

**Mr Terry Seymour
Rogers Cory Partnership Ltd
The Old School
Old School Road
Hook
Hampshire
RG27 9NJ**

**Our ref: HA/2017/119278/02
Your Ref: PAC/SLTSDN/00192
Date: 21 April 2017**

Dear Mr Seymour

DETAILED ADVICE - FLOOD RISK & SUDS STRATEGY NOTE

LAND AT WESTWOOD CLOSE EMSWORTH, HAMPSHIRE

Thank you for accepting our offer to provide detailed planning advice. We have reviewed the following documents:

- *Flood Risk & SuDs Strategy Note February 2017 – Doc Ref: TRS/HAM/E4559/16562*

We are providing this advice under Agreement **PAC/SLTSDN/00192**. Please note we have taken 3 hours to review and provide our advice on these documents which is in line with what we estimated in our Programme of Works. Please note that we have only reviewed this document in terms of flood risk.

Environment Agency Advice

We have reviewed the submitted information in relation to the proposed development and have the following detailed comments:

As stated within the report the proposed site includes land designated as flood zones 1, 2 and 3, defined as having a low, medium and high probability of flooding. Flood zones 2 and 3 are generally confined to the south-eastern most corner of the plot. Paragraph 103, footnote 20 of the National Planning Policy Framework (NPPF) requires applicants for planning permission to submit an FRA when development is proposed in such locations.

We are pleased to see that the sequential approach has been proposed on this site. As set out within paragraph 101 of the NPPF, utilisation of the sequential approach within proposed sites ensures that new development is steered to areas with the lowest

probability of flooding. This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.

Application of the sequential approach in the plan-making process, in particular application of the Sequential Test, will help ensure that development can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds.

Should a planning application for this site come forward where the sequential approach has been applied, as illustrated within this Strategy Note, the Environment Agency would not have any objections on flood risk grounds. However, should plans for this site change at any time prior to submission or during the planning process to include development within either flood zone 2 and/or 3 we would expect the local planning authority to apply the Sequential Test; that is, it must consider whether the applicant has demonstrated and sufficiently justified that no alternative sites are available in a lower flood risk zone.

In Section 2 of the Flood Risk & SuDs Strategy Note reference is made to the requirement of Flood Defence Consent from the Environment Agency should any works fall within 8 metres of a designated Main River. Please note that this process has recently changed and the permit/consent is now referred to as a Flood Risk Activity Permit under the Environmental Permitting (England and Wales) Regulations 2010.

The need for an environmental permit is separate to the need for planning permission. The granting of planning permission does not necessarily lead to the granting of an environmental permit.

Further details and guidance are available on the GOV.UK website:

www.gov.uk/guidance/flood-risk-activities-environmental-permits

As stated within the document, amendments to the Development Management Procedure Order (DMPO) came into effect on 15th April 2015. As a result the Environment Agency is no longer a statutory consultee on surface water drainage, in terms of flood risk. Hampshire County Council as the Lead Local Flood Authority are now statutory consultee for 'Major development with Surface Water Drainage'.

Next Steps

Should you proceed with a planning application for this site, in line with both national and local planning policy you will need to produce an adequate FRA. We would recommend that you clearly illustrate within the FRA that the sequential approach has been undertaken on site and that no development is to be located within flood zones 2 and/or 3.

I hope the above advice is helpful. If there is any further work you anticipate needing our detailed advice on in relation to this project please let me know so it can be incorporated into this charging agreement.

Yours sincerely

Jon Maskell

Sustainable Places
Environment Agency
PlanningSSD@environment-agency.gov.uk

Disclaimer

Our opinion is based on the information available to us at the time of the enquiry. When the formal planning application is submitted, our position may change if there have been changes to environmental risk or evidence, and/or planning policy.



**LAND AT WESTWOOD CLOSE
EMSWORTH, HAMPSHIRE**

FLOOD RISK & SUDS STRATEGY NOTE

FEBRUARY 2017

Rogers Cory Partnership
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Document Control Sheet

Project name: Westwood Close, Emsworth
Project ref: HAM/E4559
Report Title Flood Risk and SuDS Strategy Note
Doc. ref: TRS/HAM/E4559/16562
Date: 8th February 2017

	Name	Position	Signature	Date
Prepared by:	Terry Seymour	Director		08.02.2017
Approved by:	Terry Seymour	Director		08.02.2017

Revision	Date	Description	Prepared	Approved

Flood Risk and SuDS Strategy Note

Contents

1. Introduction	2
2. Existing Site	3
3. Existing Flood Risk	4
4. Sustainable Drainage Systems and Surface Water Management.....	8

Flood Risk and SuDS Strategy Note

1.0 Introduction

Rogers Cory Partnership Limited have been instructed on behalf of Hampshire Homes Group to prepare a preliminary flood risk and sustainable drainage systems appraisal to support the proposals for the residential development at Westwood Close in Emsworth, Hampshire.

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 consultation carried out with the Environment Agency's (EA) has identified the development site to be located within Flood Zone 1, 2 and 3. The area proposed for the residential development within the site is to be kept outside of Flood Zones 2 and 3 and wholly within Flood Zone 1, considered to be at low risk of flooding from rivers respectively, 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."

Flood Risk and SuDS Strategy Note

2.0 Existing Site

The site is located off Westwood Close and is bounded to the west and north by residential properties, to the south by open fields and the A27 and to the east by fields and the River Ems. The River Ems is designated as a Main River by the EA.

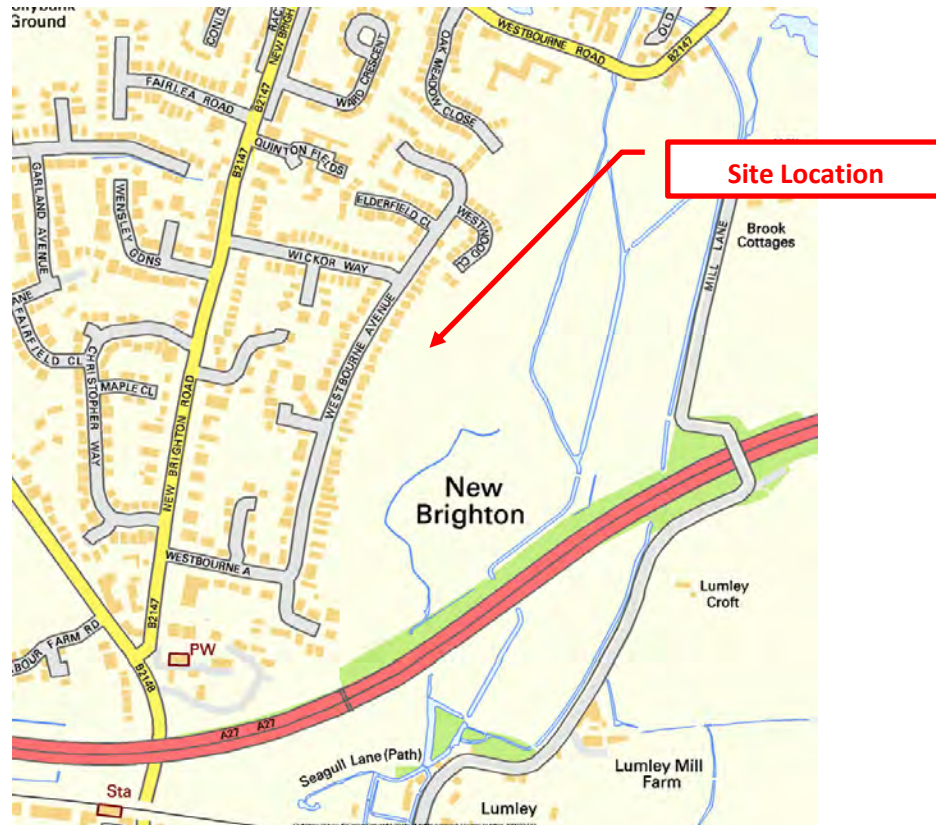


Figure 1: Site location

The existing site consists open fields with grasslands. The approximate centre of the site is at Ordnance Survey (OS) Grid Reference 475222; 106949.

Hydrology

The EA flood maps (see **figure 2** below) indicate the presence of existing watercourses in the vicinity of the site. There is an existing watercourse immediately east of the site as well as the designated Main River (River Ems). Any works within 8m of these Main Rivers will be subject to a Flood Defence Consent from the EA.

