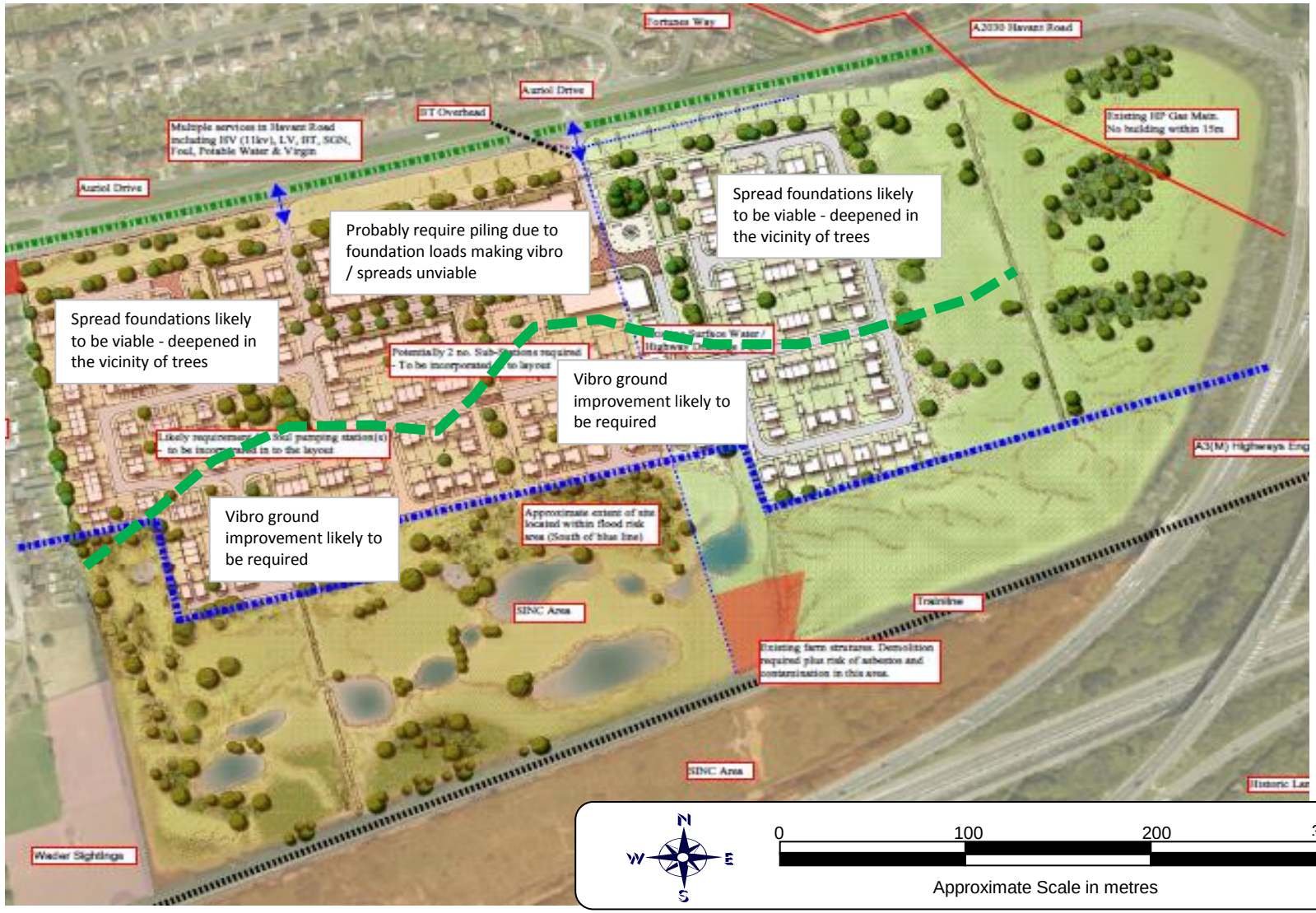
Site Plan

Site Forty Acre Farm, Havant Road, Bedhampton

Client BDW Southampton

PRELIMINARY FOUNDATIONS ASSESSMENT

Note that this plan is for preliminary discussion only and is subject to change



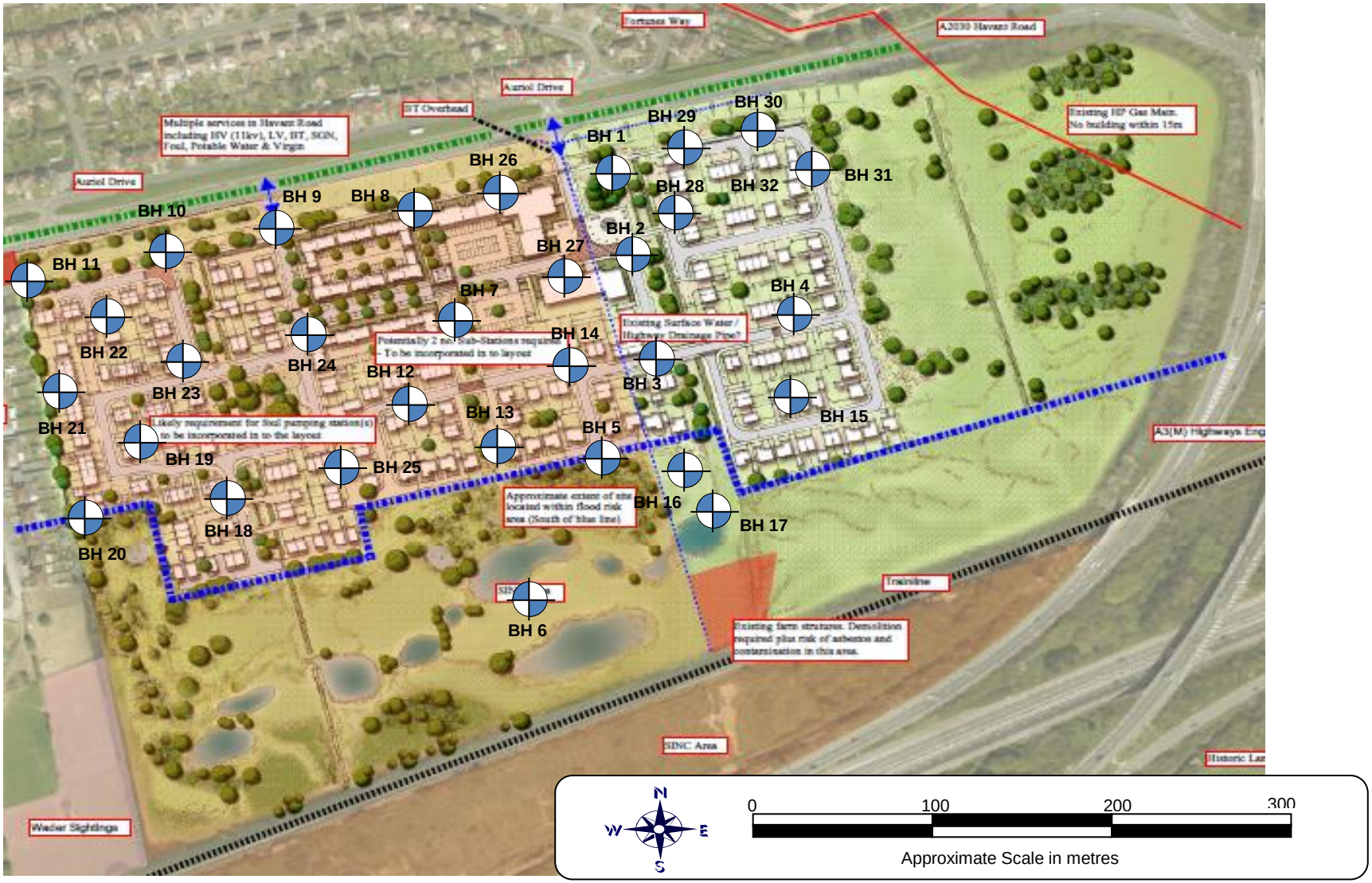
WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Carters Barn
Sherrington
Wiltshire
BA12 0SN

Site Plan

Site Forty Acre Farm, Havant Road, Bedhampton

Client BDW Southampton



WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.35			TOPSOIL
		0.50	D					Firm locally stiff pale brown and orange-brown silty slightly sandy CLAY with abundant fine gravel and occasional flint cobbles
		1.00	D		1.20			
		1.50	D					Pale yellowosh silty SAND with abundant fine chalk fragments, occasional flint cobbles and pockets of firm brown clay
		2.00	D					
		2.50	D					
					3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Groundwater not encountered. Standpipe installed with a response zone from 1.00m to 3.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			TOPSOIL
		0.50	D					Soft slightly sandy very clayey SILT locally grading into very silty clay with occasional fine to medium flint gravel and occasional fine chalk fragments
		1.00	D					
		1.50	D		1.40			Soft and very soft pale yellowish brown and brown silty fine SAND with abundant fine chalk fragments and scattered fine flint gravel
		2.00	D					
	▽	2.50	D		2.30			Off white, yellowish brown and orange-brown mottled clayey sandy SILT with abundant chalk and fine flint gravel and occasional fine to medium flint gravel
		3.00	D					
		3.50	D		3.40			Soft pale grey CLAY
					4.00			End of Borehole at 4.00 m
			Type	Results				

1 2 3 4 5 6 7 8 9

Remarks: Groundwater encountered at 2.40m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH3
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.15			TOPSOIL
		0.50	D					Soft becoming form pale brown very silty slightly sandy CLAY with scattered fine flint and chalk gravel
		1.00	D					
		1.50	D					
		2.00	D					
		2.50	D		2.40			Soft pale brown and off whie clayey SILT with abudant fine chalk and flint gravel
	▽	3.00	D					
					3.20			Recovered as white and off whie completely weathered CHALK
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

1 2 3 4 5 6 7 8 9

Remarks: Groundwater seepage at 3.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH4
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND (crushed taramc and brick rubble)
		0.50	D					Soft pale brown and brown silty locally very silty CLAY with scattered fine flint and chalk gravel
		1.00	D					
		1.50	D					
		2.00	D					
					2.30			Pale yellowish brown, pale brown, pale orange-brown and off hite sandy clayey SILT with scattered fine flint and chalk gravel
		2.50	D					
	▽	3.00	D					
					3.20			Pale yellowish orange-brown silty SAND with fine chalk and flint gravel
		3.50	D		3.50			Soft pale grey CLAY with yellowish brown mottled chalk gravel
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater seepage at 3.20m. Standpipe installed with a response zone from 1.00m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH5
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			TOPSOIL
		0.50	D					Firm orange-brown silty sandy CLAY with occasional fine chalk and flint gravel
		1.00	D		1.10			Soft locally firm pale grey and pale brown very sandy silty CLAY with occasional fine chalk gravel
		1.50	D					
		2.00	D					
	▽	2.50	D		2.30			Pale grey with orange-brown mottled silty clayey fine SAND
		3.00	D					
		3.50	D					
					3.60			Off white chalk derived sandy SILT with flint cobbles
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.50m. Standpipe installed with a response zone from 1.00m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH6
Sheet 1 of 1

Project Name: 40 Acre Farm	Project No.: J16120	Co-ords: -	Hole Type: WLS
Location: Havant Road, Bedhampton		Level: -	Scale: 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By: DPB

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.15			TOPSOIL
		0.50	D					Soft pale brown silty sandy CLAY with abundant fine chalk gravel
		1.00	D					
		1.50	D		1.40			Soft pale brown and pale yellowish brown silty sandy CLAY with scattered flint and chalk gravel
	▽	2.00	D					
		2.50	D		2.20			Off white chalk derived very silty GRAVEL of flint and chalk
		3.00	D					
		3.50	D					
					3.80			Recovered as completely weathered CHALK
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encoutered at 1.80m. Standpipe installed with a response zone from 0.50m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH7
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.50			TOPSOIL
		1.00	D		1.20			Firm orange-brown and brown silty sandy CLAY with scattered fine flint and chalk gravel
		1.50	D					Soft pale yellowish brown silty sandy CLAY
		2.00	D		2.30			
		2.50	D					Soft pale yellowish brown silty sandy CLAY with abundant fine chalk gravel
		3.00	D					
		3.50	D		4.00			End of Borehole at 4.00 m
			Type	Results				

1 2 3 4 5 6 7 8 9

Remarks: Groundwater not encountered. Standpipe installed with a response zone from 0.50m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH8
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	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		0.30			TOPSOIL
		0.50	D					Firm brown and dark brown silty sandy CLAY
		0.75	D		0.90			
		1.00	D					Soft pale yellowish brown very silty locally sandy CLAY with abundant fine flint and chalk gravel and occasional flint cobbles
		1.50	D					
		2.00	D					
	▽	2.50	D					
		3.00	D					
		3.50	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 2.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH9
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND (crushed gravel and tarmac)
		0.50	D					Soft locally firm pale brown silty very silty CLAY with occasional flint and chalk gravel
		1.00	D					
		1.50	D					
		2.00	D		2.10			
	▽							Soft pale grey and pale brown mottled clayey SILT with silty sandy partings and occasional fine chalk gravel
		2.50	D					
		3.00	D					
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.30m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH10
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25			TOPSOIL
		0.50	D					Firm dark orange-brown silty sandy CLAY with scattede flint cobbles and gravel
		1.00	D					
		1.50	D		1.40			Soft pale yellowish brown silty CLAY with abundant fine chalk and flint gravel
		2.00	D		2.00			Off white silty sandy chalk derived GRAVEL of weak chalk fragments
		2.50	D					
		3.00	D		3.00			Completely weathered CHALK
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater not encountered.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH11
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	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					Pale yellowish brown silty sandy chalk derived GRAVEL with abundant weak chalk and flint gravel and occasional flint cobbles
		1.00	D					
		1.50	D					
		2.00	D					
		2.50	D					
		3.00	D		2.80			Recovered as completely weathered CHALK
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater not encountered. Standpipe installed with a response zone from 1.0m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH12
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	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		0.40			Ploughed TOPSOIL
		0.50	D					Firm dak brown and brown silty sandy CLAY with occasional flint cobbles
		1.00	D		1.30			
		1.50	D					Soft pale yellowish brown very silty CLAY with abundant fline chalk fragments, flint gravel and occasiona flint cobbles
		2.00	D					
	▽	2.50	D		2.70			Recovered as compltely weatherd white and off white CHALK
		3.00	D					
		3.50	D		4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.70m as seepage.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH13
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.50			Ploughed TOPSOIL
		1.00	D					Firm locally soft dark brown sitly sandy CLAY with cocasional flint cobbles
		1.50	D		1.80			
		2.00	D					Off white and pale yellowish brown chalk derived sandy SILT with abundant fragments of weak white chalk, occasional flint grvael and scattered flint cobbles
		2.50	D					
		3.00	D					
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

1 2 3 4 5 6 7 8 9

Remarks: Groundwater not ecountered.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH14
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	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					TOPSOIL
		0.50	D		0.80			
		1.00	D					Firm becoming soft brown silty CLAY with occasional sandy partings and occasional flint gravel
		1.50	D					
		2.00	D		2.00			Soft yellowish brown silty sandy CLAY with abundant fine chalk and flint gravel
	▽	2.50	D		2.60			Soft pale grey with orage-brown mottled sandy SILT with abundant fine chalk gravel
		3.00	D					
		3.50	D					
					4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.40m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH15
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	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		0.30			MADE GROUND (reworked topsoil wth gravel)
		0.50	D					Firm becoming soft below 1.20m brown silty sandy CLAY with occasional fine chalk fragments
		1.00	D					
		1.50	D					
		2.00	D					
		2.50	D		2.30			Soft and very soft pale yellowish brown and off white sandy SILT with abundant fine chalk fragments
	▽	3.00	D		3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH16
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND (tarmac)
		0.50	D					MADE GROUND (black sandy gravel with brick and gravel)
					0.60			Very soft grey silty CLAY with occasional decayed organic matter
		1.00	D					
	▽	1.50	D					
		2.00	D					
		2.50	D					
					2.80			Very soft pale grey silty clayey locally clayey SILT with occasional weak chalk gravel
					3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Groundwater encountered at 1.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH17
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 03/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.50	D		0.60			MADE GROUND (black sandy clay with abundant brick and gravel)
		1.00	D					Very soft pale grey silty CLAY with occasional decayed organic matter - possble made ground
	▽	1.50	D		1.80			
		2.00	D					Black amorphorus PEAT with layers of decayed fiborous organic matter
		2.50	D		2.30			Soft pale grey clayey SILT with occasional weak chalk gravel
					3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Grounwater encountered at 1.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH18
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	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		0.35			TOPSOIL (dry and dusty)
		0.50	D					"Stiff" dark orange-brown and brown silty sandy CLAY with occasional fine gravel, roots, rootlets and roothairs - desiccated soil
		1.00	SPT	N=14				
		1.00	D	(2,3/ 3,3,4,4)				
		1.50	D					
		2.00	SPT	N=8	2.00			
		2.00	D	(2,2/ 2,2,2,2)	2.15			Firm dark orange-brown and brown silty sandy CLAY
		2.50	D					Soft locally firm pale yellowish brown, pale orage-brown and pale grey very silty sandy CLAY with abundant fine chalk gravel
	▽	3.00	SPT	N=7				
	▽	3.00	D	(2,2/ 2,1,2,2)				
		3.50	D					
		4.00	SPT	N=8				
		4.00	D	(1,2/ 2,2,2,2)				
		4.50	D		4.40			Pale off white SILT
					4.60			Soft pale grey very silty CLAY
		5.00	SPT	N=7 (1,2/ 2,1,2,2)	5.00			End of Borehole at 5.00 m

1 2 3 4 5 6 7 8 9

Type Results

Remarks: Groundwater encountered at 3.20m. Standpipe installed with a response zone from 0.50m to 5.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH19
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.35			TOPSOIL
		0.50	D					"Firm" pale orange-brown and brown silty slightly sandy CLAY with occasional flint cobbles - desiccated
		1.00	D		0.90			Pale yellowish and off whte silty fine SAND with abundant fine chalk fragments
	▽	1.50	D					
		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				

Remarks: Groundwater encountered at 1.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH20
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	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					Stiff brown and dark orange-brown silty sandy CLAY
		0.75	D		0.80			
		1.00	D					Firm becoming soft brown and dark orange-brown silty sandy CLAY
		1.50	D					
					1.80			
		2.00	D					Very soft pale grey silty CLAY with fine chalk gravel
	▽	2.50	D		2.60			
		3.00	D					White and off white completely weathered CHALK
		3.50	D					
		4.00	D		4.00			End of Borehole at 4.00 m
				Type / Results				

Remarks: Groundwater seepage at 2.60m. Standipe installed with a resonse zone from 0.50m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH21
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			TOPSOIL
		0.50	D					Firm dark orange-brown silty sandy CLAY with occasional fine to medium flint gravel
		1.00	SPT	N=9	0.90			
		1.00	D	(2,2/ 2,2,2,3)				Soft locally firm, pale yellowish brown and brown silty sandy CLAY with occasional fne chalk and flint gravel and occasional flint cobbles
		1.50	D					
	▽	2.00	SPT	N=8				
		2.00	D	(2,2/ 2,2,2,2)				
		2.50	D		2.40			Recovered as completely weathered CHALK
		3.00	SPT	N=9	3.00			
		3.00	D	(3,2/ 2,3,2,2)				End of Borehole at 3.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.10m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH22
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	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		0.40			TOPSOIL
		0.50	D					Firm orange-brown silty sandy CLAY with occasional flint cobbles
		1.00	SPT	N=7				
		1.00	D	(1,1/ 1,2,2,2)				
		1.50	D					
	▽				1.80			
		2.00	SPT	N=6				Soft pale yellowish brown silty locally very sandy CLAY with abundant fine chalk gravel
		2.00	D	(2,1/ 2,1,2,1)				
		2.50	D					
		3.00	SPT	N=10				
		3.00	D	(2,2/ 2,3,2,3)				
		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 seepage at 1.90m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH23
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	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					"Stiff" orange-brown silty sandy CLAY with occasional mediium flint gravel - desiccated
		1.00	D					
		1.50	D		1.60			"Stiff" yellowish brown silty sandy CLAY with abundant fine chalk fragments - desiccated
		2.00	D		2.20			Firm yellowish brown and pale grey silty sandy CLAY with occasional flint cobbles
		2.50	D					
		3.00	D		3.00			End of Borehole at 3.00 m
			Type	Results				

Remarks: Groundwater not encountered.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH24
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 06/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.40			TOPSOIL
		0.50	D					Firm dark yellowish orange-brown silty sandy CLAY with occasional fine flint gravel
		1.00	SPT	N=13				
		1.00	D	(3,3/ 3,3,3,4)	1.20			
		1.50	D					Pale yellowish brown clayey sandy SILT with abundant fine chalk and flint gravel
	▽	2.00	SPT	N=15				
		2.00	D	(2,2/ 2,4,4,5)				
		2.50	D					
		3.00	SPT	N=11				
		3.00	D	(3,2/ 2,3,3,3)				
		3.50	D					
		4.00	SPT	N=10	4.00			
		4.00	D	(3,3/ 2,3,3,2)				End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH25
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.35			TOPSOIL
		0.50	D					Firm brown silty sandy CLAY with occasional fine flint and chalk gravel
		1.00	D					
		1.50	D					
	▽	2.00	D		1.90			Soft pale yellowish brown very silty very sandy CLAY with abundant flint and chalk gravel
		2.50	D					
		3.00	D		2.80			Recovered as completely weathered white CHALK
		3.50	D					
		4.00	D		4.00			End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 2.30m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH26
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	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 brown silty sandy CLAY with occasional flint cobbles
		1.00	D					
		1.50	D					
		2.00	D		2.10			
		2.50	D					Pale orange-brown silty very sandy CLAY with abundant fine chalk gravel and occasional flint cobbles
		3.00	D					
		3.50	D		3.20			Recovered as completely weathered white CHALK
		4.00	D		4.00			End of Borehole at 4.00 m
				Type / Results				

Remarks: Groundwater not encountered. Damp below 2.90m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH27
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	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 brown silty sandy CLAY woth occasional flint cbbles
		1.00	SPT	N=7				
		1.00	D	(1,1/ 2,1,2,2)				
		1.50	D					
		2.00	SPT	N=8				
		2.00	D	(1,1/ 2,2,2,2)				Locally soft 2.00m to 2.50m.
		2.50	D					
					2.90			
		3.00	SPT	N=9				Soft orange-brown and dark yellowish orange-brown silty sandy CLAY with occasional flint and chalk gravel
		3.00	D	(1,2/ 3,2,2,2)				
		3.50	D					
					3.90			
		4.00	SPT	N=11	4.00			Yellowish brown very silty sandy CLAY with flint cobbles
		4.00	D	(2,3/ 3,2,3,3)				End of Borehole at 4.00 m
				Type Results				

Remarks: Groundwater not encountered. Damp below 2.50m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH28
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.25			TOPSOIL
		0.50	D					Firm brown and dark orange-brown silty sandy CLAY with scattered flint cobbles
		1.00	SPT	N=6				
		1.00	D	(1,1/ 1,1,2,2)				
		1.50	D					
		2.00	SPT	N=10				
		2.00	D	(2,2/ 2,2,3,3)				
		2.50	D					
		3.00	SPT	N=15	3.00			
		3.00	D	(2,2/ 3,4,4,4)				Pale grey and off white clayey SILT with chalk gravel
		3.50	D					
	▽				3.80			Recovered as completely weathered CHALK
		4.00	SPT	N=16	4.00			
		4.00	D	(4,4/ 4,4,4,4)				End of Borehole at 4.00 m
			Type	Results				

Remarks: Groundwater encountered at 3.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH29
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.35			TOPSOIL
		0.50	D					Firm brown silty sandy CLAY with occasinal flint cobbles
		1.00	D					
		1.50	D					
		2.00	D		2.10			Poor recovered 2.00m to 3.00m
		2.50	D					Pale yellowish silty SAND with layers of silty sandy clay and abundant fine flint and chalk gravel
		3.00	D		2.80			Pale brown silty SAND with abundant fine chalk gravel
		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 not encountered. Damp below 3.10m. Poor recovery 2.00m to 3.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH30
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			TOPSOIL
		0.50	D					Firm brown silty sandy CLAY with occasional flint and chalk gravel
		1.00	SPT	N=10				
		1.00	D	(3,2/ 3,2,3,2)				
		1.50	D		1.60			Recovered as completely weathered CHALK
		2.00	SPT	N=18				
		2.00	D	(3,4/ 5,5,4,4)				
		2.50	D					
		3.00	SPT	N=13				
		3.00	D	(3,3/ 3,2,4,4)				
		3.50	D					
		4.00	SPT	N=16	4.00			End of Borehole at 4.00 m
		4.00	D	(4,4/ 4,4,4,4)				
			Type	Results				

1 2 3 4 5 6 7 8 9

Remarks: Groundwater not encountered. Damp below 1.80m. Standpipe installed with a response zone from 0.50m to 4.00m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH31
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	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			Firm dark orange-brown silty sandy CLAY with occasional fine chalk gravel
		1.00	D		1.10			White and off white sandy SILT
		1.50	D					Soft pale yellowish brown silty sandy CLAY with abundant fine chalk gravel and occasional flint cobbles
		2.00	D					
		2.50	D		2.40			Recovered as completely weathered CHALK with occasional flint cobbles
		3.00	D					
		3.50	D					
		4.00	D		4.00			End of Borehole at 4.00 m
				Type / Results				

Remarks: Groundwater not encountered. Damp below 2.80m.

AGS

WILSON BAILEY
GEOTECHNICAL & ENVIRONMENTAL

Borehole No
BH32
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
40 Acre Farm	J16120		WLS
Location: Havant Road, Bedhampton		Level: -	Scale 1:50
Client: BDW Southampton		Dates: 07/08/2016	Logged By DPB

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25			TOPSOIL
		0.50	D					Firm orange-brown and brown silty sandy CLAY with occasional fine to medium flint and chalk gravel
		1.00	SPT	N=8 (1,1/ 2,2,2,2)				
		1.00	D					
		1.50	D					
					1.90			
		2.00	SPT	N=7 (1,1/ 2,2,1,2)				Pale brown and off white clayey silty SAND with abundant fine to medium flint and chalk gravel and occasional flint cobbles
		2.00	D					
		2.50	D					
		3.00	SPT	N=7 (1,2/ 1,2,2,2)				
		3.00	D					
		3.50	D					
		4.00	SPT	N=7 (2,2/ 1,2,2,2)				
		4.00	D					
		4.50	D					
		5.00	D		5.00			End of Borehole at 5.00 m
		Type		Results				

Remarks: Groundwater not encountered. Damp below 2.50m.

AGS

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
21767	40 Acre Farm	Samples received	12/10/2016
		Schedule received	16/10/2016
Project No.	Client	Project started	17/10/2016
-	Wilson Bailey	Testing Started	26/10/2016

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BHA	-	1.00	-	D	Brown sandy silty CLAY with occasional roots	16	100	56	22	34	
BHA	-	2.00	-	D	Brown sandy silty CLAY with rare fine chalk gravel	18	95	39	18	21	
BHA	-	2.10	-	D	Brown sandy silty CLAY with rare fine chalk gravel	21	98	38	18	20	
BHA	-	3.00	-	D	Pale brown and orangish brown silty CLAY with occasional fm chalk gravel	17	90	28	17	11	
BHC	-	1.00	-	D	Brown slightly sandy silty CLAY	23	100	48	21	27	
BHD	-	1.00	-	D	Brown sandy silty CLAY with rare fine chalk gravel	18	95	38	19	19	
BHD	-	2.00	-	D	Brown sandy silty CLAY with rare fine chalk gravel	19	95	28	17	11	
BHE	-	1.00	-	D	Brown slightly sandy silty CLAY	21	100	45	21	24	
BHE	-	1.50	-	D	Brown and orangish brown sandy silty CLAY with rare fm and sub-angular gravel	20	98	41	18	23	
BHE	-	2.50	-	D	Pale brown silty CLAY with rare fine chalk gravel	19	98	32	17	15	
BHF	-	1.00	-	D	Brown sandy silty CLAY with rare fine gravel	15	99	47	21	26	
BHF	-	2.50	-	D	Pale brown and orangish brown silty CLAY with rare fine chalk gravel	17	95	30	16	14	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 01/11/2016

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
21767	40 Acre Farm	Samples received	12/10/2016
		Schedule received	16/10/2016
Project No.	Client	Project started	17/10/2016
-	Wilson Bailey	Testing Started	26/10/2016

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BHG	-	1.00	-	D	Brown and orangish brown slightly sandy silty CLAY with rare fine gravel	20	99	45	20	25	
BHG	-	3.00	-	D	Pale brown slightly gravelly slightly sandy silty CLAY with occasional fm chalk gravel (gravel is fm and sub-angular)	16	85	26	16	10	
BHJ	-	1.00	-	D	Brown slightly sandy silty CLAY	20	100	42	20	22	
BHK	-	1.00	-	D	Brown slightly sandy silty CLAY	21	100	49	20	29	
BHO	-	1.00	-	D	Brown and orangish brown slightly sandy silty CLAY	17	100	45	20	25	
BHO	-	1.50	-	D	Brown slightly gravelly CLAY (gravel is fmc and sub-angular to sub-rounded)	17	95	70	31	39	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 01/11/2016

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R1(b)

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
21767	40 Acre Farm	Samples received	12/10/2016
		Schedule received	16/10/2016
Project No.	Client	Project started	17/10/2016
	Wilson Bailey	Testing Started	19/10/2016

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top	Base	Type		%	g/l	g/l		
BHA	-	2.00	-	D	Brown sandy silty CLAY with rare fine chalk gravel	97	0.22	0.26	7.48	
BHD	-	1.00	-	D	Brown sandy silty CLAY with rare fine chalk gravel	97	0.15	0.18	7.48	
BHE	-	2.50	-	D	Pale brown silty CLAY with rare fine chalk gravel	98	0.17	0.21	7.50	
BHJ	-	1.00	-	D	Brown slightly sandy silty CLAY	100	0.12	0.14	6.80	
BHO	-	1.50	-	D	Brown slightly gravelly CLAY (gravel is fmc and sub-angular to sub-rounded)	97	0.70	0.84	7.53	

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials J.P

Date: 01/11/2016

Dominic Brightman
Wilson Bailey Geotechnical & Environmental Ltd
Carters Cottage
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BA12 0SN

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 16-48037

Site Reference:	40 Acre Farm
Project / Job Ref:	None Supplied
Order No:	None Supplied
Sample Receipt Date:	16/08/2016
Sample Scheduled Date:	16/08/2016
Report Issue Number:	1
Reporting Date:	19/08/2016

Authorised by:

Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BH2	BH5	BH7	BH8	BH9
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.50	0.50	0.50	0.25	0.35
Reporting Date: 19/08/2016	**QTSE Sample No**	222900	222901	222902	222903	222904

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.1	7.2	7.8	7.6	7.6
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.7	0.9	0.3	0.3	0.8
Arsenic (As)	mg/kg	< 2	MCERTS	7	9	7	9	12
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	21	22	32	26	28
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	9	11	13	12	13
Lead (Pb)	mg/kg	< 3	MCERTS	13	16	10	9	14
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	10	14	24	18	17
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	44	43	50	43	48
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BH12	BH14	BH15	BH16	BH17
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.25	0.25	0.25	0.50	0.50
Reporting Date: 19/08/2016	**QTSE Sample No**	222905	222906	222907	222908	222909

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.7	7.7	7.8	7.6	7.4
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	1.9	1.1	1	0.5	4.6
Arsenic (As)	mg/kg	< 2	MCERTS	14	7	11	13	9
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	1.2	1.2
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	0.2	< 0.2	< 0.2	0.7
Chromium (Cr)	mg/kg	< 2	MCERTS	19	18	25	26	16
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	19	12	14	13	21
Lead (Pb)	mg/kg	< 3	MCERTS	55	18	20	14	73
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	14	10	14	24	13
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	64	42	51	48	474
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

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Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis [S]

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 40 Acre Farm	**TP / BH No**	BH17	BH17	BH17		
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	**Depth (m)**	1.00	2.00	2.50		
Reporting Date: 19/08/2016	**QTSE Sample No**	222910	222911	222912		

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	**ISO17025**	Not Detected	Not Detected	Not Detected		
pH	pH Units	N/a	**MCERTS**	7.5	7.4	8.0		
Total Organic Carbon (TOC)	%	< 0.1	**MCERTS**	0.6	4.4	0.4		
Arsenic (As)	mg/kg	< 2	**MCERTS**	11	10	< 2		
W/S Boron	mg/kg	< 1	NONE	1	3.5	< 1		
Cadmium (Cd)	mg/kg	< 0.2	**MCERTS**	< 0.2	0.2	< 0.2		
Chromium (Cr)	mg/kg	< 2	**MCERTS**	23	21	8		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2		
Copper (Cu)	mg/kg	< 4	**MCERTS**	20	20	7		
Lead (Pb)	mg/kg	< 3	**MCERTS**	24	29	4		
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	**MCERTS**	21	14	6		
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3		
Zinc (Zn)	mg/kg	< 3	**MCERTS**	59	67	19		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

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Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Graham Revell

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
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Lenham Heath
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4480

Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-48037	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	TP / BH No	BH2	BH5	BH7	BH8	BH9
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.50	0.50	0.25	0.35
Reporting Date: 19/08/2016	QTSE Sample No	222900	222901	222902	222903	222904

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-48037	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	TP / BH No	BH12	BH14	BH15	BH16	BH17
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.25	0.25	0.25	0.50	0.50
Reporting Date: 19/08/2016	QTSE Sample No	222905	222906	222907	222908	222909

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.19
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.45
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	0.38	< 0.1	< 0.1	< 0.1	0.59
Pyrene	mg/kg	< 0.1	MCERTS	0.32	< 0.1	< 0.1	< 0.1	0.50
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1	0.17
Chrysene	mg/kg	< 0.1	MCERTS	0.23	< 0.1	< 0.1	< 0.1	0.26
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.28	< 0.1	< 0.1	< 0.1	0.33
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.15	< 0.1	< 0.1	< 0.1	0.15
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.24	< 0.1	< 0.1	< 0.1	0.22
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	< 0.1	0.20
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	< 0.1	< 0.1	0.17
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	2	< 1.6	< 1.6	< 1.6	3.2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 40 Acre Farm	**TP / BH No**	BH17	BH17	BH17		
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	**Depth (m)**	1.00	2.00	2.50		
Reporting Date: 19/08/2016	**QTSE Sample No**	222910	222911	222912		

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BH2	BH5	BH7	BH8	BH9
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.50	0.50	0.50	0.25	0.35
Reporting Date: 19/08/2016	**QTSE Sample No**	222900	222901	222902	222903	222904

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BH12	BH14	BH15	BH16	BH17
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.25	0.25	0.25	0.50	0.50
Reporting Date: 19/08/2016	**QTSE Sample No**	222905	222906	222907	222908	222909

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-48037	Date Sampled	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: 40 Acre Farm	TP / BH No	BH17	BH17	BH17		
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	1.00	2.00	2.50		
Reporting Date: 19/08/2016	QTSE Sample No	222910	222911	222912		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21		
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BH2	BH5	BH7	BH8	BH9
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.50	0.50	0.50	0.25	0.35
Reporting Date: 19/08/2016	**QTSE Sample No**	222900	222901	222902	222903	222904

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-48037	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	TP / BH No	BH12	BH14	BH15	BH16	BH17
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.25	0.25	0.25	0.50	0.50
Reporting Date: 19/08/2016	QTSE Sample No	222905	222906	222907	222908	222909

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-48037	**Date Sampled**	None Supplied	None Supplied	None Supplied		
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: 40 Acre Farm	**TP / BH No**	BH17	BH17	BH17		
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	**Depth (m)**	1.00	2.00	2.50		
Reporting Date: 19/08/2016	**QTSE Sample No**	222910	222911	222912		

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5		
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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4480

Soil Analysis Certificate - Sample Descriptions
QTS Environmental Report No: 16-48037
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: 40 Acre Farm
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 19/08/2016

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 222900	BH2	None Supplied	0.50	13.9	Brown loamy clay
^ 222901	BH5	None Supplied	0.50	12	Brown loamy clay
^ 222902	BH7	None Supplied	0.50	15.8	Light brown clay
^ 222903	BH8	None Supplied	0.25	15.7	Light brown clay
^ 222904	BH9	None Supplied	0.35	13.7	Light brown loamy clay
^ 222905	BH12	None Supplied	0.25	14.6	Brown loamy clay
^ 222906	BH14	None Supplied	0.25	12	Brown loamy clay
^ 222907	BH15	None Supplied	0.25	12	Brown loamy clay
^ 222908	BH16	None Supplied	0.50	17.8	Brown clay
^ 222909	BH17	None Supplied	0.50	32.1	Brown loamy clay with brick and chalk
^ 222910	BH17	None Supplied	1.00	18.4	Light grey clay
^ 222911	BH17	None Supplied	2.00	40	Black loamy clay with stones
^ 222912	BH17	None Supplied	2.50	11.9	Light grey clay with chalk and stones

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

^ no sampling date provided; unable to confirm if samples are within acceptable holding times

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4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 16-48037
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: 40 Acre Farm
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 19/08/2016

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Dominic Brightman
Wilson Bailey Geotechnical & Environmental Ltd
Carters Cottage
Sherrington
Wiltshire
BA12 0SN

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QTS Environmental Report No: 16-48972

Site Reference:	40 Acre Farm
Project / Job Ref:	None Supplied
Order No:	None Supplied
Sample Receipt Date:	09/09/2016
Sample Scheduled Date:	09/09/2016
Report Issue Number:	1
Reporting Date:	15/09/2016

Authorised by:

Kevin Old
Associate Director of Laboratory

Authorised by:

Russell Jarvis
Associate Director of Client Services

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4480

Soil Analysis Certificate						
QTS Environmental Report No: 16-48972	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BHA	BHC	BHC	BHE	BHI
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.50	0.25	0.75	0.21	0.50
Reporting Date: 15/09/2016	**QTSE Sample No**	226702	226703	226704	226705	226706

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.1	7.4	7.7	7.9	7.2
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.7	0.5	0.1	0.9	1
Arsenic (As)	mg/kg	< 2	MCERTS	7	6	22	8	10
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.2	0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	19	19	27	19	18
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	8	8	14	11	11
Lead (Pb)	mg/kg	< 3	MCERTS	12	10	10	17	23
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	11	11	27	13	12
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	42	46	55	48	47
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis (S)

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Soil Analysis Certificate						
QTS Environmental Report No: 16-48972	**Date Sampled**	None Supplied	None Supplied			
Wilson Bailey Geotechnical & Environmental Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: 40 Acre Farm	**TP / BH No**	BHK	BHO			
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	0.50	0.25			
Reporting Date: 15/09/2016	**QTSE Sample No**	226707	226708			

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	7.5	7.5			
Total Organic Carbon (TOC)	%	< 0.1	MCERTS	0.4	0.2			
Arsenic (As)	mg/kg	< 2	MCERTS	11	9			
W/S Boron	mg/kg	< 1	NONE	< 1	< 1			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	28	25			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	18	12			
Lead (Pb)	mg/kg	< 3	MCERTS	11	10			
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	22	21			
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3			
Zinc (Zn)	mg/kg	< 3	MCERTS	50	44			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis (S)

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-48972	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	TP / BH No	BHA	BHC	BHC	BHE	BHI
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.25	0.75	0.21	0.50
Reporting Date: 15/09/2016	QTSE Sample No	226702	226703	226704	226705	226706

