Flood estimation report

Introduction

This report template is based on a supporting document to the Environment Agency's flood estimation guidelines (Version 5, 2015). It provides a record of the hydrological context, the method statement, the calculations, and decisions made during flood estimation and the results.

Contents

Revision history

Revision ref / date issued	Amendments	Issued to
Version 1.0 (17/02/2017)	N/A	A Picton
Version 2.0	Internal draft	
Version 3.0 (08/03/2017)	Amended to respond to WSCC comments	A Picton

Approval

	Name and qualifications	Date
Method statement prepared by:	A Barber BSc	17/02/2017
Method statement reviewed by:	J Southon BSc MSc FRGS MCIWEM C.WEM CSci CEnv	17/02/2017
Calculations prepared by:	A Barber BSc	17/02/2017
Calculations reviewed by:	J Southon BSc MSc FRGS MCIWEM C.WEM CSci CEnv	17/02/2017

Abbreviations

AM.................................. Annual Maximum

AREA .... Catchment area (km^2)

BFI .... Base Flow Index

BFIHOST .... Base Flow Index derived using the HOST soil classification

CFMP.............................. Catchment Flood Management Plan

CPRE.............................. Council for the Protection of Rural England

FARL............................... FEH index of flood attenuation due to reservoirs and lakes

FEH................................. Flood Estimation Handbook

FSR................................. Flood Studies Report

HOST .... Hydrology of Soil Types

NRFA .... National River Flow Archive

POT................................. Peaks Over a Threshold

QMED .... Median Annual Flood (with return period 2 years)

ReFH .... Revitalised Flood Hydrograph method

SAAR .... Standard Average Annual Rainfall (mm)

SPR................................. Standard percentage runoff

SPRHOST .... Standard percentage runoff derived using the HOST soil classification

Tp(0) .... Time to peak of the instantaneous unit hydrograph

URBAN .... Flood Studies Report index of fractional urban extent

URBEXT1990 .... FEH index of fractional urban extent

URBEXT2000 .... Revised index of urban extent, measured differently from URBEXT1990

WINFAP-FEH .... Windows Frequency Analysis Package – used for FEH statistical method

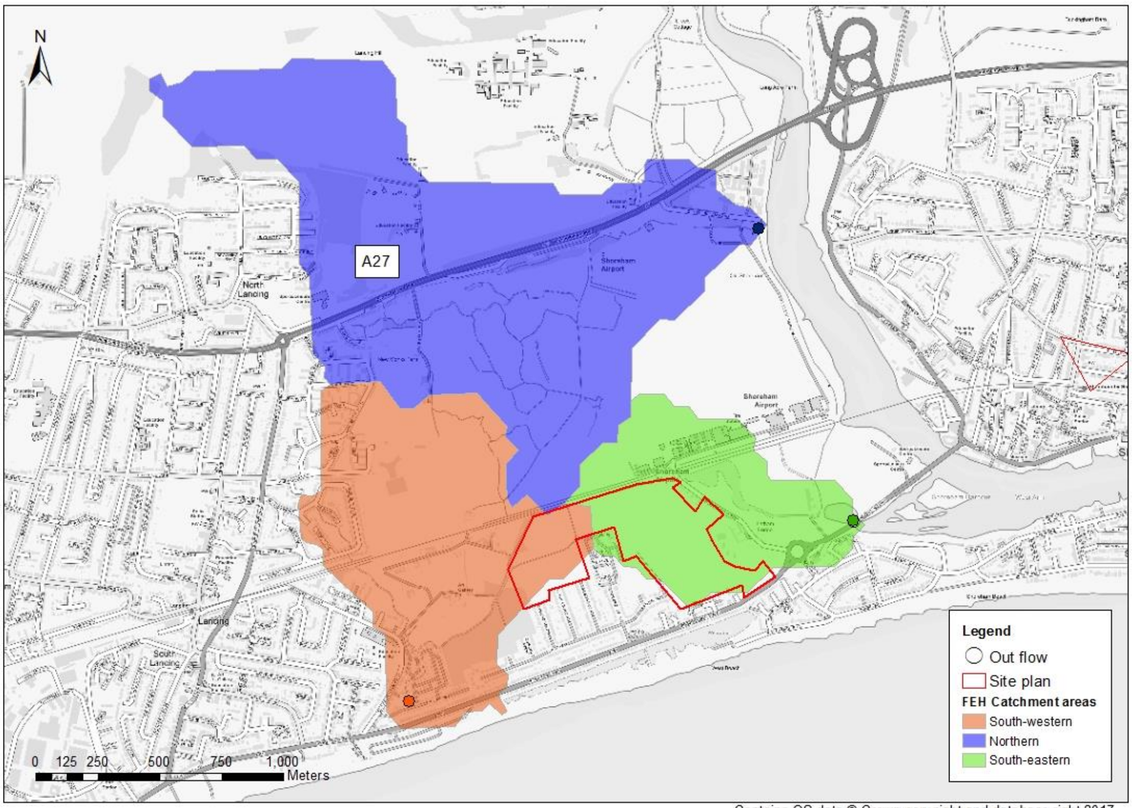
1 Method statement

1.1 Requirements for flood estimates

Item	Comments
Overview • Purpose of study • Peak flows or hydrographs? • Range of return periods and locations	The aim of this project is to better understand the flood risk associated with the Lancing Brooks drainage system, between Shoreham and Lancing, West Sussex. The purpose of the hydrological assessment is to derive inflows for the detailed hydraulic model. Full hydrographs will be derived for the following annual exceedance probability (AEP) events: 5%, 1%, and 0.1%. Additional model runs are needed for the 1% AEP event, with flows increased to allow for the possible effects of climate change. The climate change scenarios follow the Environment Agency's guidance: Flood risk assessments: climate change allowances[1] initially released in February 2016. In line with Table 2 of the updated climate change guidance, 20% and 40% uplift to account for the "Central" and "Upper End" respectively was applied to represent the anticipated changes in extreme rainfall intensity in small catchments for the 2080s epoch (2070 to 2115).

[1] Environment Agency (2016). Flood risk assessments: climate change allowances. https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

1.2 The catchment

<table>
<tr><th>Item</th><th>Comments</th></tr>
<tr><td colspan="2">Map (Include river network, catchment boundary and gauging stations)</td></tr>
<tr><td colspan="2">


Contains OS data © Crown copyright and database right 2017
</td></tr>
<tr><td>Description
Include topography, climate, geology, soils, land use and any unusual features that may affect the flood hydrology.</td><td>The Lancing Brooks are a series of ditches that drain the Lancing area, between Lancing and Shoreham, West Sussex. The ditches flow through open scrubland, and is culverted under Brighton/Shoreham Airport and the West Coastway Railway Line. From here, the drains flow south east towards the tidal sluice outflow with the River Adur.
The Lancing Brooks are a series of drainage ditches on flat, low lying land near the coast. The site is underlain by superficial alluvium and tidal deposits, sitting above bedrock of clay and chalk. The clay is locally variable in thickness and extent in the Lancing Brooks catchment. The underlying Chalk deposit outcrops at the surface towards the north of the site. Areas of land to the north of the railway line are overlain with several meters of made ground, below the new Golf Course and Brighton and Hove football training ground.
The Lancing Brooks catchment is permeable, with a BFIHOST of 0.68 (>0.65 threshold for defining a permeable catchment).
Regional groundwater flow occurs from the North in the Chalk downs, flowing south downhill towards the coast. Within the Lancing Brooks, groundwater emergence is variable, depending on the presence of the overlying clay, acting as an aquitard, preventing emergence of groundwater. The superficial alluvium deposits within the Lancing Brook catchment is also fairly permeable, containing local scale aquifers, sometimes perched above clay, restricting infiltration to the deeper chalk aquifer. Groundwater flooding is known to occur, especially in the winter, where the regional groundwater flow in the chalk aquifer is greater, and the water table is higher. In areas where the clay aquitard is breached, the groundwater has potential to rise to the surface in the form of an artesian well.
The Lancing Brooks catchment is moderately urbanised. Surface water sewer outfalls are located around the edges of development in Shoreham and Lancing. The existing developments currently have flooding issues related to emergence of groundwater, and surface water flooding.</td></tr>
</table>

	There are three identified surface water outfall locations within the Lancing Brooks system, shown in the figure above. The outfalls broadly correspond with the FEH catchment areas. However, there are some drains which cut across topographic catchment boundaries. The outfall locations are tidal on their downstream end which can result in tidal locking, which prevent the Lacing Brook drainage network from fully discharging into the Adur Estuary, and this would allow water levels to increase in the Lancing Brook drainage network. The catchment is poorly defined due to the low relief and the artificial nature of the drainage network, and is ungauged.