Flood Risk and SuDS Strategy Note

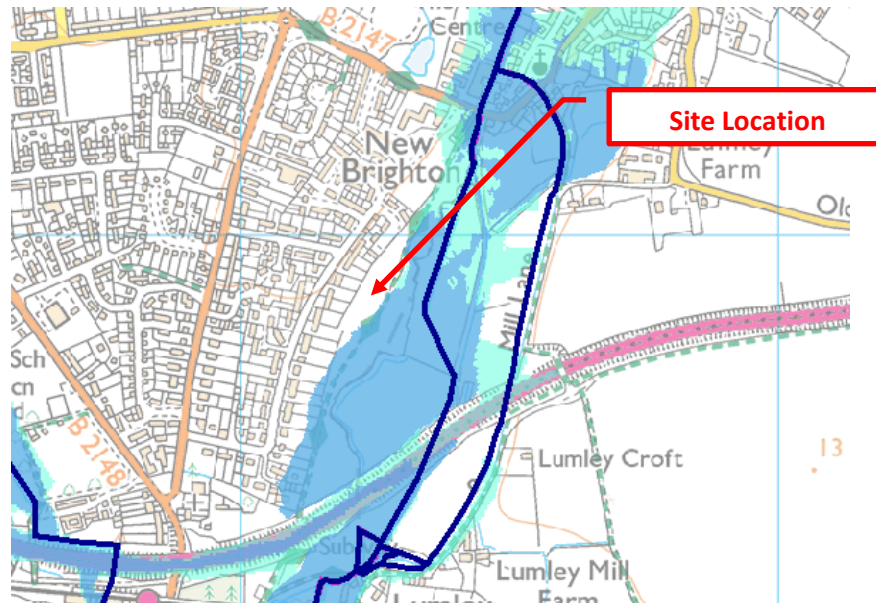


Figure 2- Extract of EA's Flood Map

Ground Conditions

According to existing British Geological Survey (BGS) maps the site is located over the London Clay Formation with a superficial Head deposit comprising of Clayey Gravel. Detailed ground investigations, including groundwater monitoring and infiltration testing to BRE365 will be carried out to support the site specific flood risk assessment and drainage strategy proposals.

3.0 Flood Risk

National policy regarding flood risk is contained within the National Planning Policy Framework and Technical guidance which was issued by the 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

Flood Risk and SuDS Strategy Note

proposed use of SuDS will need to be demonstrated on all major developments unless it can be demonstrated otherwise.

Local Planning Policies

Any future development would need to accord with the policies set out in the Havant Borough Council Core Strategy (adopted 2011)

The policy most relevant to this scheme in regards to flood risk and surface water drainage requirements from policy CS15. In this regard the policy states:

“Policy CS15 Flood and Coastal Erosion Risk

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

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

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.”

Flood Risk and SuDS Strategy Note

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.

Fluvial Flood Risk

The site lies partly within Flood Zone 1, 2 and 3 respectively. The residential portion of the development is proposed to be located wholly within Flood zone 1 (considered low risk of flooding from rivers and sea) **figure 2**. In accordance with the NPPF, Flood Zone is compatible with residential land use which is classified as "more vulnerable" development.

In order to assess the area within the site which falls wholly within Flood Zone 1, the fluvial flood model data was obtained from the EA to determine the extent the Flood Zones within the site. Using the modelled flood level data the extent of Flood Zone 2, which is the extent of area susceptible to fluvial flooding between the 1 in 100 year and 1 in 1000 year event, has been assessed in relation to the existing site levels using 1m DTM LiDAR information. By assessing the extent of the 1 in 1000 year fluvial flood event and ensuring that the proposed residential development lies outside of this zone, this ensures that the residential development proposals will be kept outside of the 1 in 100 year plus climate change fluvial flood event, to satisfy the new climate change requirements introduced by DEFRA in February 2016.

Drawing HAM/E4559/SK010 provides an overlay of the modelled fluvial flood levels in relation to the LiDAR level information. This information has been used to

Flood Risk and SuDS Strategy Note

determine the extent of the 1 in 1000 year flood event (Flood Zone 2) and thus determine area of the site which would be designated as Flood Zone 1.

As part of the development of the site specific flood risk assessment, a detailed consultation process will also be undertaken with the EA to support the development.

Surface Water Flood Risk

The Environment Agency's maps for the risk of potential surface water flooding (**figure 3**) indicates that the proposed area for the residential portion within the site is not at risk of flooding from surface water. The EA's maps for surface water flooding is based on a coarse level of modelling which does not account for the presence of existing drainage networks or features which may already accommodate surface water run-off.

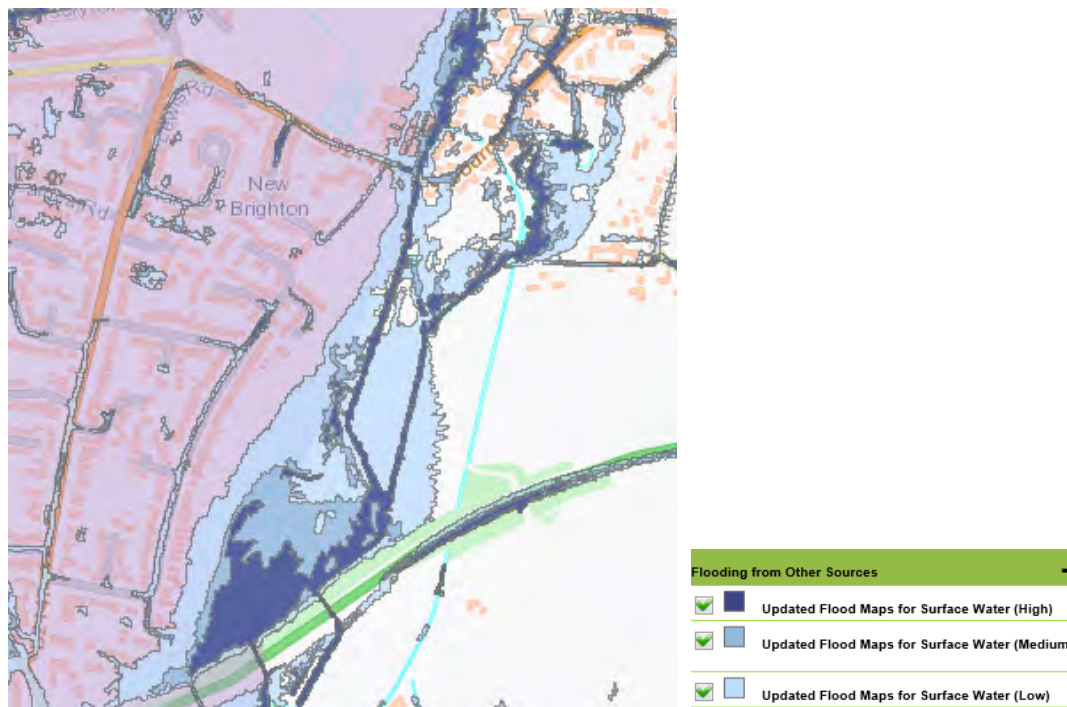


Figure 3- Extract from PUSH Maps of Surface Water Flooding Map

Groundwater Flood Risk

The PUSH maps indicate that whilst the site is located in an area with low bedrock permeability there are no recorded incidences of groundwater flooding.

4 Sustainable Drainage Systems and Surface Water Management

Hampshire County Council (HCC) are the Lead local flood Authority for Havant 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.

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 which should be considered for the development will investigate the opportunities to implement the following SuDS measures throughout the development:

Flood Risk and SuDS Strategy Note

- Swales;
- Ditches;
- SuDS Attenuation Basins;
- Cellular storage tanks

Surface Water Drainage Strategy

In view of the requirements of the NPPF, PPG, HCC the design parameters and constraints associated with redeveloping this site and the Code for sustainable homes, 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 will be 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.

Flow Control

The proposed discharge from the site is to be restricted to the Mean Annual Average Greenfield rate (Q_{bar}) which represents a betterment to the calculated 1 in 30 Year and 1 in 100 Year Greenfield run-off rates.

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

Water Quality

It is important to address issues with regards to quality when considering surface water management. The development proposals will implement a SuDS Management Train in accordance with the recommendations of the SuDS Manual (Ciria 753) and as required by the LLFA.

Flood Risk and SuDS Strategy Note

Long Term Maintenance

Consideration will be given to the long term maintenance of the proposed drainage structures and SuDS features.

Use of Environment Agency Information for Flood Risk Assessments

Important

If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

You should refer to the Environment Agency's Flood Risk Standing Advice, Planning Practice Guidance, and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

<https://www.gov.uk/flood-risk-assessment-standing-advice>

<http://planningguidance.planningportal.gov.uk/>

<http://www.planningportal.gov.uk/planning/planningpolicyandlegislation/previousenglishpolicy/ppgpps/pps25>

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

You should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but does not constitute such an assessment on its own.
2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.
3. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.
4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

The Old School Road
Hampshire
RG27 9NJ

Our ref: SSD/25878

Date: 18/11/2016

Dear Lorraine Green

Provision of Product 4 for address: Hampshire Farm, Emsworth, PO10 7QU

Thank you for your request of 13th October 2016 to use Environment Agency data, Product 4. The information is attached.

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area partially located within Flood Zone 3 shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself.

Please find attached a copy of the Flood Map for Planning (Rivers and Sea) for the area relating to your address.