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.14
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	0.13
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 16-48972	Date Sampled	None Supplied	None Supplied			
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied			
Site Reference: 40 Acre Farm	TP / BH No	BHK	BHO			
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	0.25			
Reporting Date: 15/09/2016	QTSE Sample No	226707	226708			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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4480

Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-48972	**Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	**TP / BH No**	BHA	BHC	BHC	BHE	BHI
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	0.50	0.25	0.75	0.21	0.50
Reporting Date: 15/09/2016	**QTSE Sample No**	226702	226703	226704	226705	226706

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - TPH CWG Banded						
QTS Environmental Report No: 16-48972	Date Sampled	None Supplied	None Supplied			
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied			
Site Reference: 40 Acre Farm	TP / BH No	BHK	BHO			
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied			
Order No: None Supplied	Depth (m)	0.50	0.25			
Reporting Date: 15/09/2016	QTSE Sample No	226707	226708			

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10			
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21			
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	4			
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3			
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10			
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21			
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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4480

Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-48972	Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Wilson Bailey Geotechnical & Environmental L	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 40 Acre Farm	TP / BH No	BHA	BHC	BHC	BHE	BHI
Project / Job Ref: None Supplied	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	Depth (m)	0.50	0.25	0.75	0.21	0.50
Reporting Date: 15/09/2016	QTSE Sample No	226702	226703	226704	226705	226706

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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4480

Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 16-48972	**Date Sampled**	None Supplied	None Supplied			
Wilson Bailey Geotechnical & Environmental L	**Time Sampled**	None Supplied	None Supplied			
Site Reference: 40 Acre Farm	**TP / BH No**	BHK	BHO			
Project / Job Ref: None Supplied	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	0.50	0.25			
Reporting Date: 15/09/2016	**QTSE Sample No**	226707	226708			

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2			
Toluene	ug/kg	< 5	MCERTS	< 5	< 5			
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2			
p & m-xylene	ug/kg	< 2	MCERTS	< 2	< 2			
o-xylene	ug/kg	< 2	MCERTS	< 2	< 2			
MTBE	ug/kg	< 5	MCERTS	< 5	< 5			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Soil Analysis Certificate - Sample Descriptions
QTS Environmental Report No: 16-48972
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: 40 Acre Farm
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 15/09/2016

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 226702	BHA	None Supplied	0.50	7	Brown clay with vegetation
^ 226703	BHC	None Supplied	0.25	11.5	Brown clay
^ 226704	BHC	None Supplied	0.75	15.9	Light brown clay
^ 226705	BHE	None Supplied	0.21	15	Brown clay
^ 226706	BHI	None Supplied	0.50	14.8	Brown clay
^ 226707	BHK	None Supplied	0.50	14.7	Light brown clay
^ 226708	BHO	None Supplied	0.25	12	Light brown clay

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

^ no sampling date provided; unable to confirm if samples are within acceptable holding times

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4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 16-48972
Wilson Bailey Geotechnical & Environmental Ltd
Site Reference: 40 Acre Farm
Project / Job Ref: None Supplied
Order No: None Supplied
Reporting Date: 15/09/2016

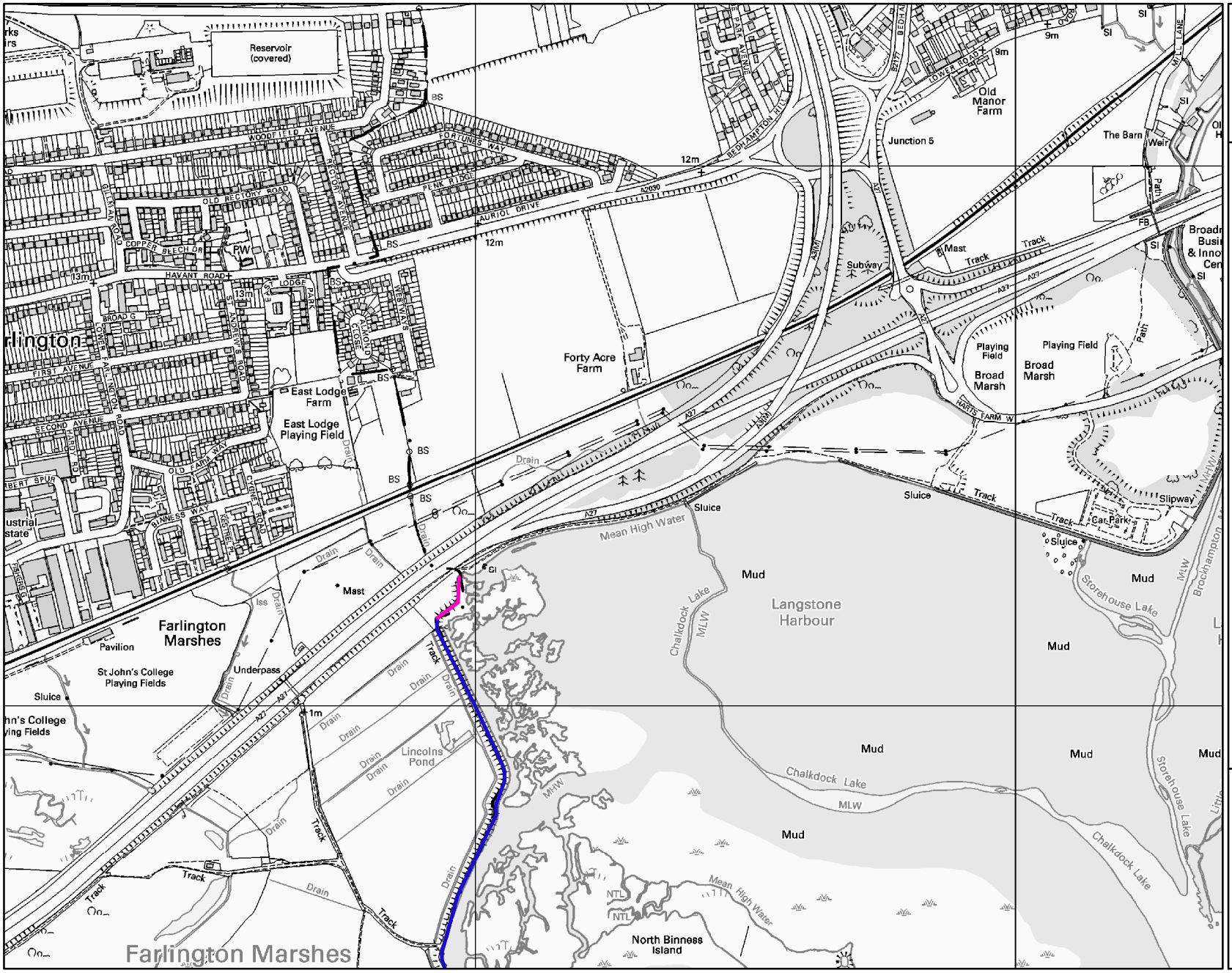
Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix (E)

Environment Agency Correspondence

Defences Centered on Havant Road - Created 26 July 2016 (Ref: SSD/17380)



Legend

Defence

Asset Ref

- 071EAS9040901C02
- 071EAS9041801C01

1:10,264 *

*when printed at A4.

N

0 200 400

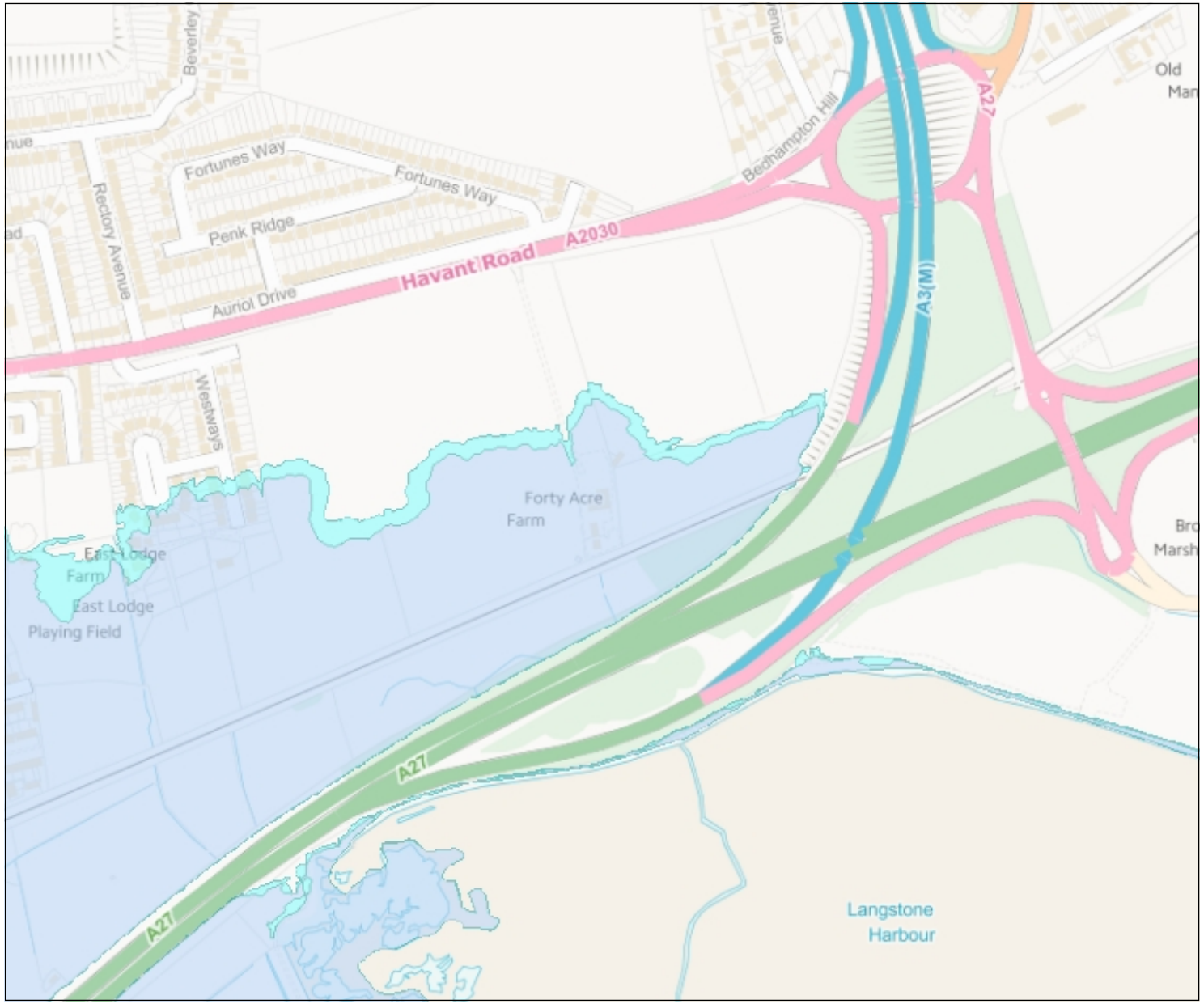
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Asset Ref.	Asset Type	Description	Location	Estimated Design Standard
071EAS9041801C01	sea defence (man-made)	Concrete sea wall	FARLINGTON MARSH	1:25
071EAS9040901C02	sea defence (man-made)	embankment		

Flood Map for Planning (Rivers and Sea) Centered on Havant Road - Created 26 July 2016



Environment Agency

Scale 1: 6,973

N
W E
S

Flood Map for Planning (Rivers & Sea)

- Flood Map - Defences
- Area Benefitting from Flood Defences
- Flood Map - Flood Storage Area
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occuring each year.

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From:	Lorraine Green
To:	Terry Seymour
Subject:	FW: Flood Risk Information for Forty Acre Farm - Ref: SSD/17380
Date:	27 July 2016 14:31:32
Attachments:	image001.gif Defences Map.pdf Flood Map for Planning (Rivers and Sea).pdf Risk of Flooding from Surface Water.pdf Open Government Licence.pdf uFMfSW Fact Sheet.pdf

---

From: Partnership and Strategic Overview team, HIOW [mailto:psohiow@environment-agency.gov.uk]
Sent: 26 July 2016 15:28
To: Lorraine Green <Lorraine@rcpconsultants.co.uk>
Cc: SSD Enquiries <SSDEnquiries@environment-agency.gov.uk>
Subject: Flood Risk Information for Forty Acre Farm - Ref: SSD/17380

Dear Lorraine,

Provision of Product 4 for forty Acre Farm, Havant Road, Havant, PO9 3LW.

Thank you for your request to use Environment Agency data, in the development of Forty Acre Farm, Havant Road, Havant, PO9 3LW. The information is attached.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

The site may be affected by an extreme flood. According to our published flood map, which provides a general estimate of the likelihood of flooding across England & Wales, the property is shown to be within Flood Zone 3 - an area which may have a 0.5% chance of flooding annually (1 in 200), **ignoring** the presence and effect of any flood defences.

The Environment Agency has no record of flooding to this area, but not all flooding events are reported to us and further information may be available from Havant Borough Council.

Defences – See attached map. The defences were found to be in good to fair condition when we last inspected them. Information on any nearby sea defences is available from Havant Borough Council.

Sea levels (still water design estimates) for the 0.5% (1:200) and the 0.1% (1:1000) annual exceedance probabilities relevant to your site are provided in the table below.

Chainage point: 160	Easting: 468789	Northing: 100080

Year	Tide Level (mAOD*)	
	0.5% annual exceedance probability/1 in 200 Year (Flood Zone 3)	**0.1% annual exceedance probability/1 in 1000 Year (Flood Zone 2)**
2011	3.2	3.4
2070	3.7	3.9
2115	4.4	4.5

* Levels in metres above Ordnance Datum Newlyn.

These values are based on 2011 base data, and have been projected for climate change using estimates for sea level rise presented in Table 4 of the Technical Guidance to the National Planning Policy Framework.

Note 1:
Extreme sea level values are for still water sea levels only. Extreme sea level values include the effect of storm surge but do not account for any local increase in sea level that may be induced by onshore wave action. Wave set-up would need to be estimated separately.

Note 2:
Annual exceedance probability describes the likelihood (chance) of being exceeded in any given year.

This information is provided subject to the enclosed *notice*, which you should read.

I hope that we have correctly interpreted your request. Please see the attached Standard Notice or licence for details of permitted use.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.
If you have any queries or would like to discuss the content of this letter further please call us on 08708 506506.

If you have any queries or would like to discuss the content of this letter further please contact the Partnership and Strategic Overview Team at the Environment Agency.

Yours faithfully

Aimee Cox
Partnership and Strategic Overview team, Hampshire and Isle of Wight
Environment Agency

Direct dial 020 8474 5815
Email psohiow@environment-agency.gov.uk
Part Time Tuesday, Wednesday and Thursday

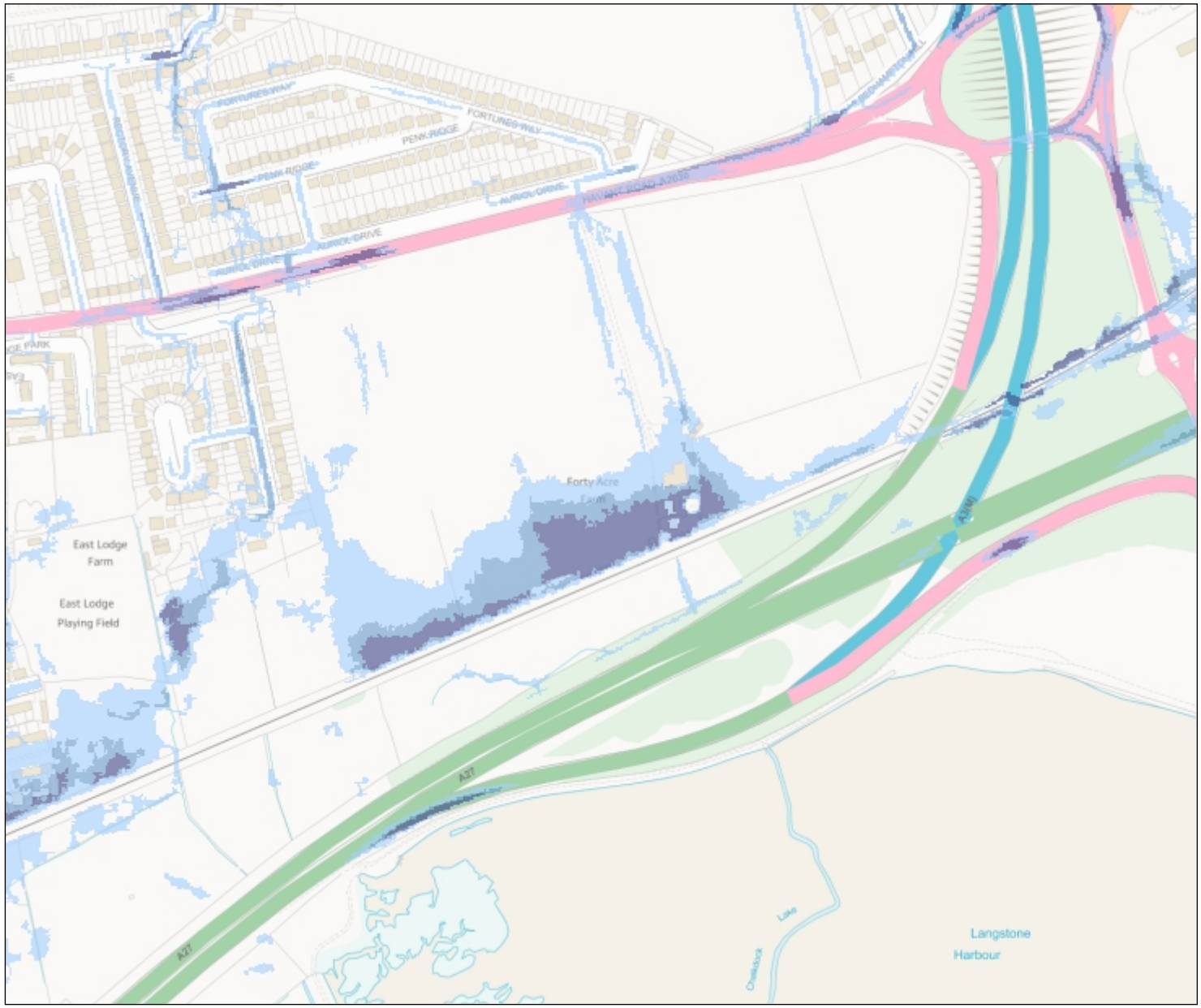
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Risk of flooding from Surface Water Centered on Havant Road - Created 26 July 2016



Environment Agency

Scale 1:6,250

N
W E
S

Likelihood of flooding from Surface Water

- High (1 in 30yr)
- Medium (1 in 100yr)
- Low (1 in 1000yr)
- Very Low

Likelihood of flooding from Surface Water

High:	Greater than or equal to 1 in 30 (3.3%) chance in any given year
Medium:	Less than 1 in 30 (3.3%) but greater than or equal to 1 in 100 (1%) chance in any given year
Low:	Less than 1 in 100 (1%) but greater than or equal to 1 in 1,000 (0.1%) chance in any given year
Very Low:	Less than 1 in 1,000 (0.1%) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on our website.

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What is the updated Flood Map for Surface Water?

Report version 1.0

November 2013

We are the Environment Agency. We protect and improve the environment and make it **a better place** for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

Published by:

Environment Agency
Horizon House, Deanery Road
Bristol BS1 5AH
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

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E: enquiries@environment-agency.gov.uk.

What is this document about?

It explains why and how the updated Flood Map for Surface Water was produced including:

- Historic and legislative context
- How it was produced
- What validation was carried out
- How locally produced information has been incorporated
- How we have ensured consistency while using both nationally produced mapping and locally produced information
- What outputs are available

Who does it apply to?

This document will be useful for:

- Risk Management Authorities and other partners (under the Civil Contingencies Act, for example), including:
  - Lead Local Flood Authorities (LLFAs)
  - Local Planning Authorities (LPAs)
  - Local Resilience Forums (LRFs)
- Commercial and non-commercial customers
- Environment Agency staff including the following teams:
  - Partnership and Strategic Overview
  - Customers and Engagement
  - Flood Resilience
  - Sustainable places
  - Regional Incidents and Emergency Planning
  - LRF and Flooding sub-group representatives

Contents

What is this document about? 1
Who does it apply to? 1

1 Introduction 4

2 Background 5
2.1 Why has the Environment Agency produced surface water flood maps? 5
2.2 Previous nationally produced surface water flood mapping 5
2.3 Flood Risk Regulations 6

3 What is the updated Flood Map for Surface Water? 7
3.1 What is the nationally produced surface water flood mapping? 7
3.2 Why produce an updated Flood Map for Surface Water? 7
3.3 Why is it an improvement? 8

4 Developing the nationally produced modelling 9
4.1 Scope of the nationally produced mapping 9
4.2 Hydrological (rainfall) modelling 10
4.3 Digital Terrain Model (DTM) 13
4.4 Hydraulic modelling approach 15
4.5 Validation 16
4.6 Comparison of nationally produced modelling approach with previous national mapping 17

5 Incorporating local information 20
5.1 Overview 20
5.2 Reviewing the nationally produced surface water flood mapping 20
5.3 Submitting locally produced mapping 20
5.4 Creating the uFMfSW 22

6 Post-processing national and local model outputs 23
6.1 Re-sampling to produce a consistent regular grid 23
6.2 Filtering model output data 23

7 Outputs 24
7.1 Overview 24
7.2 Extent of flooding 24
7.3 Depth 25
7.4 Velocity 25
7.5 Hazard rating 26
7.6 Model details 26
7.7 Suitability 28

8 Strengths and limitations of the uFMfSW 30

8.1 Strengths 30
8.2 Limitations 30

9 Validation studies 32
9.1 Overview 32
9.2 Greater Manchester 32
9.3 Gloucestershire 32
9.4 Rhondda Cynon Taff 33
9.5 Further information 33

10 Where to go for more information 34
10.1 Further supporting documents 34
10.2 Who to contact for more information 34

Annex A – Flood Risk Regulations 36
A.1 What do the Flood Risk Regulations say? 36
A.2 What are flood hazard maps? 36
A.3 Rainfall probabilities 36

Annex B – Model improvements 37

Annex C – DTM Data Sources 38

Annex D – Source of modelling in uFMfSW v1 39

Annex E – Post processing examples 40
E.1 Re-sampling to produce a regular grid 40
E.2 Filtering - removing very low hazard below 0.575 41
E.3 Filtering - removing small areas of flooding / filling isolated dry areas 44
E.4 Banding - depth 45
E.5 Banding - velocity 46
E.6 Banding - hazard rating 47

1 Introduction

In 2013 the Environment Agency, working with Lead Local Flood Authorities (LLFAs), produced the updated Flood Map for Surface Water. This is the third national surface water map produced by the Environment Agency under our Strategic Overview role.

We consider it to represent a significant improvement on the previous surface water flood maps, both in terms of method and representation of the risk of flooding. We have considerably improved the modelling techniques and data used, and also incorporated locally produced mapping where this is available to represent features best modelled at a local scale.

The updated Flood Map for Surface Water assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1 in 30 (3.3%)
- 1 in 100 (1%)
- 1 in 1000 (0.1%)

It provides the following data for each flooding scenario:

- Extent
- Depth
- Velocity (including flow direction at maximum velocity)
- Hazard (as a function of depth and velocity)

It also includes information about the source of the data (i.e. whether it was from the nationally produced modelling or locally produced modelling) and the confidence in the data outputs.

This document describes in detail:

- the background to the production of the maps
- the method used to produce the maps
- what is included in the resulting maps
- a summary of the strengths and limitations of the maps

The updated Flood Map for Surface Water is published on the Environment Agency website where it is known as the **Risk of Flooding from Surface Water** map.

2 Background

This section sets out the historical and legal context behind why the Environment Agency has produced the updated Flood Map for Surface Water.

2.1 Why has the Environment Agency produced surface water flood maps?

Although managing the risk of flooding from surface water is the responsibility of LLFAs, we've produced these maps under our Strategic Overview role in England and Strategic Oversight role in Wales. This is a role which was given to us by government following the recommendations of Sir Michael Pitt's review of the 2007 summer floods.

A key part of this role is to provide local authorities and partners with data, tools and guidance on flood risk management activities. The distribution of flood risk data supports local authorities and contributes towards the aim of our Strategic Overview role to ensure all floods are assessed and managed.

In April 2013, the strategic oversight role in Wales transferred from Environment Agency Wales to Natural Resources Wales. The Environment Agency has produced this map on behalf of Natural Resources Wales.

2.2 Previous nationally produced surface water flood mapping

The Environment Agency shared two surface water flood maps to support local flood risk management in England and Wales.

- Areas Susceptible to Surface Water Flooding maps (2008)
- Flood Map for Surface Water (2010)

The first map was produced following a recommendation in the Pitt review that the Environment Agency, supported by local authorities and water companies should urgently identify the areas that are at highest risk from surface water flooding.

The differences between the previous nationally produced surface water flood mapping products are explained in more detail in section 4.6. For more information about why these earlier maps were produced and the method used to produce them please refer to previous guidance or the *Summary of previous nationally produced surface water flood mapping* which will be available from early 2014. Some highlights are included below

2.2.1 Areas Susceptible to Surface Water Flooding maps

JBA Consulting developed the first nationally produced model of surface water flooding in 2007 and we procured a license to use the map, not the model itself, from JBA in 2008. We bought it so we could provide Local Resilience Forums (LRFs) with an initial indication of areas that may be susceptible to surface water flooding.

We first supplied it to LRFs in August 2008. We updated this in July 2009 (when new digital terrain model data became available) and sent the data to Local Planning Authorities (LPAs) in England. Following consultation with the Welsh Government, Welsh Local Government Association and the Planning Inspectorate, the data was

made available to LPAs in Wales in November 2009. It was also provided to Regional Resilience Teams for use in their functions which relate to emergencies as defined and as required by the Civil Contingencies Act 2004.

2.2.2 Flood Map for Surface Water (2010)

In March 2009 the Environment Agency commissioned JBA Consulting (working in partnership with Halcrow) to work with us to develop the Flood Map for Surface Water (FMfSW).

FMfSW used more up to date data, and more advanced modelling techniques to better represent the mechanisms that cause surface water flooding. This included a number of improvements to the original model in areas where it was known to be weaker; for example considering:

- an additional rainfall probability
- the influence of buildings
- reduction of effective rainfall through taking account of drainage and infiltration
- a better digital terrain model that incorporated the Environment Agency's high quality LIDAR data

The FMfSW was made available in 2010 to the same organisations as the AStSWF map.

2.2.3 Locally agreed information

Although FMfSW (2010) used more up to date data and more advanced modelling techniques to represent surface water flooding, in some areas (particularly extensive, flat landscapes) AStSWF was felt to provide a better representation of flooding. Neither map was considered definitive, but provided information to support local flood risk management. We asked each LLFA to make a decision on their locally agreed flood risk information, i.e. which map (AStSWF, FMfSW or local information) best represented the flooding in their area. In some cases they selected different maps to represent different parts of their area. This process provided useful feedback from local experts.

2.3 Flood Risk Regulations

The Flood Risk Regulations 2009 which implement the requirements of the European Floods Directive aim to provide a consistent approach to managing flood risk from all sources across Europe.

Under these regulations, LLFAs are responsible for producing flood hazard maps for surface water within designated Flood Risk Areas (as defined in the Preliminary Flood Risk Assessments), and the Environment Agency is responsible for publishing these maps by December 2013. The updated nationally produced surface water flood mapping was created, in part, so that LLFAs could use these maps to meet the requirements of the Flood Risk Regulations.

More information about the requirements of the Flood Risk Regulations is shown in Annex A.

3 What is the updated Flood Map for Surface Water?

It has been created from:

- the Environment Agency's new nationally produced surface water flood mapping, and;
- appropriate **locally produced mapping** from LLFAs

These are brought together into one map to form the updated Flood Map for Surface Water (uFMfSW) (see section 5.4). Our aim is to provide the best single source of information on surface water flooding for England and Wales that includes local information and knowledge. **LLFAs will be able to update the Flood Map for Surface Water with local information in the future**. More details on this update process will be available in early 2014.

3.1 What is the nationally produced surface water flood mapping?

The new nationally produced mapping improves on previous maps in many ways by using **local information** supplied from LLFAs and **better data and modelling techniques**. Some LLFAs supplied the following local information as **inputs to the modelling**:

- drainage rates
- percentage runoff rates
- critical storm durations

Where LLFAs were not able to supply this information we used values that were felt to give the best national representation.

We based the improvements on the findings of pilot studies which we carried out with LLFAs. These studies also highlighted that there was a demand for updated maps.

Section 4 and Annex B provide more information about the modelling techniques used.

3.2 Why produce an updated Flood Map for Surface Water?

There are a number of drivers and benefits for producing an updated Flood Map for Surface Water:

- To help LLFAs, customers, Environment Agency and government understand surface water flood risk consistently across all England and Wales.
- To help LLFAs focus on managing surface water flood risk.
- To help the Environment Agency to take a strategic overview and provide evidence for future funding decisions.

- To provide the public and other customers with easy access to consistent information on surface water flood risk enabling them to make better informed decisions.
- To meet ministerial commitments to make updated and improved surface water flood mapping available for England and Wales. Government have funded the update to the nationally produced mapping.
- To make it easier to share information with our customers. Until now, surface water flood mapping was not publicly available from a single organisation or place.
- To use new data and modelling techniques to produce a more representative picture of flood risk.
- To meet the requirements of the Flood Risk Regulations in the most efficient and cost effective way and reduce the burden on LLFAs.

The data also enables the government to meet their commitment to make updated and improved surface water flood mapping available to insurers, as set out in the memorandum of understanding between government and the Association of British Insurers. It will also help inform the planning process in relation to surface water flood risk.

3.3 Why is it an improvement?

The uFMfSW improves upon previous nationally produced surface water flood mapping as it:

- incorporates significant improvements in modelling techniques
- incorporates significant improvements in data:
    - We now have digital terrain information at 2m resolution or finer for over 90% of urban areas in England and Wales. Although there are still some areas with coarser resolution data (5m) where the flood maps will be less accurate, these are significantly reduced from previous national surface water flood maps.
    - The data used is more representative of flow routes than before. However, it still cannot represent every detail of the urban landscape and very local mechanisms of flooding.
- combines appropriate local mapping from LLFAs with national mapping to provide an improved and consistent picture of surface water flood risk
- provides velocity and depth information for a range of flood probabilities

Although it is an improvement, there are inevitably still assumptions in the model. Urban drainage capacity is the biggest uncertainty in the modelling. Whilst we have obtained local drainage rates where possible, we have made assumptions where no drainage data was available and in these areas the outputs of the model may be less representative.

Improvements in the modelling are detailed further in Annex B.

4 Developing the nationally produced modelling

This section gives an overview of the approach used for the nationally produced modelling and how this compares to the previous national surface water products.

Further detail of the methodology used for the nationally produced modelling and mapping can be found in the **National modelling and mapping method statement - May 2013** available from local Environment Agency offices.

It should be noted that the approach will differ in the areas where locally produced flood mapping is being used to replace the nationally produced modelling. The approach for these areas is outlined in Section 5.

4.1 Scope of the nationally produced mapping

4.1.1 Flooding from local sources

In 2010 the Flood and Water Management Act (FWMA) defined ‘surface runoff’ in the following terms:

"The flooding that takes place from the 'surface runoff' generated by rainwater (including snow and other precipitation) which: (a) is on the surface of the ground (whether or not it is moving), and (b) has not yet entered a watercourse, drainage system or public sewer."

This is the main type of flooding shown by the uFMfSW.

The nationally produced surface water flood mapping only indicates where surface water flooding could occur as a result of local rainfall. It does not fully represent flooding that occurs from:

- ordinary watercourses
- drainage systems or public sewers caused by catchment-wide rainfall events
- rivers
- groundwater.

Due to the modelling techniques used, the mapping picks out depressions in the ground surface and simulates some flow along natural drainage channels, rivers, low areas in floodplains, and flow paths between buildings. Although the maps appear to show flooding from ordinary watercourses, they should not be taken as definitive mapping of flood risk from these as the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled. Also, structures (such as bridges, culverts and weirs) and flood risk management infrastructure (such as defences) are not represented.

LLFAs in their Preliminary Flood Risk Assessments (2011) identified surface water flooding as the most significant source of flooding compared to groundwater or ordinary watercourses, although there is often interaction between these sources. Although the nationally produced surface water flood mapping is for surface water flood risk only, it

can be valuable when combined with local experience and knowledge to inform the overall picture of flood risk in the area.

4.1.2 Other influences on water levels

The nationally produced surface water flood mapping does not take account of the effect of pumping stations in catchments with pumped drainage.

No allowance is made for tide locking, high tidal or fluvial levels where sewers cannot discharge in to rivers or the sea.

Further information on the limitations of the modelling is given in section 8.2.

4.1.3 Antecedent conditions

The modelling assumes an initial level of soil moisture (or antecedent condition) and then represents the way the infiltration rate slows as rainfall continues – so, as the soil becomes more saturated, runoff increases (see section 4.2.3). However, it cannot account for all possible antecedent conditions and therefore if rain falls on already fully saturated ground, flooding may be more extensive than is shown on the maps.

4.1.4 Scenarios

The nationally produced surface water flood mapping presents the surface water flood risk for a **'current day' scenario**. The mapping does not take into account possible 'future' scenarios such as climate change, urban creep, or various post-scheme implementation scenarios.

4.1.5 Flood defences and flood alleviation schemes

The method does not explicitly take into account flood barriers or defences (fluvial, tidal or surface water) or any flood alleviation schemes.

4.2 Hydrological (rainfall) modelling

4.2.1 Description

The uFMfSW models the response of the ground surface to a rainfall event with the following properties and rationale:

Rainfall Event Properties	Rationale
1 in 30 1 in 100 1 in 1000 chance of occurring in any year	To meet the requirements of the Flood Risk Regulations 2009 and for consistency with national flood mapping for rivers and sea, the modelling and mapping work was undertaken for three rainfall probabilities. The 1 in 30 rainfall is the largest common design standard for urban drainage. Note that unlike previous nationally produced surface water flood mapping, the modelling did not include a rainfall probability of 1 in 200 chance of occurring in any year.

Rainfall Event Properties	Rationale
1 hour 3 hour 6 hour storm durations	Choosing a single representative critical storm duration is difficult, because any modelled area will include a number of sub-catchments of different size, steepness and shape. A short duration storm (around 1 hour) generally better represents the type of event that leads to surface water flooding, but there is also evidence that longer storms may be critical in flatter areas. Critical duration is also strongly linked to the topography. In low-lying areas, near to rivers, the critical duration is long because surface runoff drains into these areas from larger catchments. On hill slopes the critical duration is generally short because the greatest flood depth arises from high intensity rainfall. The modelling includes storm durations of 1, 3 and 6 hours for each rainfall probability. These are merged into a 'worst case' maximum output for each probability, to ensure a realistic approximation of critical storm duration is represented in all locations.
50% summer rainfall profile	Total rainfall depths for each rainfall probability / storm duration were scaled across a standardised storm profile to produce design hyetographs. Two standard profiles are typically recommended in the Flood Estimation Handbook: a 75% winter profile, for rural catchments, and a 50% summer profile, for urban catchments. The summer profile is more peaked than the winter profile, because of the prevalence of intense convective storms during the summer, so the intensity is greater in the middle of the storm. The summer profile is more likely to be critical for surface water flooding.

The probability relates to the chance of rainfall, and not of the resulting flood extent occurring. It provides a general indication of areas which may be more likely to suffer from surface water flooding in these rainfall probabilities. However, use of multiple storm durations should make the final mapping more representative of a 1 in x chance flood, rather than only representing a 1 in x chance rainfall event.

4.2.2 Depth-duration-frequency curves

England and Wales was divided into 5km x 5km "tiles" that provided the basis for rainfall estimation and subsequent hydraulic modelling. For each tile, a model of rainfall depth-duration-frequency (DDF) was constructed using parameters available from the FEH (Flood Estimation Handbook) CD-ROM at the tile centroid, and the techniques outlined in Volume 2 of the FEH. Each DDF curve was then used to calculate a tile-specific total rainfall depth for a storm of given duration and probability.

4.2.3 Adjustments to calculate effective rainfall

Adjustments are made to calculate effective rainfall. These differed depending on whether areas were urban or rural.

Urban areas were defined based on Ordnance Survey MasterMap information for grid squares 250m by 250m. Where more than 50% of the grid square consists of man-made land uses (including all buildings, roads, paths and other hard-standing) the

square was determined as "urban" and urban runoff rules were applied. All other squares were defined as "rural" and ReFH rainfall-runoff methods were applied.

Adjustments in rural areas

The approach for calculating **runoff in rural areas** used the rainfall losses model from the Revitalised Flood Hydrograph (ReFH) rainfall-runoff method and parameters from the National Soil Resources Institute (NSRI) 'SERIES Hydrology' data.

The losses in the model are controlled by the maximum soil moisture storage capacity. The model calculates the volume of runoff at each time step as a function of the current soil moisture content, so that the percentage runoff increases as the rainfall continues. This increase is fairly minor for short duration storm events.

Adjustments in urban areas

In urban areas, rainfall is reduced to 70% to represent infiltration, then a rainfall reduction of 12mm/hr is applied to represent the effects of the drainage system.

The **runoff coefficient** of 70% was chosen for **urban areas** as this is a good average runoff coefficient for built-up areas including gardens and green verges and a mix of city centre and more suburban land uses. The FEH catchment descriptor assumes a 70% coefficient for urban areas.

The losses model from the ReFH rainfall-runoff method that was used for rural areas was also applied for calculation of runoff within the green portions of urban areas.

Urban drainage systems vary in nature between catchments, those built at different times and using different techniques. Their effectiveness in different storm events is linked to very local characteristics such as the arrangement and capacity of road gullies and whether drainage is via combined or separate sewerage systems. Previous national studies have carried out analysis of the sewer capacity to derive a nationally representative figure, from the following factors:

- service level (or standard of protection from flooding) for drainage systems (between 1 in 5 and 1 in 30 years, centred around 1 in 10 years)
- estimates of critical storm duration (0.5 to 2 hours)
- estimates of percentage impermeable area (30% to 80%)
- estimates of DDF rainfall parameters

The calculated range of sewer capacities was in the range between 5mm/hr and 54mm/hr; with a **typical drainage removal rate of 12mm/hr** across catchments in England and Wales. Independent validation carried out as part of these earlier studies confirms that 12mm/hr is a suitable 'typical' value to represent the effects of urban drainage, and there is no new information available that contradicts this assumption.

A **drainage removal rate of 12mm/hr** has therefore been adopted in the nationally produced mapping unless otherwise specified by LLFAs. In areas of known low or high drainage capacity, LLFAs could substitute alternative values of 6mm/hr or 20mm/hr.

4.3 Digital Terrain Model (DTM)

4.3.1 Description

The modelling and mapping use the Environment Agency's 2012 composite DTM product, known as FMfSW DTM 2012. This is a LIDAR / NEXTMap composite digital terrain model.

It provides a continuous model of "bare earth" topography across England and Wales at a horizontal grid resolution of 2m. It includes all the LIDAR data obtained by the Environment Agency up to April 2012 but does not include any LIDAR data held by LLFAs or Water & Sewerage Companies (WaSCs). The LIDAR has good coverage of urban areas as a programme to infill all areas greater than 3km^2 was completed in August 2011.