1.3 Source of flood peak data

Source Record any changes made	There is no available flood peak data within the Lancing Brook catchment, and no representative donor was identified.

1.4 Other data available and how it has been obtained

Type of data	Data relevant to this study?	Data available ?	Source of data	Details
Check flow gaugings (if planned to review ratings)	N/A		None Available	Ungauged
Historic flood data Include chronology and interpretation of flood history in Annex or separate report.	Yes	Limited	Lancing SWMP, Internet	Past 2012/13 and 2013/14 flooding events in Lancing housing estates, caused by surface water flooding and maintenance issues with surface water sewers. Ground water emergence and effect on soakaway performance.
Flow or river level data for events	N/A		None Available	Ungauged
Rainfall data for events		Yes	Available but not used	TBR data could have been licensed from the Met office or the EA however it was not felt that it would add significant rigor to the flow estimation over and above the use of FEH-DDF values
Potential evaporation data		Yes	Available but not used	PE data could have been licensed from the EA however it was not felt that it would add significant rigor to the flow estimation over and above sensitivity testing of runoff coefficients.
Results from previous studies		Yes	SWMP	A 1D model was produced for the SWMP. The inflows for this study were not supported by recognised flow estimation methods
Other data or information (e.g. groundwater, tides, channel widths, low flow statistics)		Yes		Tide data available but not used. Tide-locked scenarios ran. Soil Moisture Deficit data not acquired for this assessment.

1.5 Hydrological understanding of catchment

Outline the conceptual model, addressing questions such as: • Where are the main sites of interest? • What is likely to cause flooding at those locations? (peak flows, flood volumes, combinations of peaks, groundwater, snowmelt, tides…) • Might those locations flood from runoff generated on part of the catchment only, e.g. downstream of a reservoir? • Is there a need to consider temporary debris dams that could collapse?	The main area of interest is shown in red on the figure above. It is located to the south of the railway line that crosses the brook system and spans across two of the three FEH catchment areas. The likely cause of flooding in this area is excess surface water which is unable to drain away due to tide locking issues and/or as a result of elevated groundwater levels. This results in the drainage ditches exceeding the channel capacity.
Any unusual catchment features to take into account?	Poorly defined topographical catchment due to the dense network of drainage ditches. Tidal Locking. Low lying topography. Some drainage ditches may cut across topographical catchment boundaries. Bidirectional flow is possible in these channels. No pumps are present.

1.6 Initial choice of approach

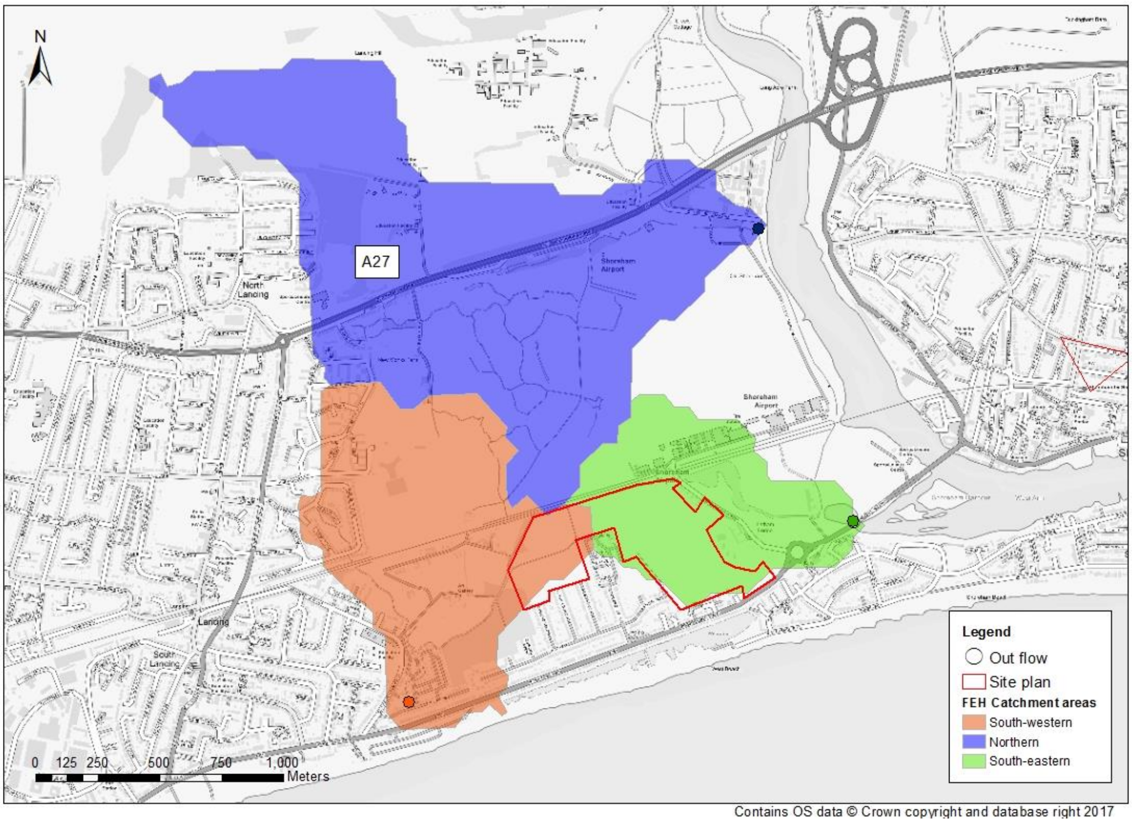
Is FEH appropriate? (it may not be for extremely heavily urbanised or complex catchments) If not, describe other methods to be used.	No - FEH Statistical methods and ReFH methods are not appropriate due to the low topographic gradient which would make it difficult to select inflow points that properly represent the contribution of flow within the catchment.
Initial choice of method(s) and reasons How will hydrograph shapes be derived if needed? Will the catchment be split into sub-catchments? If so, how?	Initially it was identified that using Continuous Simulation would be the most appropriate hydrological method for this complex catchment. However, it was found there was insufficient hydrometric data to calibrate the Probability Distributed Model (PDM). Therefore, it was proposed that Direct Rainfall would be applied. Direct Rainfall has the significant advantage of avoiding applying discrete inflows to the model at specified locations (as is usual in hydraulic modelling) which may result in unreliable results because of gentle topography of the coastal plains. Direct rainfall also has the benefit of providing outputs compatible with the requirements for a combined source (integrated model) model In an integrated model, rainfall is routed overland, through the pipe network and into the river systems. With exception of groundwater, this is a good description of the physical process occurring within a catchment. In effect, this is a fully distributes hydraulic model and appropriate for use as a pseudo fluvial model. Similar recent studies on nearby catchments with similar characteristics have shown that the application of the FEH Statistical, ReFH, or FEH Rainfall Runoff methods not to be the robust way forward for this type of catchment. For the direct rainfall hydrological approach to give an accurate representation of the flows, the entire topographic catchment (the area contributing runoff to the site) had to be modelled. Due to the gentle relief in the area the it was concluded that the FEH catchments were not representative. Therefore, a desktop assessment was undertaken to delineate the contributing drainage area for the site. This was undertaken in GIS software and included reviewing topographic LIDAR data for the