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>

Supporting Information

Flood Defences

Based on our records, there are no formal raised defences in this area.

Model Information

The levels, depths and flood outlines are taken from the River Ems Flood Study, completed in 2006 by Peter Brett Associates using ISIS (1D) software.

Flood History

We do not have any records of previous flood risk events affecting this location. However, for a more comprehensive flood history I would suggest also contacting the local Hampshire County Council.

Please note our records are not comprehensive and may not include all events, you can contact your Local Authority to check if they hold any relevant information regarding your application.

You are encouraged to use and re-use this information freely and flexibly, with only a few conditions. Details of which can be found here:

<http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

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 03708 506506.

Yours faithfully

Galeb Aqel
PSO West Sussex

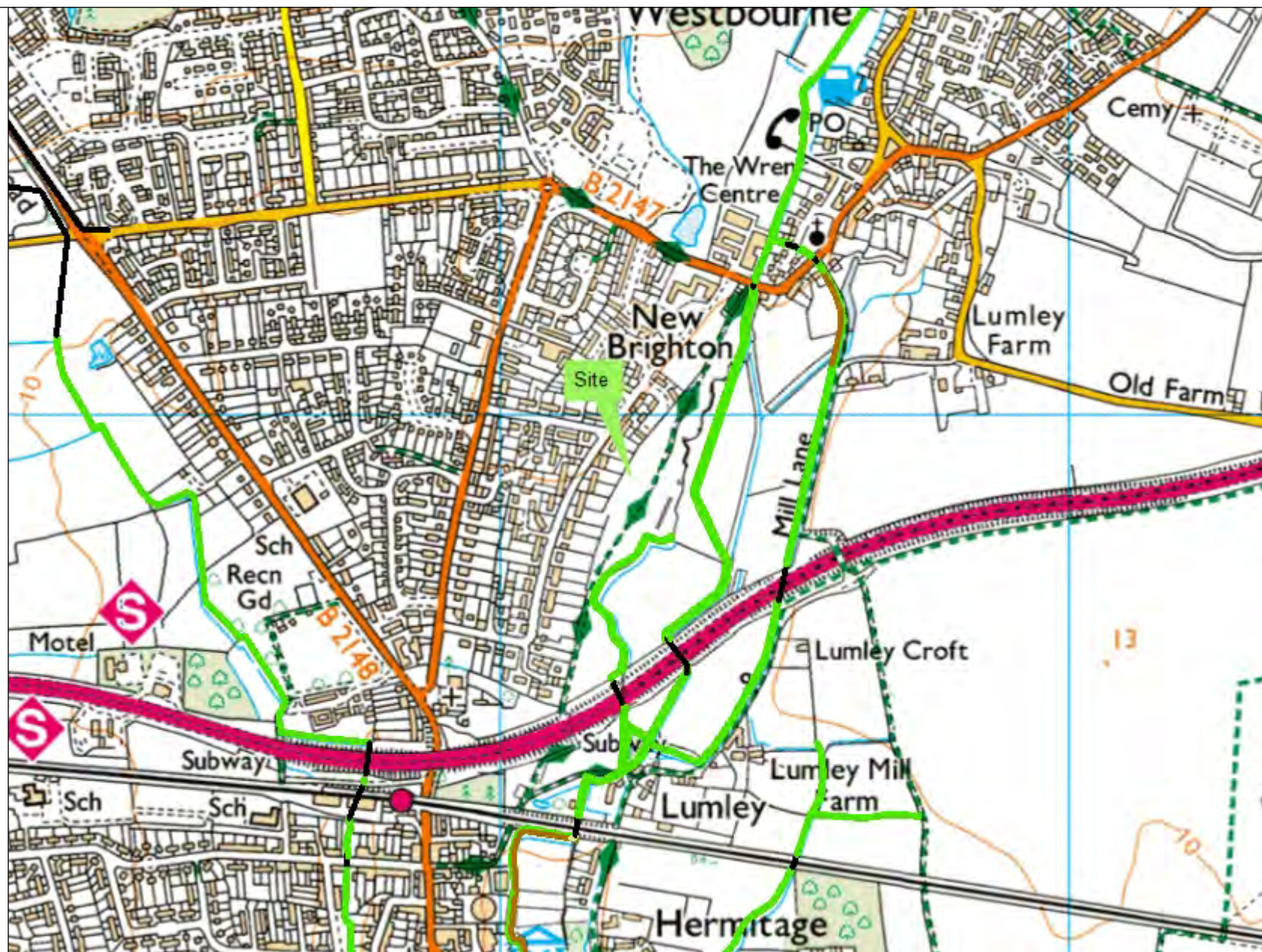
Enc. Flood Map (Rivers and Sea) / Node point locations / Flood levels/depths /
Modelled flood outlines / Flood Defence Locations

Flood defence location centred PO10 7QU. Created 17/11/16.

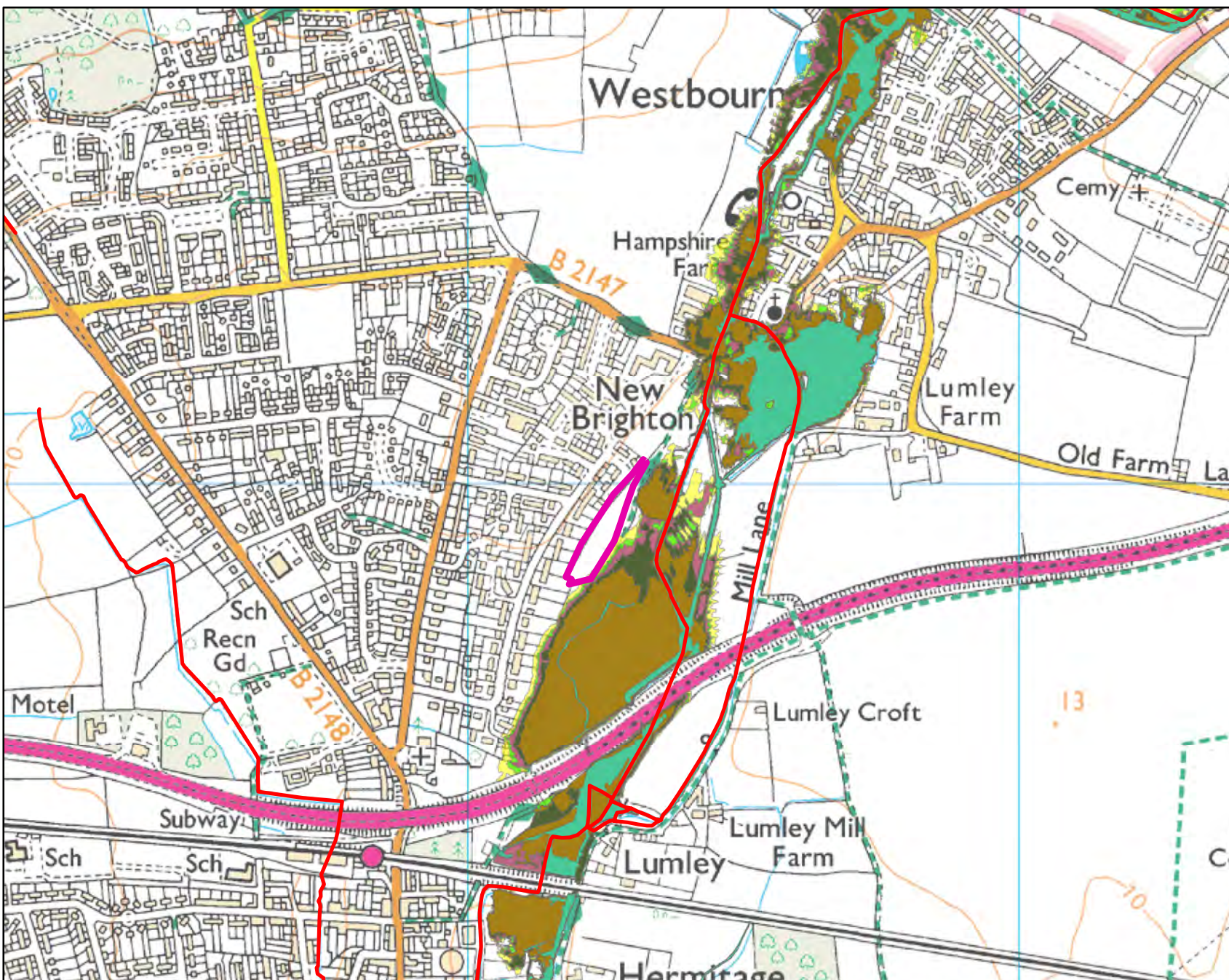
Legend

Defences

- Embankment
- Wall
- Flood Gate
- Demountable Defence
- Bridge Abutment
- High Ground
- Beach
- Barrier Beach
- Promenade
- Quay
- Cliff
- Dunes
- Culvert