The composite dataset consists of:

- Environment Agency LIDAR (a composite of 0.25m, 0.5m, 1m and 2m data downgraded to 2m resolution)
- Infoterra LIDAR (1m and 2m data available under the Pan Government Agreement 2)
- Intermap Technologies NEXTMap Britain IfSAR data

A breakdown of the proportions contained in the final DTM is shown in the table below (in order of precedence, so items lower in the list were only used if those above were not available):

Environment Agency LIDAR	67.7%
Infoterra 1m LIDAR	0.8%
Infoterra 2m LIDAR	0.2%
NEXTMap SAR	31.3%

A map showing the location of the different data sources used across England and Wales is shown in Annex C.

4.3.2 Quoted accuracy

All LIDAR within the composite DTM has a quoted accuracy of ±15 cm or better in its original form, although it is thought that the accuracy of Environment Agency LIDAR data has been closer to ±5cm since 2005.

The NEXTMap data (derived from Interferometric Synthetic Aperture Radar) has a quoted vertical accuracy of ±1 m or better.

These data and accuracy statistics will only reflect a "snapshot" of the landscape at the time of data capture and where the landscape has subsequently changed (e.g. due to urban development, natural change, landfill, coastal realignment), then the potential for anomalies is much greater.

4.3.3 Model resolution

Flood modelling was carried out on a **2m resolution grid** for all England and Wales. The underlying DTM data varies in horizontal resolution from 0.25m to 5m; the DTM data was re-sampled to a 2m grid, so in some places some of the detail of the finer resolution LIDAR data has been lost.

A 2m regular grid is fine enough to allow the model to represent some small scale features of the urban landscape such as pathways between buildings that may significantly influence wider inundation patterns. However, although a 2m grid means that the overall patterns of flooding are more representative than they would otherwise be, this does not mean that the mapping is accurate to the nearest 2m, due to the other uncertainties in the modelling.

4.3.4 Representation of buildings

Surface water flooding, especially in urban areas is influenced by features of the urban landscape, particularly buildings and roads. In certain types of catchment, buildings are an important factor in determining pathways for surface water flooding. A lack of buildings in the model can contribute to inaccuracy in the modelling.

The value of modelling buildings has to be balanced against the considerable data processing overheads (for inputs and outputs) and potential implications for model stability.

Ordnance Survey MasterMap data was used to raise the ground level within building footprints (according to the bare earth DTM) by an average of 0.3m. Typically the building is raised by 0.3m above the average height of the building footprint to give an upstand with a horizontal 'floor level', which deflects flow. An algorithm was used to ensure that the building floor levels are always at or above ground level even on the steepest slopes.

This requirement was based on the conclusions of the FMfSW improvements pilot studies (Halcrow/JBA Consulting, 2012), which demonstrated the importance of modelling the "deflection effect" of buildings on surface water flows.

Buildings are also represented so water can flow through them once the depth exceeds the height of the upstand. This is consistent with reports of flooding in steeper catchments where water is observed to pass through, rather than around, buildings. This approach provides the best compromise currently available for building representation in nationally produced surface water flood modelling.

4.3.5 Representation of structures

Where the resolution of the DTM was downgraded to 2m from the higher resolution LIDAR data, this has removed some of the detail of local surface features. This means that some features, such as smaller hydraulic structures or flow paths may not be represented in the model.

Some flow paths under bridges and through embankments are not captured within the DTM because the top of the feature is represented rather than the opening through it.

These features include:

- road and railway embankments
- bridges
- subways
- tunnels

This can cause runoff to back up and flood a larger area "upstream" of the feature, and areas "downstream" of the obstruction may be unrealistically shown as being free from flood risk. If these locations were not edited, the resulting flood extent would show a different pattern of flooding than would be expected in reality.

The DTM was manually edited to represent flow paths through "flyover" features that present unrealistic obstructions to known flow routes. The model run is completed and the results from the model run were used to identify where water is retained. Edits are then made to the local DTM values and a further model run is undertaken until satisfactory results are achieved. Approximately 91,000 edits were made to the DTM as part of this project, which is an increase of over 50,000 from previous generations of national surface water modelling.

4.3.6 Representation of other features

The representation of the **road network**, which is known to preferentially collect and route storm water when it rains, was improved within the DTM.

Road surfaces, selected from OS MasterMap data, were **lowered by 0.125m** (the height of a British Standard kerb) to better delineate these important pathways in the hydraulic modelling and mapping. Using this method to represent roads ensures that the principal flood pathways along roads are better represented in the 2m model grid.

This approach may overestimate the routing effect of roads in rural areas where there are fewer raised kerbs or where the kerb height is substantially less because the road has been resurfaced.

Other features such as fences, walls, dropped kerbs and speed bumps may not be explicitly represented within the DTM. These subtle changes in local topography can significantly affect the direction of flow and extent of flooding particularly during higher probability events where depths may be low. These small scale hydraulic features cannot be represented in a national scale model, but could be incorporated in local scale modelling at a finer resolution.

4.4 Hydraulic modelling approach

4.4.1 Description

The flood modelling approach was based on the **direct rainfall** concept where net, or effective runoff volumes, applied to each grid cell in the hydraulic model are routed dynamically across the DTM surface, identifying flooding pathways and areas where ponding will occur. The approach simply allows rainfall to spread across the surface of the DTM and allows water to move and pond in topographical low points.

The direct rainfall approach was used for both previous nationally produced surface water flood mapping exercises and is widely accepted as an appropriate method for analysing higher magnitude, lower probability storms where subsurface drainage systems are likely to be overwhelmed and/or inlet capacities exceeded.

England and Wales was divided into approximately 7100 5km x 5km tiles. These modelling tiles included a 500m overlap with adjacent tiles to ensure that modelled areas overlap sufficiently and "edge effects" are not visible in the final map.

4.4.2 Modelling software and equations

The routing/model simulations were carried out using the **JFlow+ 2D hydraulic model** which solves the Shallow Water Equations.

JFlow+ is commercially available software which has been benchmarked using the test cases proposed by the Environment Agency in the Science Report SC120002,

Benchmarking the latest generation of 2D hydraulic modelling packages, and the results have been submitted to the Environment Agency. Results for Test 8A which considers rainfall and point source surface flow in an urban area have demonstrated the ability of JFlow+ to deliver robust modelling of direct rainfall applications.

4.4.3 Manning's n values

The Manning's n values are varied according to Ordnance Survey MasterMap Topography Layer Feature Code. The values are varied to take account of variability of hydraulic roughness of different land uses and their influence on wider inundation patterns. The variability in values allows some of the effects of vegetation and other hydraulic obstructions not represented explicitly in the model to be approximated.

Typical values used were 0.02 for tarmac roads or pavement, 0.03 for grassland areas and 0.1 for heavy woodland and vegetation.

4.5 Validation

Validation of the nationally produced mapping results was undertaken for three pilot areas using historical observations and local modelling data (see section 9 of this document for further details).

4.6 Comparison of nationally produced modelling approach with previous national mapping

The table below shows a summary of the differences in modelling approach between the nationally produced surface water flood mapping and the previous products. Note that where local mapping has been used in the uFMfSW this is likely to use different approaches, parameters or data.

	Nationally produced surface water flood mapping (2013)	FMfSW (2010)	AStSWF (2008)
Hydraulic modelling	2D overland flow modelling	2D overland flow modelling	2D overland flow modelling
Model software and equations	JFlow+ (Shallow Water Equation-based)	JFlow-DW (diffusion wave-based) - does not solve full shallow water equations	JFlow-DW (diffusion wave-based) - does not solve full shallow water equations
Hydrological modelling	Direct Rainfall approach with allowances for the sewer network and infiltration (see below).	Direct Rainfall approach with allowances for the sewer network and infiltration (see below).	Direct Rainfall approach with no allowances made for the sewer network and infiltration.
Design rainfall	FEH depth-duration-frequency parameters defined on a regular 5km grid (with no areal reduction factor applied) for rainfall with a probability of occurring in any year: • 1 in 30 • 1 in 100 • 1 in 1,000	FEH depth-duration-frequency parameters defined on a regular 5km grid (with no areal reduction factor applied) for rainfall with a probability of occurring in any year: • 1 in 30 • 1 in 200	FEH depth-duration-frequency parameters defined on a regular 5km grid (with no areal reduction factor applied) for rainfall with a probability of occurring in any year: • 1 in 200
Storm duration(s)	**1, 3 and 6hrs** used for all scenarios (unless specified locally by LLFA) 50% summer storm profile	1.1hrs used for all scenarios 50% summer storm profile	6.25hrs used for all scenarios 50% summer storm profile

	Nationally produced surface water flood mapping (2013)	FMfSW (2010)	AStSWF (2008)
Reduction in rainfall to represent sewers	In urban areas, a default loss of 12mm/hour	12mm/hour	0mm/hour (No reduction due to sewer drainage represented)
Reduction to rainfall to represent infiltration	Urban 70% runoff coefficient is applied In rural areas, runoff variation based on nationally mapped local soil types uses the ReFH losses model, and NSRIs 'SERIES Hydrology' data. Runoff parameters adjusted by local drainage information (from LLFAs and Water and Sewerage Companies) where available.	Urban 70% Rural 39%	100%
Digital terrain model (DTM)	Bare earth LIDAR/NEXTMap composite DTM provided by Geomatics in 2012. LIDAR data 2m horizontal resolution or finer in 90% of urban areas, 5m NEXTMap SAR elsewhere.	Bare earth LIDAR/NEXTMap composite DTM at 5m horizontal resolution provided by Geomatics in 2010 containing Environment Agency LIDAR, PGA2 LIDAR and SAR.	Infoterra bare earth LIDAR and GeoPerspectives DTM provided in 2007.
Model grid size	2m regular grid	5m regular grid	5m regular grid
Representation of buildings	Use of a (typically) 0.3m high "up-stand" and depth-varying roughness coefficients within the OS MasterMap building footprint.	Represented explicitly as unfloodable objects in the DTM. Building footprints raised by 5m in DTM as defined in 2009 OS MasterMap data.	Not represented

	Nationally produced surface water flood mapping (2013)	FMfSW (2010)	AStSWF (2008)
Representation of structures	DTM was manually edited in over 91,000 locations to improve flow through 'flyover' features, such as rail/road embankment culverts, bridges etc.	DTM was manually edited in over 40,000 locations to improve flow through 'flyover' features, such as rail/road embankment culverts, bridges etc.	DTM was manually edited in over 5,000 locations to improve flow through 'flyover' features, such as rail/road embankment culverts, bridges etc.
Representation of other features	Road network defined in OS MasterMap Topography data lowered by 0.125m.	Not taken into account	Not taken into account
Manning's n values	Varied by OS MasterMap Topography Layer Feature Code	0.1 rural, 0.03 urban	0.1
Mass balance	0% (JFlow+ is mass conservative)	±1%	Not recorded
End of simulation criteria	Rainfall event duration + 3hrs	Dynamic stopping condition. Models stop running if the number of wet cells is unchanged over a 1 hour period.	Dynamic stopping condition. Models stop running if the number of wet cells is unchanged over a 1 hour period.
Downstream boundary conditions	Free outfall	Free outfall	Free outfall
Validation	3 pilot areas using historical observations and local modelling data	11 areas using historical observations and local modelling data.	Some qualitative comparison against historical observations and local modelling data.
Sensitivity testing	None	None	None

5 Incorporating local information

5.1 Overview

LLFAs are responsible for managing the risk of flooding from surface water and therefore have local knowledge about the surface water mechanisms in their area. Some LLFAs have also created their own surface water flood maps. This has been an important feature of surface water management plans and local flood risk management strategies, where detailed mapping work has been carried out. To ensure the uFMfSW is the best single source of surface water flooding information for England and Wales, the LLFAs were given the opportunity to:

- review the nationally produced mapping
- submit their own local surface water mapping for inclusion where compatible

LLFAs were asked to complete the review process or submit their local mapping by 22 June 2013. As a result of this 32 local models were submitted for inclusion in uFMfSW v1. A map showing the areas where locally produced mapping has been included in uFMfSW v1 is shown in Annex D.

LLFA maps have been created using a range of methods and data. It is important that local and nationally produced mapping is sufficiently consistent and compatible so information can be brought together into a single map. This enables Risk Management Authorities and customers to **interpret surface water flood risk in a consistent way across England and Wales** and make better informed decisions.

5.2 Reviewing the nationally produced surface water flood mapping

LLFAs were asked to review the nationally produced mapping by:

- using local recorded flood data and local knowledge to identify areas that are known to flood, and to highlight unexpected patterns of flooding
- identifying how confident they are in the national mapping
- comparing locally produced information with the nationally produced mapping to determine which mapping is more representative for each area

5.3 Submitting locally produced mapping

5.3.1 Compatibility

We took the principles behind the uFMfSW, and identified which **elements of the modelling or model input or output data have a significant influence on the resulting flood maps or on the way that they will be used.**

Minimum standards were set for locally produced information. There are also **recommended standards** which offer 'good practice' approaches to surface water modelling at this scale but do not need to be met for data to be included in the uFMfSW.

More information about compatibility criteria and where to find more detailed guides to technical modelling specifications will be found in related guidance **Maintaining the Flood Map for Surface Water**, which will be produced in early 2014.

5.3.2 Requirements for locally produced mapping

Locally produced information has been included where it:

- includes a flooding scenario as a result of rainfall with **1 in 30**, **1 in 100** and **1 in 1000** chance of occurring in any year (where the 1 in 1000 was not available, alternatives could be agreed, as shown below)
- includes flood **extent**, **depth, velocity, and flow direction data**
- takes into account the **deflection effect of buildings**
- takes into account **sub-surface drainage**
- uses a model grid size no larger than **5m**
- provides the best representation of flood risk within the LLFA area
- is compatible with the nationally produced mapping and the Regulations
- has an equal or higher confidence score than the nationally produced mapping

These requirements will also apply to any locally produced mapping that is to be included in future updates of the uFMfSW.

Alternatives to 1 in 1000 chance scenario

Where outputs for a flooding scenario for rainfall with a 1 in 1000 chance of occurring (in any year) were not available this did not automatically exclude the locally produced mapping from being incorporated. In some cases, other available scenarios were used and merged with the nationally produced modelling for a flooding scenario for rainfall with a 1 in 1000 chance of occurring in any year to create a worst case scenario to use in place of locally modelled 1 in 1000 probability data.

These scenarios included:

- a flooding scenario for rainfall with a 1 in 200 chance of occurring in any year
- a flooding scenario for rainfall with a 1 in 100 chance of occurring in any year adjusted to take into account climate change predictions

5.3.3 Other influences on water levels in locally produced modelling

Some locally produced surface water flood models take into account main river, and possibly coastal/estuary components. It is quite common to run integrated catchment model scenarios with low and high water levels in main rivers and other receiving water bodies and interfaces (such as gates or outfalls). Factors such as phasing of tide cycles and gate operations can have a large influence on surface water flooding in coastal locations.

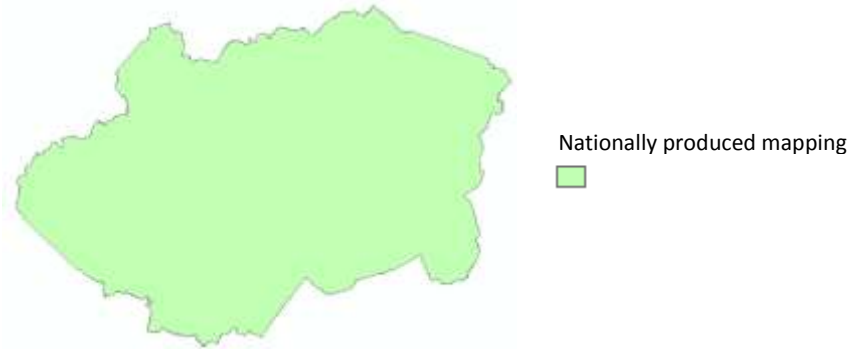
To ensure compatibility with the nationally produced mapping, LLFAs were asked to provide model output data for a modelling scenario where flooding is **predominantly the result of surface water conditions**, and where non-surface water influences

(such as river, sea and groundwater conditions) do not unduly exacerbate, dominate, or equal the representation of surface water flooding conditions.

5.4 Creating the uFMfSW

The uFMfSW draws together nationally produced mapping and appropriate locally produced mapping from LLFAs in the following way.

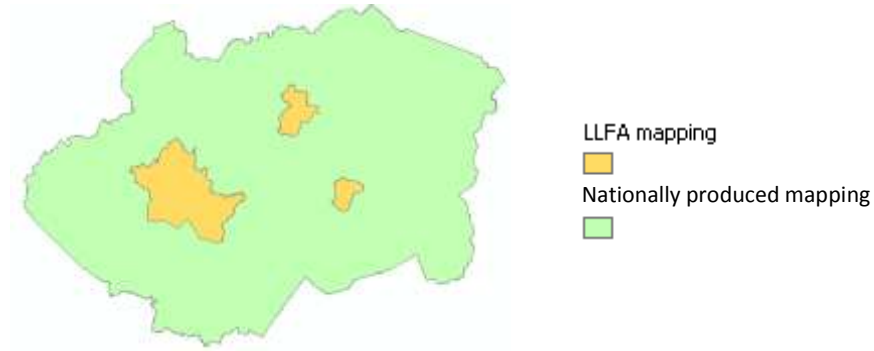
Nationally produced mapping is available for whole LLFA area.



LLFAs identify compatible and more representative mapping for areas within their boundary.



Nationally produced and local mapping are brought together to form a single map - the uFMfSW - where LLFA mapping replaces nationally produced mapping for a defined spatial area.



6 Post-processing national and local model outputs

We held workshops across the country in November 2012 as part of the Defra / Welsh Government / Environment Agency capacity building programme to gather views from LLFAs on creating a consistent map. Based on feedback from LLFAs and common modelling post-processing practice we have processed the national and local model outputs.

See Annex E for examples using model outputs, of the **effect of the processing** at two different levels of detail: a detailed view so that the effects can be clearly seen, and a wider area view, which is similar to the finest scale at which the published maps will be viewed.

6.1 Re-sampling to produce a consistent regular grid

The nationally produced mapping has been produced at a **2m model grid resolution**.

All locally produced model outputs have been **re-sampled to a 2m grid**. When data is re-sampled, we have applied a number of processes and assumptions to create a new dataset from the original data.

Some locally produced model outputs exist in Triangulated Irregular Network (TIN) format, rather than a regular square grid. TINs are another way of representing topography in models. All TINs were re-sampled into a regular grid at 2m resolution to create a consistent format. Examples are shown in Annex E.

6.2 Filtering model output data

Based on feedback from LLFAs, we have:

- **removed flooded areas with a very low hazard rating below 0.575** (for more information on how hazard is calculated see section 7.5).

  There is **no filtering on depth information alone**.

- **removed areas of flooding with a total area of less than 100 square metres** (to ensure the maps are clear and avoid presenting data at too fine a scale)
- **filled in isolated dry areas (within a larger flooded area) of less than 50 square metres**

Where cells are joined diagonally, they are deemed to be part of the same flooded area.

See Annex E for further information.

7 Outputs

7.1 Overview

For each rainfall probability (1 in 30, 1 in 100 and 1 in 1000 chance of occurring in any year) the following datasets have been created:

- extent of flooding
- depth
- velocity (including magnitude and flow direction at maximum velocity)
- hazard

In addition there are datasets that contain information about the source of the data (i.e. whether it was from the nationally produced modelling or locally produced modelling) and the confidence in the data outputs:

- model details
- suitability

The uFMfSW outputs are banded to make the data easier to interpret for map users and to provide a consistent final map. Note that for the published version which will be available to view on our website as part of the **Risk of Flooding from Surface Water** map, we have merged some of the depth and velocity bands together, to provide a simpler, clearer picture for the public, with just three depth bands and two velocity bands.

Validation work focussed on the mapped flood extents. There is likely to be greater uncertainty in depth, velocity and hazard datasets.

7.2 Extent of flooding

The extent of flooding is available as a separate layer for each rainfall probability and each shows the area modelled as flooding at that probability or greater.

The published map available to view on our website as part of the **Risk of Flooding from Surface Water** map appears as one layer with the following categories:

High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year
Low	Flooding occurring as a result of rainfall of between 1 in 1000 (0.1%) and 1 in 100 (1%) chance in any given year
Very Low	Flooding occurring as a result of rainfall with less than 1 in 1000 (0.1%) chance in any given year

7.3 Depth

Based on feedback from LLFAs, the following categories have been selected for banding flood water depth (above ground level).

Depth (m)	Threshold
< 0.15	
0.15 – 0.30	At 0.15m, flooding would: • typically exceed kerb height (standard kerb height is 125mm) • likely exceed the level of a damp-proof course • cause property flooding in some areas
0.30 – 0.60	At 0.30m flooding is likely to cause property flooding. This is based on average property threshold levels.
0.60 – 0.90	Property-level flood resilience measures are typically effective up to a water depth of 0.60m above floor level. Above depths of 0.60m these measures are likely to be much less effective and structural damage is more likely to occur. However, as floor levels vary, the maximum flood depth where resilience measures are still effective may be in a range between 0.60m and 0.90m above ground level.
0.90 – 1.20	Very likely to exceed the maximum flood depth where property-level flood resilience measures are still effective.
> 1.20	

The published map available to view on our website as part of the **Risk of Flooding from Surface Water** map groups these into categories of 'below 300mm', '300 – 900mm' and 'above 900mm'.

7.4 Velocity

7.4.1 Speed

There were no strong views from LLFAs on appropriate categories for water velocity. We have selected categories which show a simple spread of data and are consistent with previous studies.

The following categories are used for flood water velocity in metres/second (for context, typical walking speed is approximately 1.5m/s):

- < 0.25
- 0.25 - 0.50
- 0.50 - 1.00
- 1.00 - 2.00
- > 2.00

The published map available to view on our website as part of the **Risk of Flooding from Surface Water** map groups these into categories of 'less than 0.25 m/s' and 'over 0.25m/s'. We know the majority of the public's preference is for depth and direction and

most people are not interested in the speed of water. So to keep things simple we are only using the two categories to show whether water is moving, or is effectively still.

7.4.2 Direction (at maximum speed)

The flow direction at maximum speed has been created for the standard 2m grid cell resolution; it has also been produced at a reduced resolution of 25m for easier display. It is split into eight directional bands: N, NE, E, SE, S, SW, W, NW.

Flow direction data was not a compulsory requirement when locally produced modelling was supplied, so in some locations where local data has been used there is no information available. We hope LLFAs will provide flow direction data for future updates.

7.5 Hazard rating

We have gone a step further than the requirements of the Flood Risk Regulations and also produced maps showing hazard rating based on a function of simultaneous depth and velocity for England and Wales. This uses the following equation taken from Defra R&D on risks to people, where:

Hazard rating = depth x (velocity + 0.5) + debris factor

Debris factors are also defined in Defra R&D on risks to people. The nationally produced surface water flood mapping uses a debris factor of:

- 0.5 for depths less than or equal to 0.25m
- 1.0 for depths greater than 0.25m (irrespective of the type of land use).

As mentioned above in section 6.2, we have removed areas from the mapping that have a very low hazard rating below 0.575 using these debris factors. This is where flood water depth and velocity are low.

The following hazard categories are used:

- low hazard (hazard rating 0.5 - 0.75)
- moderate hazard (hazard rating 0.75 - 1.25)
- significant hazard (hazard rating 1.25 - 2.0)
- extreme hazard (hazard rating 2.0 and above)

For more information about calculating hazard ratings and for further definitions of the hazard categories above, please refer to Defra R&D on risks to people.

7.6 Model details

This layer gives information about the source of the modelling information and the parameters used.

When LLFAs provided locally produced information for inclusion in the uFMfSW, we asked them to provide some background information (metadata). **This information is provided with the maps so that map users can identify the source of the information.**

A description of the information available is shown in the table below. The model details layer contains both information about the nationally produced surface water flood mapping and the locally produced information.

Attribute	Description	Database name	Example
ID (auto-generated)	This is a number auto-generated by GIS software	ID	15467
LLFA name	Full LLFA name	Name	Puddleton County Council
Data owner	LLFA name, or 3rd party name (if applicable)	Data_own	Puddleton County Council
Model domain reference	A unique reference for your model	Dom_ref	Example: RiverTow_2010_03 (for a model carried out in River Town completed (or updated) in March 2010)
Model name	Name of model including reference to location	Mod_name	River Town SWMP modelling 2010
Description	Describe reason for modelling	Descrip	River Town SWMP covering town centre (completed March 2010)
Model completion date	Date model complete (or the last update to the model)	Mod_date	03/2010
Model type	Type of model	Mod_type	Hydraulic model with basic drainage/surface interactions
Model software	Name of software used	Mod_soft	TUFLOW
Hydrology type	Name/type of hydrology used	Hyd_type	Direct rainfall - FEH Depth Duration Frequency
Source digital terrain model	Source of digital terrain model used	DTM	LIDAR EA
Source DTM resolution	Grid resolution of the digital terrain model	DTM_res	1m / 2m
Model grid resolution	Resolution of the model grid	Mod_grid	2m
Storm duration	Rainfall storm durations	Stor_Dur	1hr, 3hr, 6hr

Representation of sub-surface drainage	Representation of sub-surface drainage	Sewer	Reduction in rainfall amount of 12mm/hr
Surface roughness values	Source of information on surface roughness defined according to land use	Manning	OS MasterMap
Representation of buildings	Representation of buildings in urban areas	Build	Raised building footprints by 300mm
Debris factor (this is only mandatory where hazard information is provided)	Debris factor(s) used in calculating hazard rating as defined in Defra R&D on risks to people Hazard rating = depth x (velocity + 0.5) + debris factor	Debris	Debris factor of 0.5 for depths <=0.25m, and 1.0 for depths >0.25m (irrespective of landuse type)* **N.B. these figures are used as standard in Infoworks software, but can be varied in TUFLOW*
Confidence score	Confidence score assigned to locally produced modelling - see Annex B for more information on assessing confidence.	Confid	3
Comments	Other details about model	Comments	None

7.7 Suitability

The suitability data gives an indication of the scale that the data is applicable at, based on the confidence in the modelling at that location, and can inform better decision making by helping users understand the reliability of the data for assessing flood risk at different scales..

As part of the modelling process all areas were assigned a default confidence rating, which relates to the suitability shown above, based on the modelling methodology, data availability and parameters used in that location. Unless there was clear evidence to change this during the review process these are unchanged from the default value.

Much of the data from the uFMfSW has a suitability category of ‘county to town’ or ‘town to street’ unless local modelling was used or there was clear evidence available to validate the results. Where model results correlated well with historic flood records the confidence rating was raised. Where correlation was poor the confidence rating was lowered. In some cases the data may be more or less reliable than shown, but this has not been changed if there is no clear evidence to amend the rating. As more local evidence becomes available to LLFAs, they will be able to submit this for future updates to improve the suitability rating, in addition to any new local modelling, and therefore this should improve further for future updates.

The descriptions of the suitability are as follows:

Suitability: 'it's good enough for...'		Reliability: 'how good is it for...'		Examples of this kind of flood risk information
Indicative suitable scale	**Indicative suitable use**	**How reliable is this for a local area?**	**How reliable is this for an individual property?**	
National to county - suitable for identifying which parts of countries or counties are at risk, or which countries or counties have the most risk.	Suitable for identifying areas with a natural vulnerability to flood first, deepest or most frequently.	Very unlikely to be reliable for a local area.	Extremely unlikely to be reliable for identifying individual properties at risk.	The first "National Flood Risk Assessment" (NaFRA, 2004, 2005, and 2006). The first national surface water map "Areas Susceptible to Surface Water Flooding" (AStSWF, 2009).
County to town - suitable for identifying which parts of counties or towns are at risk, or which counties or towns have the most risk.	Suitable for identifying approximate extents, shallower and deeper areas.	Unlikely to be reliable for a local area.	Very unlikely to be reliable for identifying individual properties at risk.	The majority of the current NaFRA which dates from 2008. The second national surface water map "Flood Map for Surface Water" (FMfSW, 2010).
Town to street - suitable for identifying which parts of towns or streets are at risk, or which towns or streets have the most risk.	Suitable for identifying flood extents, approximate depth of flooding, and identifying streets at risk of flooding.	Likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Unlikely to be reliable for identifying individual properties at risk (and so the information is suitable for areas of land, not individual properties).	Some parts of the current NaFRA which benefit from good local data and have been validated (checked). The Flood Map for Planning (Rivers and Sea) (previously known as the Flood Map, containing Flood Zones).
Street to parcels of land - suitable for identifying which parts of streets or parcels* of land are at risk, or which streets or parcels of land have the most risk.	Suitable for identifying flood extents, depths and approximate velocities.	Very likely to be reliable for a local area (and so the information is suitable for areas of land, not individual properties).	Likely to be reliable for identifying individual properties at risk (though not whether they flood internally, so the information is suitable for areas of land, not individual properties).	Flood models and maps from detailed local studies, which have been successfully calibrated (tuned) and validated (checked) against observed local flood data.
Property (including internal) - suitable for identifying which parts of a property are at risk (including internal / external distinction), or which properties have the most risk.	Suitable for identifying flood extents, depths, velocities, and distinguishing between street and property flooding.	Extremely likely to be reliable for a local area.	Likely to be very reliable at identifying individual properties at risk, including depths of flooding internally (this provides a genuine property level assessment).	Flood models and maps of the whole water system. These are exceptionally detailed local studies which benefit from excellent input data such as long records. This kind of information is only available in a limited number of areas.

8 Strengths and limitations of the uFMfSW

8.1 Strengths

We learned from past studies and pilots to develop the uFMfSW with the aim of producing the best national surface water flood map for England and Wales. The strengths of the maps include:

- 2 metre model grid used, so many small ground features are taken into account
- high quality ground level information, which was enhanced to better represent buildings and roads, with manual editing to "flyover features"
- a wide range of storm scenarios were modelled using three flood probabilities (1:30, 1:100 and 1:1,000)
- the influence of land use and soil type were taken into account
- more accurate local mapping provided by LLFAs was incorporated where it was compatible
- complex processing which reflects LLFA preferences to make the maps as clear as possible, for example in filtering out particularly small areas of flooding whilst retaining potentially significant flooded areas
- depth, velocity, flow direction and hazard maps have been produced

Local validation by LLFAs improved the ‘suitability’ information where flood records were available. This ‘suitability’ information allows users to understand the variation in the reliability of the data for a range of uses. We therefore have a map which contains broadly nationally consistent data, and which is suitable for comparing risk from surface water flooding in different places. In some locations, we know that the maps are also a good reflection of recorded flooding. There is also the opportunity to further refine the data in future by incorporating local information.

We regard the map as the best available source of national information on surface water flooding. It is an excellent starting point for understanding patterns and probability of surface water flooding.

8.2 Limitations

Although the uFMfSW is a significant improvement on past nationally produced surface water flood mapping, it is important not to lose sight of the limitations which remain. These include the following:

- We assumed a single drainage rate for all urban areas within the nationally produced modelling unless LLFAs were able to give us better local data. Modelled flood extents are particularly sensitive to the way drainage is taken into account. Omitting large subsurface drainage elements such as flood relief culverts and flood storage can also significantly affect the modelled pattern of flooding.

- The nationally produced modelling assumes a free outfall and so does not take into account tide locking or high river levels which may prevent surface water from draining away freely.
- Limited recorded surface water flood data exists for LLFAs , so in many places LLFAs have not yet been able to validate the nationally produced modelling.
- As with many other flood models:
    - The input information, model performance and modelling that we used to create the nationally produced modelling vary for different areas. For example, in many areas, the ground level data is based on detailed LIDAR information, but where this is not available ground levels are much less accurate. Similarly, models of this type tend to perform better in steeper rural areas than in flat urban areas. These variations affect the reliability of the mapped flood extents and, in turn, the suitability for different applications.
    - uFMfSW does not take individual property threshold heights into account so the map shows areas that may potentially flood but cannot accurately predict the impacts on individual properties.
    - The flood extents show predicted patterns of flooding based on modelled rainfall. The patterns of flooding from two similar storm events can vary due to many local circumstances.

Consequently these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding, and the maps are not suitable for use at an individual property level.

9 Validation studies

9.1 Overview

When we developed the nationally produced surface water flood mapping, we benefitted from the experience gained in developing the 2008 and 2010 national surface water flood maps, and also from the feedback received from local authorities as users of these maps. We were also able to take note of the findings of the 2012 surface water mapping pilot studies. Validation was an important part of all of these studies, and consequently has influenced the development of the uFMfSW.

Further validation was carried out to assess how well it reproduces observed flooding and how well the discrepancies between the nationally produced map and observed flooding are reflected by the confidence rating.

The validation work carried out as part of the pilot studies demonstrated the sensitivity of the modelling to the rainfall-runoff coefficients, and therefore helped us to decide which values to use. The validation process carried out on the uFMfSW modelling results allowed us to ensure that the confidence scores reflect how well the model was performing.

The review process described in section 5.2 allowed validation to be carried out at a local level. Early validation was also undertaken for the three pilot locations of Greater Manchester, Gloucestershire and Rhondda Cynon Taff. This used both qualitative methods and quantitative analysis of flooded properties identified by the nationally produced map. For Greater Manchester, only a visual comparison between model outputs and validation data was possible due to the quality of the data. For Gloucestershire and Rhondda Cynon Taff, where point data sets of recorded flood incidents are available, two methods for validation were used

9.2 Greater Manchester

Validation data from Greater Manchester consisted of polygons of flooding recorded in Bolton, with source noted as surface water, and polygons of other wet spots recorded in Bolton. However, the lack of further suitable evidence makes it difficult to draw conclusions about model performance. The nationally produced map correctly identifies some known flooding locations, but not all. There are some areas of significant flooding shown on the map that have no known flooding history. There is little evidence of an improvement in results compared to previous national surface water flood mapping.

The validation data was of insufficient quality to assess whether the assigned confidence ratings were appropriate

9.3 Gloucestershire

Validation data for Gloucestershire consisted of a point dataset of recorded possible surface water flood incidents from summer 2007 and an output from an InfoWorks ICM model for 1 in 100 probability event roughly consistent with the 2007 event. The local model represents sub-surface drainage through a linked sewer model and therefore provides a good test of quality of the nationally produced model.

The validation showed a close correspondence between the two models, with both picking out properties reported as flooding in 2007. The nationally produced mapping

predicts significantly deeper water than the InfoWorks model, but the two models predict approximately the same areas of lower and higher velocity.

The dataset of properties flooded in summer 2007 allows a quantitative comparison of properties predicted as flooding to be made for floods recorded in Cheltenham. However, property counts are sensitive to buffering and the thresholds that area applied. The result is consistent with previous studies with the majority of properties observed to flood being correctly identified by the nationally produced map. The nationally produced map and the local InfoWorks ICM give similar results in identifying the location of the properties that flooded in 2007.

9.4 Rhondda Cynon Taff

For Rhondda Cynon Taff a point dataset was available showing surface water incidents that have been recorded over a period of approximately ten years. We would expect this to correspond most closely with the 1 in 30 probability event. However, there is little correlation between the national flood map and the locations of flood incidents, which are scattered throughout the urban areas with no obvious clustering.

9.5 Further information

All three generations of national surface water flood mapping show a similar performance in terms of validation of properties shown in areas at risk of flooding, correctly identifying approximately a third of the 1,000 buildings known to have flooded. This stresses the importance of using the maps as an indication of patterns and probability of flooding, as feedback suggests that these have improved considerably over the three generations of national surface water flood mapping, and confirms that the data is not suitable for identifying individual properties at risk.

Further information on the validation work that was carried out can be found in the **National modelling and mapping method statement - May 2013** and the **Updated Flood Map for Surface Water – National Scale Surface Water Flood Mapping Confidence and Validation – March 2013** reports, available from your local Environment Agency office.

Future validation exercises would benefit from more locations and data to test against. Our recommendation is that good quality records are kept – including flood extents and depths, and the date of flooding, as well as the properties affected.

10 Where to go for more information

10.1 Further supporting documents

This document is the first of a suite of supporting documents that will help you understand what the uFMfSW is, how it can be used and how it will be maintained in the future. The other documents that will be produced include the following:

- **Using the updated Flood Map for Surface Water** – document describing what the maps are suitable for, and the limitations of the maps. This is expected to be completed in November 2013.
- **Summary of previous surface water flood mapping** – document summarising elements of the existing guidance on the superseded national surface water flood mapping. This is expected to be completed in early 2014.
- **Maintaining the updated Flood Map for Surface Water** – document describing how the new maps will be updated in future, and how data should be submitted for inclusion in future updates. This is expected to be completed in early 2014.

Further detail of the methodology used for the nationally produced modelling and mapping can be found in the **National modelling and mapping method statement - May 2013** available from your local Environment Agency office.

10.2 Who to contact for more information

For further information please contact:

- the Environment Agency National Customer Contact Centre on 03708 506506 for general queries
- the Environment Agency DataInfo team on data.info@environment-agency.gov.uk for any questions about the data download or licensing
- your LLFA for queries about **local** surface water flood risk mapping and management

Annex A – Flood Risk Regulations

A.1 What do the Flood Risk Regulations say?

The Flood Risk Regulations (2009) (the Regulations) implement the requirements of the European Floods Directive which aims to provide a consistent approach to managing flood risk from all sources across Europe. The approach is based on a six year cycle of planning which includes the publication of:

- Preliminary Flood Risk Assessments (PFRAs) by 22 December 2011
- Flood hazard and risk maps by 22 December 2013
- Flood risk management plans by 22 December 2015

As part of the Preliminary Flood Risk Assessment, LLFAs identified Flood Risk Areas, which are designated areas where flood risk from local sources is considered to be significant as identified in accordance with government guidance. Under the Regulations, there is only a requirement for LLFAs to produce flood hazard and risk maps, and for the Environment Agency to publish them, in Flood Risk Areas. However surface water flood risk is widespread and needs to be managed both in and outside Flood Risk Areas through Local Flood Risk Management Strategies which are required under the Flood and Water Management Act, and so Defra and Welsh Government asked us to produce them for all England and Wales.

A.2 What are flood hazard maps?

The term ‘hazard’ has been described in previous research as a combination of the effects of water depth, velocity and debris. The term ‘hazard’ is described in the Regulations, and defines flood hazard maps as showing:

- the likely **extent** of flooding
- **depth** of flooding
- the **direction** and **speed** of flow
- the **probability** of the floods occurring

The nationally produced surface water flood mapping, and therefore also the updated uFMfSW, enables LLFAs to meet the requirements of the Regulations for flood hazard maps for surface water within designated Flood Risk Areas (as defined in the PFRAs).