	wider area, OS mapping, available topographic and cross section survey, and available surface water sewer records. From this a contributing catchment was defined. This area was extended out by buffer of 100m to account for uncertainty and this area was used for the 2D zone. The FEH CD-ROM contains a database of catchment descriptors, along with parameters of the FEH rainfall Depth-Duration-Frequency (DDF) model. Parameters are provided both for point rainfall, on a 1km2 grid, and for catchment-average rainfall. The parameters produced for a watercourse catchment are an amalgamation of the 1 km2 grid parameters within the catchment. Design rainfall statistics for each of the 1km grid squares across the catchment were extracted from the FEH CD-ROM (v3) in order to assess the variability in rainfall depths and storm duration across the catchment. As there was little variation in these parameters across the model domain the parameters for the South-west catchment DDF parameters were used to create a hyetograph specific to the model domain. The events simulated for this study follow a summer profile. During the summer months' interception from deciduous trees and evapo-transpiration can be important losses, however given the land cover type found in the catchment it was considered that these losses would be negligible during a flood event. Therefore, infiltration was the major loss considered. The approach selected to model rainfall losses via infiltration in rural areas of the catchment was to calculate infiltration in the hydraulic model using fixed infiltration zones. These were applied at a uniform spatial distribution across the 2D zone. The design runoff used SPRHOST value from catchment descriptors to determine runoff. This was sensitivity tested using Other values used for runoff coefficient testing in 10% intervals up to 100% runoff to represent a completely saturated or completely impermeable surface.
Software to be used (with version numbers)	FEH CD-ROM V3.0 InfoWorks ICM v7.0

Hyetograph	**FEH Rainfall Parameters**					
	C	D1	D2	D3	E	F
Catch 1	-0.026	0.407	0.315	0.366	0.309	2.392

2 Locations where flood estimates required

The table below lists the locations of subject sites. The site codes listed below are used in all subsequent tables to save space.



2.1 Summary of subject sites

Site code	Type of estimate L: lumped catchment S: Sub-catchment	Watercourse	Name or description of site	Easting	Northing	AREA on FEH CD-ROM (km^2)	Revised AREA if altered
Catch1	Direct Rainfall	Lancing Brooks	Lancing Brooks	519175	104680	N/A	N/A

N.B. Based on south-west catchment

2.2 Important catchment descriptors at each subject site (incorporating any changes made)

Site code	FARL	PROPWET	BFIHOST	SPRHOST	DPLBAR (km)	DPSBAR (m/km)	SAAR (mm)	URBEXT 2000	FPEXT
Catch1	1	0.34	0.68	28.27	1.54	5.6	725	0.1395	0.7063

Note: Red text denotes catchment descriptors which have been changed from FEH CD-ROM values. See Section 2.3 for an explanation of these changes.

2.3 Checking catchment descriptors

Record how catchment boundary was checked and describe any changes (add maps if needed)	FEH catchment areas were identified. However, there is a low level of confidence in the drainage areas that contribute flow within the catchment due to the low relief and artificial nature of the drainage system. It was not possible to accurately derive updated catchment areas using common methods (such as ArcHydro) therefore direct rainfall was used. The direct rainfall area was determined by reviewing the channel gradients and drainage directions to establish likely drainage catchment area and then increasing this to account for any areas that drain away from the site.
Record how other catchment descriptors were checked and describe any changes. Include before/after table if necessary.	No other catchment descriptors were adjusted.
Source of URBEXT	N/A
Method for updating of URBEXT	N/A

3 Statistical method NOT USED

3.1 Overview of estimation of QMED at each subject site

Site code	QMED from CDs (m^3/s) RURAL	Final method	Data transfer: NRFA numbers for donor sites used (see 3.3)	Data transfer: Distance between centroids d_{ij} (km)	Data transfer: Power term, a	Data transfer: Moderated QMED adjustment factor, $(A/B)^a$	Data transfer: If more than one donor: Weight	Data transfer: If more than one donor: Weighted ave. adjustment	Final estimate of QMED (m^3/s) URBAN
Are the values of QMED spatially consistent?									

Notes

Methods: AM – Annual maxima; POT – Peaks over threshold; DT – Data transfer (with urban adjustment); CD – Catchment descriptors alone (with urban adjustment); BCW – Catchment descriptors and bankfull channel width (add details); LF – Low flow statistics (add details).

When QMED is estimated from POT data, it should also be adjusted for climatic variation. Details should be added below.

The QMED adjustment factor A/B for each donor site is given in Table 3.2. This is moderated using the power term, a, which is a function of the distance between the centroids of the subject catchment and the donor catchment. The final estimate of QMED is $(A/B)^a$ times the initial estimate from catchment descriptors.

If more than one donor has been used, use multiple rows for the site and give the weights used in the averaging. Record the weighted average adjustment factor in the penultimate column.

Important note on urban adjustment

The method used to adjust QMED for urbanisation, for both subject sites and donor sites, is that published in Kjeldsen (2010)[2] in which PRUAF is calculated from BFIHOST. The result will differ from that of WINFAP-FEH v3.0.003 which does not correctly implement the urban adjustment of Kjeldsen (2010). Significant differences will occur only on urban catchments that are highly permeable.

3.2 Search for donor sites for QMED (if applicable)

Comment on potential donor sites	
Mention: • Number of potential donor sites available • Distances from subject site • Similarity in terms of AREA, BFIHOST, FARL and other catchment descriptors • Quality of flood peak data Include a map if necessary. Note that donor catchments should usually be rural.	

[2] Kjeldsen, T. R. (2010). Modelling the impact of urbanization on flood frequency relationships in the UK. Hydrol. Res. **41**. 391-405.

3.3 Donor sites chosen and QMED adjustment factors

NRFA no.	Reasons for choosing	Method (AM or POT)	Adjust-ment for climatic variation?	QMED from flow data (A)	QMED from catchment descriptors (B)	Adjust-ment ratio (A/B)

3.4 Derivation of pooling groups

Several subject sites may use the same pooling group.

Name of group	Site code from whose descriptors group was derived	Subject site treated as gauged? (enhanced single site analysis)	Changes made to default pooling group, with reasons .	Weighted average L-moments, L-CV and L-skew, (before urban adjustment)
Notes Pooling groups were derived using the procedures from Science Report SC050050 (2008).				

3.5 Derivation of flood growth curves at subject sites

Site code	Method (SS, P, ESS, J)	If P, ESS or J, name of pooling group (Error! Reference source not found.)	Distribution used and reason for choice	Note any urban adjustment or permeable adjustment	Parameters of distribution (location, scale and shape after adjustments)	Growth factor for 100-year return period
Notes Methods: SS – Single site; P – Pooled; ESS – Enhanced single site; J – Joint analysis A pooling group (or ESS analysis) derived at one gauge can be applied to estimate growth curves at a number of ungauged sites. Each site may have a different urban adjustment, and therefore different growth curve parameters. Urban adjustments are all carried out using the v3 method: Kjeldsen (2010). Growth curves were derived using the procedures from Science Report SC050050 (2008).						