Modelled flood outline centred PO10 7QU. Created 17/11/2016 (Ref: SSD/25878)

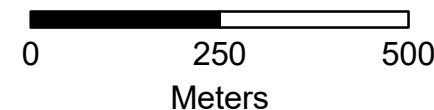


Legend

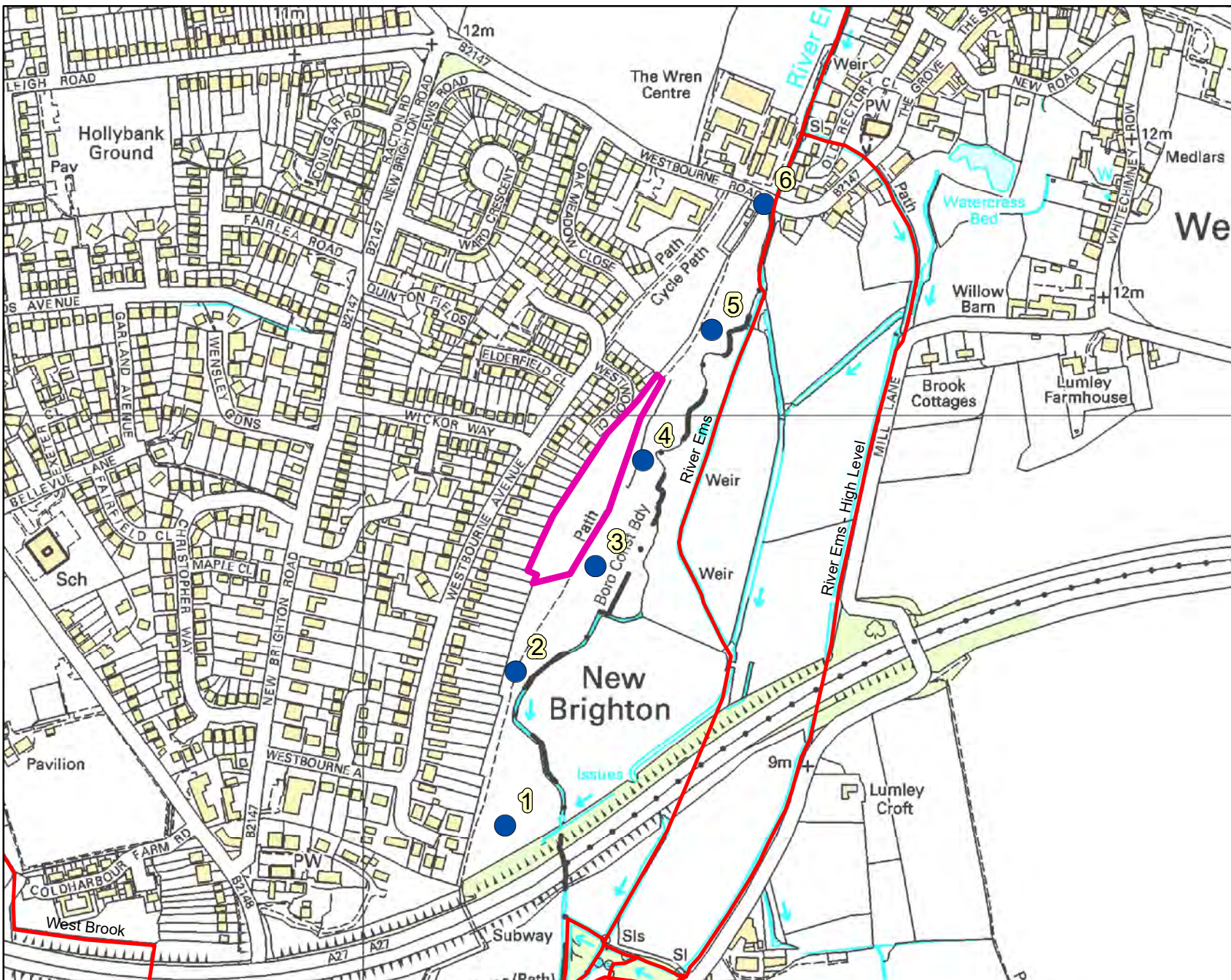
- Main River
- Boundary line
- 20% AEP (Un defended Fluvial)
- 4% AEP (Un defended Fluvial)
- 2% AEP (Un defended Fluvial)
- 1.3% AEP (Un defended Fluvial)
- 1% AEP (Un defended Fluvial)
- 1% AEP Plus Climate Change (Un defended Fluvial)

Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



Modelled Site Node Points centred PO10 7QU. Created 17/11/2016 (Ref: SSD/25878)



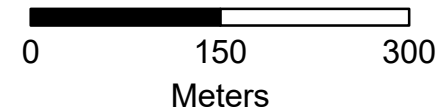
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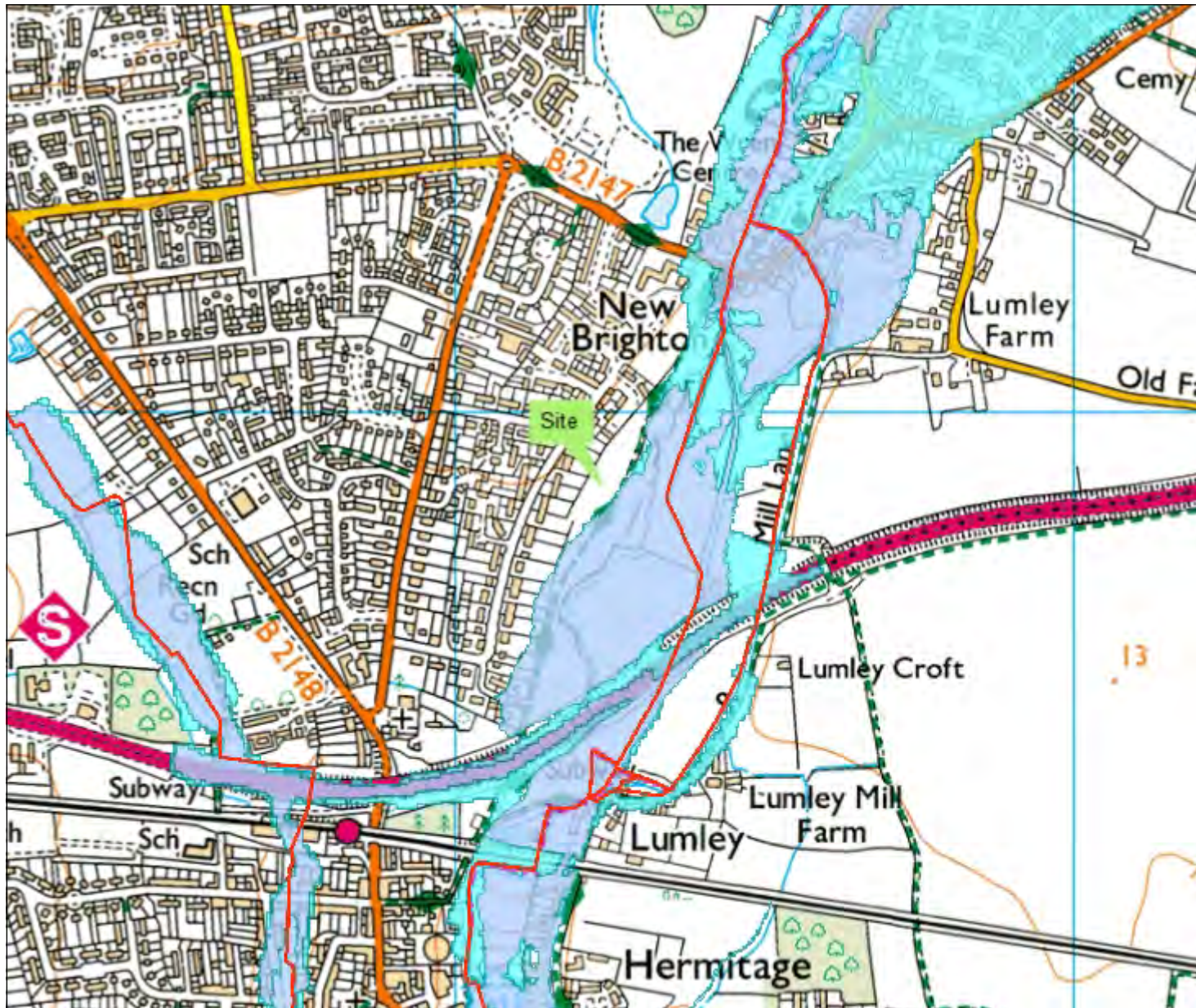
Legend

- Main River
- Boundary line
- Node

Scale: 1:6,000



Risk of Flooding (Rivers and Sea) centred PO10 7QU. Created 17/11/2016.