A.3 Rainfall probabilities

To meet the requirements of the Regulations, the uFMfSW assesses a flooding scenario as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1 in 30 (3.3%)
- 1 in 100 (1%)
- 1 in 1000 (0.1%)

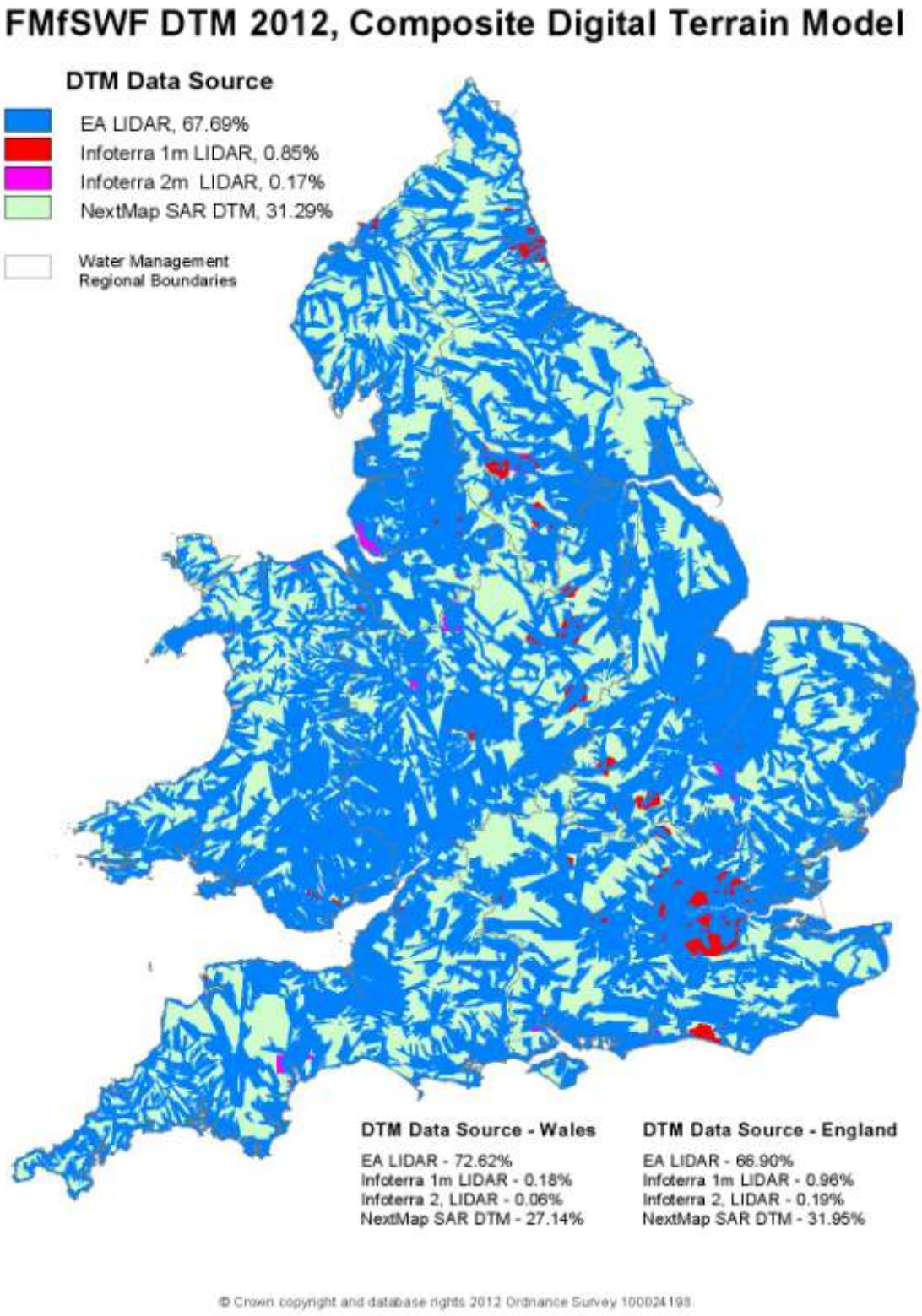
Previous nationally produced surface water flood mapping and most locally produced mapping does not provide all of this information.

Annex B – Model improvements

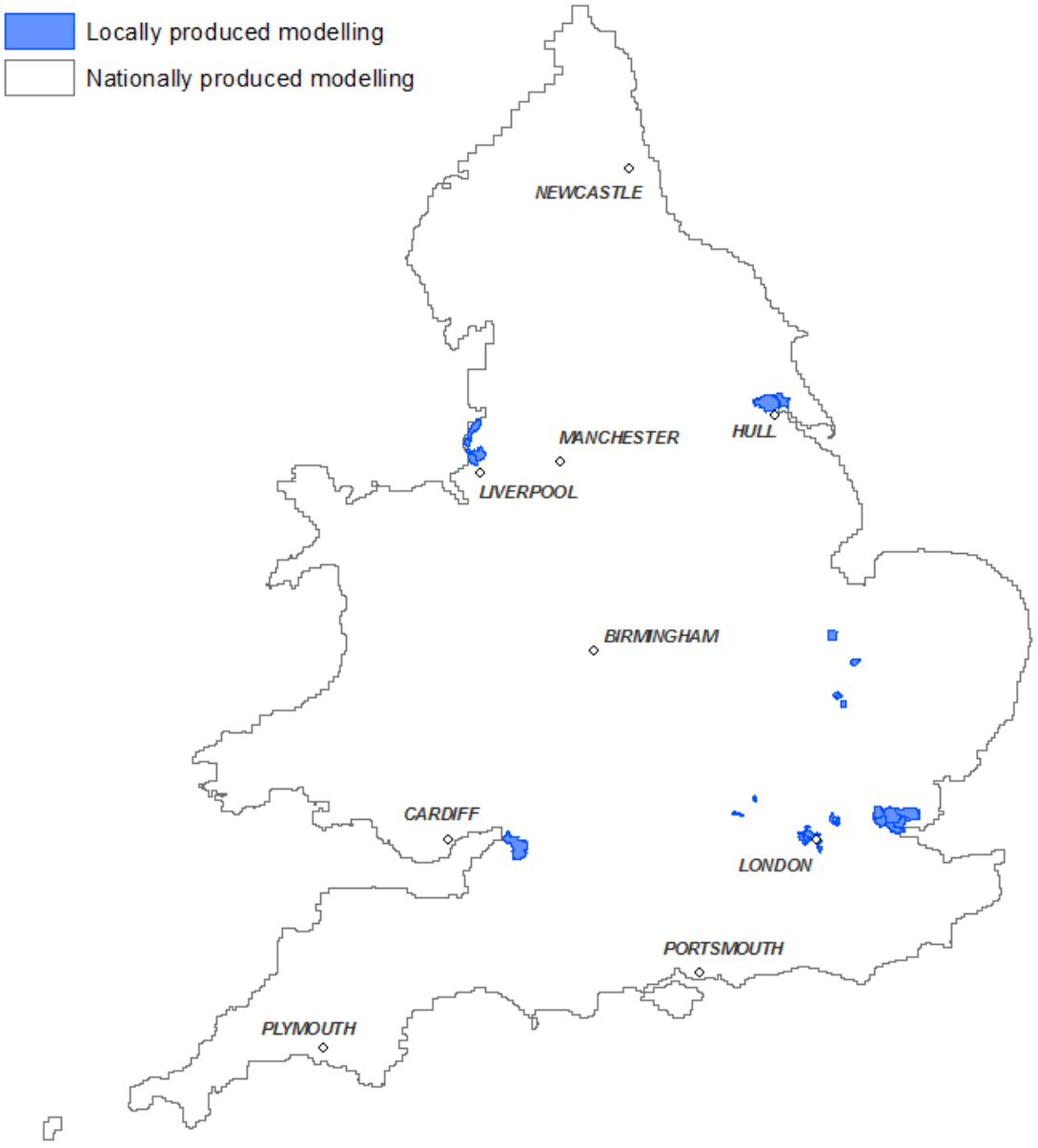
The table below outlines the improvements in modelling techniques and data that make the updated nationally produced surface water flood mapping a more representative map of surface water flood risk than previous nationally produced mapping.

Area of improvement	Improvements
Digital terrain model	Environment Agency's LIDAR/NEXTMap composite DTM which includes high resolution (2m or finer) LIDAR for **all urban areas greater than 3km²** in England and Wales. Small topographic features and flow paths can be represented in the model.
Model grid size	The flood modelling will be undertaken on a **2m resolution** grid for all England and Wales. Our confidence in this data will also depend on other inputs to the model such as the Digital Terrain Model.
Representation of buildings and other topographic controls on flow	OS MasterMap data has been used to **represent buildings in the digital terrain model**. The method allows flood water to flow into the building footprint once the water depth exceeds 300mm. The road network is known to preferentially collect and route water. Road surfaces as defined in OS MasterMap will be lowered by 125mm (height of a standard kerb) to better delineate these flow routes.
Reduction to rainfall to represent sewers	Drainage capacity is the source of greatest uncertainty in the modelling. Information from LLFAs on drainage capacity, infiltration/runoff rates has been incorporated into the model where it is available. Where local information is not available, the modelling has used a **default drainage rate of 12mm/hr** to reflect the 'national average' capacity of urban drainage systems.
Reduction to rainfall to represent infiltration	Land use has a strong influence on the way water on the surface behaves. OS MasterMap data on land cover, and data on soil type and land permeability is used to represent the **spatial variation in runoff and infiltration rates**.
Storm duration(s)	The duration and intensity of a rainfall storm that causes the most flooding varies widely between areas as it is strongly linked to the topography. Information from LLFAs about rainfall storms that have the greatest effect in an area has been incorporated into the model where available. Where local information is not available, storm durations of **1 hour, 3 hours, and 6 hours** using the 50% summer rainfall profile.
Surface roughness (Manning's 'n')	OS MasterMap data has been used to define spatially vary surface roughness according to land cover type.
Flooding as a result of rainfall probability	The model produced outputs for flooding outcomes as a result of three rainfall probabilities - **1 in 30, 1 in 100 and 1 in 1000** chance of occurring in any year.
Model software and equations	The modelling software uses more detailed mathematical equations (full shallow water equations) permitting production of more accurate velocity information.

Annex C – DTM Data Sources



Annex D – Source of modelling in uFMfSW v1



Annex E – Post processing examples

E.1 Re-sampling to produce a regular grid

E.1.1 Detailed view

Model outputs re-sampled from Infoworks 2D mesh export (TIN) to a 2m resolution regular grid.

Infoworks mesh export



Re-sampled to 2m regular grid



E.2 Filtering - removing very low hazard below 0.575

E.2.1 Detailed view

Model output data before filtering

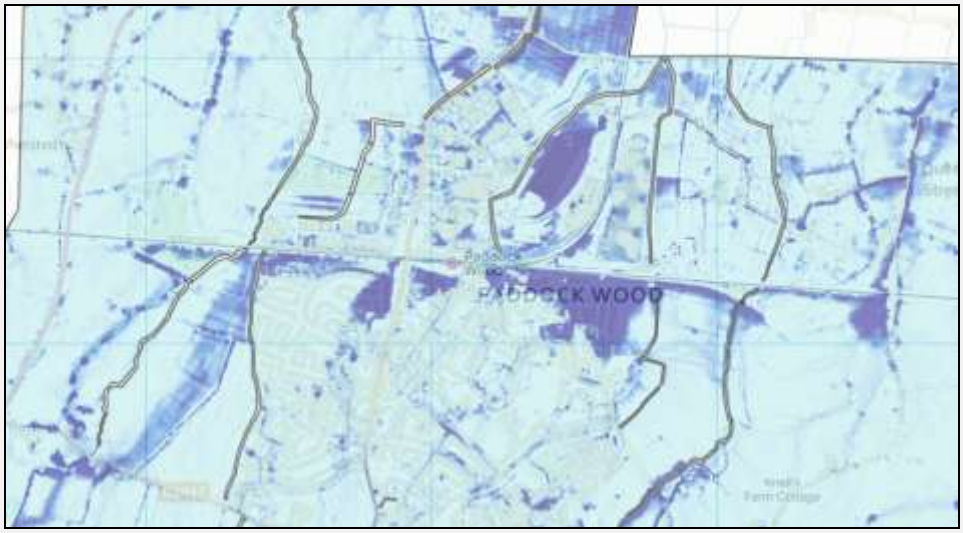


Filtered model output data - removing very low hazard below 0.575

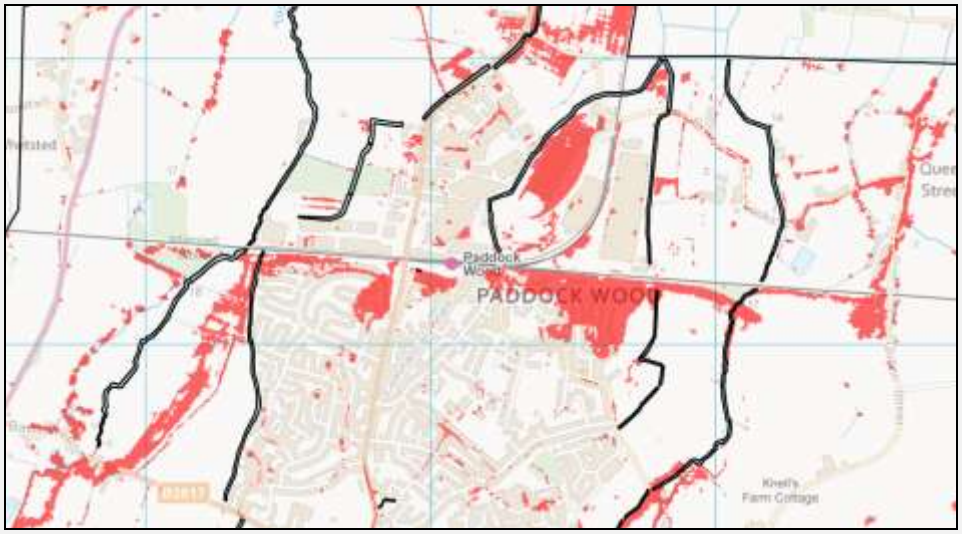


E.2.2 Wider area view

Model output data before filtering



Filtered model output data - removing very low hazard below 0.575

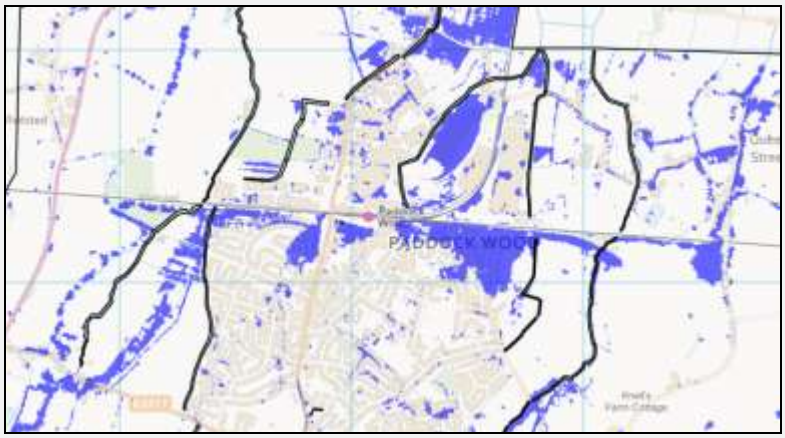


E.2.3 Wider area view - removing flooding below 0.1m, 0.3m, and 0.5m thresholds

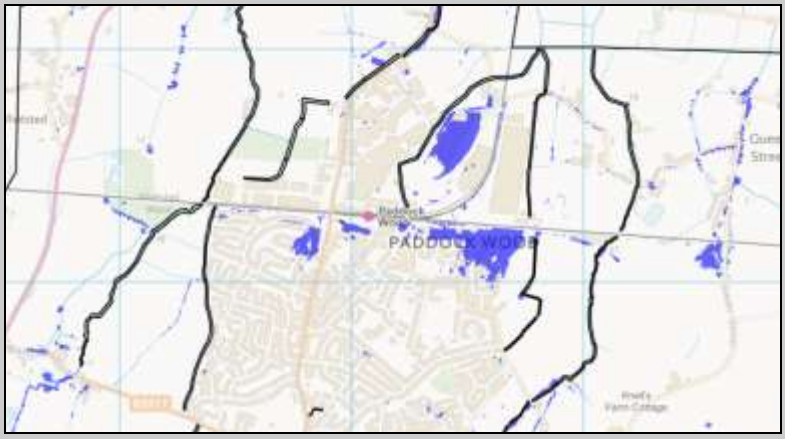
The uFMfSW is filtered by hazard rating, rather than a depth threshold. However, this information is provided for context as many locally produced studies use a depth threshold, rather than a hazard rating, to filter model output data.

Filtered model output data - removing depths below a threshold

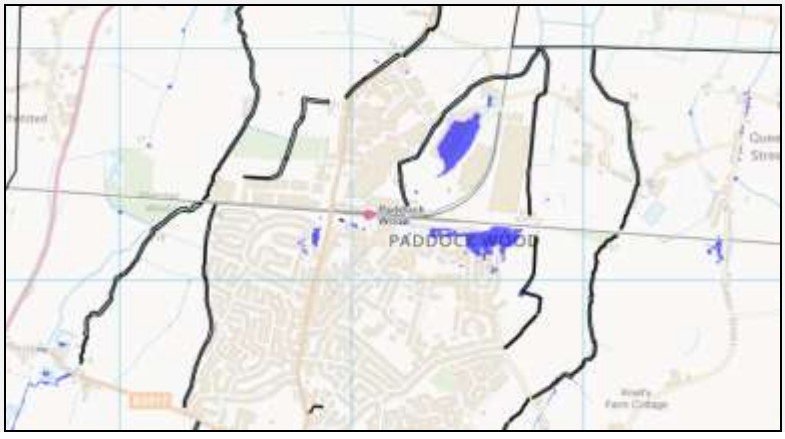
0.1m



0.3m



0.5m

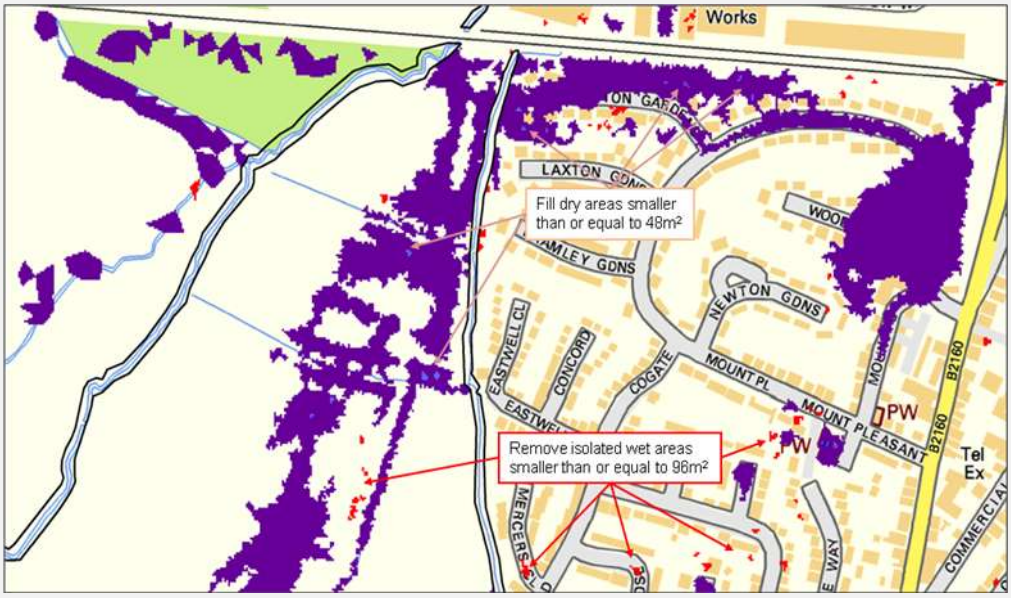


E.3 Filtering - removing small areas of flooding / filling isolated dry areas

Removing small areas of flooding less than 100 square metres (due to the grid size this equates to areas smaller than or equal to 96 square metres), and filling dry areas less than 100 square metres (due to the grid size this equates to areas smaller than or equal to 48 square metres).

E.3.1 Detailed view

Filtered model output data



E.3.2 Wider area view

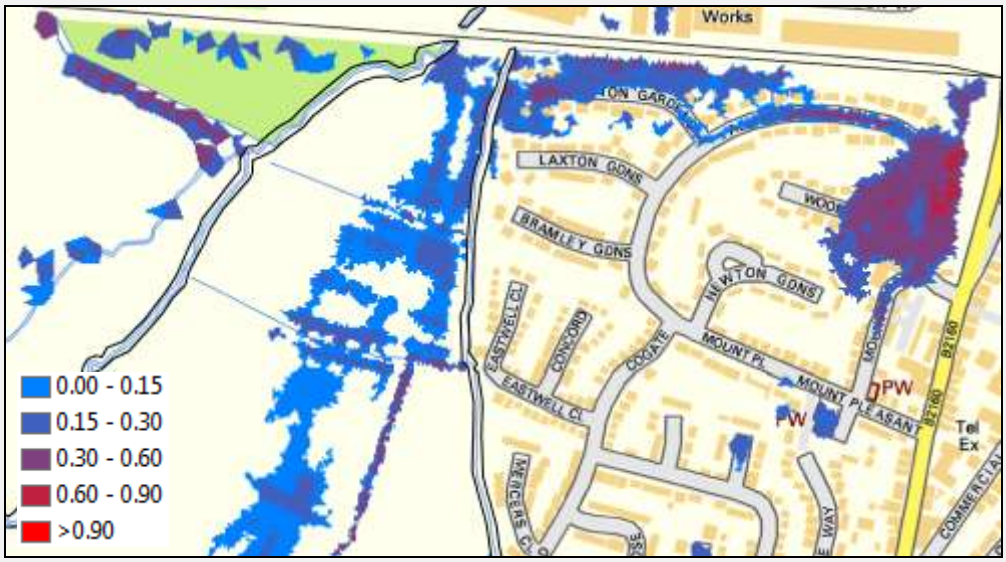
Filtered model output data



E.4 Banding - depth

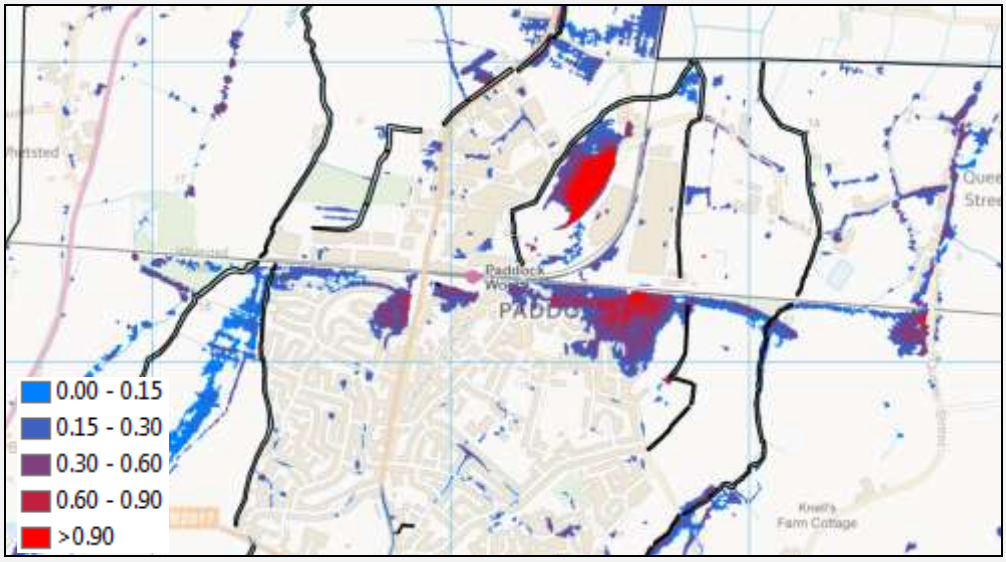
E.4.1 Detailed view

Banded model output data



E.4.2 Wider area view

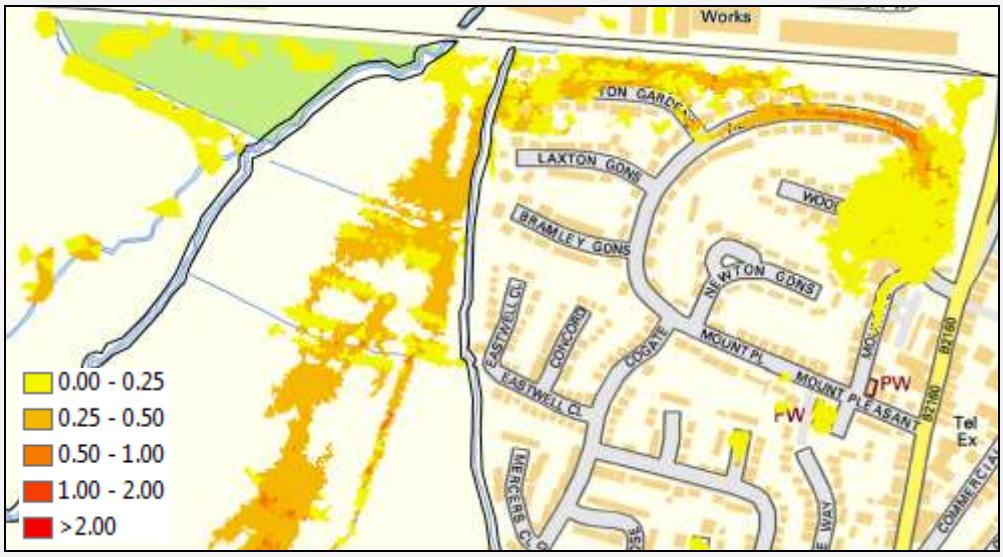
Banded model output data



E.5 Banding - velocity

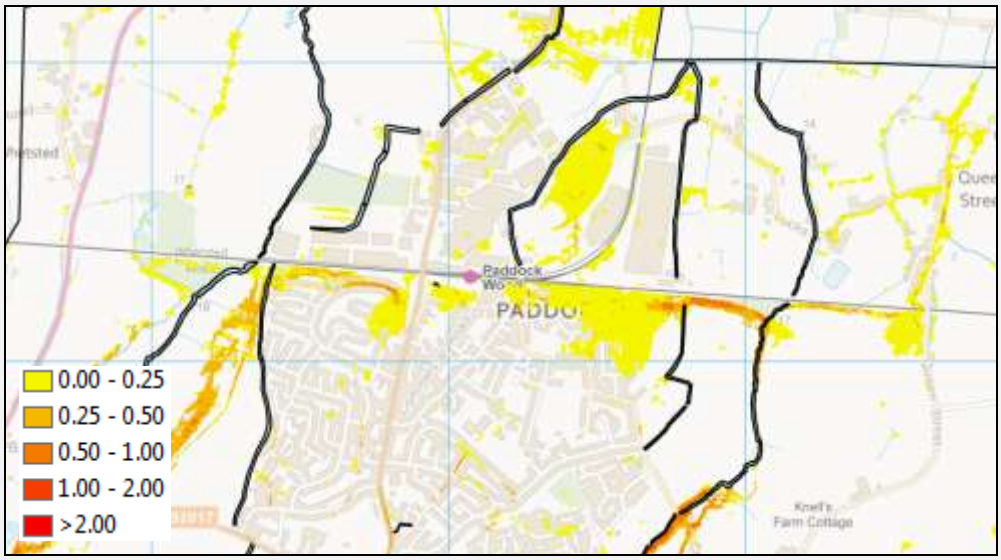
E.5.1 Detailed view

Banded model output data



E.5.2 Wider area view

Banded model output data



E.6 Banding - hazard rating

These examples are provided for information only; maps showing hazard ratings are not necessary to meet the requirements of the Flood Risk Regulations.

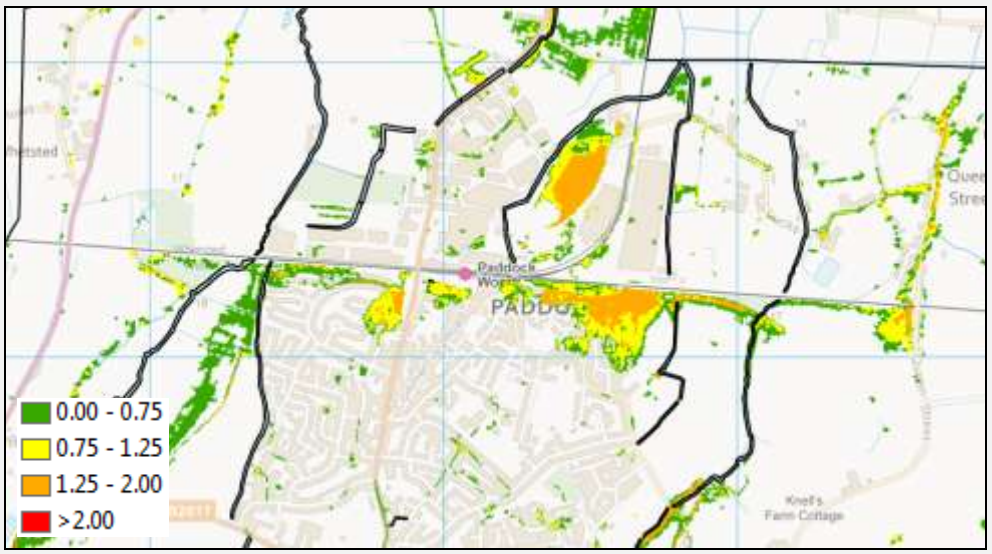
E.6.1 Detailed view

Banded model output data



E.6.2 Wider area view

Banded model output data



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incident hotline 0800 80 70 60 (24hrs)
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Appendix (F)

Lead Local Flood Authority Correspondence

Hampshire County Council

Terry Seymour

RCP Consultants
Old School, Old School Road,
Hook,
Hants RG27 9NJ

Economy, Transport and Environment Department
Elizabeth II Court West, The Castle
Winchester, Hampshire SO23 8UD

Tel: 0300 555 1375 (General Enquiries)
0300 555 1388 (Roads and Transport)
0300 555 1389 (Planning)
Textphone 0300 555 1390
Fax 01962 847055
www.hants.gov.uk

Enquiries to Flood & Water Management

Direct line 01962 846730

Date 1th July 2017

My reference LLFA/Pre-app/2017/0014

Your reference C4C 100326419

E-mail Swm.consultee@hants.gov.uk

Dear Sir,

Re: Land Adjacent to Langstone Harbour

We refer to your request for pre-application advice on 22nd May 2017 and our subsequent meeting on 7th July 2017.

Pre-application advice
As the Lead Local Flood Authority (LLFA) Hampshire County Council is a statutory consultee for Surface Water Drainage on applications for major development. From 15 April 2015 Hampshire County Council are required to be consulted on these developments when a planning application is received by the Local Planning Authority. Further to this we have a regulatory role in relation to consenting works on ordinary watercourses.

Historic Flooding information
We have reviewed our records of flood incidents for this area. We have no records of surface water flooding from pluvial events within a 500m radius of the site. This does not necessarily mean that other flood events have not occurred, they either may not have been reported or events may have occurred prior to 2012 – HCC records have only be maintained since then. The EA may hold data on flood events prior to this date.

There is a range of modelling information from the EA which highlights the potential risk from surface water flooding in a GIS format. Each model makes different assumptions regarding drainage provision, permeability of the area, routing around buildings etc. Therefore, each model should be considered. The different models are as follows:
Areas susceptible to surface water flooding (AStSWf)
Flood Map for Surface Water (FMfSW)
Updated Flood Map for Surface Water (uFMfSW)

It is recommended that all modelling sets are used to assess the site for surface water flooding events and a suitable model be developed. The level of complexity should be site dependant including for topography and permeability of the area.

The Waterbody Catchment is Hermitage Stream. There is no main river within the search area however a coastal zone (Farlington Marshes Gutter) is within 500m radius of the site and advice on coastal flooding risk should be sought from the EA and the Local Planning Authority.

For information regarding Fluvial flooding please contact the Environment Agency. Please refer to the following EA website: https://flood-map-for-planning.service.gov.uk/

For information regarding foul flooding, please contact the relevant sewerage provider.

Ordinary Watercourse consenting
HCC have no records of Ordinary Watercourse Consents within the search area

Any works to ordinary watercourses that impact on capacity will require Ordinary Watercourse Consent. Please refer to the HCC OWC website for further information and the forms for consents. Consenting process takes approximately 2 months.

Drainage Assets
Please refer to attached map which shows Hampshire CC drainage assets.

Surface Water drainage
Notes from meeting between HCC Flood and Water Management Team and RCP Consultants held on 7th July 2017:

Summary of Development and location:

- The developer Barratt Homes are proposing a scheme of 341 dwellings.
- The proposals include a protected and educational area to the east for Brent Geese and the southern part of the site, adjacent to the railway will be designated as Public Open Space

Potential existing flooding constraints:

- The site is currently Greenfield therefore proposed discharge rates and volumes must not exceed existing Greenfield runoff rates.
- The southern half of the site is located with **Flood Zones 2 & 3** – *HCC note that RCP have consulted with the EA and any proposed housing within this zone will be elevated by 300mm. The FRA will also take into account tidal lock events.*
- A culvert passes under the railway embankment towards Langstone Harbour at the point where EA surface water mapping shows a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%). *HCC note that any necessary liaison with Network Rail will be undertaken by Southern Water as it is their pipe that passes under the embankment.*

- EA mapping also indicates the possibility of surface water flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year across the site from North to South

Drainage proposals:

- Site investigations will be required to determine whether infiltration drainage is feasible (best practice requires that drainage via infiltration is considered at the outset before alternative SuDS features are investigated). Infiltration tests must be undertaken in accordance with BRE365. *HCC will expect to see evidence that infiltration has been considered and if not feasible an explanation of why this isn't a suitable method of drainage for the site.*
- Where possible green corridors should be used to take exceedance flows and follow modelled flow routes thereby mimicking the existing situation.
- Surface level SuDS features such as permanent wet ponds would be considered highly beneficial from both a water quality and quantity point of view as well as providing the site with bio-diversity and amenity value and should be considered at the outset. *HCC note that a number of attenuation basins are proposed – these should be located outside of the flood zones in order to function effectively. They will also provide treatment, it is anticipated that 3 levels of treatment will be achieved throughout the system.*
- The drainage proposals are currently to use a piped system within the built up areas, these feed into attenuation basins which are linked together ultimately discharging into the existing southern water surface water system
- Increased tree planting – particularly within public open space and as tree belts along with areas of vegetation naturally slow down water and increase infiltration. Appropriately selected tree species can also intercept up to 60% of rainfall.
- As stated on the HCC website we would expect to have demonstrated existing Greenfield runoff rates and volumes as well as proposed rates and volumes to reflect existing. *HCC note that Qbar Greenfield rates are being proposed*
- HCC would expect to see reference made to a maintenance/management plan in the Surface Water Drainage Plan for all SuDS features within the site – who will be responsible for which features. HCC Highways currently will consider adoption of SuDS features that take Highways run-off only. *Barratt Homes are working with ICOSA water (regulated by OfWat) on an agreement for them to undertake all maintenance of SuDS features including ones related to the highway (anticipated to be adopted by HCC). ICOSA would liaise with Southern Water for the discharge connection*
- *We would recommend consideration of phasing work in particular SuDS features throughout the construction period in order to ensure they are protected and thereby work effectively following completion of the works.*

Drainage Provision

The SuDS Manual Ciria C753 provides best practise and design advice on SuDS design and should be referred to during the design process. Drainage systems should look to mimic the natural processes as far as practicable, collecting and storing / infiltrating rain water as close to the source as possible. If infiltration is not

possible, attenuation options should be considered with a controlled outfall so that water leaving the site is minimised and the 'peak runoff value' flattened.

The site geology appears to be from the south towards the north: Beach and Tidal Flat deposits (Clay, Silt, Sand, Gravel), Raised Marine Deposits (Sand & Gravel), River Terrace Deposits (Sand, Silt, Clay) and Head (Clay, Silt, Sand, Gravel) located on Lewes Nodular Chalk Formation and Seaford Chalk.

Vulnerability of site from surface or ground water information

- The site has a likelihood of 25-50% groundwater flooding with the eastern edge at a higher likelihood of 50-75%

For further information on the vulnerability of the area from either surface water or river/sea flooding, please see the maps available from the Environment Agency on the .GOV website: http://maps.environment-agency.gov.uk/ and more specifically for flood zones: https://flood-map-for-planning.service.gov.uk/

Hampshire also have a draft Groundwater Management Plan that was never published but is available on our website which contains useful information

HCC prepared Surface Water Management Plans which are available on our website however these will be replaced by Catchment Approach Plans over the forthcoming months.

Planning requirements

Hampshire County Council's website lists all the information required when assessing planning applications. This information should be provided within a Flood Risk Assessment, Drainage Strategy, drawings and calculations.
We would recommend the inclusion of an executive summary to provide key information in a more accessible format.

The County Council requirements, and guidance, in relation to the Lead Local Authority Role can be found on our website.

Please note: the Environment Agency guidance relating to climate change was updated in February 2016. A link is provided on the County Council webpage. *We would expect that the system is tested to a 40% climate change uplift.*

We would also expect to see a suitable allowance for urban creep, this factor reflects the future predicted increase of urban development, and with it, the increase of the impervious area. An allowance of 10% on impermeable areas is suitable in relation to confirming that the proposed system is acceptable.

This response has been provided using the best knowledge and information submitted as part of the planning application at the time of responding and is reliant on the accuracy of that information.

If you have any queries on this pre-application advice please contact the FWM Team quoting the above reference.

Regards



FWM Team
fwm@hants.gov.uk

Users' declaration

I understand that in using advice provided by the Hampshire Flood and Water Management Team I am aware of the following:

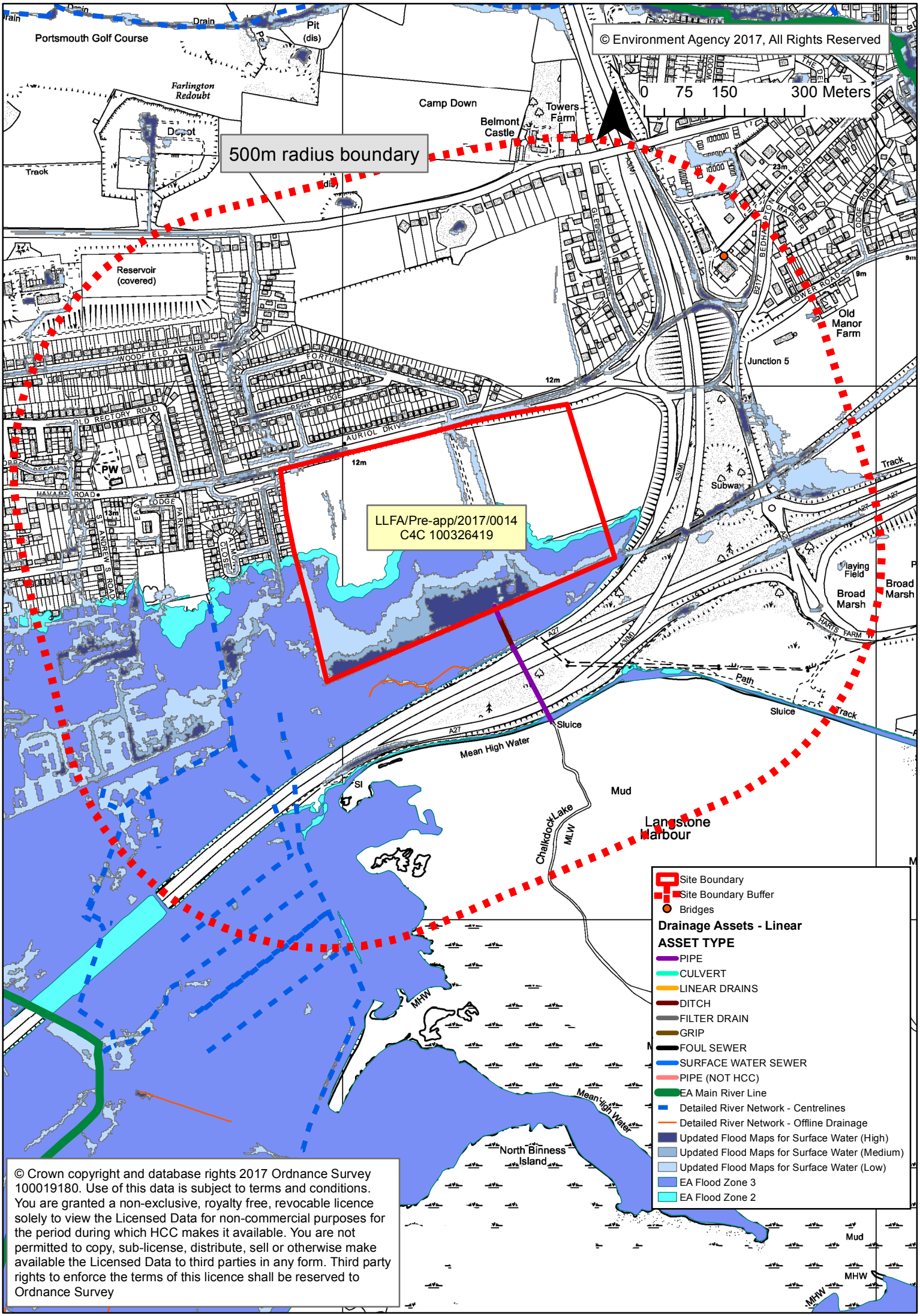
1. The Flood and Water Management (FWM) Team is part of Hampshire County Council ("We/Us/Our"). The Council holds copyright of this information and advice on behalf of the FWM team except where service level agreements state otherwise. No direct reproduction of this advice will be allowed as a direct copy, except for the purpose of Environment Information Requests.