3.6 Flood estimates from the statistical method

3.6.1 Design Events

Table 3-1: Flow estimates derived using pooled analysis with donor adjustment

Site code	Flood peak (m^3/s) for the following return periods (in years)										
	2	5	10	20	25	30	50	75	100	200	1000

Table 3-2: Flow estimates derived using an Enhanced Single Site analysis with donor adjustment

Site code	Flood peak (m^3/s) for the following return periods (in years)										
	2	5	10	20	25	30	50	75	100	200	1000

3.6.2 Climate change events

Table 3-3: Climate change flow estimates derived using pooled analysis with donor adjustment

Site code	Flood peak (m^3/s) for the following climate change scenarios		
	1% (plus 35%)	1% (plus 45%)	1% (plus 105%)

Table 3-4: Climate change flow estimates derived using an enhanced single site analysis

Site code	Flood peak (m^3/s) for the following climate change scenarios		
	1% (plus 35%)	1% (plus 45%)	1% (plus 105%)

4 Revitalised flood hydrograph (ReFH) method - NOT USED

4.1 Parameters for ReFH model (rural catchments)

Site code	**Method** OPT: Optimisation BR: Baseflow recession fitting CD: Catchment descriptors DT: Data transfer (give details)	**Tp (hours)** Time to peak	**C_{max} (mm)** Maximum storage capacity	**BL (hours)** Baseflow lag	**BR** Baseflow recharge
Brief description of any flood event analysis carried out (further details should be given in the annex)	N/A				

4.2 Design events for ReFH method

Site code	Urban or rural	Season of design event (summer or winter)	Storm duration (hours)	Storm area for ARF (if not catchment area)
Are the storm durations likely to be changed in the next stage of the study, e.g. by optimisation within a hydraulic model?				

4.3 Flood estimates from the ReFH method

Site code	Flood peak (m^3/s) for the following return periods (in years)									

5 Discussion and summary of results

5.1 Final choice of method

Choice of method and reasons. Include reference to type of study, nature of catchment and type of data available.	Taking into consideration the flat nature of the catchment, and the predominant sources of water coming from surface water runoff, local runoff and groundwater, the Direct Rainfall method is considered the most suitable. The method chosen to derive the rainfall inputs is the FEH DDF method. Hydrological analysis was undertaken identify critical storm duration. The direct rainfall statistics will be input into InfoWorks ICM. Fixed infiltration losses were selected, a steady runoff coefficient is set. This remains constant throughout the simulation

5.2 Assumptions, limitations and uncertainty

List the main assumptions made (specific to this study)	The main assumptions in this study are that: • Catchment boundary – it is assumed that the 2D direct rainfall boundary accounts for the area that contributes runoff to the relevant section of the Lancing Brook system that presents flood risk to the site. It is assumed that the LIDAR data available fairly reflects the catchment topography. • Other watercourses – it is assumed that the remainder of the Lancing Brook with a channel gradient draining away from the site does not contribute to flood risk to the site. This includes much of the drainage to the west and north of the airport and all areas north the of A27. • Contributing areas – it is assumed that there is not significant inflow to the top of the Marsh Barn Lane channel from areas to the west of the A2025 (Grinstead Lane). It is assumed that any urban drainage infrastructure in these areas would have a limited design capacity (up to 1:30 AEP capacity) and that any overland flows in excess of the local urban drainage infrastructure would be curtailed by the A2025 (Grinstead Lane) which bisects the area. It is not known if any urban drainage infrastructure is connected upstream. The 2D model boundary around the area is based on the south-west FEH catchment boundary, extrapolated into the south east area for the outfall. • Runoff Coefficient – Sensitivity tests have been undertaken on runoff coefficients. Initially based on SPRHOST value of 28.27, and tested up to 100% runoff in 10% increments thereafter • SPRHOST runoff has been used throughout the model domain including the more urban areas to the south and west of the model domain. Runoff may be greater in these urban areas, but so too will the flows lost to urban drainage infrastructure. It is understood that most of the properties in this area drain to soakaway. It was concluded that these areas only represent a small portion of the contributing area are the increase in runoff as a result of the presence of impermeable surfaces would be similar to the decrease observed by accounting for the presence of urban drainage infrastructure including soakaways. • A range of storm duration scenarios were tested in the Hydraulic model. These tests produced a critical duration for the site of 4.5 hours. As a result of this test it was recommended a design storm duration of 4.5 hours (270

	minutes) was used in the model. A summer profile was used.
Discuss any particular limitations, e.g. applying methods outside the range of catchment types or return periods for which they were developed.	DDF rainfall is extrapolated when used beyond the 1:200 AEP event However it is common practice to use up to 1:1000 AEP event.
Give what information you can on uncertainty in the results, e.g. confidence limits from Kjeldsen (2014).	There are a number of catchment characteristics that make flood flow estimation difficult for the catchment: • Permeable nature of the catchment. • Urban areas adjacent to the catchment • Tidally influenced outfall. • Low-lying and flat with extensive floodplains. • Multiple outfalls for drainage system with potential for channels to flow in both directions. • Number of potential sources of flooding under different conditions - fluvial, pluvial, groundwater. The 'Flood estimation guidelines' state that: "It is inevitable that on unusual catchments or for extreme return periods there are few ideal methods. Standard methods are likely to be least applicable to very small or large catchments, complex urban catchments, permeable catchments and extreme events." On this basis, 'standard methods' were rejected for this study in favour of Direct Rainfall. However, Direct Rainfall also has inherent areas of uncertainty. One aspect of uncertainty considered for the Direct Rainfall approach was that the Annual Exceedance Probability (AEP) of the rainfall event is unlikely to equal the AEP of the fluvial flow. The AEP of a fluvial flow is a result of the joint probability of the rainfall event and the antecedent conditions. In order to make a direct rainfall approach equivalent to a fluvial flow the antecedent conditions for design events have been set. An appropriate antecedent condition has been estimated based on Catchment Descriptors and local knowledge.
Comment on the suitability of the results for future studies, e.g. at nearby locations or for different purposes.	This work has been used to inform a site-specific flood risk assessment. Future use of these flows should satisfy themselves that rainfall parameters are appropriate for the subject site and that critical storm duration and profile has been considered prior to re-using the results of these estimates.
Give any other comments on the study, e.g. suggestions for additional work.	Future gauging of the Lancing Brooks would be recommended to improve confidence in flow estimates in the catchment.

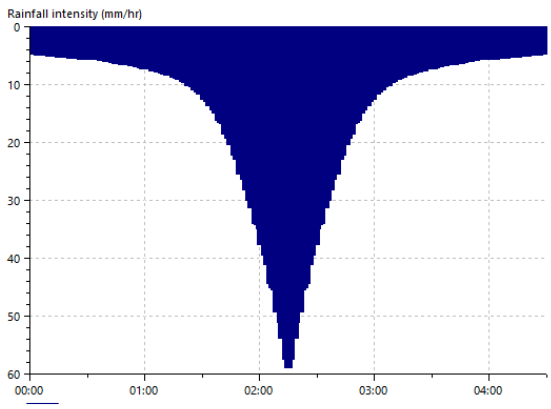
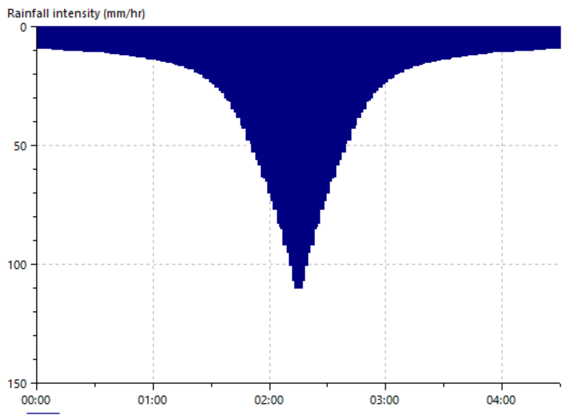
5.3 Checks

Are the results consistent, for example at confluences?	Yes, flood peaks within the model increase with both catchment size and return period.
What do the results imply regarding the return periods of floods during the period of record?	No observed flood peaks to compare against.
What is the range of 100-year growth factors? Is this realistic?	N/A
If 1000-year flows have been derived, what is the range of ratios	Only rainfall values have been produced.