Scale 1:10,000



Likelihood of Flooding from Rivers and the Sea

- Sealed Main Rivers
- - - Defences
- ... Flood Storage Areas
- ▨ Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Likelihood of flooding from Rivers and the Sea (taking into account defences)

- 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 Rivers and the Sea map on our website.

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Product 4 Flood Risk Data Requested by: Terry Seymour

Site: Hampshire Farm, Emsworth, PO10 7QU

Table 1: Water Levels (mOD): Fluvial Undefended

	NGR		Modelled Flood Levels in Metres			
			Undefended Annual Exceedance Probability			
Node Reference	Eastings	Northings	20%	1%	1% Plus Climate Change	0.1%*
1	475168	106570	-	-	-	6.14
2	475201	106737	-	-	-	6.14
3	475276	106830	-	-	-	6.84
4	475304	106952	7.30	7.68	7.75	7.53
5	475379	107094	7.83	8.20	8.28	8.76
6	475436	107231	8.93	9.51	9.57	9.83

Table 2: Water Depth (m): Fluvial Undefended

	NGR		Modelled Flood Depth in Metres			
			Undefended Annual Exceedance Probability			
Node Reference	Eastings	Northings	20%	1%	1% Plus Climate Change	0.1%**
1	475168	106570	-	-	-	0.50
2	475201	106737	-	-	-	0.34
3	475276	106830	-	-	-	0.18

Table 3: Flow rate (m³/s): In channel flow (closest to node).

	NGR		Modelled Flood Flow Rate			
			Annual Exceedance Probability			
Node Reference	Eastings	Northings	20%	1%	1% Plus Climate Change	0.1%
4	-	-	2.36	6.89	8.23	-
5	-	-	2.36	6.89	8.23	-
6	-	-	2.40	-	8.43	-

All levels and flow rates are taken from River Ems Flood Study, completed in 2006 by Peter Brett Associates.

*The 0.1% levels are estimated by comparing 2009 JFLOW depths with current ground levels taken from LiDAR.

** The 0.1% depths are taken from JFLOW modelling 2009 by JBA.

Product 4 Flood Risk Data Requested by: Terry Seymour

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1	475168	106570	-	-	-	0.50
2	475201	106737	-	-	-	0.34
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** The 0.1% depths are taken from JFLOW modelling 2009 by JBA.

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

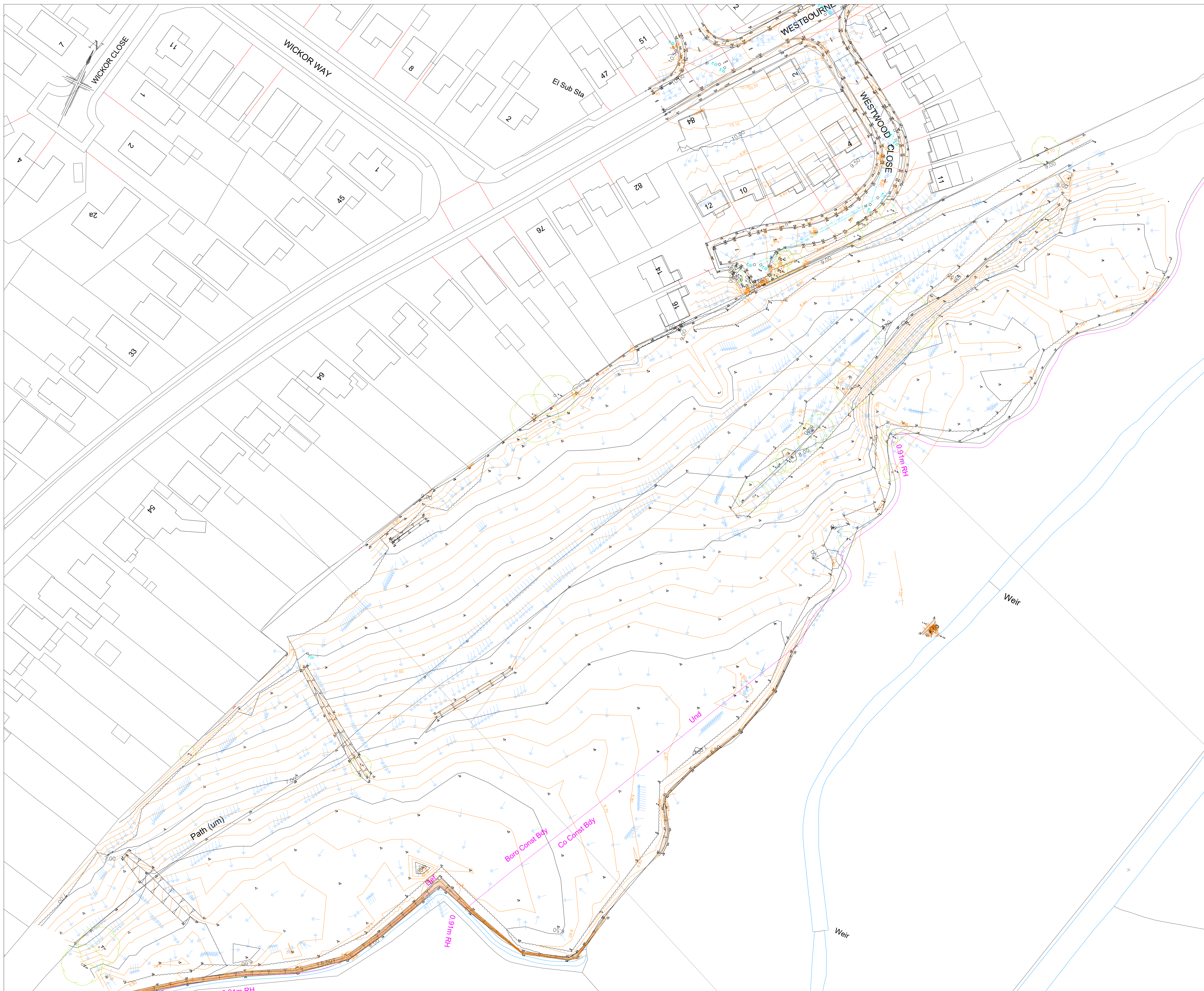
Produced on 05/01/2017

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.

Produced on 05/01/2017

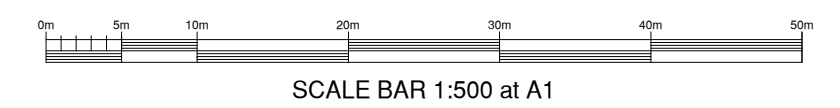
Appendix (F)

Existing Drainage Regime



NOTES

1. Existing Levels based on Topographic Survey carried out by Global Surveys in May 2017 (17026-TOPO).
2. All dimensions are in metres unless stated otherwise.
3. Background based on OS mapping.



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Rev.	Date	Details	By	Chkd	Appd
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Client:-



Site:-
Land at Westwood
Close
Emsworth

Drawing Title:-
**BASELINE
HYDROLOGY
PLAN**

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

Drawing No.

HAM/E4559/007

PRELIMINARY



Rogers Cory Partnership
Architectural and Civil Consultants
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Rogers Cory Ptn Ltd		Page 1
The Old School Old School Road Hook RG27 9NJ		
Date 19/02/2018 23:16 File	Designed by Terry Checked by	
Micro Drainage		Source Control 2017.1.2
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.450 Area (ha) 0.810 Urban 0.000 SAAR (mm) 827 Region Number Region 7 Results 1/s QBAR Rural 4.3 QBAR Urban 4.3 Q100 years 13.8 Q1 year 3.7 Q30 years 9.8 Q100 years 13.8		
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The Old School Old School Road Hook RG27 9NJ																												
Date 19/02/2018 23:19 File	Designed by Terry Checked by																											
Micro Drainage		Source Control 2017.1.2																										
<u>Greenfield Runoff Volume</u> FSR Data <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.600</td> </tr> <tr> <td>Ratio R</td> <td>0.324</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>0.810</td> </tr> <tr> <td>SAAR (mm)</td> <td>826</td> </tr> <tr> <td>CWI</td> <td>118.600</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>47.000</td> </tr> </table> Results <table> <tr> <td>Percentage Runoff (%)</td> <td>49.88</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>269.510</td> </tr> </table>			Return Period (years)	100	Storm Duration (mins)	360	Region	England and Wales	M5-60 (mm)	19.600	Ratio R	0.324	Areal Reduction Factor	1.00	Area (ha)	0.810	SAAR (mm)	826	CWI	118.600	Urban	0.000	SPR	47.000	Percentage Runoff (%)	49.88	Greenfield Runoff Volume (m ³)	269.510
Return Period (years)	100																											
Storm Duration (mins)	360																											
Region	England and Wales																											
M5-60 (mm)	19.600																											
Ratio R	0.324																											
Areal Reduction Factor	1.00																											
Area (ha)	0.810																											
SAAR (mm)	826																											
CWI	118.600																											
Urban	0.000																											
SPR	47.000																											
Percentage Runoff (%)	49.88																											
Greenfield Runoff Volume (m ³)	269.510																											
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Appendix (G)