2. Advice provided by the Hampshire FWM Team will only be used for the purpose stated and will not be stored beyond the life of the project for which it was acquired.

3. Any personal information supplied in association with these records will not be used, copied, or passed to any third party without the consent of the Hampshire FWM Team and in accordance with the Data Protection Act.

4. Whilst every reasonable effort is made to validate information supplied to and by the Hampshire FWM Team owing to the dynamic and judgmental nature of information relating to flooding, the Hampshire disclaims any responsibility for the accuracy or comprehensiveness of the information supplied, and accepts no liability for any indirect, consequential, or incidental damages or losses arising from use of the information.

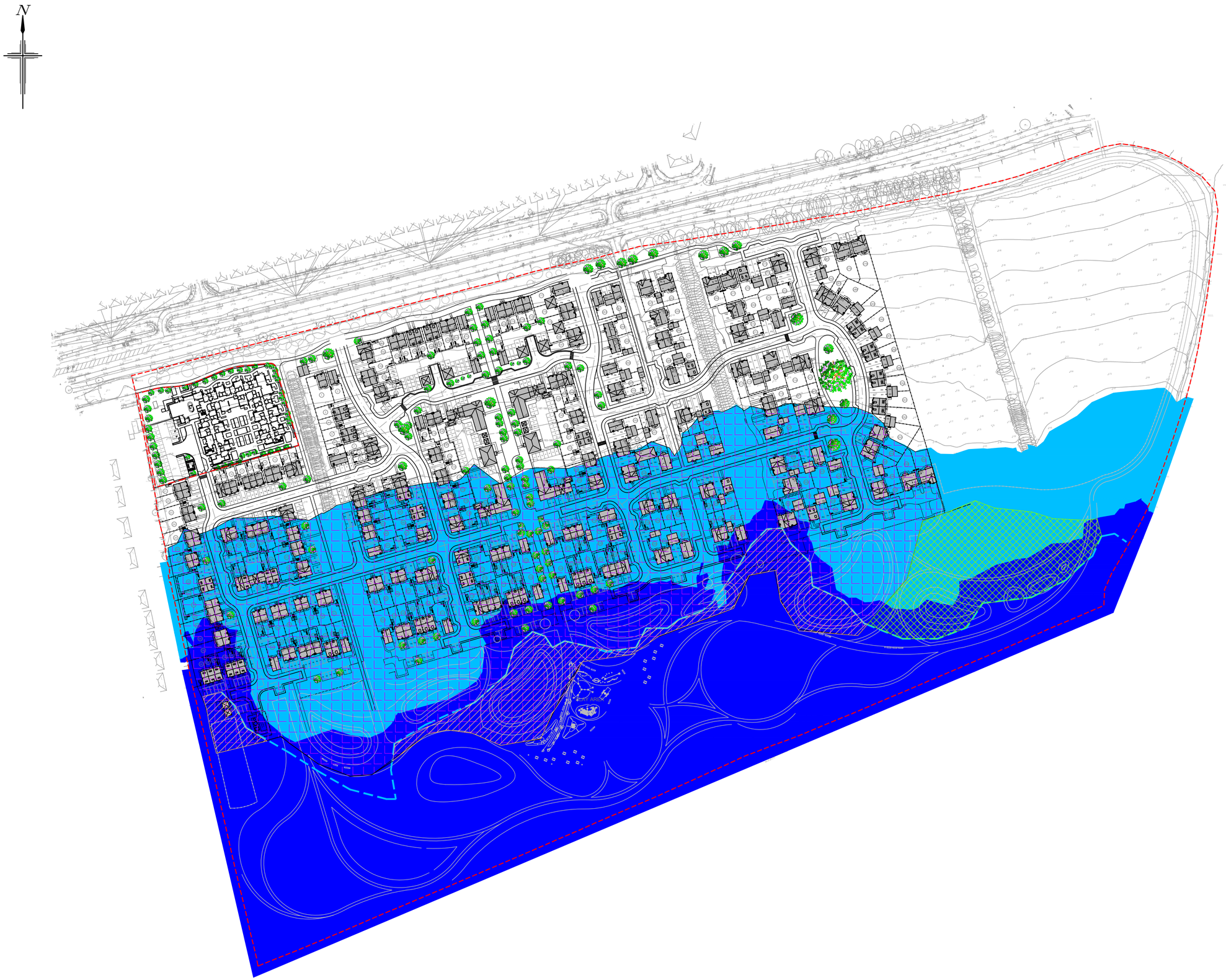
5. I am aware of the Hampshire FWM Team charging schedule and understand I may be charged for the advice.



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Appendix (G)

Flood Risk Mitigation



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. This drawing should be read in conjunction with the Architect's and Structural Engineer's design drawings and specification and External Works Layouts.
4. Topographic Survey as per Siteline survey drawing number 36FA01 dated August 2016.
5. ***ANY VARIANCE OR DISCREPANCY MUST BE REPORTED BACK TO RCP ENGINEERING BEFORE WORK BEGINS.***

KEY

1 in 200 Year Tidal Event For The Year 2011 (3.2m A.O.D.)

1 in 200 Year Tidal Event For The Year 2115 (4.4m A.O.D.)

Extent of development proposals where ground levels are to be raised to a min. 4.4m to mitigate the impacts of the peak Tidal Flood Event

Approximate extent of area of low risk of surface water flooding from ufSWM

Extent of development proposals which lie within the approximate extent of the low risk of surface water flooding.

Extent of mitigation area proposed for compensation for surface water flood risk

MINIMUM FINISHED FLOOR LEVELS TO BE MINIMUM 300mm ABOVE 1 IN 200 YEAR + CLIMATE CHANGE EVENT (4.7m A.O.D.)

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 12.5m 25m 50m 75m 100m 125m

SCALE BAR 1:1250 at A1

Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Turning head removed from opposite Plots 278 & 279.	AC	AC	TRS

Client:-

BARRATT HOMES

DAVID WILSON HOMES
WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm,Havant Road Havant

Drawing Title:-
FLOOD MITIGATION PROPOSALS

Date: April 2018 | Scales: 1:1250 at A1

Drawn: TRS | Checked: AC | Approved: TRS

Drawing No.
BSO/E4519/029 A

FOR INFORMATION ONLY

Rogers Cory Partnership
Architectural and Civil Consultants
The Old School Old School Road
Hook Hampshire RG27 9NJ
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Appendix (H)

Existing Drainage Regime

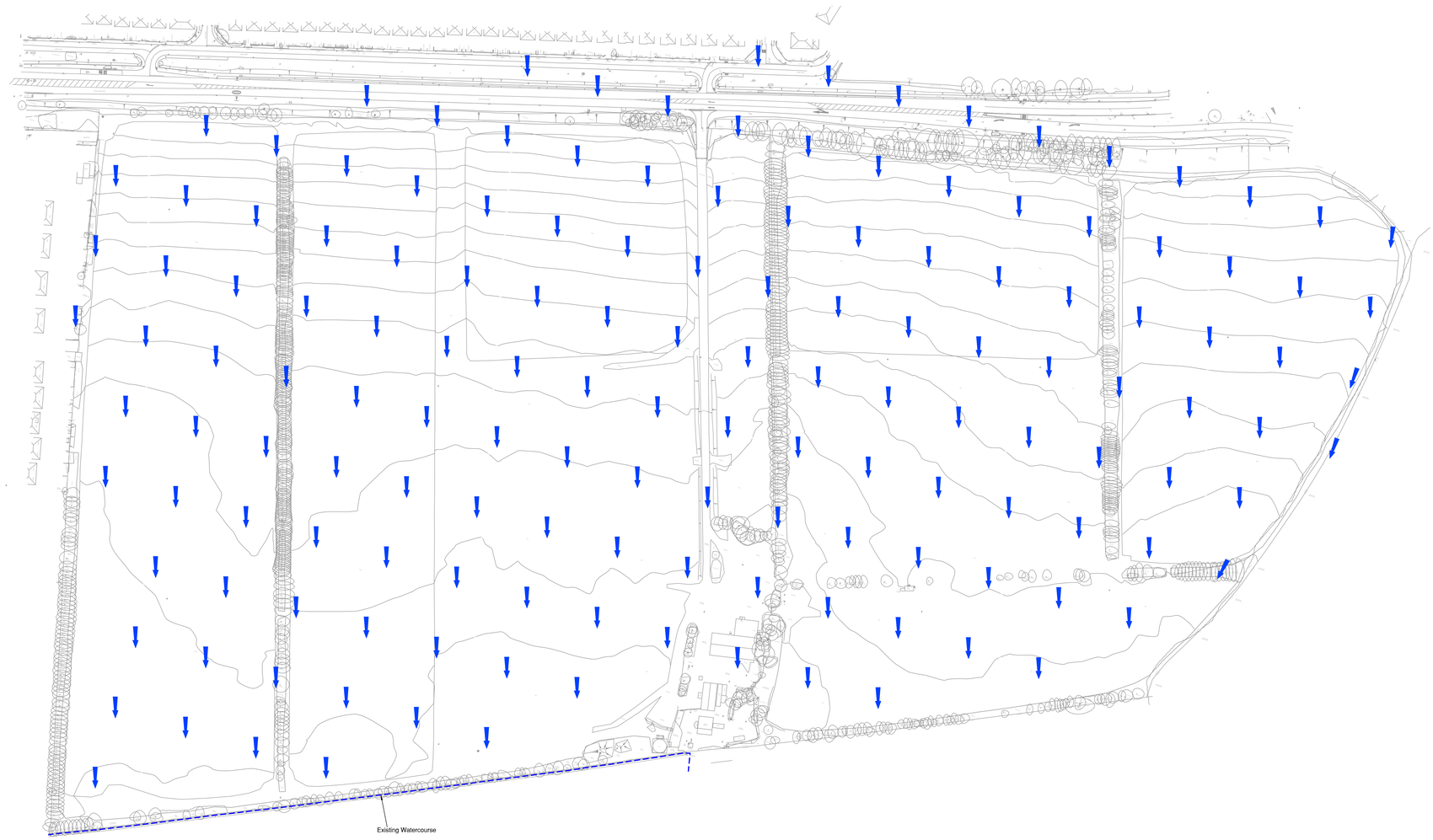


NOTES

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, drawing number PL06 dated April 2018.
4. Topographic Survey as per Siteline survey drawing number 36FA01 dated August 2016.

KEY

Existing Overland Flow



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

SCALE BAR 1:1000 at A0

Rev.	Date	Details	By	Chkd	Appd

Client:- BARRATT HOMES / DAVID WILSON HOMES WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm, Havant Road Havant

Drawing Title:-
BASELINE HYDROLOGY LAYOUT

Date:	April 2018	Scales:	1:500 at A0
Drawn:	WD	Checked: AC	Approved: TRS

Drawing No. BSO/E4519/018

PRELIMINARY

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ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	6.560	Urban	0.000
SAAR (mm)	735	Region Number	Region 7

Results l/s

QBAR Rural	23.6
QBAR Urban	23.6
Q100 years	75.4
Q1 year	20.1
Q30 years	53.6
Q100 years	75.4

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Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.300
Ratio R	0.350
Areal Reduction Factor	1.00
Area (ha)	6.560
SAAR (mm)	718
CWI	107.323
Urban	0.000
SPR	37.000

Results

Percentage Runoff (%)	36.73
Greenfield Runoff Volume (m^3)	1539.098

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Appendix (I)

Proposed Drainage 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. This drawing should be read in conjunction with the Architect's and Structural Engineer's design drawings and specification and External Works Layouts.
3. Site layout based on ID Partnership Proposed Site Layout, drawing number PL06 dated April 2018.
4. Topographic Survey as per Siteline survey drawing number 36FA01 dated August 2016.
5. The proposed finished levels are indicative only and subject to further design development. The finished floor levels may vary by 300mm from what is currently proposed.
6. No retaining walls are currently shown subject to further design development.
7. All construction to be in accordance with Sewers for Adoption 6th Edition & Interim Addendum and the specific requirements of the Sewage Undertaker.

KEY

Proposed Surface Water drainage

Drainage basin

Pond

Basin Outline

Pond Outline

Headwall

0m 10m 20m 40m 60m 80m 100m

SCALE BAR 1:1000 at A1

Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Turning head removed from opposite Plots 278 & 279.	AC	AC	TRS

Client:-

BARRATT HOMES

DAVID WILSON HOMES
WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm, Havant Road, Havant

Drawing Title:-
DRAINAGE STRATEGY KEYPLAN

SHEET 1 OF 3

Date: April 2018
Scales: 1:1250 at A1
Drawn: WD
Checked: AC
Approved: TS

Drawing No.
BSO/E4519/020 A

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6. No retaining walls are currently shown subject to further design development.
7. All construction to be in accordance with Sewers for Adoption 6th Edition & Interim Addendum and the specific requirements of the Sewage Undertaker.

KEY

Proposed Surface Water drainage

Drainage basin

Pond

Basin Outline

Pond Outline

Headwall

Basin 1

Basin 2

Basin 3

Basin 4

Pond 1

PLAY AREA

Hydro-Break chamber restricting flows to the 1yr, 30yr & 100yr greenfield ratios.

SCALE BAR 1:500 at A0

Rev.	Date	Details	By	Chkd	Appd

Client:- BARRATT HOMES / DAVID WILSON HOMES WHERE QUALITY LIVES

Site:- Land at Forty Acre Farm, Havent Road, Havent

Drawing Title:- DRAINAGE STRATEGY PLAN

SHEET 2 OF 3

Date:	April 2018		Scales:	1:500 at A0
Drawn:	WD	Checked:	AC	Approved: TRS

Drawing No. BSO/E4519/021

PRELIMINARY

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NOTES

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6. No retaining walls are currently shown subject to further design development.
7. All construction to be in accordance with Sewers for Adoption 6th Edition & Interim Addendum and the specific requirements of the Sewage Undertaker.

KEY

Proposed Surface Water drainage

Drainage basin

Pond

Basin Outline

Pond Outline

Headwall

Basin 3

Basin 4

Pond 2

Hydro-Break chamber restricting flows to the 1yr, 30yr & 100yr greenfield ratios.

SCALE BAR 1:500 at A0

Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Turning head removed from opposite Plots 278 & 279.	AC	AC	TRS

Client:-

BARRATT HOMES

DAVID WILSON HOMES
WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm, Havent Road, Havent

Drawing Title:-
DRAINAGE STRATEGY PLAN

SHEET 3 OF 3

Date:	April 2018	Scales:	1:500 at A0
Drawn:	WD	Checked: AC	Approved: TRS

Drawing No.
BSO/E4519/022 A

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N

334m²
600m²
441m²
1189m²
1675m²
660m²
1514m²
696m²
644m²
1248m²
1534m²
733m²
859m²
1174m²
1612m²
1400m²
1238m²
1097m²
802m²
893m²
804m²
1555m²
2487m²
1458m²
1191m²
1192m²
1185m²
995m²
2069m²
1561m²
1448m²
1602m²
1308m²
673m²
1373m²
1169m²
700m²
3305m²
2184m²
432m²
1431m²
281m²
767m²
2032m²
767m²
1514m²
1899m²
2548m²
1897m²
295m²
481m²
1394m²
1253m²

PLAY AREA

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, drawing number PL06 dated April 2018.
4. Topographic Survey as per Siteline survey drawing number 36FA01 dated August 2016.

KEY

Impermeable Areas Outline and area in m²

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

SCALE BAR 1:500 at A0

Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Turning head removed from opposite Plots 278 & 279.	AC	AC	TRS

Client:-

BARRATT HOMES

DAVID WILSON HOMES
WHERE QUALITY LIVES

Site:-
Land at Forty Acre Farm, Havent Road, Havent

Drawing Title:-
IMPERMEABLE AREAS LAYOUT

Date:	April 2018			Scales:	1:500 at A0
Drawn:	WD	Checked:	AC	Approved:	TRS

Drawing No.
BSO/E4519/019 A

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Appendix (J)

MicroDrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW1- PDS EXPORT.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	10
Ratio R	0.350	Minimum Backdrop Height (m)	0.100
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW1- PDS EXPORT.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	33.060	1.650	20.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	20.961	1.048	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	16.980	0.848	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	33.943	0.203	167.2	0.104	5.00	0.0	0.600	o	375	Pipe/Conduit	
S2.001	14.561	0.058	250.0	0.167	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.002	7.954	0.032	248.6	0.142	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.003	25.970	0.058	447.8	0.335	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	16.884	0.034	496.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.004	17.923	0.036	497.9	0.069	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.005	55.418	0.632	87.6	0.000	0.00	0.0	0.600	o	750	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	5.19	8.525	0.000	0.0	0.0	0.0	2.94	116.8	0.0
S1.001	50.00	5.31	6.875	0.090	0.0	0.0	1.2	2.94	116.9	13.4
S1.002	50.00	5.40	5.827	0.180	0.0	0.0	2.4	2.94	116.8	26.8
S2.000	50.00	5.40	3.740	0.104	0.0	0.0	1.4	1.40	154.4	15.5
S2.001	50.00	5.62	3.537	0.271	0.0	0.0	3.7	1.14	126.1	40.4
S2.002	50.00	5.72	3.404	0.413	0.0	0.0	5.6	1.28	204.4	61.5
S2.003	50.00	6.10	3.222	0.748	0.0	0.0	10.1	1.14	323.5	111.4
S1.003	50.00	6.32	3.014	0.928	0.0	0.0	12.6	1.25	551.8	138.2
S1.004	50.00	6.56	2.980	0.997	0.0	0.0	13.5	1.25	551.1	148.5
S1.005	50.00	6.87	2.944	0.997	0.0	0.0	13.5	2.99	1321.1	148.5

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Network Design Table for SW1- PDS EXPORT.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
S3.000	43.874	0.263	166.8	0.161	5.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	36.867	0.597	61.8	0.272	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	14.607	0.029	503.7	0.310	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.007	47.227	0.094	502.4	0.145	0.00	0.0	0.600	o	750	Pipe/Conduit	
S5.000	44.319	0.363	122.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	43.017	0.258	166.7	0.152	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	32.269	0.065	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S7.000	16.665	0.423	39.4	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	40.844	1.680	24.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	35.970	1.153	31.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	63.987	0.142	450.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	14.992	0.163	92.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	34.000	0.996	34.1	0.000	0.00	0.0	0.600	o	225	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)
S3.000	50.00	5.60	3.025	0.161	0.0	0.0	2.2	1.21	85.8	24.0
S4.000	50.00	5.31	3.359	0.272	0.0	0.0	3.7	2.00	141.7	40.5
S1.006	50.00	7.07	2.311	1.740	0.0	0.0	23.6	1.24	547.8	259.2
S1.007	50.00	7.70	2.282	1.885	0.0	0.0	25.5	1.24	548.5	280.8
S5.000	50.00	5.62	3.127	0.000	0.0	0.0	0.0	1.18	47.0	0.0
S6.000	50.00	5.59	3.188	0.152	0.0	0.0	2.1	1.21	85.9	22.6
S1.008	50.00	8.13	2.188	2.037	0.0	0.0	27.6	1.24	549.9	303.4
S7.000	50.00	5.13	6.193	0.132	0.0	0.0	1.8	2.09	83.1	19.7
S7.001	50.00	5.39	5.770	0.132	0.0	0.0	1.8	2.66	106.0	19.7
S7.002	50.00	5.64	4.090	0.132	0.0	0.0	1.8	2.35	93.5	19.7
S7.003	50.00	6.76	2.712	0.132	0.0	0.0	1.8	0.95	151.4	19.7
S8.000	50.00	5.18	3.954	0.082	0.0	0.0	1.1	1.36	54.2	12.2
S8.001	50.00	5.44	3.791	0.082	0.0	0.0	1.1	2.25	89.3	12.2

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Network Design Table for SW1- PDS EXPORT.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
S7.004	60.460	0.625	96.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	36.996	0.222	166.6	0.133	5.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	10.231	0.061	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	62.920	0.377	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.005	11.651	0.021	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.006	44.594	0.081	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S10.000	46.138	0.185	250.0	0.156	5.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	35.606	0.142	250.0	0.226	5.00	0.0	0.600	o	300	Pipe/Conduit	
S10.001	55.970	0.187	299.3	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.002	8.846	0.044	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.007	34.837	0.046	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.008	25.592	0.034	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.009	67.829	0.090	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S12.000	13.000	0.645	20.2	0.132	5.00	0.0	0.600	o	150	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)
S7.004	50.00	7.25	2.570	0.214	0.0	0.0	2.9	2.07	328.8	31.9
S9.000	50.00	5.61	2.830	0.133	0.0	0.0	1.8	1.01	40.2	19.8
S9.001	50.00	5.78	2.608	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S9.002	50.00	6.82	2.547	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S7.005	50.00	7.44	1.795	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S7.006	50.00	8.16	1.774	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S10.000	50.00	5.78	3.033	0.156	0.0	0.0	2.1	0.99	70.0	23.2
S11.000	50.00	5.60	3.201	0.226	0.0	0.0	3.1	0.99	70.0	33.7
S10.001	50.00	6.67	2.773	0.551	0.0	0.0	7.5	1.04	115.1	82.1
S10.002	50.00	6.79	2.586	0.551	0.0	0.0	7.5	1.28	141.1	82.1
S7.007	48.76	8.71	1.493	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.008	47.66	9.11	1.446	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.009	45.03	10.18	1.412	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S12.000	50.00	5.10	8.762	0.132	0.0	0.0	1.8	2.25	39.8	19.7

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Network Design Table for SW1- PDS EXPORT.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
S13.000	47.008	0.188	250.0	0.248	5.00	0.0	0.600	o	375	Pipe/Conduit	
S12.001	34.981	0.437	80.0	0.136	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.002	13.954	0.695	20.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S14.000	10.531	0.105	100.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	11.690	0.117	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.002	12.175	0.122	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.003	10.900	0.109	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.003	21.920	0.219	100.0	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.004	16.477	0.182	90.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S15.000	32.938	1.469	22.4	0.070	5.00	0.0	0.600	o	150	Pipe/Conduit	
S15.001	28.922	1.269	22.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.002	45.524	0.328	138.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.005	52.467	0.245	214.2	0.251	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.000	36.016	0.362	99.5	0.110	5.00	0.0	0.600	o	300	Pipe/Conduit	
S12.006	8.863	0.104	84.9	0.127	0.00	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)
S13.000	50.00	5.69	6.851	0.248	0.0	0.0	3.4	1.14	126.0	36.9
S12.001	50.00	5.97	6.663	0.516	0.0	0.0	7.0	2.03	223.8	76.9
S12.002	50.00	6.03	6.226	0.516	0.0	0.0	7.0	4.06	448.4	76.9
S14.000	50.00	5.17	4.090	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.001	50.00	5.37	3.985	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.002	50.00	5.57	3.868	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.003	50.00	5.75	3.746	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S12.003	50.00	6.23	3.412	0.616	0.0	0.0	8.3	1.81	200.1	91.8
S12.004	50.00	6.38	3.193	0.616	0.0	0.0	8.3	1.91	210.6	91.8
S15.000	50.00	5.26	6.302	0.070	0.0	0.0	0.9	2.14	37.7	10.4
S15.001	50.00	5.48	4.833	0.070	0.0	0.0	0.9	2.12	37.4	10.4
S15.002	50.00	6.17	3.489	0.070	0.0	0.0	0.9	1.11	44.1	10.4
S12.005	50.00	7.01	2.935	0.937	0.0	0.0	12.7	1.39	220.3	139.6
S16.000	50.00	5.38	3.352	0.110	0.0	0.0	1.5	1.58	111.4	16.4
S12.006	50.00	7.08	2.690	1.174	0.0	0.0	15.9	2.21	351.1	174.9

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Network Design Table for SW1- PDS EXPORT.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
S17.000	17.848	0.071	251.4	0.207	5.00	0.0	0.600	o	300	Pipe/Conduit	
S17.001	15.170	0.141	107.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.007	13.907	0.028	496.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.008	28.913	0.058	498.5	0.359	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.009	7.235	0.014	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.010	17.210	0.038	455.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.011	40.896	0.058	705.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.012	37.397	0.061	609.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.013	28.513	0.057	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.009	41.043	0.051	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.010	83.206	0.104	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.011	41.787	0.052	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S18.000	21.994	0.840	26.2	0.094	5.00	0.0	0.600	o	150	Pipe/Conduit	
S18.001	8.576	0.344	25.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S18.002	52.985	2.028	26.1	0.143	0.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	31.169	0.123	253.4	0.268	5.00	0.0	0.600	o	450	Pipe/Conduit	
S19.001	27.732	0.185	149.9	0.000	0.00	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)
S17.000	50.00	5.30	2.948	0.207	0.0	0.0	2.8	0.99	69.8	30.8
S17.001	50.00	5.47	2.877	0.207	0.0	0.0	2.8	1.52	107.1	30.8
S12.007	50.00	7.26	2.286	1.381	0.0	0.0	18.7	1.25	551.7	205.7
S12.008	50.00	7.65	2.258	1.740	0.0	0.0	23.6	1.25	550.7	259.2
S12.009	50.00	7.74	2.200	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S12.010	50.00	7.96	2.186	1.740	0.0	0.0	23.6	1.31	576.6	259.2
S12.011	49.02	8.62	2.148	1.740	0.0	0.0	23.6	1.05	462.2	259.2
S12.012	47.52	9.17	2.090	1.740	0.0	0.0	23.6	1.13	497.4	259.2
S12.013	46.54	9.55	2.028	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S1.009	43.62	10.82	1.247	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.010	41.12	12.10	1.195	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.011	39.99	12.75	1.091	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S18.000	50.00	5.19	6.116	0.094	0.0	0.0	1.3	1.98	34.9	14.0
S18.001	50.00	5.26	5.276	0.094	0.0	0.0	1.3	2.02	35.8	14.0
S18.002	50.00	5.60	4.858	0.237	0.0	0.0	3.2	2.57	102.2	35.3
S19.000	50.00	5.41	2.913	0.268	0.0	0.0	3.6	1.27	202.4	39.9
S19.001	50.00	5.69	2.790	0.268	0.0	0.0	3.6	1.66	263.7	39.9

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Network Design Table for SW1- PDS EXPORT.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
S18.003	10.755	0.024	448.1	0.203	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.004	17.016	0.038	447.8	0.189	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.005	24.230	0.054	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.006	22.336	0.050	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.007	14.516	0.182	79.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S20.000	42.000	0.251	167.0	0.104	5.00	0.0	0.600	o	225	Pipe/Conduit	
S20.001	18.361	0.718	25.6	0.154	0.00	0.0	0.600	o	225	Pipe/Conduit	
S18.008	42.896	0.086	498.8	0.125	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.009	14.300	0.029	493.1	0.139	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.010	21.315	0.053	400.0	0.380	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.011	16.231	0.044	369.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.012	33.807	0.195	173.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.013	153.083	0.255	600.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.012	13.545	0.027	500.0	0.000	0.00	0.0	0.600	o	875	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)
S18.003	50.00	5.82	2.305	0.708	0.0	0.0	9.6	1.32	581.1	105.5
S18.004	50.00	6.04	2.281	0.897	0.0	0.0	12.1	1.32	581.3	133.6
S18.005	50.00	6.35	2.243	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.006	50.00	6.63	2.189	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.007	50.00	6.71	2.140	0.897	0.0	0.0	12.1	3.14	1386.1	133.6
S20.000	50.00	5.69	3.452	0.104	0.0	0.0	1.4	1.01	40.1	15.5
S20.001	50.00	5.81	3.201	0.258	0.0	0.0	3.5	2.60	103.3	38.4
S18.008	50.00	7.28	1.957	1.280	0.0	0.0	17.3	1.25	550.5	190.7
S18.009	50.00	7.47	1.871	1.419	0.0	0.0	19.2	1.25	553.7	211.4
S18.010	50.00	7.73	1.842	1.799	0.0	0.0	24.4	1.39	615.4	268.0
S18.011	50.00	7.91	1.789	1.799	0.0	0.0	24.4	1.45	640.5	268.0
S18.012	50.00	8.18	1.745	1.799	0.0	0.0	24.4	2.12	936.8	268.0
S18.013	44.48	10.43	1.550	1.799	0.0	0.0	24.4	1.14	501.5	268.0
S1.012	39.71	12.91	1.039	6.474	0.0	0.0	69.6	1.37	823.9	766.0

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Simulation Criteria for SW1- PDS EXPORT.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 Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	30
Ratio R	0.350		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	360 Winter	1	+0%				
S1.001	S2	15 Winter	1	+0%				
S1.002	S3	15 Winter	1	+0%	100/15 Summer			
S2.000	S38	15 Winter	1	+0%	100/15 Summer		100/15 Winter	1
S2.001	S39	15 Winter	1	+0%	100/15 Summer			
S2.002	S40	15 Winter	1	+0%	100/15 Summer			
S2.003	S41	15 Winter	1	+0%	100/15 Summer			
S1.003	S4	15 Winter	1	+0%	100/15 Summer			
S1.004	S5	15 Winter	1	+0%	100/15 Summer			
S1.005	S6	15 Winter	1	+0%	100/15 Summer			
S3.000	S34	15 Winter	1	+0%	100/15 Summer			
S4.000	S37	15 Winter	1	+0%	100/15 Summer			
S1.006	S7	15 Winter	1	+0%	30/15 Summer			
S1.007	S8	15 Winter	1	+0%	30/15 Summer			
S5.000	S35	360 Winter	1	+0%	100/15 Summer			
S6.000	S36	15 Winter	1	+0%	100/15 Winter			
S1.008	S9	15 Winter	1	+0%	30/15 Winter			
S7.000	S15	15 Winter	1	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.921	-0.179	0.000	0.09		9.7	OK	
S1.002	S3	5.893	-0.159	0.000	0.19		19.3	OK	
S2.000	S38	3.818	-0.297	0.000	0.09	0.0	12.9	OK	
S2.001	S39	3.680	-0.232	0.000	0.31		30.9	OK	
S2.002	S40	3.586	-0.268	0.000	0.34		46.0	OK	
S2.003	S41	3.453	-0.369	0.000	0.31		80.5	OK	
S1.003	S4	3.319	-0.445	0.000	0.32		98.0	OK	
S1.004	S5	3.273	-0.457	0.000	0.32		103.3	OK	
S1.005	S6	3.096	-0.597	0.000	0.09		103.7	OK	
S3.000	S34	3.128	-0.197	0.000	0.25		20.4	OK	
S4.000	S37	3.464	-0.195	0.000	0.26		34.0	OK	
S1.006	S7	2.750	-0.312	0.000	0.64		175.1	OK	
S1.007	S8	2.650	-0.383	0.000	0.40		182.8	OK	
S5.000	S35	3.127	-0.225	0.000	0.00		0.0	OK	
S6.000	S36	3.288	-0.200	0.000	0.24		19.3	OK	
S1.008	S9	2.540	-0.398	0.000	0.45		193.8	OK	
S7.000	S15	6.266	-0.152	0.000	0.23		16.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.001	S16	15 Winter	1	+0%				
S7.002	S17	15 Winter	1	+0%				
S7.003	S18	15 Winter	1	+0%	100/15 Summer			
S8.000	S32	15 Winter	1	+0%				
S8.001	S33	15 Winter	1	+0%				
S7.004	S19	15 Winter	1	+0%	100/15 Summer			
S9.000	S24	15 Winter	1	+0%	30/15 Summer			
S9.001	S25	15 Winter	1	+0%	30/15 Summer			
S9.002	S26	15 Winter	1	+0%	100/15 Summer			
S7.005	S20	15 Winter	1	+0%	30/15 Summer			
S7.006	S21	30 Winter	1	+0%	30/15 Summer			
S10.000	S27	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
S11.000	S31	15 Winter	1	+0%	30/15 Winter	100/15 Summer		
S10.001	S28	15 Winter	1	+0%	30/15 Summer			
S10.002	S29	15 Winter	1	+0%	30/15 Summer			
S7.007	S30	30 Winter	1	+0%	30/15 Summer			
S7.008	S22	30 Winter	1	+0%	30/15 Summer			
S7.009	S23	30 Winter	1	+0%	30/15 Summer			
S12.000	S42	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	1	+0%	100/15 Summer			
S12.001	S43	15 Winter	1	+0%	100/15 Summer			
S12.002	S44	15 Winter	1	+0%				
S14.000	S55	360 Winter	1	+0%	100/15 Summer	100/15 Winter		
S14.001	S56	360 Winter	1	+0%	100/15 Summer			
S14.002	S57	360 Winter	1	+0%	30/15 Winter			
S14.003	S58	360 Winter	1	+0%	30/15 Summer			
S12.003	S45	15 Winter	1	+0%	30/15 Summer			
S12.004	S46	15 Winter	1	+0%	30/15 Summer			
S15.000	S60	15 Winter	1	+0%	100/15 Summer			
S15.001	S61	15 Winter	1	+0%	100/15 Summer			
S15.002	S62	15 Winter	1	+0%	30/15 Summer		100/15 Summer	5
S12.005	S47	15 Winter	1	+0%	30/15 Summer			
S16.000	S63	15 Winter	1	+0%	100/15 Summer			
S12.006	S48	15 Winter	1	+0%	30/15 Summer			
S17.000	S64	15 Winter	1	+0%	30/15 Winter			
S17.001	S65	15 Winter	1	+0%	100/15 Summer			
S12.007	S49	15 Winter	1	+0%	30/15 Summer			
S12.008	S50	15 Winter	1	+0%	30/15 Summer			
S12.009	S51	15 Winter	1	+0%	30/15 Summer			
S12.010	S52	15 Winter	1	+0%	30/15 Winter			
S12.011	S53	15 Winter	1	+0%	100/15 Summer			
S12.012	S54	15 Winter	1	+0%	100/15 Summer			
S12.013	S62	15 Winter	1	+0%	100/15 Summer			
S1.009	S10	30 Winter	1	+0%	30/15 Summer			
S1.010	S11	30 Winter	1	+0%	30/15 Summer			
S1.011	S12	30 Winter	1	+0%	30/15 Summer	100/15 Summer		
S18.000	S66	15 Winter	1	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S16	5.832	-0.163	0.000	0.16		16.5	OK	
S7.002	S17	4.157	-0.158	0.000	0.19		16.7	OK	
S7.003	S18	2.815	-0.347	0.000	0.11		15.7	OK	
S8.000	S32	4.025	-0.154	0.000	0.22		10.4	OK	
S8.001	S33	3.844	-0.172	0.000	0.12		10.3	OK	
S7.004	S19	2.657	-0.363	0.000	0.08		25.3	OK	
S9.000	S24	2.936	-0.119	0.000	0.44		16.5	OK	
S9.001	S25	2.719	-0.114	0.000	0.49		16.5	OK	
S9.002	S26	2.649	-0.123	0.000	0.42		16.4	OK	
S7.005	S20	2.017	-0.378	0.000	0.29		41.2	OK	
S7.006	S21	1.966	-0.408	0.000	0.13		33.1	OK	
S10.000	S27	3.146	-0.187	0.000	0.29		19.2	OK	1
S11.000	S31	3.342	-0.159	0.000	0.45		28.7	OK	2
S10.001	S28	2.985	-0.163	0.000	0.59		63.1	OK	
S10.002	S29	2.801	-0.161	0.000	0.62		62.2	OK	
S7.007	S30	1.962	-0.331	0.000	0.19		78.0	OK	
S7.008	S22	1.937	-0.309	0.000	0.19		62.6	OK	
S7.009	S23	1.922	-0.290	0.000	0.11		48.6	OK	
S12.000	S42	8.834	-0.078	0.000	0.46		16.7	OK	1
S13.000	S59	6.984	-0.242	0.000	0.26		30.7	OK	
S12.001	S43	6.805	-0.233	0.000	0.31		61.3	OK	
S12.002	S44	6.335	-0.266	0.000	0.19		61.0	OK	
S14.000	S55	4.090	-0.150	0.000	0.00		0.0	OK	1
S14.001	S56	3.985	-0.150	0.000	0.00		0.0	OK	
S14.002	S57	3.868	-0.150	0.000	0.00		0.0	OK	
S14.003	S58	3.746	-0.150	0.000	0.00		0.0	OK	
S12.003	S45	3.582	-0.205	0.000	0.42		71.0	OK	
S12.004	S46	3.365	-0.203	0.000	0.43		71.3	OK	
S15.000	S60	6.352	-0.100	0.000	0.24		8.9	OK	
S15.001	S61	4.884	-0.099	0.000	0.24		8.8	OK	
S15.002	S62	3.559	-0.155	0.000	0.21	0.0	8.9	OK	
S12.005	S47	3.169	-0.217	0.000	0.52		103.9	OK	
S16.000	S63	3.426	-0.226	0.000	0.13		13.8	OK	
S12.006	S48	2.969	-0.171	0.000	0.69		126.4	OK	
S17.000	S64	3.088	-0.160	0.000	0.43		25.8	OK	
S17.001	S65	2.988	-0.189	0.000	0.29		26.1	OK	
S12.007	S49	2.701	-0.335	0.000	0.54		148.2	OK	
S12.008	S50	2.662	-0.346	0.000	0.42		178.4	OK	
S12.009	S51	2.611	-0.339	0.000	0.58		176.3	OK	
S12.010	S52	2.581	-0.354	0.000	0.52		176.0	OK	
S12.011	S53	2.533	-0.365	0.000	0.45		169.0	OK	
S12.012	S54	2.443	-0.397	0.000	0.40		161.4	OK	
S12.013	S62	2.348	-0.430	0.000	0.38		160.1	OK	
S1.009	S10	1.875	-0.247	0.000	0.65		337.2	OK	
S1.010	S11	1.819	-0.252	0.000	0.55		313.4	OK	
S1.011	S12	1.756	-0.211	0.000	0.56		290.9	OK	7