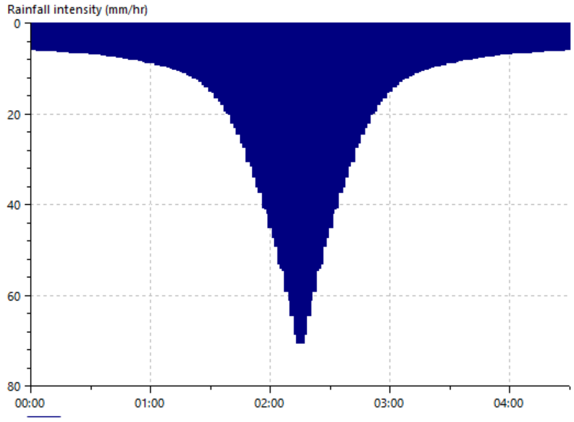
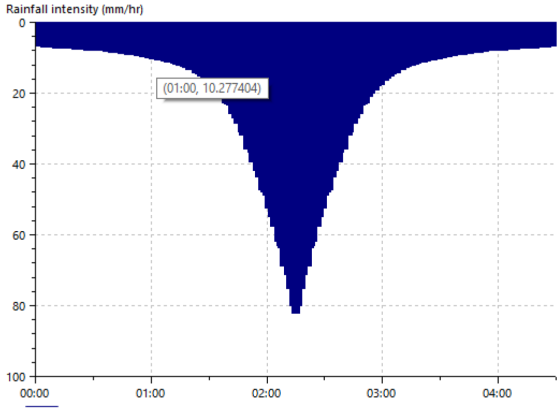
for 1000-year flow over 100-year flow?	
How do the results compare with those of other studies? Explain any differences and conclude which results should be preferred.	A 1D model was produced for the SWMP. The inflows for that study were not supported by recognised flow estimation methods therefore they have not been compared to the values here in.
Are the results compatible with the longer-term flood history?	No quantitative flood history available to compare to.
Describe any other checks on the results	No other checks on specific flows have been undertaken. The flowing sensitivity test have been undertaken: Runoff Coefficient -tested from SPRHOST coefficient of 28.27% standard, with scenarios also tested at increments of 10% up to 100%. Direct rainfall Catchment – tested with larger active domain (see Annex). Storm duration - Tested for a range of storm duration to determine critical duration for the site.

5.4 Final results –

5.4.1 Design Events

Site code	Rainfall intensity (mm/hr) for the following annual exceedance probabilities (%)	
	1	0.1
Catch 1		

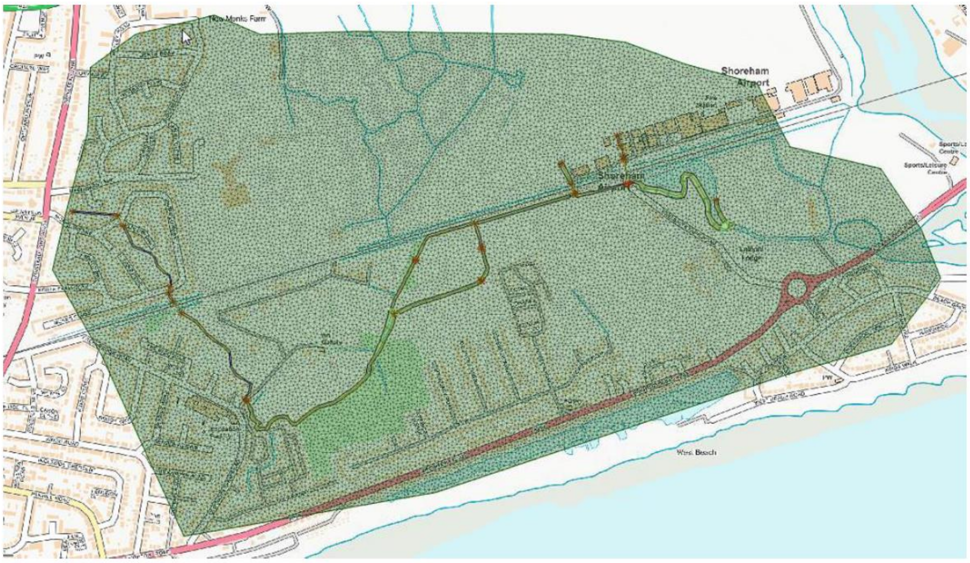
5.4.2 Climate change events

Site code	Rainfall intensity (mm/hr) for the following annual exceedance probabilities (%)	
	1+20%	1+40%
Catch 1		

If flood hydrographs are needed for the next stage of the study, where are they provided? (e.g. give filename of spreadsheet, hydraulic model, or reference to table below)	Hyetographs stored within ICM database and in section 7 below

6 Applying the flows to the hydraulic model

6.1 Simulating design floods in the hydraulic model

How are the inflows applied to the hydraulic model to represent design flood conditions throughout the model domain?	Hyetographs applied to as direct rainfall to 2D domain as shown below. See comments on runoff coefficient above. 
Record the results of any checks between the peak flows given in this report and the peak flows within the hydraulic model.	No peak flows established in this report. Peak rainfall intensities match values applied. Losses are accounted for using SPRHOST coefficients, detailing the percentage of rainfall runoff into channels. SPRHOST coefficient of 28.27% standard, with scenarios also tested at increments of 10% up to 100%.

6.2 Calibration flows for the model

Is there enough certainty in hydrological data or models to calculate flows for calibration events that will reduce uncertainty in the hydraulic model structure and parameters?	No
How are the flows calculated for calibration events?	No calibration data available

Annex – supporting informationDesign Rainfall values

Time	Rainfall intensity (mm/hr) for the following annual exceedance probabilities (%)			
	1.00	1+20%	1+40%	0.10
00::00:00	5.01	5.01	5.01	9.34
00::00:01	5.01	5.01	5.01	9.34
00::00:02	5.06	5.06	5.06	9.42
00::00:03	5.17	5.17	5.17	9.63
00::00:04	5.17	5.17	5.17	9.63
00::00:05	5.17	5.17	5.17	9.63
00::00:06	5.17	5.17	5.17	9.63
00::00:07	5.17	5.17	5.17	9.63
00::00:08	5.31	5.31	5.31	9.89
00::00:09	5.32	5.32	5.32	9.92
00::00:10	5.32	5.32	5.32	9.92
00::00:11	5.32	5.32	5.32	9.92
00::00:12	5.32	5.32	5.32	9.92
00::00:13	5.40	5.40	5.40	10.07
00::00:14	5.48	5.48	5.48	10.21
00::00:15	5.48	5.48	5.48	10.21
00::00:16	5.48	5.48	5.48	10.21
00::00:17	5.48	5.48	5.48	10.21
00::00:18	5.49	5.49	5.49	10.24
00::00:19	5.63	5.63	5.63	10.50
00::00:20	5.63	5.63	5.63	10.50
00::00:21	5.63	5.63	5.63	10.50
00::00:22	5.63	5.63	5.63	10.50
00::00:23	5.63	5.63	5.63	10.50
00::00:24	5.74	5.74	5.74	10.71
00::00:25	5.79	5.79	5.79	10.79
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00::00:27	5.79	5.79	5.79	10.79
00::00:28	5.79	5.79	5.79	10.79
00::00:29	5.84	5.84	5.84	10.88
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00::00:31	5.95	5.95	5.95	11.09
00::00:32	5.95	5.95	5.95	11.09
00::00:33	5.95	5.95	5.95	11.09
00::00:34	5.95	5.95	5.95	11.09
00::00:35	6.09	6.09	6.09	11.35
00::00:36	6.10	6.10	6.10	11.38
00::00:37	6.14	6.14	6.14	11.44
00::00:38	6.26	6.26	6.26	11.67
00::00:39	6.26	6.26	6.26	11.67
00::00:40	6.34	6.34	6.34	11.82
00::00:41	6.42	6.42	6.42	11.96
00::00:42	6.42	6.42	6.42	11.96
00::00:43	6.54	6.54	6.54	12.20
00::00:44	6.57	6.57	6.57	12.25
00::00:45	6.59	6.59	6.59	12.28
00::00:46	6.73	6.73	6.73	12.55
00::00:47	6.73	6.73	6.73	12.55
00::00:48	6.79	6.79	6.79	12.66
00::00:49	6.89	6.89	6.89	12.84
00::00:50	6.89	6.89	6.89	12.84
00::00:51	7.00	7.00	7.00	13.04
00::00:52	7.04	7.04	7.04	13.13
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00::00:54	7.20	7.20	7.20	13.42
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00::00:56	7.29	7.29	7.29	13.60
00::00:57	7.51	7.51	7.51	14.00
00::00:58	7.51	7.51	7.51	14.00
00::00:59	7.61	7.61	7.61	14.18
00::01:00	7.67	7.67	7.67	14.30
00::01:01	7.67	7.67	7.67	14.30
00::01:02	7.95	7.95	7.95	14.82
00::01:03	7.98	7.98	7.98	14.88
00::01:04	8.01	8.01	8.01	14.94
00::01:05	8.14	8.14	8.14	15.17