Proposed Drainage Strategy

Appendix (H)

MicroDrainage Calculations

Rogers Cory Ptn Ltd		Page 1
The Old School Old School Road Hook RG27 9NJ		
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Micro Drainage		Network 2017.1.2

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	25.000	0.083	301.2	0.112	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.800	0.056	300.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	6.973	0.023	303.2	0.149	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	60.295	0.201	300.0	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	12.000	0.040	300.0	0.128	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	29.958	0.100	299.6	0.085	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	24.373	0.081	300.9	0.153	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	37.483	0.121	309.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	5.000	0.014	357.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	30.000	0.100	300.0	0.156	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.010	26.000	0.087	298.9	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)
S1.000	50.00	5.56	7.000	0.112	0.0	0.0	1.5	0.75	29.7	16.7
S1.001	50.00	5.87	6.620	0.190	0.0	0.0	2.6	0.90	63.8	28.3
S1.002	50.00	6.00	6.564	0.339	0.0	0.0	4.6	0.90	63.5	50.5
S1.003	50.00	7.11	6.541	0.381	0.0	0.0	5.2	0.90	63.8	56.8
S1.004	50.00	7.33	6.340	0.509	0.0	0.0	6.9	0.90	63.8«	75.8
S1.005	50.00	7.88	5.700	0.594	0.0	0.0	8.0	0.90	63.8«	88.5
S1.006	50.00	8.34	5.600	0.747	0.0	0.0	10.1	0.90	63.7«	111.3
S1.007	50.00	9.04	5.519	0.747	0.0	0.0	10.1	0.89	62.8«	111.3
S1.008	50.00	9.14	5.398	0.747	0.0	0.0	10.1	0.83	58.4«	111.3
S1.009	50.00	9.57	5.234	0.903	0.0	0.0	12.2	1.17	185.8	134.5
S1.010	50.00	9.94	5.134	0.903	0.0	0.0	12.2	1.17	186.2	134.5

Rogers Cory Ptn Ltd		Page 2
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26	Designed by Terry	
File proposed-rev1-without m...	Checked by	
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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.112	0.112	0.112
1.001	-	-	100	0.078	0.078	0.078
1.002	-	-	100	0.149	0.149	0.149
1.003	-	-	100	0.042	0.042	0.042
1.004	-	-	100	0.128	0.128	0.128
1.005	-	-	100	0.085	0.085	0.085
1.006	-	-	100	0.153	0.153	0.153
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.156	0.156	0.156
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.903	0.903	0.903

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

S1.010	S	6.700	5.047	0.000	0	0
--------	---	-------	-------	-------	---	---

Simulation Criteria for Storm

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.600	Storm Duration (mins)	30
Ratio R	0.324		

Rogers Cory Ptn Ltd		Page 3
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26	Designed by Terry	
File proposed-rev1-without m...	Checked by	
Micro Drainage		Network 2017.1.2

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	1	+0%	30/15 Summer			
S1.001	S2	15 Winter	1	+0%	30/15 Summer	100/15 Summer		
S1.002	S3	15 Winter	1	+0%	30/15 Summer	30/15 Winter		
S1.003	S4	15 Winter	1	+0%	30/15 Summer			
S1.004	S5	15 Winter	1	+0%	30/15 Summer	30/15 Summer		
S1.005	S6	15 Winter	1	+0%	1/15 Winter	100/15 Summer		
S1.006	S7	15 Winter	1	+0%	1/15 Winter	100/15 Summer		
S1.007	S8	15 Winter	1	+0%	1/15 Winter			
S1.008	S10	15 Winter	1	+0%	1/15 Winter			
S1.009	S10	15 Winter	1	+0%	100/15 Summer			
S1.010	S11	15 Winter	1	+0%	100/15 Summer			

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Rogers Cory Ptn Ltd		Page 4
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26	Designed by Terry	
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Micro Drainage		Network 2017.1.2

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

PN	US/MH Name	Water	Surcharged	Flooded	Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
S1.000	S1	7.116	-0.109	0.000	0.52	14.2	OK	
S1.001	S2	6.794	-0.126	0.000	0.41	22.0	OK	3
S1.002	S3	6.772	-0.092	0.000	0.81	37.0	OK	7
S1.003	S4	6.723	-0.118	0.000	0.65	39.5	OK	
S1.004	S5	6.572	-0.068	0.000	0.95	49.0	OK	13
S1.005	S6	6.018	0.018	0.000	0.94	54.4	SURCHARGED	4
S1.006	S7	5.937	0.037	0.000	1.11	62.8	SURCHARGED	2
S1.007	S8	5.843	0.024	0.000	1.05	61.2	SURCHARGED	
S1.008	S10	5.705	0.007	0.000	1.31	61.0	SURCHARGED	
S1.009	S10	5.440	-0.244	0.000	0.42	67.5	OK	
S1.010	S11	5.339	-0.245	0.000	0.43	67.0	OK	

Rogers Cory Ptn Ltd		Page 5
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26	Designed by Terry	
File proposed-rev1-without m...	Checked by	
Micro Drainage		Network 2017.1.2

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	30/15 Summer			
S1.001	S2	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
S1.002	S3	15 Winter	30	+0%	30/15 Summer	30/15 Winter		
S1.003	S4	15 Summer	30	+0%	30/15 Summer			
S1.004	S5	15 Winter	30	+0%	30/15 Summer	30/15 Summer		
S1.005	S6	15 Winter	30	+0%	1/15 Winter	100/15 Summer		
S1.006	S7	15 Winter	30	+0%	1/15 Winter	100/15 Summer		
S1.007	S8	15 Winter	30	+0%	1/15 Winter			
S1.008	S10	15 Winter	30	+0%	1/15 Winter			
S1.009	S10	15 Winter	30	+0%	100/15 Summer			
S1.010	S11	30 Winter	30	+0%	100/15 Summer			

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Rogers Cory Ptn Ltd		Page 6
The Old School Old School Road Hook RG27 9NJ		
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Micro Drainage		Network 2017.1.2

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

PN	US/MH Name	Water	Surcharged	Flooded			Pipe	Status	Level
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)		Exceeded
S1.000	S1	7.529	0.304	0.000	1.07		29.5	SURCHARGED	
S1.001	S2	7.414	0.494	0.000	0.86		46.6	FLOOD RISK	3
S1.002	S3	7.340	0.476	0.002	1.52		69.3	FLOOD	7
S1.003	S4	7.298	0.457	0.000	1.18		71.4	FLOOD RISK	
S1.004	S5	7.006	0.366	5.786	1.83		94.3	FLOOD	13
S1.005	S6	6.968	0.968	0.000	1.70		98.5	FLOOD RISK	4
S1.006	S7	6.795	0.895	0.000	2.12		120.3	FLOOD RISK	2
S1.007	S8	6.405	0.586	0.000	2.02		117.3	SURCHARGED	
S1.008	S10	5.895	0.197	0.000	2.54		118.0	SURCHARGED	
S1.009	S10	5.582	-0.102	0.000	0.92		147.6	OK	
S1.010	S11	5.478	-0.106	0.000	0.94		146.9	OK	

Rogers Cory Ptn Ltd		Page 7
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26 File proposed-rev1-without m...		
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) SurchARGE	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	100	+40%	30/15 Summer			
S1.001	S2	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
S1.002	S3	30 Winter	100	+40%	30/15 Summer	30/15 Winter		
S1.003	S4	30 Winter	100	+40%	30/15 Summer			
S1.004	S5	30 Winter	100	+40%	30/15 Summer	30/15 Summer		
S1.005	S6	15 Winter	100	+40%	1/15 Winter	100/15 Summer		
S1.006	S7	15 Winter	100	+40%	1/15 Winter	100/15 Summer		
S1.007	S8	15 Winter	100	+40%	1/15 Winter			
S1.008	S10	15 Winter	100	+40%	1/15 Winter			
S1.009	S10	15 Winter	100	+40%	100/15 Summer			
S1.010	S11	15 Winter	100	+40%	100/15 Summer			

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Rogers Cory Ptn Ltd		Page 8
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 20:26	Designed by Terry	
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Micro Drainage		Network 2017.1.2

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

PN	US/MH Name	Water	Surcharged	Flooded	Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)		
S1.000	S1	7.919	0.694	0.000	2.18	59.9	SURCHARGED	
S1.001	S2	7.502	0.582	1.755	1.61	87.5	FLOOD	3
S1.002	S3	7.376	0.512	36.311	1.38	63.2	FLOOD	7
S1.003	S4	7.331	0.490	0.000	1.22	73.9	FLOOD RISK	
S1.004	S5	7.048	0.408	47.960	1.88	97.0	FLOOD	13
S1.005	S6	7.006	1.006	5.627	1.74	100.8	FLOOD	4
S1.006	S7	7.000	1.100	0.287	2.33	132.3	FLOOD	2
S1.007	S8	6.607	0.788	0.000	2.15	124.9	FLOOD RISK	
S1.008	S10	6.068	0.370	0.000	2.68	124.1	SURCHARGED	
S1.009	S10	5.815	0.131	0.000	1.31	209.1	SURCHARGED	
S1.010	S11	5.628	0.044	0.000	1.30	203.8	SURCHARGED	