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.000	S66	6.179	-0.087	0.000	0.36		11.9	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S18.001	S67	15 Winter	1	+0%	100/15 Summer			
S18.002	S68	15 Winter	1	+0%	100/15 Summer			
S19.000	S80	15 Winter	1	+0%	100/15 Summer			
S19.001	S81	15 Winter	1	+0%	100/15 Summer			
S18.003	S69	15 Winter	1	+0%	100/15 Summer			
S18.004	S70	15 Winter	1	+0%	100/15 Summer			
S18.005	S71	15 Winter	1	+0%	100/15 Summer			
S18.006	S72	15 Winter	1	+0%	100/15 Summer			
S18.007	S73	15 Winter	1	+0%	100/15 Summer			
S20.000	S82	15 Winter	1	+0%	100/15 Summer			
S20.001	S83	15 Winter	1	+0%	100/15 Summer			
S18.008	S74	15 Winter	1	+0%	100/15 Summer			
S18.009	S75	15 Winter	1	+0%	100/15 Summer			
S18.010	S76	15 Winter	1	+0%	100/15 Summer			
S18.011	S77	15 Winter	1	+0%	100/15 Summer			
S18.012	S78	15 Winter	1	+0%	100/15 Summer			
S18.013	S79	15 Winter	1	+0%	100/15 Summer	100/15 Summer		
S1.012	S13	30 Winter	1	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.001	S67	5.341	-0.085	0.000	0.38		11.8	OK	
S18.002	S68	4.939	-0.144	0.000	0.28		27.3	OK	
S19.000	S80	3.048	-0.315	0.000	0.19		33.5	OK	
S19.001	S81	2.905	-0.335	0.000	0.15		33.4	OK	
S18.003	S69	2.591	-0.464	0.000	0.29		81.8	OK	
S18.004	S70	2.559	-0.472	0.000	0.29		99.8	OK	
S18.005	S71	2.499	-0.494	0.000	0.23		98.9	OK	
S18.006	S72	2.435	-0.504	0.000	0.23		98.1	OK	
S18.007	S73	2.338	-0.551	0.000	0.14		96.5	OK	
S20.000	S82	3.544	-0.133	0.000	0.34		12.9	OK	
S20.001	S83	3.288	-0.138	0.000	0.32		29.3	OK	
S18.008	S74	2.298	-0.409	0.000	0.28		126.8	OK	
S18.009	S75	2.240	-0.381	0.000	0.48		134.2	OK	
S18.010	S76	2.173	-0.419	0.000	0.36		158.3	OK	
S18.011	S77	2.115	-0.424	0.000	0.39		158.4	OK	
S18.012	S78	1.987	-0.508	0.000	0.23		157.5	OK	
S18.013	S79	1.848	-0.453	0.000	0.31		146.0	OK	5
S1.012	S13	1.707	-0.207	0.000	1.04		397.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	360 Winter	30	+0%				
S1.001	S2	15 Winter	30	+0%				
S1.002	S3	15 Summer	30	+0%	100/15 Summer			
S2.000	S38	15 Winter	30	+0%	100/15 Summer		100/15 Winter	1
S2.001	S39	15 Winter	30	+0%	100/15 Summer			
S2.002	S40	15 Winter	30	+0%	100/15 Summer			
S2.003	S41	15 Winter	30	+0%	100/15 Summer			
S1.003	S4	15 Winter	30	+0%	100/15 Summer			
S1.004	S5	15 Winter	30	+0%	100/15 Summer			
S1.005	S6	15 Winter	30	+0%	100/15 Summer			
S3.000	S34	15 Winter	30	+0%	100/15 Summer			
S4.000	S37	15 Winter	30	+0%	100/15 Summer			
S1.006	S7	15 Winter	30	+0%	30/15 Summer			
S1.007	S8	15 Winter	30	+0%	30/15 Summer			
S5.000	S35	360 Winter	30	+0%	100/15 Summer			
S6.000	S36	15 Winter	30	+0%	100/15 Winter			
S1.008	S9	15 Winter	30	+0%	30/15 Winter			
S7.000	S15	15 Winter	30	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.956	-0.144	0.000	0.28		30.0	OK	
S1.002	S3	5.950	-0.102	0.000	0.58		60.0	OK	
S2.000	S38	3.871	-0.244	0.000	0.23	0.0	31.8	OK	
S2.001	S39	3.809	-0.103	0.000	0.84		84.2	OK	
S2.002	S40	3.762	-0.092	0.000	0.96		128.4	OK	
S2.003	S41	3.681	-0.141	0.000	0.90		230.6	OK	
S1.003	S4	3.601	-0.163	0.000	0.92		282.7	OK	
S1.004	S5	3.552	-0.178	0.000	0.92		296.5	OK	
S1.005	S6	3.224	-0.470	0.000	0.26		296.3	OK	
S3.000	S34	3.198	-0.127	0.000	0.61		49.0	OK	
S4.000	S37	3.536	-0.123	0.000	0.64		83.3	OK	
S1.006	S7	3.106	0.044	0.000	1.74		478.5	SURCHARGED	
S1.007	S8	3.046	0.014	0.000	1.06		486.7	SURCHARGED	
S5.000	S35	3.127	-0.225	0.000	0.00		0.0	OK	
S6.000	S36	3.355	-0.133	0.000	0.59		47.1	OK	
S1.008	S9	2.944	0.006	0.000	1.20		517.3	SURCHARGED	
S7.000	S15	6.314	-0.104	0.000	0.55		41.0	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.001	S16	15 Winter	30	+0%				
S7.002	S17	15 Winter	30	+0%				
S7.003	S18	15 Winter	30	+0%	100/15 Summer			
S8.000	S32	15 Winter	30	+0%				
S8.001	S33	15 Winter	30	+0%				
S7.004	S19	15 Winter	30	+0%	100/15 Summer			
S9.000	S24	15 Winter	30	+0%	30/15 Summer			
S9.001	S25	15 Winter	30	+0%	30/15 Summer			
S9.002	S26	15 Winter	30	+0%	100/15 Summer			
S7.005	S20	30 Winter	30	+0%	30/15 Summer			
S7.006	S21	30 Winter	30	+0%	30/15 Summer			
S10.000	S27	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
S11.000	S31	15 Winter	30	+0%	30/15 Winter	100/15 Summer		
S10.001	S28	15 Winter	30	+0%	30/15 Summer			
S10.002	S29	15 Winter	30	+0%	30/15 Summer			
S7.007	S30	30 Winter	30	+0%	30/15 Summer			
S7.008	S22	30 Winter	30	+0%	30/15 Summer			
S7.009	S23	30 Winter	30	+0%	30/15 Summer			
S12.000	S42	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	30	+0%	100/15 Summer			
S12.001	S43	15 Winter	30	+0%	100/15 Summer			
S12.002	S44	15 Winter	30	+0%				
S14.000	S55	360 Winter	30	+0%	100/15 Summer	100/15 Winter		
S14.001	S56	15 Winter	30	+0%	100/15 Summer			
S14.002	S57	15 Winter	30	+0%	30/15 Winter			
S14.003	S58	15 Winter	30	+0%	30/15 Summer			
S12.003	S45	15 Winter	30	+0%	30/15 Summer			
S12.004	S46	15 Winter	30	+0%	30/15 Summer			
S15.000	S60	15 Winter	30	+0%	100/15 Summer			
S15.001	S61	15 Winter	30	+0%	100/15 Summer			
S15.002	S62	15 Winter	30	+0%	30/15 Summer		100/15 Summer	5
S12.005	S47	15 Winter	30	+0%	30/15 Summer			
S16.000	S63	15 Winter	30	+0%	100/15 Summer			
S12.006	S48	15 Winter	30	+0%	30/15 Summer			
S17.000	S64	15 Winter	30	+0%	30/15 Winter			
S17.001	S65	15 Winter	30	+0%	100/15 Summer			
S12.007	S49	15 Winter	30	+0%	30/15 Summer			
S12.008	S50	15 Winter	30	+0%	30/15 Summer			
S12.009	S51	15 Winter	30	+0%	30/15 Summer			
S12.010	S52	15 Winter	30	+0%	30/15 Winter			
S12.011	S53	15 Winter	30	+0%	100/15 Summer			
S12.012	S54	15 Winter	30	+0%	100/15 Summer			
S12.013	S62	30 Winter	30	+0%	100/15 Summer			
S1.009	S10	30 Winter	30	+0%	30/15 Summer			
S1.010	S11	30 Winter	30	+0%	30/15 Summer			
S1.011	S12	30 Winter	30	+0%	30/15 Summer	100/15 Summer		
S18.000	S66	15 Winter	30	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S16	5.871	-0.124	0.000	0.40		40.5	OK	
S7.002	S17	4.199	-0.116	0.000	0.46		40.7	OK	
S7.003	S18	2.879	-0.283	0.000	0.27		38.5	OK	
S8.000	S32	4.072	-0.107	0.000	0.53		25.4	OK	
S8.001	S33	3.876	-0.140	0.000	0.30		25.2	OK	
S7.004	S19	2.708	-0.312	0.000	0.20		61.5	OK	
S9.000	S24	3.085	0.030	0.000	1.03		39.2	SURCHARGED	
S9.001	S25	2.849	0.016	0.000	1.17		39.3	SURCHARGED	
S9.002	S26	2.737	-0.035	0.000	0.99		38.4	OK	
S7.005	S20	2.586	0.191	0.000	0.53		75.0	SURCHARGED	
S7.006	S21	2.580	0.206	0.000	0.28		69.7	SURCHARGED	
S10.000	S27	3.443	0.110	0.000	0.65		42.6	SURCHARGED	1
S11.000	S31	3.513	0.012	0.000	1.04		67.3	SURCHARGED	2
S10.001	S28	3.352	0.203	0.000	1.30		139.5	SURCHARGED	
S10.002	S29	3.029	0.067	0.000	1.39		140.3	SURCHARGED	
S7.007	S30	2.574	0.281	0.000	0.42		167.9	SURCHARGED	
S7.008	S22	2.560	0.314	0.000	0.49		156.6	SURCHARGED	
S7.009	S23	2.547	0.335	0.000	0.31		143.8	SURCHARGED	
S12.000	S42	8.998	0.086	0.000	1.06		38.6	SURCHARGED	1
S13.000	S59	7.077	-0.149	0.000	0.65		75.1	OK	
S12.001	S43	6.912	-0.126	0.000	0.77		153.9	OK	
S12.002	S44	6.407	-0.194	0.000	0.47		153.7	OK	
S14.000	S55	4.090	-0.150	0.000	0.00		0.0	OK	1
S14.001	S56	4.019	-0.116	0.000	0.04		0.7	OK	
S14.002	S57	4.073	0.055	0.000	0.24		3.9	SURCHARGED	
S14.003	S58	4.073	0.177	0.000	0.65		10.3	SURCHARGED	
S12.003	S45	4.143	0.356	0.000	0.99		169.1	SURCHARGED	
S12.004	S46	3.914	0.346	0.000	1.02		170.5	SURCHARGED	
S15.000	S60	6.386	-0.066	0.000	0.60		21.7	OK	
S15.001	S61	4.918	-0.065	0.000	0.60		21.5	OK	
S15.002	S62	3.781	0.067	0.000	0.46	0.0	19.4	SURCHARGED	
S12.005	S47	3.720	0.335	0.000	1.21		243.8	SURCHARGED	
S16.000	S63	3.472	-0.180	0.000	0.33		33.5	OK	
S12.006	S48	3.345	0.205	0.000	1.64		298.2	SURCHARGED	
S17.000	S64	3.251	0.003	0.000	1.03		62.0	SURCHARGED	
S17.001	S65	3.134	-0.043	0.000	0.66		59.4	OK	
S12.007	S49	3.065	0.029	0.000	1.28		350.4	SURCHARGED	
S12.008	S50	3.029	0.021	0.000	0.98		416.4	SURCHARGED	
S12.009	S51	2.970	0.020	0.000	1.37		415.9	SURCHARGED	
S12.010	S52	2.942	0.007	0.000	1.22		416.7	SURCHARGED	
S12.011	S53	2.898	0.000	0.000	1.04		393.0	OK	
S12.012	S54	2.688	-0.152	0.000	0.94		375.6	OK	
S12.013	S62	2.590	-0.188	0.000	0.80		337.6	OK	
S1.009	S10	2.529	0.407	0.000	1.61		827.7	SURCHARGED	
S1.010	S11	2.414	0.343	0.000	1.38		791.6	SURCHARGED	
S1.011	S12	2.218	0.252	0.000	1.52		786.6	FLOOD RISK	7

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.000	S66	6.227	-0.039	0.000	0.88		29.1	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S18.001	S67	15 Winter	30	+0%	100/15 Summer			
S18.002	S68	15 Winter	30	+0%	100/15 Summer			
S19.000	S80	15 Winter	30	+0%	100/15 Summer			
S19.001	S81	15 Winter	30	+0%	100/15 Summer			
S18.003	S69	15 Winter	30	+0%	100/15 Summer			
S18.004	S70	15 Winter	30	+0%	100/15 Summer			
S18.005	S71	15 Winter	30	+0%	100/15 Summer			
S18.006	S72	15 Winter	30	+0%	100/15 Summer			
S18.007	S73	15 Winter	30	+0%	100/15 Summer			
S20.000	S82	15 Winter	30	+0%	100/15 Summer			
S20.001	S83	15 Winter	30	+0%	100/15 Summer			
S18.008	S74	15 Winter	30	+0%	100/15 Summer			
S18.009	S75	15 Winter	30	+0%	100/15 Summer			
S18.010	S76	15 Winter	30	+0%	100/15 Summer			
S18.011	S77	15 Winter	30	+0%	100/15 Summer			
S18.012	S78	30 Winter	30	+0%	100/15 Summer			
S18.013	S79	30 Winter	30	+0%	100/15 Summer	100/15 Summer		
S1.012	S13	30 Winter	30	+0%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.001	S67	5.392	-0.034	0.000	0.92		28.8	OK	
S18.002	S68	5.009	-0.074	0.000	0.77		75.6	OK	
S19.000	S80	3.133	-0.230	0.000	0.47		81.8	OK	
S19.001	S81	2.978	-0.262	0.000	0.37		82.1	OK	
S18.003	S69	2.824	-0.231	0.000	0.77		216.8	OK	
S18.004	S70	2.794	-0.237	0.000	0.79		272.9	OK	
S18.005	S71	2.765	-0.228	0.000	0.60		258.3	OK	
S18.006	S72	2.735	-0.204	0.000	0.57		237.5	OK	
S18.007	S73	2.705	-0.185	0.000	0.32		213.5	OK	
S20.000	S82	3.613	-0.064	0.000	0.83		31.6	OK	
S20.001	S83	3.366	-0.059	0.000	0.87		80.7	OK	
S18.008	S74	2.672	-0.035	0.000	0.65		295.0	OK	
S18.009	S75	2.569	-0.052	0.000	1.10		305.0	OK	
S18.010	S76	2.416	-0.177	0.000	0.84		372.1	OK	
S18.011	S77	2.357	-0.182	0.000	0.92		370.1	OK	
S18.012	S78	2.251	-0.244	0.000	0.52		356.9	OK	
S18.013	S79	2.196	-0.105	0.000	0.69		324.8	OK	5
S1.012	S13	2.096	0.182	0.000	2.80		1069.0	FLOOD RISK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	360 Winter	100	+40%				
S1.001	S2	15 Winter	100	+40%				
S1.002	S3	15 Summer	100	+40%	100/15 Summer			
S2.000	S38	15 Winter	100	+40%	100/15 Summer		100/15 Winter	1
S2.001	S39	15 Winter	100	+40%	100/15 Summer			
S2.002	S40	15 Winter	100	+40%	100/15 Summer			
S2.003	S41	15 Winter	100	+40%	100/15 Summer			
S1.003	S4	15 Winter	100	+40%	100/15 Summer			
S1.004	S5	30 Winter	100	+40%	100/15 Summer			
S1.005	S6	30 Winter	100	+40%	100/15 Summer			
S3.000	S34	15 Winter	100	+40%	100/15 Summer			
S4.000	S37	15 Winter	100	+40%	100/15 Summer			
S1.006	S7	30 Winter	100	+40%	30/15 Summer			
S1.007	S8	15 Winter	100	+40%	30/15 Summer			
S5.000	S35	15 Winter	100	+40%	100/15 Summer			
S6.000	S36	15 Winter	100	+40%	100/15 Winter			
S1.008	S9	15 Winter	100	+40%	30/15 Winter			
S7.000	S15	15 Winter	100	+40%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.989	-0.111	0.000	0.51		54.3	OK	
S1.002	S3	6.107	0.055	0.000	1.02		106.4	SURCHARGED	
S2.000	S38	4.536	0.421	0.000	0.39	1.0	53.5	SURCHARGED	
S2.001	S39	4.446	0.534	0.000	1.44		144.3	SURCHARGED	
S2.002	S40	4.350	0.496	0.000	1.68		224.6	SURCHARGED	
S2.003	S41	4.237	0.415	0.000	1.58		405.1	SURCHARGED	
S1.003	S4	4.119	0.355	0.000	1.60		491.7	SURCHARGED	
S1.004	S5	4.071	0.341	0.000	1.34		428.9	SURCHARGED	
S1.005	S6	4.040	0.346	0.000	0.35		400.8	SURCHARGED	
S3.000	S34	3.978	0.653	0.000	0.92		74.0	SURCHARGED	
S4.000	S37	4.313	0.654	0.000	0.98		128.1	SURCHARGED	
S1.006	S7	3.807	0.745	0.000	2.45		671.7	SURCHARGED	
S1.007	S8	3.767	0.735	0.000	1.81		834.4	SURCHARGED	
S5.000	S35	3.646	0.294	0.000	0.06		2.6	SURCHARGED	
S6.000	S36	3.723	0.235	0.000	1.04		83.3	SURCHARGED	
S1.008	S9	3.666	0.727	0.000	2.08		898.0	SURCHARGED	
S7.000	S15	6.397	-0.021	0.000	0.99		73.2	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S7.001	S16	15 Winter	100	+40%				
S7.002	S17	15 Winter	100	+40%				
S7.003	S18	15 Winter	100	+40%	100/15 Summer			
S8.000	S32	15 Winter	100	+40%				
S8.001	S33	15 Winter	100	+40%				
S7.004	S19	30 Winter	100	+40%	100/15 Summer			
S9.000	S24	30 Winter	100	+40%	30/15 Summer			
S9.001	S25	30 Winter	100	+40%	30/15 Summer			
S9.002	S26	15 Winter	100	+40%	100/15 Summer			
S7.005	S20	15 Winter	100	+40%	30/15 Summer			
S7.006	S21	15 Winter	100	+40%	30/15 Summer			
S10.000	S27	15 Winter	100	+40%	30/15 Summer	100/15 Winter		
S11.000	S31	15 Winter	100	+40%	30/15 Winter	100/15 Summer		
S10.001	S28	15 Winter	100	+40%	30/15 Summer			
S10.002	S29	15 Winter	100	+40%	30/15 Summer			
S7.007	S30	15 Winter	100	+40%	30/15 Summer			
S7.008	S22	15 Winter	100	+40%	30/15 Summer			
S7.009	S23	15 Winter	100	+40%	30/15 Summer			
S12.000	S42	15 Winter	100	+40%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	100	+40%	100/15 Summer			
S12.001	S43	15 Winter	100	+40%	100/15 Summer			
S12.002	S44	15 Winter	100	+40%				
S14.000	S55	15 Winter	100	+40%	100/15 Summer	100/15 Winter		
S14.001	S56	15 Winter	100	+40%	100/15 Summer			
S14.002	S57	15 Winter	100	+40%	30/15 Winter			
S14.003	S58	15 Winter	100	+40%	30/15 Summer			
S12.003	S45	15 Winter	100	+40%	30/15 Summer			
S12.004	S46	15 Winter	100	+40%	30/15 Summer			
S15.000	S60	15 Winter	100	+40%	100/15 Summer			
S15.001	S61	15 Winter	100	+40%	100/15 Summer			
S15.002	S62	15 Winter	100	+40%	30/15 Summer		100/15 Summer	5
S12.005	S47	15 Winter	100	+40%	30/15 Summer			
S16.000	S63	30 Winter	100	+40%	100/15 Summer			
S12.006	S48	30 Winter	100	+40%	30/15 Summer			
S17.000	S64	30 Winter	100	+40%	30/15 Winter			
S17.001	S65	30 Winter	100	+40%	100/15 Summer			
S12.007	S49	15 Winter	100	+40%	30/15 Summer			
S12.008	S50	15 Winter	100	+40%	30/15 Summer			
S12.009	S51	15 Winter	100	+40%	30/15 Summer			
S12.010	S52	15 Winter	100	+40%	30/15 Winter			
S12.011	S53	15 Winter	100	+40%	100/15 Summer			
S12.012	S54	15 Winter	100	+40%	100/15 Summer			
S12.013	S62	15 Winter	100	+40%	100/15 Summer			
S1.009	S10	15 Winter	100	+40%	30/15 Summer			
S1.010	S11	15 Winter	100	+40%	30/15 Summer			
S1.011	S12	30 Winter	100	+40%	30/15 Summer	100/15 Summer		
S18.000	S66	15 Winter	100	+40%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S16	5.914	-0.081	0.000	0.73		73.6	OK	
S7.002	S17	4.248	-0.067	0.000	0.84		73.8	OK	
S7.003	S18	3.765	0.603	0.000	0.50		70.1	SURCHARGED	
S8.000	S32	4.131	-0.048	0.000	0.97		46.0	OK	
S8.001	S33	3.911	-0.105	0.000	0.54		45.5	OK	
S7.004	S19	3.720	0.701	0.000	0.29		87.2	SURCHARGED	
S9.000	S24	4.083	1.028	0.000	1.39		52.7	SURCHARGED	
S9.001	S25	3.904	1.071	0.000	1.43		47.8	SURCHARGED	
S9.002	S26	3.825	1.053	0.000	1.34		52.1	SURCHARGED	
S7.005	S20	3.644	1.249	0.000	0.80		113.1	SURCHARGED	
S7.006	S21	3.595	1.221	0.000	0.34		85.4	SURCHARGED	
S10.000	S27	4.458	1.125	0.287	1.13		73.8	FLOOD	1
S11.000	S31	4.503	1.002	1.937	1.59		102.5	FLOOD	2
S10.001	S28	4.251	1.103	0.000	2.20		236.1	FLOOD RISK	
S10.002	S29	3.793	0.831	0.000	2.33		235.5	SURCHARGED	
S7.007	S30	3.584	1.291	0.000	0.68		271.9	SURCHARGED	
S7.008	S22	3.561	1.315	0.000	0.76		244.6	SURCHARGED	
S7.009	S23	3.538	1.326	0.000	0.48		224.1	SURCHARGED	
S12.000	S42	10.062	1.150	0.286	1.67		60.7	FLOOD	1
S13.000	S59	7.530	0.304	0.000	1.10		127.7	SURCHARGED	
S12.001	S43	7.300	0.262	0.000	1.25		250.9	SURCHARGED	
S12.002	S44	6.476	-0.125	0.000	0.77		251.2	OK	
S14.000	S55	5.590	1.350	0.129	0.44		7.0	FLOOD	1
S14.001	S56	5.608	1.473	0.000	0.87		14.0	FLOOD RISK	
S14.002	S57	5.611	1.594	0.000	1.29		20.7	SURCHARGED	
S14.003	S58	5.705	1.809	0.000	1.71		27.3	SURCHARGED	
S12.003	S45	5.893	2.106	0.000	1.55		263.9	SURCHARGED	
S12.004	S46	5.379	1.811	0.000	1.61		269.6	SURCHARGED	
S15.000	S60	6.729	0.277	0.000	0.95		34.4	SURCHARGED	
S15.001	S61	5.547	0.564	0.000	0.90		32.2	SURCHARGED	
S15.002	S62	4.528	0.814	0.000	0.47	75.4	19.7	SURCHARGED	
S12.005	S47	4.946	1.560	0.000	1.64		329.9	SURCHARGED	
S16.000	S63	4.412	0.760	0.000	0.40		41.3	SURCHARGED	
S12.006	S48	4.309	1.169	0.000	2.23		406.0	SURCHARGED	
S17.000	S64	4.143	0.895	0.000	1.39		83.5	FLOOD RISK	
S17.001	S65	4.069	0.892	0.000	0.90		81.0	SURCHARGED	
S12.007	S49	3.968	0.932	0.000	1.92		525.2	SURCHARGED	
S12.008	S50	3.933	0.925	0.000	1.59		673.0	SURCHARGED	
S12.009	S51	3.874	0.924	0.000	2.22		671.5	SURCHARGED	
S12.010	S52	3.845	0.909	0.000	1.96		668.3	SURCHARGED	
S12.011	S53	3.799	0.901	0.000	1.70		643.7	SURCHARGED	
S12.012	S54	3.715	0.875	0.000	1.51		604.7	SURCHARGED	
S12.013	S62	3.610	0.831	0.000	1.36		575.3	SURCHARGED	
S1.009	S10	3.506	1.384	0.000	2.84		1463.0	SURCHARGED	
S1.010	S11	3.016	0.946	0.000	2.33		1332.1	SURCHARGED	
S1.011	S12	2.509	0.542	179.057	2.06		1063.0	FLOOD	7

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.000	S66	7.356	1.090	0.000	1.22		40.2	FLOOD RISK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S18.001	S67	15 Winter	100	+40%	100/15 Summer			
S18.002	S68	15 Winter	100	+40%	100/15 Summer			
S19.000	S80	15 Winter	100	+40%	100/15 Summer			
S19.001	S81	15 Winter	100	+40%	100/15 Summer			
S18.003	S69	15 Winter	100	+40%	100/15 Summer			
S18.004	S70	15 Winter	100	+40%	100/15 Summer			
S18.005	S71	15 Winter	100	+40%	100/15 Summer			
S18.006	S72	15 Winter	100	+40%	100/15 Summer			
S18.007	S73	15 Winter	100	+40%	100/15 Summer			
S20.000	S82	15 Winter	100	+40%	100/15 Summer			
S20.001	S83	15 Winter	100	+40%	100/15 Summer			
S18.008	S74	15 Winter	100	+40%	100/15 Summer			
S18.009	S75	15 Winter	100	+40%	100/15 Summer			
S18.010	S76	15 Winter	100	+40%	100/15 Summer			
S18.011	S77	15 Winter	100	+40%	100/15 Summer			
S18.012	S78	15 Winter	100	+40%	100/15 Summer			
S18.013	S79	30 Winter	100	+40%	100/15 Summer	100/15 Summer		
S1.012	S13	30 Winter	100	+40%	30/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.001	S67	6.081	0.655	0.000	1.45		45.5	SURCHARGED	
S18.002	S68	5.599	0.517	0.000	1.07		105.2	SURCHARGED	
S19.000	S80	3.619	0.256	0.000	0.84		146.1	SURCHARGED	
S19.001	S81	3.558	0.318	0.000	0.58		130.5	SURCHARGED	
S18.003	S69	3.439	0.384	0.000	1.21		340.8	SURCHARGED	
S18.004	S70	3.417	0.386	0.000	1.25		430.8	SURCHARGED	
S18.005	S71	3.380	0.387	0.000	0.91		390.6	SURCHARGED	
S18.006	S72	3.338	0.399	0.000	0.90		375.6	SURCHARGED	
S18.007	S73	3.296	0.407	0.000	0.56		372.5	SURCHARGED	
S20.000	S82	4.635	0.958	0.000	1.30		49.4	SURCHARGED	
S20.001	S83	4.210	0.784	0.000	1.31		121.4	SURCHARGED	
S18.008	S74	3.259	0.552	0.000	1.12		508.7	SURCHARGED	
S18.009	S75	3.148	0.527	0.000	1.97		547.2	SURCHARGED	
S18.010	S76	3.073	0.481	0.000	1.50		660.7	SURCHARGED	
S18.011	S77	2.873	0.334	0.000	1.64		657.9	SURCHARGED	
S18.012	S78	2.701	0.206	0.000	1.00		693.9	SURCHARGED	
S18.013	S79	2.533	0.232	32.694	1.06		500.1	FLOOD	5
S1.012	S13	2.289	0.374	0.000	3.72		1419.7	FLOOD RISK	

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User Report S:\Clients\BARRATT SOUTHAMPTON\4519 - Forty Acre Farm, Bedhampton\02 - ENGINEERS\01 - RCP DESIGN\03 - WINDES\Spreadsheet.SPDX for SW1- PDS EXPORT.SWS

PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
S1.000	0.000	S7.006	258.847	S12.009	1297.830
S1.001	67.018	S10.000	116.108	S12.010	1298.290
S1.002	134.023	S11.000	168.167	S12.011	1299.174
S2.000	77.418	S10.001	410.377	S12.012	1299.077
S2.001	201.754	S10.002	410.242	S12.013	1299.413
S2.002	307.557	S7.007	669.438	S1.009	3489.374
S2.003	557.070	S7.008	669.863	S1.010	3491.004
S1.003	691.482	S7.009	670.224	S1.011	3490.733
S1.004	743.265	S12.000	98.293	S18.000	69.967
S1.005	743.499	S13.000	184.581	S18.001	70.043
S3.000	119.799	S12.001	384.234	S18.002	176.501
S4.000	202.458	S12.002	384.545	S19.000	199.505
S1.006	1297.176	S14.000	0.000	S19.001	199.574
S1.007	1405.483	S14.001	0.000	S18.003	527.545
S5.000	0.000	S14.002	0.000	S18.004	668.344
S6.000	113.102	S14.003	0.000	S18.005	668.665
S1.008	1519.159	S12.003	458.996	S18.006	668.848
S7.000	98.252	S12.004	459.237	S18.007	669.098
S7.001	98.316	S15.000	52.103	S20.000	77.405
S7.002	98.362	S15.001	52.137	S20.001	192.142
S7.003	98.454	S15.002	52.145	S18.008	954.628
S8.000	61.036	S12.005	698.548	S18.009	1058.225
S8.001	61.074	S16.000	81.885	S18.010	1341.451
S7.004	159.547	S12.006	875.166	S18.011	1342.001
S9.000	98.991	S17.000	154.079	S18.012	1342.688
S9.001	99.072	S17.001	154.171	S18.013	1343.275
S9.002	99.123	S12.007	1029.760	S1.012	4833.548
S7.005	258.696	S12.008	1297.555		

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW1- PDS EXPORT.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	10
Ratio R	0.350	Minimum Backdrop Height (m)	0.100
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW1- PDS EXPORT.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	33.060	1.650	20.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	20.961	1.048	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	16.980	0.848	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	33.943	0.203	167.2	0.104	5.00	0.0	0.600	o	375	Pipe/Conduit	
S2.001	14.561	0.058	250.0	0.167	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.002	7.954	0.032	248.6	0.142	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.003	25.970	0.058	447.8	0.335	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	16.884	0.034	496.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.004	17.923	0.036	497.9	0.069	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.005	55.418	0.632	87.6	0.000	0.00	0.0	0.600	o	750	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	5.19	8.525	0.000	0.0	0.0	0.0	2.94	116.8	0.0
S1.001	50.00	5.31	6.875	0.090	0.0	0.0	1.2	2.94	116.9	13.4
S1.002	50.00	5.40	5.827	0.180	0.0	0.0	2.4	2.94	116.8	26.8
S2.000	50.00	5.40	3.740	0.104	0.0	0.0	1.4	1.40	154.4	15.5
S2.001	50.00	5.62	3.537	0.271	0.0	0.0	3.7	1.14	126.1	40.4
S2.002	50.00	5.72	3.404	0.413	0.0	0.0	5.6	1.28	204.4	61.5
S2.003	50.00	6.10	3.222	0.748	0.0	0.0	10.1	1.14	323.5	111.4
S1.003	50.00	6.32	3.014	0.928	0.0	0.0	12.6	1.25	551.8	138.2
S1.004	50.00	6.56	2.980	0.997	0.0	0.0	13.5	1.25	551.1	148.5
S1.005	50.00	6.87	2.944	0.997	0.0	0.0	13.5	2.99	1321.1	148.5

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Network Design Table for SW1- PDS EXPORT.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
S3.000	43.874	0.263	166.8	0.161	5.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	36.867	0.597	61.8	0.272	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	14.607	0.029	503.7	0.310	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.007	47.227	0.094	502.4	0.145	0.00	0.0	0.600	o	750	Pipe/Conduit	
S5.000	44.319	0.363	122.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	43.017	0.258	166.7	0.152	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	32.269	0.065	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S7.000	16.665	0.423	39.4	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	40.844	1.680	24.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	35.970	1.153	31.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	63.987	0.142	450.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	14.992	0.163	92.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	34.000	0.996	34.1	0.000	0.00	0.0	0.600	o	225	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)
S3.000	50.00	5.60	3.025	0.161	0.0	0.0	2.2	1.21	85.8	24.0
S4.000	50.00	5.31	3.359	0.272	0.0	0.0	3.7	2.00	141.7	40.5
S1.006	50.00	7.07	2.311	1.740	0.0	0.0	23.6	1.24	547.8	259.2
S1.007	50.00	7.70	2.282	1.885	0.0	0.0	25.5	1.24	548.5	280.8
S5.000	50.00	5.62	3.127	0.000	0.0	0.0	0.0	1.18	47.0	0.0
S6.000	50.00	5.59	3.188	0.152	0.0	0.0	2.1	1.21	85.9	22.6
S1.008	50.00	8.13	2.188	2.037	0.0	0.0	27.6	1.24	549.9	303.4
S7.000	50.00	5.13	6.193	0.132	0.0	0.0	1.8	2.09	83.1	19.7
S7.001	50.00	5.39	5.770	0.132	0.0	0.0	1.8	2.66	106.0	19.7
S7.002	50.00	5.64	4.090	0.132	0.0	0.0	1.8	2.35	93.5	19.7
S7.003	50.00	6.76	2.712	0.132	0.0	0.0	1.8	0.95	151.4	19.7
S8.000	50.00	5.18	3.954	0.082	0.0	0.0	1.1	1.36	54.2	12.2
S8.001	50.00	5.44	3.791	0.082	0.0	0.0	1.1	2.25	89.3	12.2

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Network Design Table for SW1- PDS EXPORT.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
S7.004	60.460	0.625	96.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	36.996	0.222	166.6	0.133	5.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	10.231	0.061	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	62.920	0.377	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.005	11.651	0.021	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.006	44.594	0.081	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S10.000	46.138	0.185	250.0	0.156	5.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	35.606	0.142	250.0	0.226	5.00	0.0	0.600	o	300	Pipe/Conduit	
S10.001	55.970	0.187	299.3	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.002	8.846	0.044	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.007	34.837	0.046	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.008	25.592	0.034	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.009	67.829	0.090	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S12.000	13.000	0.645	20.2	0.132	5.00	0.0	0.600	o	150	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)
S7.004	50.00	7.25	2.570	0.214	0.0	0.0	2.9	2.07	328.8	31.9
S9.000	50.00	5.61	2.830	0.133	0.0	0.0	1.8	1.01	40.2	19.8
S9.001	50.00	5.78	2.608	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S9.002	50.00	6.82	2.547	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S7.005	50.00	7.44	1.795	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S7.006	50.00	8.16	1.774	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S10.000	50.00	5.78	3.033	0.156	0.0	0.0	2.1	0.99	70.0	23.2
S11.000	50.00	5.60	3.201	0.226	0.0	0.0	3.1	0.99	70.0	33.7
S10.001	50.00	6.67	2.773	0.551	0.0	0.0	7.5	1.04	115.1	82.1
S10.002	50.00	6.79	2.586	0.551	0.0	0.0	7.5	1.28	141.1	82.1
S7.007	48.76	8.71	1.493	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.008	47.66	9.11	1.446	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.009	45.03	10.18	1.412	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S12.000	50.00	5.10	8.762	0.132	0.0	0.0	1.8	2.25	39.8	19.7

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Network Design Table for SW1- PDS EXPORT.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
S13.000	47.008	0.188	250.0	0.248	5.00	0.0	0.600	o	375	Pipe/Conduit	
S12.001	34.981	0.437	80.0	0.136	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.002	13.954	0.695	20.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S14.000	10.531	0.105	100.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	11.690	0.117	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.002	12.175	0.122	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.003	10.900	0.109	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.003	21.920	0.219	100.0	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.004	16.477	0.182	90.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S15.000	32.938	1.469	22.4	0.070	5.00	0.0	0.600	o	150	Pipe/Conduit	
S15.001	28.922	1.269	22.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.002	45.524	0.328	138.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.005	52.467	0.245	214.2	0.251	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.000	36.016	0.362	99.5	0.110	5.00	0.0	0.600	o	300	Pipe/Conduit	
S12.006	8.863	0.104	84.9	0.127	0.00	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)
S13.000	50.00	5.69	6.851	0.248	0.0	0.0	3.4	1.14	126.0	36.9
S12.001	50.00	5.97	6.663	0.516	0.0	0.0	7.0	2.03	223.8	76.9
S12.002	50.00	6.03	6.226	0.516	0.0	0.0	7.0	4.06	448.4	76.9
S14.000	50.00	5.17	4.090	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.001	50.00	5.37	3.985	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.002	50.00	5.57	3.868	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.003	50.00	5.75	3.746	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S12.003	50.00	6.23	3.412	0.616	0.0	0.0	8.3	1.81	200.1	91.8
S12.004	50.00	6.38	3.193	0.616	0.0	0.0	8.3	1.91	210.6	91.8
S15.000	50.00	5.26	6.302	0.070	0.0	0.0	0.9	2.14	37.7	10.4
S15.001	50.00	5.48	4.833	0.070	0.0	0.0	0.9	2.12	37.4	10.4
S15.002	50.00	6.17	3.489	0.070	0.0	0.0	0.9	1.11	44.1	10.4
S12.005	50.00	7.01	2.935	0.937	0.0	0.0	12.7	1.39	220.3	139.6
S16.000	50.00	5.38	3.352	0.110	0.0	0.0	1.5	1.58	111.4	16.4
S12.006	50.00	7.08	2.690	1.174	0.0	0.0	15.9	2.21	351.1	174.9

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Network Design Table for SW1- PDS EXPORT.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
S17.000	17.848	0.071	251.4	0.207	5.00	0.0	0.600	o	300	Pipe/Conduit	
S17.001	15.170	0.141	107.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.007	13.907	0.028	496.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.008	28.913	0.058	498.5	0.359	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.009	7.235	0.014	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.010	17.210	0.038	455.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.011	40.896	0.058	705.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.012	37.397	0.061	609.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.013	28.513	0.057	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.009	41.043	0.051	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.010	83.206	0.104	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.011	41.787	0.052	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S18.000	21.994	0.840	26.2	0.094	5.00	0.0	0.600	o	150	Pipe/Conduit	
S18.001	8.576	0.344	25.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S18.002	52.985	2.028	26.1	0.143	0.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	31.169	0.123	253.4	0.268	5.00	0.0	0.600	o	450	Pipe/Conduit	
S19.001	27.732	0.185	149.9	0.000	0.00	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)
S17.000	50.00	5.30	2.948	0.207	0.0	0.0	2.8	0.99	69.8	30.8
S17.001	50.00	5.47	2.877	0.207	0.0	0.0	2.8	1.52	107.1	30.8
S12.007	50.00	7.26	2.286	1.381	0.0	0.0	18.7	1.25	551.7	205.7
S12.008	50.00	7.65	2.258	1.740	0.0	0.0	23.6	1.25	550.7	259.2
S12.009	50.00	7.74	2.200	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S12.010	50.00	7.96	2.186	1.740	0.0	0.0	23.6	1.31	576.6	259.2
S12.011	49.02	8.62	2.148	1.740	0.0	0.0	23.6	1.05	462.2	259.2
S12.012	47.52	9.17	2.090	1.740	0.0	0.0	23.6	1.13	497.4	259.2
S12.013	46.54	9.55	2.028	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S1.009	43.62	10.82	1.247	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.010	41.12	12.10	1.195	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.011	39.99	12.75	1.091	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S18.000	50.00	5.19	6.116	0.094	0.0	0.0	1.3	1.98	34.9	14.0
S18.001	50.00	5.26	5.276	0.094	0.0	0.0	1.3	2.02	35.8	14.0
S18.002	50.00	5.60	4.858	0.237	0.0	0.0	3.2	2.57	102.2	35.3
S19.000	50.00	5.41	2.913	0.268	0.0	0.0	3.6	1.27	202.4	39.9
S19.001	50.00	5.69	2.790	0.268	0.0	0.0	3.6	1.66	263.7	39.9