00::01:06	8.14	8.14	8.14	15.17
00::01:07	8.30	8.30	8.30	15.46
00::01:08	8.45	8.45	8.45	15.75
00::01:09	8.45	8.45	8.45	15.75
00::01:10	8.70	8.70	8.70	16.22
00::01:11	8.77	8.77	8.77	16.34
00::01:12	8.80	8.80	8.80	16.40
00::01:13	9.08	9.08	9.08	16.92
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00::01:15	9.27	9.27	9.27	17.27
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00::01:17	9.55	9.55	9.55	17.80
00::01:18	9.88	9.88	9.88	18.41
00::01:19	10.02	10.02	10.02	18.67
00::01:20	10.02	10.02	10.02	18.67
00::01:21	10.64	10.64	10.64	19.84
00::01:22	10.64	10.64	10.64	19.84
00::01:23	10.83	10.83	10.83	20.19
00::01:24	11.27	11.27	11.27	21.01
00::01:25	11.27	11.27	11.27	21.01
00::01:26	11.83	11.83	11.83	22.06
00::01:27	12.21	12.21	12.21	22.76
00::01:28	12.21	12.21	12.21	22.76
00::01:29	13.05	13.05	13.05	24.33
00::01:30	13.15	13.15	13.15	24.51
00::01:31	13.37	13.37	13.37	24.92
00::01:32	14.24	14.24	14.24	26.55
00::01:33	14.24	14.24	14.24	26.55
00::01:34	14.87	14.87	14.87	27.72
00::01:35	15.50	15.50	15.50	28.88
00::01:36	15.50	15.50	15.50	28.88
00::01:37	16.87	16.87	16.87	31.45
00::01:38	17.22	17.22	17.22	32.09
00::01:39	17.42	17.42	17.42	32.47
00::01:40	19.25	19.25	19.25	35.88
00::01:41	19.25	19.25	19.25	35.89
00::01:42	20.07	20.07	20.07	37.40
00::01:43	21.29	21.29	21.29	39.68
00::01:44	21.29	21.29	21.29	39.68
00::01:45	23.04	23.04	23.04	42.94
00::01:46	23.79	23.79	23.79	44.35
00::01:47	23.79	23.79	23.79	44.35
00::01:48	26.61	26.61	26.61	49.60
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00::01:51	29.43	29.43	29.43	54.85
00::01:52	29.43	29.43	29.43	54.85
00::01:53	31.30	31.30	31.30	58.35
00::01:54	32.56	32.56	32.56	60.68
00::01:55	32.56	32.56	32.56	60.68
00::01:56	35.37	35.37	35.37	65.93
00::01:57	35.69	35.69	35.69	66.52
00::01:58	36.38	36.38	36.38	67.80
00::01:59	39.13	39.13	39.13	72.94
00::02:00	39.13	39.13	39.13	72.94
00::02:01	41.01	41.01	41.01	76.44
00::02:02	42.89	42.89	42.89	79.94
00::02:03	42.89	42.89	42.89	79.94
00::02:04	46.14	46.14	46.14	86.01
00::02:05	46.96	46.96	46.96	87.52
00::02:06	47.40	47.40	47.40	88.34
00::02:07	51.34	51.34	51.34	95.69
00::02:08	51.34	51.34	51.34	95.69
00::02:09	53.22	53.22	53.22	99.19
00::02:10	56.04	56.04	56.04	104.45
00::02:11	56.04	56.04	56.04	104.44
00::02:12	59.76	59.76	59.76	111.39
00::02:13	61.36	61.36	61.36	114.37
00::02:14	61.36	61.36	61.36	114.36

00::02:15	61.36	61.36	61.36	114.36
00::02:16	61.36	61.36	61.36	114.37
00::02:17	59.76	59.76	59.76	111.39
00::02:18	56.04	56.04	56.04	104.44
00::02:19	56.04	56.04	56.04	104.45
00::02:20	53.22	53.22	53.22	99.19
00::02:21	51.34	51.34	51.34	95.69
00::02:22	51.34	51.34	51.34	95.69
00::02:23	47.40	47.40	47.40	88.34
00::02:24	46.96	46.96	46.96	87.52
00::02:25	46.14	46.14	46.14	86.01
00::02:26	42.89	42.89	42.89	79.94
00::02:27	42.89	42.89	42.89	79.94
00::02:28	41.01	41.01	41.01	76.44
00::02:29	39.13	39.13	39.13	72.94
00::02:30	39.13	39.13	39.13	72.94
00::02:31	36.38	36.38	36.38	67.80
00::02:32	35.69	35.69	35.69	66.52
00::02:33	35.37	35.37	35.37	65.93
00::02:34	32.56	32.56	32.56	60.68
00::02:35	32.56	32.56	32.56	60.68
00::02:36	31.30	31.30	31.30	58.35
00::02:37	29.43	29.43	29.43	54.85
00::02:38	29.43	29.43	29.43	54.85
00::02:39	27.45	27.45	27.45	51.17
00::02:40	26.61	26.61	26.61	49.60
00::02:41	26.61	26.61	26.61	49.60
00::02:42	23.79	23.79	23.79	44.35
00::02:43	23.79	23.79	23.79	44.35
00::02:44	23.04	23.04	23.04	42.94
00::02:45	21.29	21.29	21.29	39.68
00::02:46	21.29	21.29	21.29	39.68
00::02:47	20.07	20.07	20.07	37.40
00::02:48	19.25	19.25	19.25	35.89
00::02:49	19.25	19.25	19.25	35.88
00::02:50	17.42	17.42	17.42	32.47
00::02:51	17.22	17.22	17.22	32.09
00::02:52	16.87	16.87	16.87	31.45
00::02:53	15.50	15.50	15.50	28.88
00::02:54	15.50	15.50	15.50	28.88
00::02:55	14.87	14.87	14.87	27.72
00::02:56	14.24	14.24	14.24	26.55
00::02:57	14.24	14.24	14.24	26.55
00::02:58	13.37	13.37	13.37	24.92
00::02:59	13.15	13.15	13.15	24.51
00::03:00	13.05	13.05	13.05	24.33
00::03:01	12.21	12.21	12.21	22.76
00::03:02	12.21	12.21	12.21	22.76
00::03:03	11.83	11.83	11.83	22.06
00::03:04	11.27	11.27	11.27	21.01
00::03:05	11.27	11.27	11.27	21.01
00::03:06	10.83	10.83	10.83	20.19
00::03:07	10.64	10.64	10.64	19.84
00::03:08	10.64	10.64	10.64	19.84
00::03:09	10.02	10.02	10.02	18.67
00::03:10	10.02	10.02	10.02	18.67
00::03:11	9.88	9.88	9.88	18.41
00::03:12	9.55	9.55	9.55	17.80
00::03:13	9.55	9.55	9.55	17.80
00::03:14	9.27	9.27	9.27	17.27
00::03:15	9.08	9.08	9.08	16.92
00::03:16	9.08	9.08	9.08	16.92
00::03:17	8.80	8.80	8.80	16.40
00::03:18	8.77	8.77	8.77	16.34
00::03:19	8.70	8.70	8.70	16.22
00::03:20	8.45	8.45	8.45	15.75
00::03:21	8.45	8.45	8.45	15.75
00::03:22	8.30	8.30	8.30	15.46
00::03:23	8.14	8.14	8.14	15.17