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Network 2017.1.2

PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
S1.000	87.851	S1.004	399.250	S1.008	585.933
S1.001	149.033	S1.005	465.922	S1.009	708.297
S1.002	265.905	S1.006	585.933	S1.010	708.297
S1.003	298.849	S1.007	585.933		

Rogers Cory Ptn Ltd		Page 1
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX		
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Micro Drainage		Network 2017.1.2

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.600	Add Flow / Climate Change (%)	10
Ratio R	0.324	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

« - Indicates pipe capacity < flow

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	25.000	0.083	301.2	0.112	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	16.800	0.056	300.0	0.078	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	6.973	0.023	303.2	0.149	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.003	60.295	0.201	300.0	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	12.000	0.040	300.0	0.128	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.005	29.958	0.100	299.6	0.085	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	24.373	0.081	300.9	0.153	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	37.483	0.121	309.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.008	5.000	0.014	357.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.009	30.000	0.100	300.0	0.156	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.010	26.000	0.087	298.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL Σ (m)	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	5.56	7.000	0.112	0.0	0.0	1.5	0.75	29.7	16.7
S1.001	50.00	5.87	6.620	0.190	0.0	0.0	2.6	0.90	63.8	28.3
S1.002	50.00	6.00	6.564	0.339	0.0	0.0	4.6	0.90	63.5	50.5
S1.003	50.00	7.11	6.541	0.381	0.0	0.0	5.2	0.90	63.8	56.8
S1.004	50.00	7.33	6.340	0.509	0.0	0.0	6.9	0.90	63.8«	75.8
S1.005	50.00	7.88	5.700	0.594	0.0	0.0	8.0	0.90	63.8«	88.5
S1.006	50.00	8.34	5.600	0.747	0.0	0.0	10.1	0.90	63.7«	111.3
S1.007	50.00	9.04	5.519	0.747	0.0	0.0	10.1	0.89	62.8«	111.3
S1.008	50.00	9.14	5.398	0.747	0.0	0.0	10.1	0.83	58.4«	111.3
S1.009	50.00	9.57	5.234	0.903	0.0	0.0	12.2	1.17	185.8	134.5
S1.010	50.00	9.94	5.134	0.903	0.0	0.0	12.2	1.17	186.2	134.5

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Rogers Cory Ptn Ltd		Page 2
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage	Network 2017.1.2	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.112	0.112	0.112
1.001	-	-	100	0.078	0.078	0.078
1.002	-	-	100	0.149	0.149	0.149
1.003	-	-	100	0.042	0.042	0.042
1.004	-	-	100	0.128	0.128	0.128
1.005	-	-	100	0.085	0.085	0.085
1.006	-	-	100	0.153	0.153	0.153
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.156	0.156	0.156
1.010	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.903	0.903	0.903

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.010	S	6.700	5.047	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.600	Storm Duration (mins)	30
Ratio R	0.324		

Rogers Cory Ptn Ltd		Page 3
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage	Network 2017.1.2	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S11, DS/PN: S1.010, Volume (m³): 6.7

Unit Reference	MD-SHE-0091-4300-1500-4300
Design Head (m)	1.500
Design Flow (l/s)	4.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	91
Invert Level (m)	5.134
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	4.3
Flush-Flo™	0.398	4.0
Kick-Flo®	0.810	3.2
Mean Flow over Head Range	-	3.6

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	2.8	1.200	3.9	3.000	5.9	7.000	8.9
0.200	3.7	1.400	4.2	3.500	6.4	7.500	9.1
0.300	4.0	1.600	4.4	4.000	6.8	8.000	9.4
0.400	4.0	1.800	4.7	4.500	7.2	8.500	9.7
0.500	4.0	2.000	4.9	5.000	7.5	9.000	10.0
0.600	3.9	2.200	5.1	5.500	7.9	9.500	10.2
0.800	3.3	2.400	5.3	6.000	8.2		
1.000	3.6	2.600	5.5	6.500	8.5		

Rogers Cory Ptn Ltd		Page 4
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage Network 2017.1.2		

Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	35.0
Max Percolation (l/s)	58.3	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	7.000	Cap Volume Depth (m)	0.450

Porous Car Park Manhole: S3, DS/PN: S1.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	6.0
Membrane Percolation (mm/hr)	1000	Length (m)	81.6
Max Percolation (l/s)	136.0	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	6.564	Cap Volume Depth (m)	0.450

Cellular Storage Manhole: S6, DS/PN: S1.005

Invert Level (m)	5.700	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	280.0	0.0	1.000	280.0	0.0
0.500	280.0	0.0	1.001	0.0	0.0

Cellular Storage Manhole: S7, DS/PN: S1.006

Invert Level (m)	5.600	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	182.0	0.0	1.001	0.0	0.0
1.000	182.0	0.0			

Cellular Storage Manhole: S8, DS/PN: S1.007

Invert Level (m)	5.519	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	200.0	0.0	1.001	0.0	0.0
1.000	200.0	0.0			

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Rogers Cory Ptn Ltd		Page 5
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage Network 2017.1.2		

Complex Manhole: S10, DS/PN: S1.009

Cellular Storage

Invert Level (m) 5.234 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	70.0	0.0	1.001	0.0	0.0
1.000	70.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 6.0
Membrane Percolation (mm/hr) 1000 Length (m) 11.0
Max Percolation (l/s) 18.3 Slope (1:X) 500.0
Safety Factor 2.0 Depression Storage (mm) 5
Porosity 0.30 Evaporation (mm/day) 3
Invert Level (m) 6.000 Cap Volume Depth (m) 0.450

Porous Car Park Manhole: S11, DS/PN: S1.010

Infiltration Coefficient Base (m/hr) 0.00000 Width (m) 6.0
Membrane Percolation (mm/hr) 1000 Length (m) 11.0
Max Percolation (l/s) 18.3 Slope (1:X) 500.0
Safety Factor 2.0 Depression Storage (mm) 5
Porosity 0.30 Evaporation (mm/day) 3
Invert Level (m) 6.000 Cap Volume Depth (m) 0.450

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Rogers Cory Ptn Ltd		Page 6
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX		
Designed by Terry Checked by		
Micro Drainage		Network 2017.1.2

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	1	+0%	100/15 Summer				7.080
S1.001	S2	30 Winter	1	+0%	100/15 Summer				6.729
S1.002	S3	30 Winter	1	+0%	100/15 Summer				6.693
S1.003	S4	30 Winter	1	+0%	100/15 Summer				6.658
S1.004	S5	30 Winter	1	+0%	30/15 Summer				6.494
S1.005	S6	120 Winter	1	+0%	30/360 Winter				5.814
S1.006	S7	600 Winter	1	+0%	30/120 Winter				5.735
S1.007	S8	600 Winter	1	+0%	30/60 Winter				5.732
S1.008	S10	600 Winter	1	+0%	1/240 Winter				5.735
S1.009	S10	600 Winter	1	+0%	1/180 Winter				5.732
S1.010	S11	600 Winter	1	+0%	1/60 Winter				5.810

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Rogers Cory Ptn Ltd		Page 7
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage	Network 2017.1.2	

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
S1.000	S1	-0.145	0.000	0.27		7.5		OK	
S1.001	S2	-0.191	0.000	0.25		13.7		OK	
S1.002	S3	-0.171	0.000	0.38		17.6		OK	
S1.003	S4	-0.183	0.000	0.32		19.4		OK	
S1.004	S5	-0.146	0.000	0.52		26.7		OK	
S1.005	S6	-0.186	0.000	0.31		18.0		OK	
S1.006	S7	-0.165	0.000	0.20		11.6		OK	
S1.007	S8	-0.087	0.000	0.17		9.8		OK	
S1.008	S10	0.037	0.000	0.19		9.0	SURCHARGED		
S1.009	S10	0.048	0.000	0.06		9.5	SURCHARGED		
S1.010	S11	0.226	0.000	0.03		4.0	SURCHARGED		

Rogers Cory Ptn Ltd		Page 8
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX		
Designed by Terry Checked by		
Micro Drainage		Network 2017.1.2