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Network Design Table for SW1- PDS EXPORT.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
S18.003	10.755	0.024	448.1	0.203	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.004	17.016	0.038	447.8	0.189	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.005	24.230	0.054	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.006	22.336	0.050	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.007	14.516	0.182	79.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S20.000	42.000	0.251	167.0	0.104	5.00	0.0	0.600	o	225	Pipe/Conduit	
S20.001	18.361	0.718	25.6	0.154	0.00	0.0	0.600	o	225	Pipe/Conduit	
S18.008	42.896	0.086	498.8	0.125	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.009	14.300	0.029	493.1	0.139	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.010	21.315	0.053	400.0	0.380	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.011	16.231	0.044	369.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.012	33.807	0.195	173.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.013	153.083	0.255	600.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.012	13.545	0.027	500.0	0.000	0.00	0.0	0.600	o	875	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)
S18.003	50.00	5.82	2.305	0.708	0.0	0.0	9.6	1.32	581.1	105.5
S18.004	50.00	6.04	2.281	0.897	0.0	0.0	12.1	1.32	581.3	133.6
S18.005	50.00	6.35	2.243	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.006	50.00	6.63	2.189	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.007	50.00	6.71	2.140	0.897	0.0	0.0	12.1	3.14	1386.1	133.6
S20.000	50.00	5.69	3.452	0.104	0.0	0.0	1.4	1.01	40.1	15.5
S20.001	50.00	5.81	3.201	0.258	0.0	0.0	3.5	2.60	103.3	38.4
S18.008	50.00	7.28	1.957	1.280	0.0	0.0	17.3	1.25	550.5	190.7
S18.009	50.00	7.47	1.871	1.419	0.0	0.0	19.2	1.25	553.7	211.4
S18.010	50.00	7.73	1.842	1.799	0.0	0.0	24.4	1.39	615.4	268.0
S18.011	50.00	7.91	1.789	1.799	0.0	0.0	24.4	1.45	640.5	268.0
S18.012	50.00	8.18	1.745	1.799	0.0	0.0	24.4	2.12	936.8	268.0
S18.013	44.48	10.43	1.550	1.799	0.0	0.0	24.4	1.14	501.5	268.0
S1.012	39.71	12.91	1.039	6.474	0.0	0.0	69.6	1.37	823.9	766.0

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Simulation Criteria for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for SW1- PDS EXPORT.SWS

Complex Manhole: S10, DS/PN: S1.009, Volume (m³): 66.7

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0131-1050-2191-1050
Design Head (m)	2.191
Design Flow (l/s)	10.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	131
Invert Level (m)	1.247
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.191	10.5	Kick-Flo®	1.176	7.8
Flush-Flo™	0.578	9.9	Mean Flow over Head Range	-	8.9

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	4.7	1.200	7.9	3.000	12.2	7.000	18.2
0.200	8.3	1.400	8.5	3.500	13.1	7.500	18.9
0.300	9.2	1.600	9.1	4.000	14.0	8.000	19.5
0.400	9.6	1.800	9.6	4.500	14.8	8.500	20.0
0.500	9.8	2.000	10.1	5.000	15.5	9.000	20.6
0.600	9.9	2.200	10.5	5.500	16.3	9.500	21.1
0.800	9.7	2.400	11.0	6.000	16.9		
1.000	9.1	2.600	11.4	6.500	17.6		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0193-1800-0662-1800
Design Head (m)	0.662
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	193
Invert Level (m)	3.438
Minimum Outlet Pipe Diameter (mm)	225

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Hydro-Brake® Optimum

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.662	18.0	Kick-Flo®	0.520	16.1
Flush-Flo™	0.294	18.0	Mean Flow over Head Range	-	14.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	23.9	3.000	37.1	7.000	55.6
0.200	17.4	1.400	25.7	3.500	40.0	7.500	57.6
0.300	18.0	1.600	27.4	4.000	42.6	8.000	59.5
0.400	17.6	1.800	29.0	4.500	45.2	8.500	61.4
0.500	16.5	2.000	30.5	5.000	47.5	9.000	63.2
0.600	17.2	2.200	32.0	5.500	49.8	9.500	64.9
0.800	19.7	2.400	33.3	6.000	51.9		
1.000	21.9	2.600	34.6	6.500	54.0		

Complex Manhole: S78, DS/PN: S18.012, Volume (m³): 13.2

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0143-1050-1386-1050
Design Head (m)	1.386
Design Flow (l/s)	10.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	1.745
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)	1.386	10.5	Kick-Flo®	0.872	8.4
Flush-Flo™	0.408	10.4	Mean Flow over Head Range	-	9.1

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

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Hydro-Brake® Optimum

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	9.8	3.000	15.1	7.000	22.7
0.200	9.6	1.400	10.5	3.500	16.3	7.500	23.4
0.300	10.3	1.600	11.2	4.000	17.3	8.000	24.2
0.400	10.4	1.800	11.9	4.500	18.4	8.500	24.9
0.500	10.4	2.000	12.5	5.000	19.3	9.000	25.6
0.600	10.2	2.200	13.1	5.500	20.2	9.500	26.3
0.800	9.2	2.400	13.6	6.000	21.1		
1.000	9.0	2.600	14.1	6.500	21.9		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0190-1800-0969-1800
Design Head (m)	0.969
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	190
Invert Level (m)	3.131
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.969	18.0	Kick-Flo®	0.695	15.4
Flush-Flo™	0.326	18.0	Mean Flow over Head Range	-	15.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	19.9	3.000	30.9	7.000	46.5
0.200	17.3	1.400	21.4	3.500	33.3	7.500	48.1
0.300	18.0	1.600	22.9	4.000	35.5	8.000	49.6
0.400	17.9	1.800	24.2	4.500	37.6	8.500	51.1
0.500	17.5	2.000	25.4	5.000	39.5	9.000	52.6
0.600	16.8	2.200	26.6	5.500	41.4	9.500	54.0
0.800	16.4	2.400	27.8	6.000	43.2		
1.000	18.3	2.600	28.8	6.500	44.9		

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Offline Controls for SW1- PDS EXPORT.SWS

Weir Manhole: S38, DS/PN: S2.000, Loop to PN: S1.009

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 4.500

Weir Manhole: S62, DS/PN: S15.002, Loop to PN: S18.012

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 4.400

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Storage Structures for SW1- PDS EXPORT.SWS

Tank or Pond Manhole: S30, DS/PN: S7.007

Invert Level (m) 3.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	464.0	1.000	795.0	1.300	905.0

Tank or Pond Manhole: S22, DS/PN: S7.008

Invert Level (m) 3.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	472.0	1.000	801.0	1.300	919.0

Tank or Pond Manhole: S54, DS/PN: S12.012

Invert Level (m) 3.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	357.0	1.000	705.0	1.300	822.0

Tank or Pond Manhole: S10, DS/PN: S1.009

Invert Level (m) 3.700

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1121.0	0.400	1293.0

Tank or Pond Manhole: S78, DS/PN: S18.012

Invert Level (m) 3.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1788.0	1.000	2355.0	1.300	2459.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	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.
S1.000	S1	360 Winter	1	+0%				
S1.001	S2	15 Winter	1	+0%				
S1.002	S3	15 Winter	1	+0%	100/15 Summer			
S2.000	S38	15 Winter	1	+0%	30/15 Winter		30/30 Summer	16
S2.001	S39	15 Winter	1	+0%	30/15 Summer			
S2.002	S40	15 Winter	1	+0%	30/15 Summer			
S2.003	S41	120 Winter	1	+0%	30/15 Summer			
S1.003	S4	120 Winter	1	+0%	30/15 Summer			
S1.004	S5	120 Winter	1	+0%	30/15 Summer			
S1.005	S6	120 Winter	1	+0%	30/15 Summer	100/15 Summer		
S3.000	S34	120 Winter	1	+0%	1/60 Winter	100/15 Summer		
S4.000	S37	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
S1.006	S7	120 Winter	1	+0%	1/30 Summer			
S1.007	S8	120 Winter	1	+0%	1/30 Summer			
S5.000	S35	120 Winter	1	+0%	1/60 Winter			
S6.000	S36	240 Winter	1	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.921	-0.179	0.000	0.09		9.7	OK	
S1.002	S3	5.893	-0.159	0.000	0.19		19.3	OK	
S2.000	S38	3.818	-0.297	0.000	0.09	0.0	12.9	OK	
S2.001	S39	3.680	-0.232	0.000	0.31		30.9	OK	
S2.002	S40	3.586	-0.268	0.000	0.34		46.0	OK	
S2.003	S41	3.487	-0.335	0.000	0.13		33.6	OK	
S1.003	S4	3.469	-0.294	0.000	0.14		41.6	OK	
S1.004	S5	3.453	-0.277	0.000	0.14		44.6	OK	
S1.005	S6	3.437	-0.257	0.000	0.04		43.4	OK	1
S3.000	S34	3.425	0.100	0.000	0.09		7.3	SURCHARGED	4
S4.000	S37	3.464	-0.195	0.000	0.26		34.0	OK	1
S1.006	S7	3.470	0.408	0.000	0.26		72.2	SURCHARGED	
S1.007	S8	3.531	0.498	0.000	0.13		58.0	SURCHARGED	
S5.000	S35	3.440	0.088	0.000	0.05		2.2	SURCHARGED	
S6.000	S36	3.383	-0.105	0.000	0.09		7.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.008	S9	120 Winter	1	+0%	1/30 Summer			
S7.000	S15	15 Winter	1	+0%				
S7.001	S16	15 Winter	1	+0%				
S7.002	S17	15 Winter	1	+0%				
S7.003	S18	600 Winter	1	+0%	1/60 Winter			
S8.000	S32	15 Winter	1	+0%	100/360 Winter			
S8.001	S33	15 Winter	1	+0%	100/120 Winter			
S7.004	S19	600 Winter	1	+0%	1/30 Summer			
S9.000	S24	600 Winter	1	+0%	1/30 Summer	100/15 Winter		
S9.001	S25	600 Winter	1	+0%	1/15 Winter			
S9.002	S26	600 Winter	1	+0%	1/15 Summer			
S7.005	S20	600 Winter	1	+0%	1/15 Summer			
S7.006	S21	600 Winter	1	+0%	1/15 Summer			
S10.000	S27	600 Winter	1	+0%	1/480 Winter	100/15 Summer		
S11.000	S31	600 Winter	1	+0%	30/15 Winter	100/15 Summer		
S10.001	S28	600 Winter	1	+0%	1/60 Winter			
S10.002	S29	600 Winter	1	+0%	1/30 Summer			
S7.007	S30	600 Winter	1	+0%	1/15 Summer			
S7.008	S22	600 Winter	1	+0%	1/15 Summer			
S7.009	S23	180 Winter	1	+0%	1/15 Summer			
S12.000	S42	15 Winter	1	+0%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	1	+0%	100/15 Summer			
S12.001	S43	15 Winter	1	+0%	100/15 Summer			
S12.002	S44	15 Winter	1	+0%				
S14.000	S55	360 Winter	1	+0%	100/15 Summer	100/15 Winter		
S14.001	S56	360 Winter	1	+0%	30/120 Winter			
S14.002	S57	360 Winter	1	+0%	30/15 Winter			
S14.003	S58	360 Winter	1	+0%	30/15 Summer			
S12.003	S45	15 Winter	1	+0%	30/15 Summer			
S12.004	S46	120 Winter	1	+0%	30/15 Summer			
S15.000	S60	15 Winter	1	+0%	100/15 Summer			
S15.001	S61	15 Winter	1	+0%	100/15 Summer			
S15.002	S62	15 Winter	1	+0%	30/15 Summer		100/15 Summer	7
S12.005	S47	120 Winter	1	+0%	1/120 Winter			
S16.000	S63	15 Winter	1	+0%	30/15 Winter			
S12.006	S48	180 Winter	1	+0%	1/30 Winter			
S17.000	S64	240 Winter	1	+0%	1/60 Winter			
S17.001	S65	240 Winter	1	+0%	1/60 Summer			
S12.007	S49	600 Winter	1	+0%	1/30 Summer			
S12.008	S50	600 Winter	1	+0%	1/30 Summer			
S12.009	S51	600 Winter	1	+0%	1/30 Summer			
S12.010	S52	600 Winter	1	+0%	1/30 Summer			
S12.011	S53	600 Winter	1	+0%	1/15 Winter			
S12.012	S54	600 Winter	1	+0%	1/15 Winter			
S12.013	S62	180 Winter	1	+0%	1/15 Summer			
S1.009	S10	180 Winter	1	+0%	1/15 Summer			
S1.010	S11	600 Winter	1	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S9	3.502	0.564	0.000	0.17		74.8	SURCHARGED	
S7.000	S15	6.266	-0.152	0.000	0.23		16.7	OK	
S7.001	S16	5.832	-0.163	0.000	0.16		16.5	OK	
S7.002	S17	4.157	-0.158	0.000	0.19		16.7	OK	
S7.003	S18	3.341	0.179	0.000	0.01		2.0	SURCHARGED	
S8.000	S32	4.025	-0.154	0.000	0.22		10.4	OK	
S8.001	S33	3.844	-0.172	0.000	0.12		10.3	OK	
S7.004	S19	3.341	0.321	0.000	0.01		3.1	SURCHARGED	
S9.000	S24	3.342	0.287	0.000	0.05		2.0	SURCHARGED	3
S9.001	S25	3.341	0.508	0.000	0.06		2.0	SURCHARGED	
S9.002	S26	3.341	0.569	0.000	0.05		1.9	SURCHARGED	
S7.005	S20	3.341	0.946	0.000	0.04		5.0	SURCHARGED	
S7.006	S21	3.341	0.967	0.000	0.02		5.0	SURCHARGED	
S10.000	S27	3.342	0.009	0.000	0.04		2.4	SURCHARGED	4
S11.000	S31	3.342	-0.159	0.000	0.05		3.5	OK	4
S10.001	S28	3.342	0.194	0.000	0.08		8.4	SURCHARGED	
S10.002	S29	3.341	0.380	0.000	0.08		8.4	SURCHARGED	
S7.007	S30	3.341	1.048	0.000	0.02		7.6	SURCHARGED	
S7.008	S22	3.343	1.097	0.000	0.09		28.1	SURCHARGED	
S7.009	S23	3.433	1.221	0.000	0.02		11.4	SURCHARGED	
S12.000	S42	8.834	-0.078	0.000	0.46		16.7	OK	1
S13.000	S59	6.984	-0.242	0.000	0.26		30.7	OK	
S12.001	S43	6.805	-0.233	0.000	0.31		61.3	OK	
S12.002	S44	6.335	-0.266	0.000	0.19		61.0	OK	
S14.000	S55	4.090	-0.150	0.000	0.00		0.0	OK	2
S14.001	S56	3.985	-0.150	0.000	0.00		0.0	OK	
S14.002	S57	3.868	-0.150	0.000	0.00		0.0	OK	
S14.003	S58	3.746	-0.150	0.000	0.00		0.0	OK	
S12.003	S45	3.582	-0.205	0.000	0.42		71.0	OK	
S12.004	S46	3.408	-0.160	0.000	0.17		27.7	OK	
S15.000	S60	6.352	-0.100	0.000	0.24		8.9	OK	
S15.001	S61	4.884	-0.099	0.000	0.24		8.8	OK	
S15.002	S62	3.559	-0.155	0.000	0.21	0.0	8.9	OK	
S12.005	S47	3.397	0.012	0.000	0.21		41.5	SURCHARGED	
S16.000	S63	3.426	-0.226	0.000	0.13		13.8	OK	
S12.006	S48	3.370	0.229	0.000	0.21		37.7	SURCHARGED	
S17.000	S64	3.351	0.103	0.000	0.10		5.9	SURCHARGED	
S17.001	S65	3.349	0.172	0.000	0.07		5.9	SURCHARGED	
S12.007	S49	3.348	0.312	0.000	0.07		20.3	SURCHARGED	
S12.008	S50	3.348	0.340	0.000	0.06		25.3	SURCHARGED	
S12.009	S51	3.348	0.398	0.000	0.08		25.1	SURCHARGED	
S12.010	S52	3.348	0.412	0.000	0.07		24.9	SURCHARGED	
S12.011	S53	3.347	0.449	0.000	0.06		24.5	SURCHARGED	
S12.012	S54	3.347	0.507	0.000	0.06		24.3	SURCHARGED	
S12.013	S62	3.459	0.681	0.000	0.07		31.6	SURCHARGED	
S1.009	S10	3.437	1.315	0.000	0.02		10.0	SURCHARGED	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.010	S11	1.290	-0.780	0.000	0.02		10.1	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.011	S12	360 Winter	1	+0%				
S18.000	S66	15 Winter	1	+0%	100/15 Summer			
S18.001	S67	15 Winter	1	+0%	100/15 Summer			
S18.002	S68	15 Winter	1	+0%	100/15 Summer			
S19.000	S80	120 Winter	1	+0%	30/15 Summer			
S19.001	S81	120 Winter	1	+0%	30/15 Summer			
S18.003	S69	120 Winter	1	+0%	1/30 Winter			
S18.004	S70	120 Winter	1	+0%	1/30 Winter			
S18.005	S71	120 Winter	1	+0%	1/30 Winter			
S18.006	S72	120 Winter	1	+0%	1/30 Summer			
S18.007	S73	180 Winter	1	+0%	1/30 Summer			
S20.000	S82	15 Winter	1	+0%	30/15 Winter	100/15 Winter		
S20.001	S83	15 Winter	1	+0%	30/15 Summer			
S18.008	S74	180 Winter	1	+0%	1/15 Summer			
S18.009	S75	180 Winter	1	+0%	1/15 Summer			
S18.010	S76	180 Winter	1	+0%	1/15 Summer			
S18.011	S77	180 Winter	1	+0%	1/15 Summer			
S18.012	S78	180 Winter	1	+0%	1/15 Summer			
S18.013	S79	180 Winter	1	+0%				
S1.012	S13	480 Winter	1	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.011	S12	1.203	-0.764	0.000	0.02		10.4	OK	
S18.000	S66	6.179	-0.087	0.000	0.36		11.9	OK	
S18.001	S67	5.341	-0.085	0.000	0.38		11.8	OK	
S18.002	S68	4.939	-0.144	0.000	0.28		27.3	OK	
S19.000	S80	3.151	-0.212	0.000	0.07		12.1	OK	
S19.001	S81	3.147	-0.093	0.000	0.05		12.1	OK	
S18.003	S69	3.142	0.087	0.000	0.10		27.7	SURCHARGED	
S18.004	S70	3.141	0.110	0.000	0.09		30.4	SURCHARGED	
S18.005	S71	3.138	0.145	0.000	0.06		27.2	SURCHARGED	
S18.006	S72	3.135	0.196	0.000	0.06		27.1	SURCHARGED	
S18.007	S73	3.133	0.244	0.000	0.03		23.2	SURCHARGED	
S20.000	S82	3.544	-0.133	0.000	0.34		12.9	OK	2
S20.001	S83	3.288	-0.138	0.000	0.32		29.3	OK	
S18.008	S74	3.132	0.425	0.000	0.07		33.2	SURCHARGED	
S18.009	S75	3.130	0.509	0.000	0.13		36.8	SURCHARGED	
S18.010	S76	3.129	0.537	0.000	0.11		46.6	SURCHARGED	
S18.011	S77	3.128	0.589	0.000	0.12		46.5	SURCHARGED	
S18.012	S78	3.127	0.632	0.000	0.02		10.5	SURCHARGED	
S18.013	S79	1.627	-0.674	0.000	0.02		10.5	OK	
S1.012	S13	1.169	-0.745	0.000	0.05		20.5	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	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.
S1.000	S1	360 Winter	30	+0%				
S1.001	S2	15 Winter	30	+0%				
S1.002	S3	15 Summer	30	+0%	100/15 Summer			
S2.000	S38	30 Winter	30	+0%	30/15 Winter		30/30 Summer	16
S2.001	S39	60 Winter	30	+0%	30/15 Summer			
S2.002	S40	30 Winter	30	+0%	30/15 Summer			
S2.003	S41	60 Summer	30	+0%	30/15 Summer			
S1.003	S4	60 Winter	30	+0%	30/15 Summer			
S1.004	S5	60 Summer	30	+0%	30/15 Summer			
S1.005	S6	60 Summer	30	+0%	30/15 Summer	100/15 Summer		
S3.000	S34	60 Winter	30	+0%	1/60 Winter	100/15 Summer		
S4.000	S37	60 Winter	30	+0%	30/15 Summer	100/15 Winter		
S1.006	S7	30 Winter	30	+0%	1/30 Summer			
S1.007	S8	120 Summer	30	+0%	1/30 Summer			
S5.000	S35	720 Winter	30	+0%	1/60 Winter			
S6.000	S36	30 Winter	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.956	-0.144	0.000	0.28		30.0	OK	
S1.002	S3	5.950	-0.102	0.000	0.58		60.0	OK	
S2.000	S38	4.547	0.432	0.000	0.18	30.0	24.9	SURCHARGED	
S2.001	S39	4.556	0.644	0.000	0.69		68.8	SURCHARGED	
S2.002	S40	4.569	0.715	0.000	0.74		99.6	SURCHARGED	
S2.003	S41	4.547	0.726	0.000	0.56		143.4	SURCHARGED	
S1.003	S4	4.482	0.718	0.000	0.59		181.6	SURCHARGED	
S1.004	S5	4.337	0.607	0.000	0.61		196.8	SURCHARGED	
S1.005	S6	4.267	0.573	0.000	0.18		204.5	SURCHARGED	1
S3.000	S34	4.033	0.708	0.000	0.48		38.9	SURCHARGED	4
S4.000	S37	4.037	0.378	0.000	0.50		65.5	SURCHARGED	1
S1.006	S7	4.200	1.138	0.000	1.48		405.8	SURCHARGED	
S1.007	S8	4.018	0.986	0.000	0.67		308.7	SURCHARGED	
S5.000	S35	3.772	0.420	0.000	0.09		4.0	SURCHARGED	
S6.000	S36	3.848	0.360	0.000	0.52		41.4	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.008	S9	120 Summer	30	+0%	1/30 Summer			
S7.000	S15	15 Winter	30	+0%				
S7.001	S16	15 Winter	30	+0%				
S7.002	S17	15 Winter	30	+0%				
S7.003	S18	720 Winter	30	+0%	1/60 Winter			
S8.000	S32	15 Winter	30	+0%	100/360 Winter			
S8.001	S33	15 Winter	30	+0%	100/120 Winter			
S7.004	S19	720 Winter	30	+0%	1/30 Summer			
S9.000	S24	720 Winter	30	+0%	1/30 Summer	100/15 Winter		
S9.001	S25	720 Winter	30	+0%	1/15 Winter			
S9.002	S26	720 Winter	30	+0%	1/15 Summer			
S7.005	S20	720 Winter	30	+0%	1/15 Summer			
S7.006	S21	720 Winter	30	+0%	1/15 Summer			
S10.000	S27	720 Winter	30	+0%	1/480 Winter	100/15 Summer		
S11.000	S31	720 Winter	30	+0%	30/15 Winter	100/15 Summer		
S10.001	S28	720 Winter	30	+0%	1/60 Winter			
S10.002	S29	720 Winter	30	+0%	1/30 Summer			
S7.007	S30	720 Winter	30	+0%	1/15 Summer			
S7.008	S22	720 Winter	30	+0%	1/15 Summer			
S7.009	S23	720 Winter	30	+0%	1/15 Summer			
S12.000	S42	15 Winter	30	+0%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	30	+0%	100/15 Summer			
S12.001	S43	15 Winter	30	+0%	100/15 Summer			
S12.002	S44	15 Winter	30	+0%				
S14.000	S55	120 Winter	30	+0%	100/15 Summer	100/15 Winter		
S14.001	S56	120 Winter	30	+0%	30/120 Winter			
S14.002	S57	120 Winter	30	+0%	30/15 Winter			
S14.003	S58	15 Winter	30	+0%	30/15 Summer			
S12.003	S45	15 Winter	30	+0%	30/15 Summer			
S12.004	S46	15 Winter	30	+0%	30/15 Summer			
S15.000	S60	15 Winter	30	+0%	100/15 Summer			
S15.001	S61	15 Winter	30	+0%	100/15 Summer			
S15.002	S62	15 Winter	30	+0%	30/15 Summer		100/15 Summer	7
S12.005	S47	240 Winter	30	+0%	1/120 Winter			
S16.000	S63	240 Winter	30	+0%	30/15 Winter			
S12.006	S48	240 Winter	30	+0%	1/30 Winter			
S17.000	S64	720 Winter	30	+0%	1/60 Winter			
S17.001	S65	720 Winter	30	+0%	1/60 Summer			
S12.007	S49	720 Winter	30	+0%	1/30 Summer			
S12.008	S50	720 Winter	30	+0%	1/30 Summer			
S12.009	S51	720 Winter	30	+0%	1/30 Summer			
S12.010	S52	720 Winter	30	+0%	1/30 Summer			
S12.011	S53	720 Winter	30	+0%	1/15 Winter			
S12.012	S54	720 Winter	30	+0%	1/15 Winter			
S12.013	S62	60 Winter	30	+0%	1/15 Summer			
S1.009	S10	720 Winter	30	+0%	1/15 Summer			
S1.010	S11	480 Winter	30	+0%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S9	4.000	1.062	0.000	0.73		314.9	SURCHARGED	
S7.000	S15	6.314	-0.104	0.000	0.55		41.0	OK	
S7.001	S16	5.871	-0.124	0.000	0.40		40.5	OK	
S7.002	S17	4.199	-0.116	0.000	0.46		40.7	OK	
S7.003	S18	3.771	0.609	0.000	0.03		3.6	SURCHARGED	
S8.000	S32	4.072	-0.107	0.000	0.53		25.4	OK	
S8.001	S33	3.876	-0.140	0.000	0.30		25.2	OK	
S7.004	S19	3.771	0.752	0.000	0.02		5.8	SURCHARGED	
S9.000	S24	3.777	0.722	0.000	0.10		3.6	SURCHARGED	3
S9.001	S25	3.775	0.942	0.000	0.11		3.5	SURCHARGED	
S9.002	S26	3.774	1.002	0.000	0.09		3.4	SURCHARGED	
S7.005	S20	3.771	1.376	0.000	0.06		9.1	SURCHARGED	
S7.006	S21	3.771	1.397	0.000	0.04		8.9	SURCHARGED	
S10.000	S27	3.776	0.443	0.000	0.06		4.2	SURCHARGED	4
S11.000	S31	3.777	0.276	0.000	0.10		6.3	SURCHARGED	4
S10.001	S28	3.775	0.626	0.000	0.14		14.8	SURCHARGED	
S10.002	S29	3.772	0.810	0.000	0.15		14.7	SURCHARGED	
S7.007	S30	3.771	1.478	0.000	0.03		11.3	SURCHARGED	
S7.008	S22	3.771	1.524	0.000	0.10		32.7	SURCHARGED	
S7.009	S23	3.770	1.558	0.000	0.03		15.9	SURCHARGED	
S12.000	S42	8.998	0.086	0.000	1.06		38.6	SURCHARGED	1
S13.000	S59	7.077	-0.149	0.000	0.65		75.1	OK	
S12.001	S43	6.912	-0.126	0.000	0.77		153.9	OK	
S12.002	S44	6.407	-0.194	0.000	0.47		153.7	OK	
S14.000	S55	4.165	-0.075	0.000	0.02		0.3	OK	2
S14.001	S56	4.166	0.031	0.000	0.06		1.0	SURCHARGED	
S14.002	S57	4.167	0.150	0.000	0.14		2.2	SURCHARGED	
S14.003	S58	4.204	0.308	0.000	0.51		8.1	SURCHARGED	
S12.003	S45	4.290	0.503	0.000	0.99		169.0	SURCHARGED	
S12.004	S46	4.084	0.516	0.000	0.99		165.4	SURCHARGED	
S15.000	S60	6.386	-0.066	0.000	0.60		21.7	OK	
S15.001	S61	4.918	-0.065	0.000	0.60		21.5	OK	
S15.002	S62	4.040	0.327	0.000	0.46	0.0	19.3	SURCHARGED	
S12.005	S47	3.968	0.582	0.000	0.29		58.9	SURCHARGED	
S16.000	S63	3.858	0.206	0.000	0.07		7.6	SURCHARGED	
S12.006	S48	3.853	0.713	0.000	0.41		74.3	SURCHARGED	
S17.000	S64	3.782	0.534	0.000	0.11		6.3	SURCHARGED	
S17.001	S65	3.781	0.604	0.000	0.07		6.4	SURCHARGED	
S12.007	S49	3.779	0.743	0.000	0.14		39.0	SURCHARGED	
S12.008	S50	3.778	0.770	0.000	0.12		48.7	SURCHARGED	
S12.009	S51	3.777	0.827	0.000	0.16		48.7	SURCHARGED	
S12.010	S52	3.776	0.840	0.000	0.14		48.6	SURCHARGED	
S12.011	S53	3.774	0.877	0.000	0.13		48.1	SURCHARGED	
S12.012	S54	3.773	0.933	0.000	0.19		75.8	SURCHARGED	
S12.013	S62	3.921	1.143	0.000	0.47		196.6	SURCHARGED	
S1.009	S10	3.770	1.648	0.000	0.06		28.6	SURCHARGED	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.010	S11	1.360	-0.710	0.000	0.05		28.6	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.011	S12	360 Winter	30	+0%				
S18.000	S66	15 Winter	30	+0%	100/15 Summer			
S18.001	S67	15 Winter	30	+0%	100/15 Summer			
S18.002	S68	15 Winter	30	+0%	100/15 Summer			
S19.000	S80	30 Summer	30	+0%	30/15 Summer			
S19.001	S81	15 Winter	30	+0%	30/15 Summer			
S18.003	S69	15 Winter	30	+0%	1/30 Winter			
S18.004	S70	15 Winter	30	+0%	1/30 Winter			
S18.005	S71	15 Winter	30	+0%	1/30 Winter			
S18.006	S72	15 Winter	30	+0%	1/30 Summer			
S18.007	S73	15 Winter	30	+0%	1/30 Summer			
S20.000	S82	15 Winter	30	+0%	30/15 Winter	100/15 Winter		
S20.001	S83	15 Winter	30	+0%	30/15 Summer			
S18.008	S74	30 Winter	30	+0%	1/15 Summer			
S18.009	S75	240 Winter	30	+0%	1/15 Summer			
S18.010	S76	240 Winter	30	+0%	1/15 Summer			
S18.011	S77	240 Winter	30	+0%	1/15 Summer			
S18.012	S78	240 Winter	30	+0%	1/15 Summer			
S18.013	S79	240 Winter	30	+0%				
S1.012	S13	360 Winter	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.011	S12	1.285	-0.682	0.000	0.06		28.5	OK	
S18.000	S66	6.227	-0.039	0.000	0.88		29.1	OK	
S18.001	S67	5.392	-0.034	0.000	0.92		28.8	OK	
S18.002	S68	5.009	-0.074	0.000	0.77		75.7	OK	
S19.000	S80	3.745	0.382	0.000	0.34		59.4	SURCHARGED	
S19.001	S81	3.666	0.426	0.000	0.28		62.5	SURCHARGED	
S18.003	S69	3.534	0.479	0.000	0.63		176.4	SURCHARGED	
S18.004	S70	3.515	0.484	0.000	0.61		210.3	SURCHARGED	
S18.005	S71	3.490	0.497	0.000	0.46		197.8	SURCHARGED	
S18.006	S72	3.468	0.529	0.000	0.47		199.0	SURCHARGED	
S18.007	S73	3.448	0.559	0.000	0.30		198.5	SURCHARGED	
S20.000	S82	3.722	0.045	0.000	0.79		30.3	SURCHARGED	2
S20.001	S83	3.590	0.165	0.000	0.79		73.1	SURCHARGED	
S18.008	S74	3.293	0.586	0.000	0.60		270.8	SURCHARGED	
S18.009	S75	3.288	0.667	0.000	0.32		89.3	SURCHARGED	
S18.010	S76	3.286	0.694	0.000	0.26		113.6	SURCHARGED	
S18.011	S77	3.283	0.744	0.000	0.28		113.5	SURCHARGED	
S18.012	S78	3.280	0.785	0.000	0.03		23.5	SURCHARGED	
S18.013	S79	1.657	-0.643	0.000	0.05		23.5	OK	
S1.012	S13	1.251	-0.663	0.000	0.13		51.3	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	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.
S1.000	S1	360 Winter	100	+40%				
S1.001	S2	15 Winter	100	+40%				
S1.002	S3	15 Winter	100	+40%	100/15 Summer			
S2.000	S38	15 Summer	100	+40%	30/15 Winter		30/30 Summer	16
S2.001	S39	30 Winter	100	+40%	30/15 Summer			
S2.002	S40	30 Summer	100	+40%	30/15 Summer			
S2.003	S41	15 Winter	100	+40%	30/15 Summer			
S1.003	S4	15 Winter	100	+40%	30/15 Summer			
S1.004	S5	15 Winter	100	+40%	30/15 Summer			
S1.005	S6	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
S3.000	S34	15 Winter	100	+40%	1/60 Winter	100/15 Summer		
S4.000	S37	15 Winter	100	+40%	30/15 Summer	100/15 Winter		
S1.006	S7	60 Summer	100	+40%	1/30 Summer			
S1.007	S8	60 Summer	100	+40%	1/30 Summer			
S5.000	S35	720 Winter	100	+40%	1/60 Winter			
S6.000	S36	720 Winter	100	+40%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	8.525	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	6.989	-0.111	0.000	0.51		54.3	OK	
S1.002	S3	6.126	0.074	0.000	1.02		106.0	SURCHARGED	
S2.000	S38	4.815	0.700	0.000	0.33	154.0	45.9	SURCHARGED	
S2.001	S39	5.395	1.483	0.000	0.79		79.1	FLOOD RISK	
S2.002	S40	5.430	1.576	0.000	0.92		123.2	SURCHARGED	
S2.003	S41	5.613	1.791	0.000	1.43		366.4	SURCHARGED	
S1.003	S4	5.434	1.670	0.000	1.45		444.7	SURCHARGED	
S1.004	S5	5.237	1.507	0.000	1.36		437.5	SURCHARGED	
S1.005	S6	5.042	1.348	0.963	0.36		412.0	FLOOD	1
S3.000	S34	4.451	1.126	1.485	0.96		77.2	FLOOD	4
S4.000	S37	4.859	1.200	0.225	1.04		135.9	FLOOD	1
S1.006	S7	4.696	1.635	0.000	1.99		545.9	FLOOD RISK	
S1.007	S8	4.385	1.352	0.000	1.27		585.3	SURCHARGED	
S5.000	S35	4.231	0.879	0.000	0.11		4.9	SURCHARGED	
S6.000	S36	4.232	0.744	0.000	0.25		20.3	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.008	S9	720 Winter	100	+40%	1/30 Summer			
S7.000	S15	15 Winter	100	+40%				
S7.001	S16	15 Winter	100	+40%				
S7.002	S17	15 Winter	100	+40%				
S7.003	S18	720 Winter	100	+40%	1/60 Winter			
S8.000	S32	720 Winter	100	+40%	100/360 Winter			
S8.001	S33	720 Winter	100	+40%	100/120 Winter			
S7.004	S19	720 Winter	100	+40%	1/30 Summer			
S9.000	S24	30 Summer	100	+40%	1/30 Summer	100/15 Winter		
S9.001	S25	720 Winter	100	+40%	1/15 Winter			
S9.002	S26	720 Winter	100	+40%	1/15 Summer			
S7.005	S20	720 Winter	100	+40%	1/15 Summer			
S7.006	S21	720 Winter	100	+40%	1/15 Summer			
S10.000	S27	15 Winter	100	+40%	1/480 Winter	100/15 Summer		
S11.000	S31	15 Winter	100	+40%	30/15 Winter	100/15 Summer		
S10.001	S28	15 Winter	100	+40%	1/60 Winter			
S10.002	S29	720 Winter	100	+40%	1/30 Summer			
S7.007	S30	720 Winter	100	+40%	1/15 Summer			
S7.008	S22	720 Winter	100	+40%	1/15 Summer			
S7.009	S23	720 Winter	100	+40%	1/15 Summer			
S12.000	S42	15 Winter	100	+40%	30/15 Summer	100/15 Winter		
S13.000	S59	15 Winter	100	+40%	100/15 Summer			
S12.001	S43	15 Winter	100	+40%	100/15 Summer			
S12.002	S44	15 Winter	100	+40%				
S14.000	S55	15 Winter	100	+40%	100/15 Summer	100/15 Winter		
S14.001	S56	15 Winter	100	+40%	30/120 Winter			
S14.002	S57	15 Winter	100	+40%	30/15 Winter			
S14.003	S58	15 Winter	100	+40%	30/15 Summer			
S12.003	S45	15 Winter	100	+40%	30/15 Summer			
S12.004	S46	15 Winter	100	+40%	30/15 Summer			
S15.000	S60	15 Winter	100	+40%	100/15 Summer			
S15.001	S61	15 Winter	100	+40%	100/15 Summer			
S15.002	S62	15 Winter	100	+40%	30/15 Summer		100/15 Summer	7
S12.005	S47	15 Winter	100	+40%	1/120 Winter			
S16.000	S63	15 Winter	100	+40%	30/15 Winter			
S12.006	S48	15 Winter	100	+40%	1/30 Winter			
S17.000	S64	15 Winter	100	+40%	1/60 Winter			
S17.001	S65	720 Winter	100	+40%	1/60 Summer			
S12.007	S49	720 Winter	100	+40%	1/30 Summer			
S12.008	S50	720 Winter	100	+40%	1/30 Summer			
S12.009	S51	720 Winter	100	+40%	1/30 Summer			
S12.010	S52	720 Winter	100	+40%	1/30 Summer			
S12.011	S53	720 Winter	100	+40%	1/15 Winter			
S12.012	S54	720 Winter	100	+40%	1/15 Winter			
S12.013	S62	720 Winter	100	+40%	1/15 Summer			
S1.009	S10	720 Winter	100	+40%	1/15 Summer			
S1.010	S11	720 Winter	100	+40%				