00::03:24	8.14	8.14	8.14	15.17
00::03:25	8.01	8.01	8.01	14.94
00::03:26	7.98	7.98	7.98	14.88
00::03:27	7.95	7.95	7.95	14.82
00::03:28	7.67	7.67	7.67	14.30
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00::03:33	7.29	7.29	7.29	13.60
00::03:34	7.20	7.20	7.20	13.42
00::03:35	7.20	7.20	7.20	13.42
00::03:36	7.04	7.04	7.04	13.13
00::03:37	7.04	7.04	7.04	13.13
00::03:38	7.00	7.00	7.00	13.04
00::03:39	6.89	6.89	6.89	12.84
00::03:40	6.89	6.89	6.89	12.84
00::03:41	6.79	6.79	6.79	12.66
00::03:42	6.73	6.73	6.73	12.55
00::03:43	6.73	6.73	6.73	12.55
00::03:44	6.59	6.59	6.59	12.28
00::03:45	6.57	6.57	6.57	12.25
00::03:46	6.54	6.54	6.54	12.20
00::03:47	6.42	6.42	6.42	11.96
00::03:48	6.42	6.42	6.42	11.96
00::03:49	6.34	6.34	6.34	11.82
00::03:50	6.26	6.26	6.26	11.67
00::03:51	6.26	6.26	6.26	11.67
00::03:52	6.14	6.14	6.14	11.44
00::03:53	6.10	6.10	6.10	11.38
00::03:54	6.09	6.09	6.09	11.35
00::03:55	5.95	5.95	5.95	11.09
00::03:56	5.95	5.95	5.95	11.09
00::03:57	5.95	5.95	5.95	11.09
00::03:58	5.95	5.95	5.95	11.09
00::03:59	5.95	5.95	5.95	11.09
00::04:00	5.84	5.84	5.84	10.88
00::04:01	5.79	5.79	5.79	10.79
00::04:02	5.79	5.79	5.79	10.79
00::04:03	5.79	5.79	5.79	10.79
00::04:04	5.79	5.79	5.79	10.79
00::04:05	5.74	5.74	5.74	10.71
00::04:06	5.63	5.63	5.63	10.50
00::04:07	5.63	5.63	5.63	10.50
00::04:08	5.63	5.63	5.63	10.50
00::04:09	5.63	5.63	5.63	10.50
00::04:10	5.63	5.63	5.63	10.50
00::04:11	5.49	5.49	5.49	10.24
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00::04:16	5.40	5.40	5.40	10.07
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00::04:18	5.32	5.32	5.32	9.92
00::04:19	5.32	5.32	5.32	9.92
00::04:20	5.32	5.32	5.32	9.92
00::04:21	5.31	5.31	5.31	9.89
00::04:22	5.17	5.17	5.17	9.63
00::04:23	5.17	5.17	5.17	9.63
00::04:24	5.17	5.17	5.17	9.63
00::04:25	5.17	5.17	5.17	9.63
00::04:26	5.17	5.17	5.17	9.63
00::04:27	5.06	5.06	5.06	9.42
00::04:28	5.01	5.01	5.01	9.34
00::04:29	5.01	5.01	5.01	9.34
T	1.00	1+20%	1+40%	0.10
00::00:00	5.01	5.01	5.01	9.34
00::00:01	5.01	5.01	5.01	9.34

00::00:02	5.06	5.06	5.06	9.42
00::00:03	5.17	5.17	5.17	9.63
00::00:04	5.17	5.17	5.17	9.63
00::00:05	5.17	5.17	5.17	9.63
00::00:06	5.17	5.17	5.17	9.63
00::00:07	5.17	5.17	5.17	9.63
00::00:08	5.31	5.31	5.31	9.89
00::00:09	5.32	5.32	5.32	9.92
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00::00:18	5.49	5.49	5.49	10.24
00::00:19	5.63	5.63	5.63	10.50
00::00:20	5.63	5.63	5.63	10.50
00::00:21	5.63	5.63	5.63	10.50
00::00:22	5.63	5.63	5.63	10.50
00::00:23	5.63	5.63	5.63	10.50
00::00:24	5.74	5.74	5.74	10.71
00::00:25	5.79	5.79	5.79	10.79
00::00:26	5.79	5.79	5.79	10.79
00::00:27	5.79	5.79	5.79	10.79
00::00:28	5.79	5.79	5.79	10.79
00::00:29	5.84	5.84	5.84	10.88
00::00:30	5.95	5.95	5.95	11.09
00::00:31	5.95	5.95	5.95	11.09
00::00:32	5.95	5.95	5.95	11.09
00::00:33	5.95	5.95	5.95	11.09
00::00:34	5.95	5.95	5.95	11.09
00::00:35	6.09	6.09	6.09	11.35
00::00:36	6.10	6.10	6.10	11.38
00::00:37	6.14	6.14	6.14	11.44
00::00:38	6.26	6.26	6.26	11.67
00::00:39	6.26	6.26	6.26	11.67
00::00:40	6.34	6.34	6.34	11.82
00::00:41	6.42	6.42	6.42	11.96
00::00:42	6.42	6.42	6.42	11.96
00::00:43	6.54	6.54	6.54	12.20
00::00:44	6.57	6.57	6.57	12.25
00::00:45	6.59	6.59	6.59	12.28
00::00:46	6.73	6.73	6.73	12.55
00::00:47	6.73	6.73	6.73	12.55
00::00:48	6.79	6.79	6.79	12.66
00::00:49	6.89	6.89	6.89	12.84
00::00:50	6.89	6.89	6.89	12.84
00::00:51	7.00	7.00	7.00	13.04
00::00:52	7.04	7.04	7.04	13.13
00::00:53	7.04	7.04	7.04	13.13
00::00:54	7.20	7.20	7.20	13.42
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00::00:56	7.29	7.29	7.29	13.60
00::00:57	7.51	7.51	7.51	14.00
00::00:58	7.51	7.51	7.51	14.00
00::00:59	7.61	7.61	7.61	14.18
00::01:00	7.67	7.67	7.67	14.30
00::01:01	7.67	7.67	7.67	14.30
00::01:02	7.95	7.95	7.95	14.82
00::01:03	7.98	7.98	7.98	14.88
00::01:04	8.01	8.01	8.01	14.94
00::01:05	8.14	8.14	8.14	15.17
00::01:06	8.14	8.14	8.14	15.17
00::01:07	8.30	8.30	8.30	15.46
00::01:08	8.45	8.45	8.45	15.75
00::01:09	8.45	8.45	8.45	15.75
00::01:10	8.70	8.70	8.70	16.22