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Storage Structures	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	100/15 Summer				7.145
S1.001	S2	30 Winter	30	+0%	100/15 Summer				6.830
S1.002	S3	30 Winter	30	+0%	100/15 Summer				6.797
S1.003	S4	30 Winter	30	+0%	100/15 Summer				6.774
S1.004	S5	15 Winter	30	+0%	30/15 Summer				6.667
S1.005	S6	720 Winter	30	+0%	30/360 Winter				6.050
S1.006	S7	720 Winter	30	+0%	30/120 Winter				6.047
S1.007	S8	720 Winter	30	+0%	30/60 Winter				6.044
S1.008	S10	720 Winter	30	+0%	1/240 Winter				6.040
S1.009	S10	720 Winter	30	+0%	1/180 Winter				6.039
S1.010	S11	720 Winter	30	+0%	1/60 Winter				6.038

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Rogers Cory Ptn Ltd		Page 9
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage	Network 2017.1.2	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
S1.000	S1	-0.080	0.000	0.74		20.3	OK	
S1.001	S2	-0.090	0.000	0.65		35.4	OK	
S1.002	S3	-0.067	0.000	0.96		43.7	OK	
S1.003	S4	-0.067	0.000	0.79		47.7	OK	
S1.004	S5	0.027	0.000	1.31		67.6	SURCHARGED	
S1.005	S6	0.050	0.000	0.26		14.8	SURCHARGED	
S1.006	S7	0.147	0.000	0.25		14.1	SURCHARGED	
S1.007	S8	0.225	0.000	0.16		9.4	SURCHARGED	
S1.008	S10	0.342	0.000	0.18		8.5	SURCHARGED	
S1.009	S10	0.355	0.000	0.07		11.2	SURCHARGED	
S1.010	S11	0.454	0.000	0.03		4.0	SURCHARGED	

Rogers Cory Ptn Ltd		Page 10
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX		
Designed by Terry Checked by		
Micro Drainage		Network 2017.1.2

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	7
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.324
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.600	Cv (Winter)	0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	100	+40%	100/15 Summer				7.252
S1.001	S2	30 Winter	100	+40%	100/15 Summer				7.079
S1.002	S3	30 Winter	100	+40%	100/15 Summer				7.006
S1.003	S4	30 Winter	100	+40%	100/15 Summer				6.965
S1.004	S5	15 Winter	100	+40%	30/15 Summer				6.762
S1.005	S6	960 Winter	100	+40%	30/360 Winter				6.570
S1.006	S7	960 Winter	100	+40%	30/120 Winter				6.569
S1.007	S8	960 Winter	100	+40%	30/60 Winter				6.581
S1.008	S10	960 Winter	100	+40%	1/240 Winter				6.591
S1.009	S10	960 Winter	100	+40%	1/180 Winter				6.592
S1.010	S11	960 Winter	100	+40%	1/60 Winter				6.590

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Rogers Cory Ptn Ltd		Page 11
The Old School Old School Road Hook RG27 9NJ		
Date 28/06/2018 19:59 File proposed-rev1.MDX	Designed by Terry Checked by	
Micro Drainage	Network 2017.1.2	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	(l/s)		
S1.000	S1	0.027	0.000	1.20		32.9	SURCHARGED	
S1.001	S2	0.159	0.000	1.12		60.8	SURCHARGED	
S1.002	S3	0.142	0.000	1.33		60.8	SURCHARGED	
S1.003	S4	0.124	0.000	1.10		66.8	SURCHARGED	
S1.004	S5	0.122	0.000	1.98		102.3	FLOOD RISK	
S1.005	S6	0.570	0.000	0.30		17.3	SURCHARGED	
S1.006	S7	0.669	0.000	0.26		14.5	SURCHARGED	
S1.007	S8	0.762	0.000	0.19		11.0	FLOOD RISK	
S1.008	S10	0.893	0.000	0.21		10.0	FLOOD RISK	
S1.009	S10	0.908	0.000	0.07		10.5	FLOOD RISK	
S1.010	S11	1.006	0.000	0.03		4.2	FLOOD RISK	



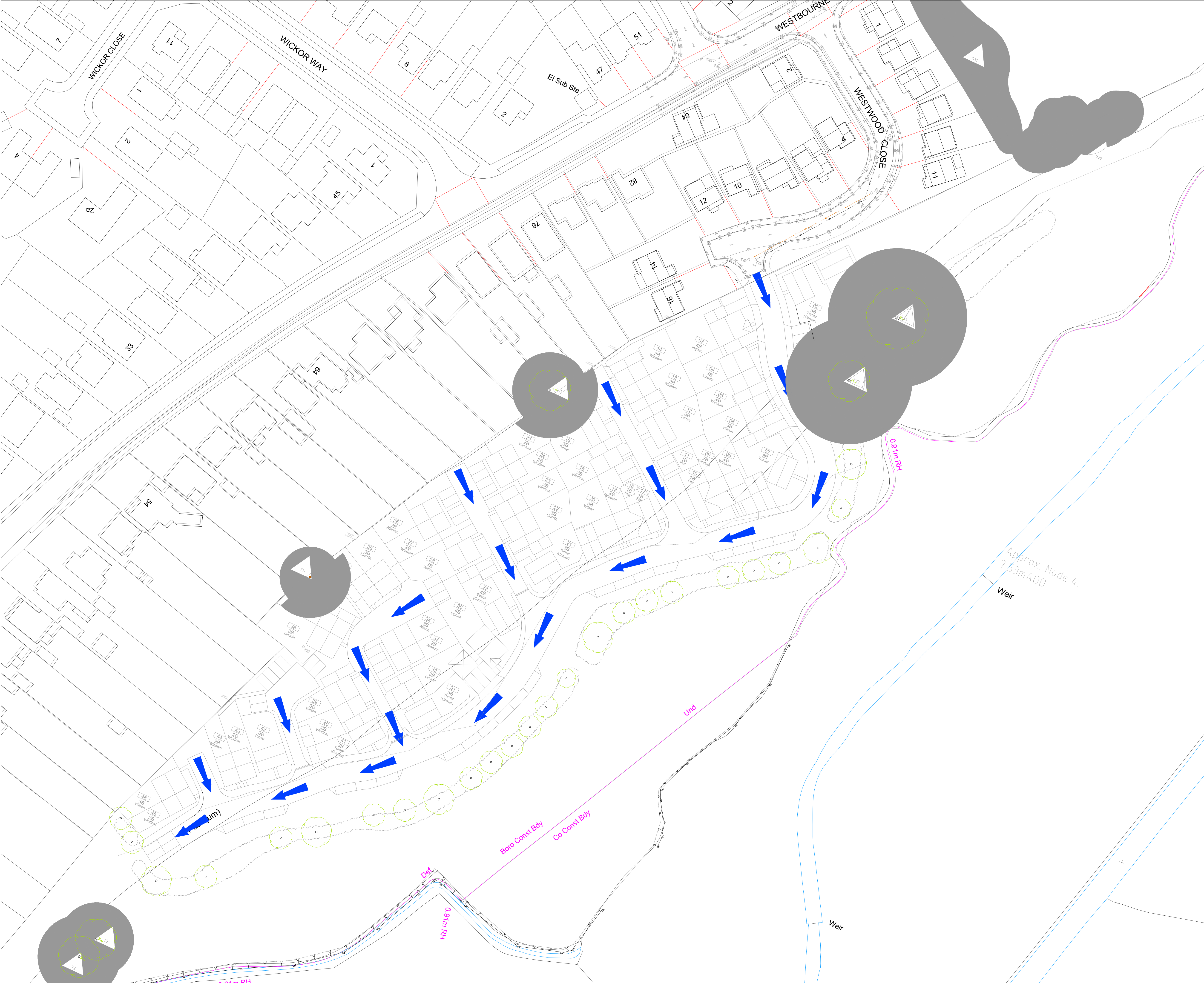
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PN	Discharge Volume (m³)	PN	Discharge Volume (m³)	PN	Discharge Volume (m³)
S1.000	86.801	S1.004	395.753	S1.008	123.594
S1.001	147.983	S1.005	293.404	S1.009	168.125
S1.002	262.408	S1.006	282.862	S1.010	155.742
S1.003	295.352	S1.007	127.226		

Appendix (I)

Exceedance Flow Paths

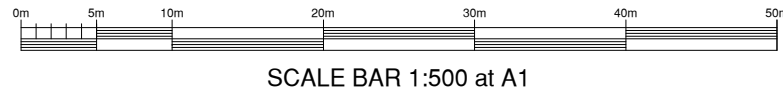


NOTES

- Existing Levels based on Topographic Survey carried out by Global Surveys in May 2017 (17026-TOPO).
- All dimensions are in metres unless stated otherwise.
- Background based on OS mapping.

KEY

Overland Flow Route



SCALE BAR 1:500 at A1

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Rev.	Date	Details	By	Chkd	Appd
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Client:-



Site:-
Land at Westwood
Close
Emsworth

Drawing Title:-
**EXCEEDANCE
FLOW LAYOUT**

Date:	June 2018	Scales:	1:500 at A1
Drawn:	WD	Checked:	TS
Approved:	TS		

Drawing No. HAM/E4559/004

PRELIMINARY



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Flood Risk Assessment