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.008	S9	4.231	1.292	0.000	0.24		101.6	SURCHARGED	
S7.000	S15	6.397	-0.021	0.000	0.99		73.2	OK	
S7.001	S16	5.914	-0.081	0.000	0.73		73.6	OK	
S7.002	S17	4.260	-0.055	0.000	0.83		73.5	OK	
S7.003	S18	4.230	1.068	0.000	0.05		6.6	FLOOD RISK	
S8.000	S32	4.233	0.054	0.000	0.09		4.2	SURCHARGED	
S8.001	S33	4.232	0.216	0.000	0.05		4.2	SURCHARGED	
S7.004	S19	4.230	1.211	0.000	0.04		10.6	SURCHARGED	
S9.000	S24	4.400	1.345	0.295	1.38		52.6	FLOOD	3
S9.001	S25	4.234	1.401	0.000	0.20		6.6	SURCHARGED	
S9.002	S26	4.232	1.461	0.000	0.17		6.5	SURCHARGED	
S7.005	S20	4.230	1.835	0.000	0.12		17.0	FLOOD RISK	
S7.006	S21	4.229	1.855	0.000	0.07		16.9	FLOOD RISK	
S10.000	S27	4.459	1.126	1.329	1.10		71.9	FLOOD	4
S11.000	S31	4.505	1.004	3.634	1.47		94.7	FLOOD	4
S10.001	S28	4.315	1.167	0.000	2.05		220.1	FLOOD RISK	
S10.002	S29	4.231	1.269	0.000	0.27		27.4	FLOOD RISK	
S7.007	S30	4.229	1.937	0.000	0.02		6.9	FLOOD RISK	
S7.008	S22	4.229	1.983	0.000	0.06		19.6	FLOOD RISK	
S7.009	S23	4.229	2.017	0.000	0.03		13.4	FLOOD RISK	
S12.000	S42	10.062	1.150	0.286	1.67		60.7	FLOOD	1
S13.000	S59	7.530	0.304	0.000	1.10		127.7	SURCHARGED	
S12.001	S43	7.300	0.262	0.000	1.25		250.9	SURCHARGED	
S12.002	S44	6.476	-0.125	0.000	0.77		251.2	OK	
S14.000	S55	5.591	1.351	0.746	0.65		10.3	FLOOD	2
S14.001	S56	5.671	1.536	0.000	0.95		15.3	FLOOD RISK	
S14.002	S57	5.744	1.726	0.000	1.33		21.4	SURCHARGED	
S14.003	S58	5.813	1.917	0.000	1.73		27.5	SURCHARGED	
S12.003	S45	6.025	2.238	0.000	1.53		259.3	SURCHARGED	
S12.004	S46	5.525	1.957	0.000	1.58		264.0	SURCHARGED	
S15.000	S60	6.730	0.278	0.000	0.95		34.4	SURCHARGED	
S15.001	S61	5.552	0.569	0.000	0.89		32.1	SURCHARGED	
S15.002	S62	4.537	0.824	0.000	0.47	85.5	19.7	SURCHARGED	
S12.005	S47	5.132	1.746	0.000	1.58		318.4	FLOOD RISK	
S16.000	S63	4.655	1.003	0.000	0.45		46.7	FLOOD RISK	
S12.006	S48	4.552	1.411	0.000	2.24		408.0	FLOOD RISK	
S17.000	S64	4.323	1.075	0.000	1.54		92.5	FLOOD RISK	
S17.001	S65	4.240	1.063	0.000	0.11		10.3	SURCHARGED	
S12.007	S49	4.239	1.203	0.000	0.25		69.1	SURCHARGED	
S12.008	S50	4.238	1.230	0.000	0.21		87.2	SURCHARGED	
S12.009	S51	4.236	1.286	0.000	0.29		87.0	SURCHARGED	
S12.010	S52	4.235	1.300	0.000	0.25		86.9	SURCHARGED	
S12.011	S53	4.234	1.336	0.000	0.23		86.7	FLOOD RISK	
S12.012	S54	4.232	1.392	0.000	0.21		83.5	FLOOD RISK	
S12.013	S62	4.231	1.452	0.000	0.14		58.0	FLOOD RISK	
S1.009	S10	4.229	2.107	0.000	0.06		30.0	FLOOD RISK	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.010	S11	1.369	-0.701	0.000	0.05		30.0	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.011	S12	720 Winter	100	+40%				
S18.000	S66	15 Winter	100	+40%	100/15 Summer			
S18.001	S67	15 Winter	100	+40%	100/15 Summer			
S18.002	S68	15 Winter	100	+40%	100/15 Summer			
S19.000	S80	30 Summer	100	+40%	30/15 Summer			
S19.001	S81	30 Summer	100	+40%	30/15 Summer			
S18.003	S69	15 Winter	100	+40%	1/30 Winter			
S18.004	S70	15 Winter	100	+40%	1/30 Winter			
S18.005	S71	30 Summer	100	+40%	1/30 Winter			
S18.006	S72	30 Summer	100	+40%	1/30 Summer			
S18.007	S73	30 Summer	100	+40%	1/30 Summer			
S20.000	S82	15 Winter	100	+40%	30/15 Winter	100/15 Winter		
S20.001	S83	15 Winter	100	+40%	30/15 Summer			
S18.008	S74	15 Winter	100	+40%	1/15 Summer			
S18.009	S75	30 Winter	100	+40%	1/15 Summer			
S18.010	S76	30 Winter	100	+40%	1/15 Summer			
S18.011	S77	240 Winter	100	+40%	1/15 Summer			
S18.012	S78	240 Winter	100	+40%	1/15 Summer			
S18.013	S79	360 Winter	100	+40%				
S1.012	S13	600 Winter	100	+40%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.011	S12	1.297	-0.669	0.000	0.06		30.0	OK	
S18.000	S66	7.532	1.266	0.000	1.15		38.1	FLOOD RISK	
S18.001	S67	6.395	0.969	0.000	1.43		44.7	SURCHARGED	
S18.002	S68	5.958	0.875	0.000	0.99		97.5	SURCHARGED	
S19.000	S80	4.253	0.890	0.000	0.68		119.6	FLOOD RISK	
S19.001	S81	4.140	0.900	0.000	0.51		115.2	FLOOD RISK	
S18.003	S69	4.002	0.947	0.000	1.15		323.2	SURCHARGED	
S18.004	S70	3.975	0.944	0.000	1.22		418.0	SURCHARGED	
S18.005	S71	3.930	0.937	0.000	0.86		369.0	SURCHARGED	
S18.006	S72	3.885	0.946	0.000	0.88		368.3	SURCHARGED	
S18.007	S73	3.842	0.952	0.000	0.56		371.9	SURCHARGED	
S20.000	S82	4.953	1.276	0.940	1.31		49.9	FLOOD	2
S20.001	S83	4.722	1.296	0.000	1.23		113.9	SURCHARGED	
S18.008	S74	3.772	1.065	0.000	1.17		530.2	SURCHARGED	
S18.009	S75	3.654	1.033	0.000	1.95		542.4	SURCHARGED	
S18.010	S76	3.587	0.995	0.000	1.54		680.4	SURCHARGED	
S18.011	S77	3.518	0.979	0.000	0.52		206.9	SURCHARGED	
S18.012	S78	3.514	1.019	0.000	0.04		29.7	SURCHARGED	
S18.013	S79	1.672	-0.629	0.000	0.06		29.7	OK	
S1.012	S13	1.268	-0.646	0.000	0.16		59.5	OK	

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PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
S1.000	0.000	S7.006	210.139	S12.009	1219.664
S1.001	67.007	S10.000	112.372	S12.010	1213.114
S1.002	134.036	S11.000	163.800	S12.011	1201.712
S2.000	76.559	S10.001	391.428	S12.012	718.400
S2.001	195.909	S10.002	383.366	S12.013	697.851
S2.002	298.481	S7.007	15.136	S1.009	1045.075
S2.003	543.376	S7.008	-571.885	S1.010	1040.995
S1.003	668.713	S7.009	-591.219	S1.011	1035.901
S1.004	711.155	S12.000	98.278	S18.000	69.986
S1.005	702.671	S13.000	184.653	S18.001	70.009
S3.000	116.759	S12.001	384.138	S18.002	176.515
S4.000	199.549	S12.002	384.260	S19.000	197.771
S1.006	1208.565	S14.000	-0.004	S19.001	193.198
S1.007	1302.993	S14.001	-0.051	S18.003	512.025
S5.000	-1.064	S14.002	-0.321	S18.004	644.768
S6.000	110.188	S14.003	-0.814	S18.005	635.637
S1.008	1379.532	S12.003	456.563	S18.006	623.186
S7.000	98.279	S12.004	453.252	S18.007	611.390
S7.001	98.310	S15.000	52.117	S20.000	77.440
S7.002	98.340	S15.001	52.134	S20.001	192.040
S7.003	95.396	S15.002	51.404	S18.008	886.302
S8.000	60.896	S12.005	684.012	S18.009	966.729
S8.001	60.329	S16.000	79.892	S18.010	1236.134
S7.004	142.448	S12.006	843.993	S18.011	1223.672
S9.000	95.182	S17.000	149.070	S18.012	997.158
S9.001	92.170	S17.001	146.596	S18.013	994.442
S9.002	90.189	S12.007	984.257	S1.012	2027.215
S7.005	216.894	S12.008	1236.199		

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW1- PDS EXPORT.SWS

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	10
Ratio R	0.350	Minimum Backdrop Height (m)	0.100
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW1- PDS EXPORT.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	33.060	1.650	20.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	20.961	1.048	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	16.980	0.848	20.0	0.090	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	33.943	0.203	167.2	0.104	5.00	0.0	0.600	o	375	Pipe/Conduit	
S2.001	14.561	0.058	250.0	0.167	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.002	7.954	0.032	248.6	0.142	0.00	0.0	0.600	o	450	Pipe/Conduit	
S2.003	25.970	0.058	447.8	0.335	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	16.884	0.034	496.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.004	17.923	0.036	497.9	0.069	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.005	55.418	0.632	87.6	0.000	0.00	0.0	0.600	o	750	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	5.19	8.525	0.000	0.0	0.0	0.0	2.94	116.8	0.0
S1.001	50.00	5.31	6.875	0.090	0.0	0.0	1.2	2.94	116.9	13.4
S1.002	50.00	5.40	5.827	0.180	0.0	0.0	2.4	2.94	116.8	26.8
S2.000	50.00	5.40	3.740	0.104	0.0	0.0	1.4	1.40	154.4	15.5
S2.001	50.00	5.62	3.537	0.271	0.0	0.0	3.7	1.14	126.1	40.4
S2.002	50.00	5.72	3.404	0.413	0.0	0.0	5.6	1.28	204.4	61.5
S2.003	50.00	6.10	3.222	0.748	0.0	0.0	10.1	1.14	323.5	111.4
S1.003	50.00	6.32	3.014	0.928	0.0	0.0	12.6	1.25	551.8	138.2
S1.004	50.00	6.56	2.980	0.997	0.0	0.0	13.5	1.25	551.1	148.5
S1.005	50.00	6.87	2.944	0.997	0.0	0.0	13.5	2.99	1321.1	148.5

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Network Design Table for SW1- PDS EXPORT.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
S3.000	43.874	0.263	166.8	0.161	5.00	0.0	0.600	o	300	Pipe/Conduit	
S4.000	36.867	0.597	61.8	0.272	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	14.607	0.029	503.7	0.310	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.007	47.227	0.094	502.4	0.145	0.00	0.0	0.600	o	750	Pipe/Conduit	
S5.000	44.319	0.363	122.1	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S6.000	43.017	0.258	166.7	0.152	5.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	32.269	0.065	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S7.000	16.665	0.423	39.4	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	40.844	1.680	24.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.002	35.970	1.153	31.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.003	63.987	0.142	450.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S8.000	14.992	0.163	92.0	0.082	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	34.000	0.996	34.1	0.000	0.00	0.0	0.600	o	225	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)
S3.000	50.00	5.60	3.025	0.161	0.0	0.0	2.2	1.21	85.8	24.0
S4.000	50.00	5.31	3.359	0.272	0.0	0.0	3.7	2.00	141.7	40.5
S1.006	50.00	7.07	2.311	1.740	0.0	0.0	23.6	1.24	547.8	259.2
S1.007	50.00	7.70	2.282	1.885	0.0	0.0	25.5	1.24	548.5	280.8
S5.000	50.00	5.62	3.127	0.000	0.0	0.0	0.0	1.18	47.0	0.0
S6.000	50.00	5.59	3.188	0.152	0.0	0.0	2.1	1.21	85.9	22.6
S1.008	50.00	8.13	2.188	2.037	0.0	0.0	27.6	1.24	549.9	303.4
S7.000	50.00	5.13	6.193	0.132	0.0	0.0	1.8	2.09	83.1	19.7
S7.001	50.00	5.39	5.770	0.132	0.0	0.0	1.8	2.66	106.0	19.7
S7.002	50.00	5.64	4.090	0.132	0.0	0.0	1.8	2.35	93.5	19.7
S7.003	50.00	6.76	2.712	0.132	0.0	0.0	1.8	0.95	151.4	19.7
S8.000	50.00	5.18	3.954	0.082	0.0	0.0	1.1	1.36	54.2	12.2
S8.001	50.00	5.44	3.791	0.082	0.0	0.0	1.1	2.25	89.3	12.2

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Network Design Table for SW1- PDS EXPORT.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
S7.004	60.460	0.625	96.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S9.000	36.996	0.222	166.6	0.133	5.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	10.231	0.061	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S9.002	62.920	0.377	167.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S7.005	11.651	0.021	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S7.006	44.594	0.081	550.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S10.000	46.138	0.185	250.0	0.156	5.00	0.0	0.600	o	300	Pipe/Conduit	
S11.000	35.606	0.142	250.0	0.226	5.00	0.0	0.600	o	300	Pipe/Conduit	
S10.001	55.970	0.187	299.3	0.169	0.00	0.0	0.600	o	375	Pipe/Conduit	
S10.002	8.846	0.044	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S7.007	34.837	0.046	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.008	25.592	0.034	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S7.009	67.829	0.090	750.0	0.000	0.00	0.0	0.600	o	800	Pipe/Conduit	
S12.000	13.000	0.645	20.2	0.132	5.00	0.0	0.600	o	150	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)
S7.004	50.00	7.25	2.570	0.214	0.0	0.0	2.9	2.07	328.8	31.9
S9.000	50.00	5.61	2.830	0.133	0.0	0.0	1.8	1.01	40.2	19.8
S9.001	50.00	5.78	2.608	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S9.002	50.00	6.82	2.547	0.133	0.0	0.0	1.8	1.01	40.1	19.8
S7.005	50.00	7.44	1.795	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S7.006	50.00	8.16	1.774	0.347	0.0	0.0	4.7	1.03	291.6	51.7
S10.000	50.00	5.78	3.033	0.156	0.0	0.0	2.1	0.99	70.0	23.2
S11.000	50.00	5.60	3.201	0.226	0.0	0.0	3.1	0.99	70.0	33.7
S10.001	50.00	6.67	2.773	0.551	0.0	0.0	7.5	1.04	115.1	82.1
S10.002	50.00	6.79	2.586	0.551	0.0	0.0	7.5	1.28	141.1	82.1
S7.007	48.76	8.71	1.493	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.008	47.66	9.11	1.446	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S7.009	45.03	10.18	1.412	0.898	0.0	0.0	11.9	1.06	530.7	130.4
S12.000	50.00	5.10	8.762	0.132	0.0	0.0	1.8	2.25	39.8	19.7

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Network Design Table for SW1- PDS EXPORT.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
S13.000	47.008	0.188	250.0	0.248	5.00	0.0	0.600	o	375	Pipe/Conduit	
S12.001	34.981	0.437	80.0	0.136	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.002	13.954	0.695	20.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S14.000	10.531	0.105	100.0	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	11.690	0.117	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.002	12.175	0.122	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S14.003	10.900	0.109	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S12.003	21.920	0.219	100.0	0.100	0.00	0.0	0.600	o	375	Pipe/Conduit	
S12.004	16.477	0.182	90.3	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S15.000	32.938	1.469	22.4	0.070	5.00	0.0	0.600	o	150	Pipe/Conduit	
S15.001	28.922	1.269	22.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.002	45.524	0.328	138.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S12.005	52.467	0.245	214.2	0.251	0.00	0.0	0.600	o	450	Pipe/Conduit	
S16.000	36.016	0.362	99.5	0.110	5.00	0.0	0.600	o	300	Pipe/Conduit	
S12.006	8.863	0.104	84.9	0.127	0.00	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)
S13.000	50.00	5.69	6.851	0.248	0.0	0.0	3.4	1.14	126.0	36.9
S12.001	50.00	5.97	6.663	0.516	0.0	0.0	7.0	2.03	223.8	76.9
S12.002	50.00	6.03	6.226	0.516	0.0	0.0	7.0	4.06	448.4	76.9
S14.000	50.00	5.17	4.090	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.001	50.00	5.37	3.985	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.002	50.00	5.57	3.868	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S14.003	50.00	5.75	3.746	0.000	0.0	0.0	0.0	1.00	17.8	0.0
S12.003	50.00	6.23	3.412	0.616	0.0	0.0	8.3	1.81	200.1	91.8
S12.004	50.00	6.38	3.193	0.616	0.0	0.0	8.3	1.91	210.6	91.8
S15.000	50.00	5.26	6.302	0.070	0.0	0.0	0.9	2.14	37.7	10.4
S15.001	50.00	5.48	4.833	0.070	0.0	0.0	0.9	2.12	37.4	10.4
S15.002	50.00	6.17	3.489	0.070	0.0	0.0	0.9	1.11	44.1	10.4
S12.005	50.00	7.01	2.935	0.937	0.0	0.0	12.7	1.39	220.3	139.6
S16.000	50.00	5.38	3.352	0.110	0.0	0.0	1.5	1.58	111.4	16.4
S12.006	50.00	7.08	2.690	1.174	0.0	0.0	15.9	2.21	351.1	174.9

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Network Design Table for SW1- PDS EXPORT.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
S17.000	17.848	0.071	251.4	0.207	5.00	0.0	0.600	o	300	Pipe/Conduit	
S17.001	15.170	0.141	107.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S12.007	13.907	0.028	496.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.008	28.913	0.058	498.5	0.359	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.009	7.235	0.014	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.010	17.210	0.038	455.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.011	40.896	0.058	705.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.012	37.397	0.061	609.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S12.013	28.513	0.057	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.009	41.043	0.051	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.010	83.206	0.104	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S1.011	41.787	0.052	800.0	0.000	0.00	0.0	0.600	o	875	Pipe/Conduit	
S18.000	21.994	0.840	26.2	0.094	5.00	0.0	0.600	o	150	Pipe/Conduit	
S18.001	8.576	0.344	25.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S18.002	52.985	2.028	26.1	0.143	0.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	31.169	0.123	253.4	0.268	5.00	0.0	0.600	o	450	Pipe/Conduit	
S19.001	27.732	0.185	149.9	0.000	0.00	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)
S17.000	50.00	5.30	2.948	0.207	0.0	0.0	2.8	0.99	69.8	30.8
S17.001	50.00	5.47	2.877	0.207	0.0	0.0	2.8	1.52	107.1	30.8
S12.007	50.00	7.26	2.286	1.381	0.0	0.0	18.7	1.25	551.7	205.7
S12.008	50.00	7.65	2.258	1.740	0.0	0.0	23.6	1.25	550.7	259.2
S12.009	50.00	7.74	2.200	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S12.010	50.00	7.96	2.186	1.740	0.0	0.0	23.6	1.31	576.6	259.2
S12.011	49.02	8.62	2.148	1.740	0.0	0.0	23.6	1.05	462.2	259.2
S12.012	47.52	9.17	2.090	1.740	0.0	0.0	23.6	1.13	497.4	259.2
S12.013	46.54	9.55	2.028	1.740	0.0	0.0	23.6	1.24	549.9	259.2
S1.009	43.62	10.82	1.247	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.010	41.12	12.10	1.195	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S1.011	39.99	12.75	1.091	4.675	0.0	0.0	55.2	1.08	649.8	607.5
S18.000	50.00	5.19	6.116	0.094	0.0	0.0	1.3	1.98	34.9	14.0
S18.001	50.00	5.26	5.276	0.094	0.0	0.0	1.3	2.02	35.8	14.0
S18.002	50.00	5.60	4.858	0.237	0.0	0.0	3.2	2.57	102.2	35.3
S19.000	50.00	5.41	2.913	0.268	0.0	0.0	3.6	1.27	202.4	39.9
S19.001	50.00	5.69	2.790	0.268	0.0	0.0	3.6	1.66	263.7	39.9

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Network Design Table for SW1- PDS EXPORT.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
S18.003	10.755	0.024	448.1	0.203	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.004	17.016	0.038	447.8	0.189	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.005	24.230	0.054	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.006	22.336	0.050	450.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.007	14.516	0.182	79.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S20.000	42.000	0.251	167.0	0.104	5.00	0.0	0.600	o	225	Pipe/Conduit	
S20.001	18.361	0.718	25.6	0.154	0.00	0.0	0.600	o	225	Pipe/Conduit	
S18.008	42.896	0.086	498.8	0.125	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.009	14.300	0.029	493.1	0.139	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.010	21.315	0.053	400.0	0.380	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.011	16.231	0.044	369.6	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.012	33.807	0.195	173.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S18.013	153.083	0.255	600.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.012	13.545	0.027	500.0	0.000	0.00	0.0	0.600	o	875	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)
S18.003	50.00	5.82	2.305	0.708	0.0	0.0	9.6	1.32	581.1	105.5
S18.004	50.00	6.04	2.281	0.897	0.0	0.0	12.1	1.32	581.3	133.6
S18.005	50.00	6.35	2.243	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.006	50.00	6.63	2.189	0.897	0.0	0.0	12.1	1.31	579.9	133.6
S18.007	50.00	6.71	2.140	0.897	0.0	0.0	12.1	3.14	1386.1	133.6
S20.000	50.00	5.69	3.452	0.104	0.0	0.0	1.4	1.01	40.1	15.5
S20.001	50.00	5.81	3.201	0.258	0.0	0.0	3.5	2.60	103.3	38.4
S18.008	50.00	7.28	1.957	1.280	0.0	0.0	17.3	1.25	550.5	190.7
S18.009	50.00	7.47	1.871	1.419	0.0	0.0	19.2	1.25	553.7	211.4
S18.010	50.00	7.73	1.842	1.799	0.0	0.0	24.4	1.39	615.4	268.0
S18.011	50.00	7.91	1.789	1.799	0.0	0.0	24.4	1.45	640.5	268.0
S18.012	50.00	8.18	1.745	1.799	0.0	0.0	24.4	2.12	936.8	268.0
S18.013	44.48	10.43	1.550	1.799	0.0	0.0	24.4	1.14	501.5	268.0
S1.012	39.71	12.91	1.039	6.474	0.0	0.0	69.6	1.37	823.9	766.0

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Surcharged Outfall Details for SW1- PDS EXPORT.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.012	S14	2.300	1.012	1.150	0	0

Datum (m) 0.000 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	0.000	120	2.200	180	4.400	240	4.400	300	2.200	360	0.000

Simulation Criteria for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for SW1- PDS EXPORT.SWS

Complex Manhole: S10, DS/PN: S1.009, Volume (m³): 66.7

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0131-1050-2191-1050
Design Head (m)	2.191
Design Flow (l/s)	10.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	131
Invert Level (m)	1.247
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.191	10.5	Kick-Flo®	1.176	7.8
Flush-Flo™	0.578	9.9	Mean Flow over Head Range	-	8.9

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	4.7	1.200	7.9	3.000	12.2	7.000	18.2
0.200	8.3	1.400	8.5	3.500	13.1	7.500	18.9
0.300	9.2	1.600	9.1	4.000	14.0	8.000	19.5
0.400	9.6	1.800	9.6	4.500	14.8	8.500	20.0
0.500	9.8	2.000	10.1	5.000	15.5	9.000	20.6
0.600	9.9	2.200	10.5	5.500	16.3	9.500	21.1
0.800	9.7	2.400	11.0	6.000	16.9		
1.000	9.1	2.600	11.4	6.500	17.6		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0193-1800-0662-1800
Design Head (m)	0.662
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	193
Invert Level (m)	3.438
Minimum Outlet Pipe Diameter (mm)	225

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Hydro-Brake® Optimum

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.662	18.0	Kick-Flo®	0.520	16.1
Flush-Flo™	0.294	18.0	Mean Flow over Head Range	-	14.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.7	1.200	23.9	3.000	37.1	7.000	55.6
0.200	17.4	1.400	25.7	3.500	40.0	7.500	57.6
0.300	18.0	1.600	27.4	4.000	42.6	8.000	59.5
0.400	17.6	1.800	29.0	4.500	45.2	8.500	61.4
0.500	16.5	2.000	30.5	5.000	47.5	9.000	63.2
0.600	17.2	2.200	32.0	5.500	49.8	9.500	64.9
0.800	19.7	2.400	33.3	6.000	51.9		
1.000	21.9	2.600	34.6	6.500	54.0		

Complex Manhole: S78, DS/PN: S18.012, Volume (m³): 13.2

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0143-1050-1386-1050
Design Head (m)	1.386
Design Flow (l/s)	10.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	1.745
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)	1.386	10.5	Kick-Flo®	0.872	8.4
Flush-Flo™	0.408	10.4	Mean Flow over Head Range	-	9.1

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

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Hydro-Brake® Optimum

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	9.8	3.000	15.1	7.000	22.7
0.200	9.6	1.400	10.5	3.500	16.3	7.500	23.4
0.300	10.3	1.600	11.2	4.000	17.3	8.000	24.2
0.400	10.4	1.800	11.9	4.500	18.4	8.500	24.9
0.500	10.4	2.000	12.5	5.000	19.3	9.000	25.6
0.600	10.2	2.200	13.1	5.500	20.2	9.500	26.3
0.800	9.2	2.400	13.6	6.000	21.1		
1.000	9.0	2.600	14.1	6.500	21.9		

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0190-1800-0969-1800
Design Head (m)	0.969
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	190
Invert Level (m)	3.131
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.969	18.0	Kick-Flo®	0.695	15.4
Flush-Flo™	0.326	18.0	Mean Flow over Head Range	-	15.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.6	1.200	19.9	3.000	30.9	7.000	46.5
0.200	17.3	1.400	21.4	3.500	33.3	7.500	48.1
0.300	18.0	1.600	22.9	4.000	35.5	8.000	49.6
0.400	17.9	1.800	24.2	4.500	37.6	8.500	51.1
0.500	17.5	2.000	25.4	5.000	39.5	9.000	52.6
0.600	16.8	2.200	26.6	5.500	41.4	9.500	54.0
0.800	16.4	2.400	27.8	6.000	43.2		
1.000	18.3	2.600	28.8	6.500	44.9		

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Offline Controls for SW1- PDS EXPORT.SWS

Weir Manhole: S38, DS/PN: S2.000, Loop to PN: S1.009

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 4.500

Weir Manhole: S62, DS/PN: S15.002, Loop to PN: S18.012

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 4.400

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.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 Storage Structures	5
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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

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

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	S1	360 Winter	1	+0%					8.525
S1.001	S2	15 Winter	1	+0%					6.921
S1.002	S3	15 Winter	1	+0%					5.893
S2.000	S38	15 Winter	1	+0%				0	3.818
S2.001	S39	240 Winter	1	+0%					3.741
S2.002	S40	240 Winter	1	+0%					3.737
S2.003	S41	240 Winter	1	+0%					3.735
S1.003	S4	240 Winter	1	+0%					3.710
S1.004	S5	240 Winter	1	+0%	1/240 Winter				3.746
S1.005	S6	240 Winter	1	+0%	1/180 Winter				3.773
S3.000	S34	240 Winter	1	+0%	1/60 Winter				3.723
S4.000	S37	240 Winter	1	+0%	1/240 Winter				3.663
S1.006	S7	180 Winter	1	+0%	1/30 Summer				3.800
S1.007	S8	180 Winter	1	+0%	1/30 Summer				3.813
S5.000	S35	240 Winter	1	+0%	1/60 Winter				3.825
S6.000	S36	240 Winter	1	+0%	1/60 Winter				3.732
S1.008	S9	180 Winter	1	+0%	1/30 Summer				3.829
S7.000	S15	15 Winter	1	+0%					6.266

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.225	0.000	0.00		0.0	OK	
S1.001	S2	-0.179	0.000	0.09		9.7	OK	
S1.002	S3	-0.159	0.000	0.19		19.3	OK	
S2.000	S38	-0.297	0.000	0.09	0.0	12.9	OK	
S2.001	S39	-0.171	0.000	0.08		7.8	OK	
S2.002	S40	-0.116	0.000	0.09		11.8	OK	
S2.003	S41	-0.087	0.000	0.08		21.4	OK	
S1.003	S4	-0.054	0.000	0.08		26.0	OK	
S1.004	S5	0.017	0.000	0.09		27.6	SURCHARGED	
S1.005	S6	0.080	0.000	0.02		26.3	SURCHARGED	
S3.000	S34	0.398	0.000	0.05		4.4	SURCHARGED	
S4.000	S37	0.004	0.000	0.06		7.8	SURCHARGED	
S1.006	S7	0.739	0.000	0.16		43.6	SURCHARGED	
S1.007	S8	0.780	0.000	0.09		39.9	SURCHARGED	
S5.000	S35	0.473	0.000	0.04		1.7	SURCHARGED	
S6.000	S36	0.244	0.000	0.10		7.7	SURCHARGED	
S1.008	S9	0.890	0.000	0.10		44.3	SURCHARGED	
S7.000	S15	-0.152	0.000	0.23		16.7	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S7.001	S16	15 Winter	1	+0%					5.832
S7.002	S17	15 Winter	1	+0%					4.157
S7.003	S18	960 Winter	1	+0%	1/60 Winter				3.345
S8.000	S32	15 Winter	1	+0%					4.025
S8.001	S33	15 Winter	1	+0%					3.844
S7.004	S19	960 Winter	1	+0%	1/30 Summer				3.345
S9.000	S24	960 Winter	1	+0%	1/30 Summer				3.345
S9.001	S25	960 Winter	1	+0%	1/15 Winter				3.345
S9.002	S26	960 Winter	1	+0%	1/15 Summer				3.345
S7.005	S20	960 Winter	1	+0%	1/15 Summer				3.345
S7.006	S21	960 Winter	1	+0%	1/15 Summer				3.345
S10.000	S27	960 Winter	1	+0%	1/600 Winter				3.345
S11.000	S31	960 Winter	1	+0%					3.345
S10.001	S28	960 Winter	1	+0%	1/60 Winter				3.345
S10.002	S29	960 Winter	1	+0%	1/30 Summer				3.345
S7.007	S30	960 Winter	1	+0%	1/15 Summer				3.345
S7.008	S22	960 Winter	1	+0%	1/15 Summer				3.345
S7.009	S23	240 Winter	1	+0%	1/15 Summer	1/180 Winter			4.436
S12.000	S42	15 Winter	1	+0%					8.834
S13.000	S59	15 Winter	1	+0%					6.984
S12.001	S43	15 Winter	1	+0%					6.805
S12.002	S44	15 Winter	1	+0%					6.335
S14.000	S55	360 Winter	1	+0%					4.090
S14.001	S56	360 Winter	1	+0%					3.985
S14.002	S57	360 Winter	1	+0%					3.868
S14.003	S58	360 Winter	1	+0%					3.746
S12.003	S45	15 Winter	1	+0%					3.582
S12.004	S46	480 Winter	1	+0%					3.438
S15.000	S60	15 Winter	1	+0%					6.352
S15.001	S61	15 Winter	1	+0%					4.884
S15.002	S62	15 Winter	1	+0%				0	3.559
S12.005	S47	480 Winter	1	+0%	1/120 Winter				3.437
S16.000	S63	480 Winter	1	+0%					3.435
S12.006	S48	480 Winter	1	+0%	1/30 Winter				3.435
S17.000	S64	480 Winter	1	+0%	1/120 Summer				3.435
S17.001	S65	480 Winter	1	+0%	1/60 Summer				3.434
S12.007	S49	480 Winter	1	+0%	1/30 Summer				3.434
S12.008	S50	480 Winter	1	+0%	1/30 Summer				3.433
S12.009	S51	480 Winter	1	+0%	1/30 Summer				3.432
S12.010	S52	480 Winter	1	+0%	1/30 Summer				3.431
S12.011	S53	480 Winter	1	+0%	1/15 Winter				3.430
S12.012	S54	480 Winter	1	+0%	1/15 Winter				3.429
S12.013	S62	240 Winter	1	+0%	1/15 Summer				3.799
S1.009	S10	180 Winter	1	+0%	1/15 Summer				3.704
S1.010	S11	480 Winter	1	+0%	1/120 Summer				2.344
S1.011	S12	480 Winter	1	+0%	1/120 Summer	1/180 Summer			2.344
S18.000	S66	15 Winter	1	+0%					6.179

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S7.001	S16	-0.163	0.000	0.16		16.5	OK	
S7.002	S17	-0.158	0.000	0.19		16.7	OK	
S7.003	S18	0.183	0.000	0.01		1.4	SURCHARGED	
S8.000	S32	-0.154	0.000	0.22		10.4	OK	
S8.001	S33	-0.172	0.000	0.12		10.3	OK	
S7.004	S19	0.325	0.000	0.01		2.2	SURCHARGED	
S9.000	S24	0.290	0.000	0.04		1.4	SURCHARGED	
S9.001	S25	0.512	0.000	0.04		1.4	SURCHARGED	
S9.002	S26	0.573	0.000	0.04		1.4	SURCHARGED	
S7.005	S20	0.950	0.000	0.03		3.6	SURCHARGED	
S7.006	S21	0.971	0.000	0.01		3.6	SURCHARGED	
S10.000	S27	0.012	0.000	0.03		1.7	SURCHARGED	
S11.000	S31	-0.156	0.000	0.04		2.5	OK	
S10.001	S28	0.197	0.000	0.05		5.7	SURCHARGED	
S10.002	S29	0.384	0.000	0.06		5.7	SURCHARGED	
S7.007	S30	1.052	0.000	0.01		3.9	SURCHARGED	
S7.008	S22	1.099	0.000	0.02		7.3	SURCHARGED	
S7.009	S23	2.223	1.145	0.02		8.3	FLOOD	1
S12.000	S42	-0.078	0.000	0.46		16.7	OK	
S13.000	S59	-0.242	0.000	0.26		30.7	OK	
S12.001	S43	-0.233	0.000	0.31		61.3	OK	
S12.002	S44	-0.266	0.000	0.19		61.0	OK	
S14.000	S55	-0.150	0.000	0.00		0.0	OK	
S14.001	S56	-0.150	0.000	0.00		0.0	OK	
S14.002	S57	-0.150	0.000	0.00		0.0	OK	
S14.003	S58	-0.150	0.000	0.00		0.0	OK	
S12.003	S45	-0.205	0.000	0.42		71.0	OK	
S12.004	S46	-0.129	0.000	0.07		11.0	OK	
S15.000	S60	-0.100	0.000	0.24		8.9	OK	
S15.001	S61	-0.099	0.000	0.24		8.8	OK	
S15.002	S62	-0.155	0.000	0.21	0.0	8.9	OK	
S12.005	S47	0.052	0.000	0.08		16.1	SURCHARGED	
S16.000	S63	-0.217	0.000	0.02		2.0	OK	
S12.006	S48	0.294	0.000	0.11		19.4	SURCHARGED	
S17.000	S64	0.187	0.000	0.06		3.3	SURCHARGED	
S17.001	S65	0.257	0.000	0.04		3.2	SURCHARGED	
S12.007	S49	0.398	0.000	0.08		21.2	SURCHARGED	
S12.008	S50	0.425	0.000	0.06		27.4	SURCHARGED	
S12.009	S51	0.482	0.000	0.09		27.1	SURCHARGED	
S12.010	S52	0.495	0.000	0.08		27.2	SURCHARGED	
S12.011	S53	0.532	0.000	0.07		27.3	SURCHARGED	
S12.012	S54	0.589	0.000	0.04		14.9	SURCHARGED	
S12.013	S62	1.021	0.000	0.05		23.0	SURCHARGED	
S1.009	S10	1.582	0.000	0.02		9.9	SURCHARGED	
S1.010	S11	0.274	0.000	0.06		37.0	SURCHARGED	
S1.011	S12	0.378	14.433	0.16		85.3	FLOOD	8

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.000	S66	-0.087	0.000	0.36		11.9	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for SW1- PDS EXPORT.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S18.001	S67	15 Winter	1	+0%					5.341
S18.002	S68	15 Winter	1	+0%					4.939
S19.000	S80	120 Winter	1	+0%					3.153
S19.001	S81	120 Winter	1	+0%					3.149
S18.003	S69	120 Winter	1	+0%	1/30 Winter				3.143
S18.004	S70	120 Winter	1	+0%	1/30 Winter				3.141
S18.005	S71	120 Winter	1	+0%	1/30 Winter				3.139
S18.006	S72	120 Winter	1	+0%	1/30 Summer				3.136
S18.007	S73	120 Winter	1	+0%	1/30 Summer				3.133
S20.000	S82	15 Winter	1	+0%					3.544
S20.001	S83	15 Winter	1	+0%					3.288
S18.008	S74	240 Winter	1	+0%	1/15 Summer				3.132
S18.009	S75	240 Winter	1	+0%	1/15 Summer				3.130
S18.010	S76	240 Winter	1	+0%	1/15 Summer				3.129
S18.011	S77	240 Winter	1	+0%	1/15 Summer				3.128
S18.012	S78	240 Winter	1	+0%	1/15 Summer				3.127
S18.013	S79	480 Winter	1	+0%	1/180 Summer				2.344
S1.012	S13	480 Winter	1	+0%	1/120 Summer	1/180 Summer			2.344

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S18.001	S67	-0.085	0.000	0.38		11.8	OK	
S18.002	S68	-0.144	0.000	0.28		27.3	OK	
S19.000	S80	-0.210	0.000	0.07		12.0	OK	
S19.001	S81	-0.091	0.000	0.05		11.7	OK	
S18.003	S69	0.088	0.000	0.10		27.4	SURCHARGED	
S18.004	S70	0.110	0.000	0.09		29.8	SURCHARGED	
S18.005	S71	0.146	0.000	0.06		27.2	SURCHARGED	
S18.006	S72	0.197	0.000	0.06		26.7	SURCHARGED	
S18.007	S73	0.244	0.000	0.04		26.4	SURCHARGED	
S20.000	S82	-0.133	0.000	0.34		12.9	OK	
S20.001	S83	-0.138	0.000	0.32		29.3	OK	
S18.008	S74	0.425	0.000	0.06		28.8	SURCHARGED	
S18.009	S75	0.509	0.000	0.11		32.0	SURCHARGED	
S18.010	S76	0.537	0.000	0.09		40.5	SURCHARGED	
S18.011	S77	0.589	0.000	0.10		40.5	SURCHARGED	
S18.012	S78	0.632	0.000	0.02		10.5	SURCHARGED	
S18.013	S79	0.044	0.000	0.05		23.5	FLOOD RISK	
S1.012	S13	0.430	34.217	0.47		177.5	FLOOD	9

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Appendix (K)

Exceedance Flow Paths

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, drawing number PL06 dated April 2018.
4. Topographic Survey as per Siteline survey drawing number 36FA01 dated August 2016.

KEY

Exceedance Flow Route

Primary Road Contour 70.000

Secondary Road Contour 69.950

PLAY AREA

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

SCALE BAR 1:500 at A0

Rev.	Date	Details	By	Chkd	Appd
A	30.04.18	Turning head removed from opposite Plots 278 & 279.	AC	AC	TRS

Client:- BARRATT HOMES / DAVID WILSON HOMES WHERE QUALITY LIVES

Site:- Land at Forty Acre Farm, Havant Road, Havant

Drawing Title:- EXCEEDANCE FLOW LAYOUT

Date: April 2018 | Scales: 1:500 at A0

Drawn: WD | Checked: AC | Approved: TRS

Drawing No. BSO/E4519/017 A

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