00::01:11	8.77	8.77	8.77	16.34
00::01:12	8.80	8.80	8.80	16.40
00::01:13	9.08	9.08	9.08	16.92
00::01:14	9.08	9.08	9.08	16.92
00::01:15	9.27	9.27	9.27	17.27
00::01:16	9.55	9.55	9.55	17.80
00::01:17	9.55	9.55	9.55	17.80
00::01:18	9.88	9.88	9.88	18.41
00::01:19	10.02	10.02	10.02	18.67
00::01:20	10.02	10.02	10.02	18.67
00::01:21	10.64	10.64	10.64	19.84
00::01:22	10.64	10.64	10.64	19.84
00::01:23	10.83	10.83	10.83	20.19
00::01:24	11.27	11.27	11.27	21.01
00::01:25	11.27	11.27	11.27	21.01
00::01:26	11.83	11.83	11.83	22.06
00::01:27	12.21	12.21	12.21	22.76
00::01:28	12.21	12.21	12.21	22.76
00::01:29	13.05	13.05	13.05	24.33
00::01:30	13.15	13.15	13.15	24.51
00::01:31	13.37	13.37	13.37	24.92
00::01:32	14.24	14.24	14.24	26.55
00::01:33	14.24	14.24	14.24	26.55
00::01:34	14.87	14.87	14.87	27.72
00::01:35	15.50	15.50	15.50	28.88
00::01:36	15.50	15.50	15.50	28.88
00::01:37	16.87	16.87	16.87	31.45
00::01:38	17.22	17.22	17.22	32.09
00::01:39	17.42	17.42	17.42	32.47
00::01:40	19.25	19.25	19.25	35.88
00::01:41	19.25	19.25	19.25	35.89
00::01:42	20.07	20.07	20.07	37.40
00::01:43	21.29	21.29	21.29	39.68
00::01:44	21.29	21.29	21.29	39.68
00::01:45	23.04	23.04	23.04	42.94
00::01:46	23.79	23.79	23.79	44.35
00::01:47	23.79	23.79	23.79	44.35
00::01:48	26.61	26.61	26.61	49.60
00::01:49	26.61	26.61	26.61	49.60
00::01:50	27.45	27.45	27.45	51.17
00::01:51	29.43	29.43	29.43	54.85
00::01:52	29.43	29.43	29.43	54.85
00::01:53	31.30	31.30	31.30	58.35
00::01:54	32.56	32.56	32.56	60.68
00::01:55	32.56	32.56	32.56	60.68
00::01:56	35.37	35.37	35.37	65.93
00::01:57	35.69	35.69	35.69	66.52
00::01:58	36.38	36.38	36.38	67.80
00::01:59	39.13	39.13	39.13	72.94
00::02:00	39.13	39.13	39.13	72.94
00::02:01	41.01	41.01	41.01	76.44
00::02:02	42.89	42.89	42.89	79.94
00::02:03	42.89	42.89	42.89	79.94
00::02:04	46.14	46.14	46.14	86.01
00::02:05	46.96	46.96	46.96	87.52
00::02:06	47.40	47.40	47.40	88.34
00::02:07	51.34	51.34	51.34	95.69
00::02:08	51.34	51.34	51.34	95.69
00::02:09	53.22	53.22	53.22	99.19
00::02:10	56.04	56.04	56.04	104.45
00::02:11	56.04	56.04	56.04	104.44
00::02:12	59.76	59.76	59.76	111.39
00::02:13	61.36	61.36	61.36	114.37
00::02:14	61.36	61.36	61.36	114.36
00::02:15	61.36	61.36	61.36	114.36
00::02:16	61.36	61.36	61.36	114.37
00::02:17	59.76	59.76	59.76	111.39
00::02:18	56.04	56.04	56.04	104.44
00::02:19	56.04	56.04	56.04	104.45

00::02:20	53.22	53.22	53.22	99.19
00::02:21	51.34	51.34	51.34	95.69
00::02:22	51.34	51.34	51.34	95.69
00::02:23	47.40	47.40	47.40	88.34
00::02:24	46.96	46.96	46.96	87.52
00::02:25	46.14	46.14	46.14	86.01
00::02:26	42.89	42.89	42.89	79.94
00::02:27	42.89	42.89	42.89	79.94
00::02:28	41.01	41.01	41.01	76.44
00::02:29	39.13	39.13	39.13	72.94
00::02:30	39.13	39.13	39.13	72.94
00::02:31	36.38	36.38	36.38	67.80
00::02:32	35.69	35.69	35.69	66.52
00::02:33	35.37	35.37	35.37	65.93
00::02:34	32.56	32.56	32.56	60.68
00::02:35	32.56	32.56	32.56	60.68
00::02:36	31.30	31.30	31.30	58.35
00::02:37	29.43	29.43	29.43	54.85
00::02:38	29.43	29.43	29.43	54.85
00::02:39	27.45	27.45	27.45	51.17
00::02:40	26.61	26.61	26.61	49.60
00::02:41	26.61	26.61	26.61	49.60
00::02:42	23.79	23.79	23.79	44.35
00::02:43	23.79	23.79	23.79	44.35
00::02:44	23.04	23.04	23.04	42.94
00::02:45	21.29	21.29	21.29	39.68
00::02:46	21.29	21.29	21.29	39.68
00::02:47	20.07	20.07	20.07	37.40
00::02:48	19.25	19.25	19.25	35.89
00::02:49	19.25	19.25	19.25	35.88
00::02:50	17.42	17.42	17.42	32.47
00::02:51	17.22	17.22	17.22	32.09
00::02:52	16.87	16.87	16.87	31.45
00::02:53	15.50	15.50	15.50	28.88
00::02:54	15.50	15.50	15.50	28.88
00::02:55	14.87	14.87	14.87	27.72
00::02:56	14.24	14.24	14.24	26.55
00::02:57	14.24	14.24	14.24	26.55
00::02:58	13.37	13.37	13.37	24.92
00::02:59	13.15	13.15	13.15	24.51
00::03:00	13.05	13.05	13.05	24.33
00::03:01	12.21	12.21	12.21	22.76
00::03:02	12.21	12.21	12.21	22.76
00::03:03	11.83	11.83	11.83	22.06
00::03:04	11.27	11.27	11.27	21.01
00::03:05	11.27	11.27	11.27	21.01
00::03:06	10.83	10.83	10.83	20.19
00::03:07	10.64	10.64	10.64	19.84
00::03:08	10.64	10.64	10.64	19.84
00::03:09	10.02	10.02	10.02	18.67
00::03:10	10.02	10.02	10.02	18.67
00::03:11	9.88	9.88	9.88	18.41
00::03:12	9.55	9.55	9.55	17.80
00::03:13	9.55	9.55	9.55	17.80
00::03:14	9.27	9.27	9.27	17.27
00::03:15	9.08	9.08	9.08	16.92
00::03:16	9.08	9.08	9.08	16.92
00::03:17	8.80	8.80	8.80	16.40
00::03:18	8.77	8.77	8.77	16.34
00::03:19	8.70	8.70	8.70	16.22
00::03:20	8.45	8.45	8.45	15.75
00::03:21	8.45	8.45	8.45	15.75
00::03:22	8.30	8.30	8.30	15.46
00::03:23	8.14	8.14	8.14	15.17
00::03:24	8.14	8.14	8.14	15.17
00::03:25	8.01	8.01	8.01	14.94
00::03:26	7.98	7.98	7.98	14.88
00::03:27	7.95	7.95	7.95	14.82
00::03:28	7.67	7.67	7.67	14.30

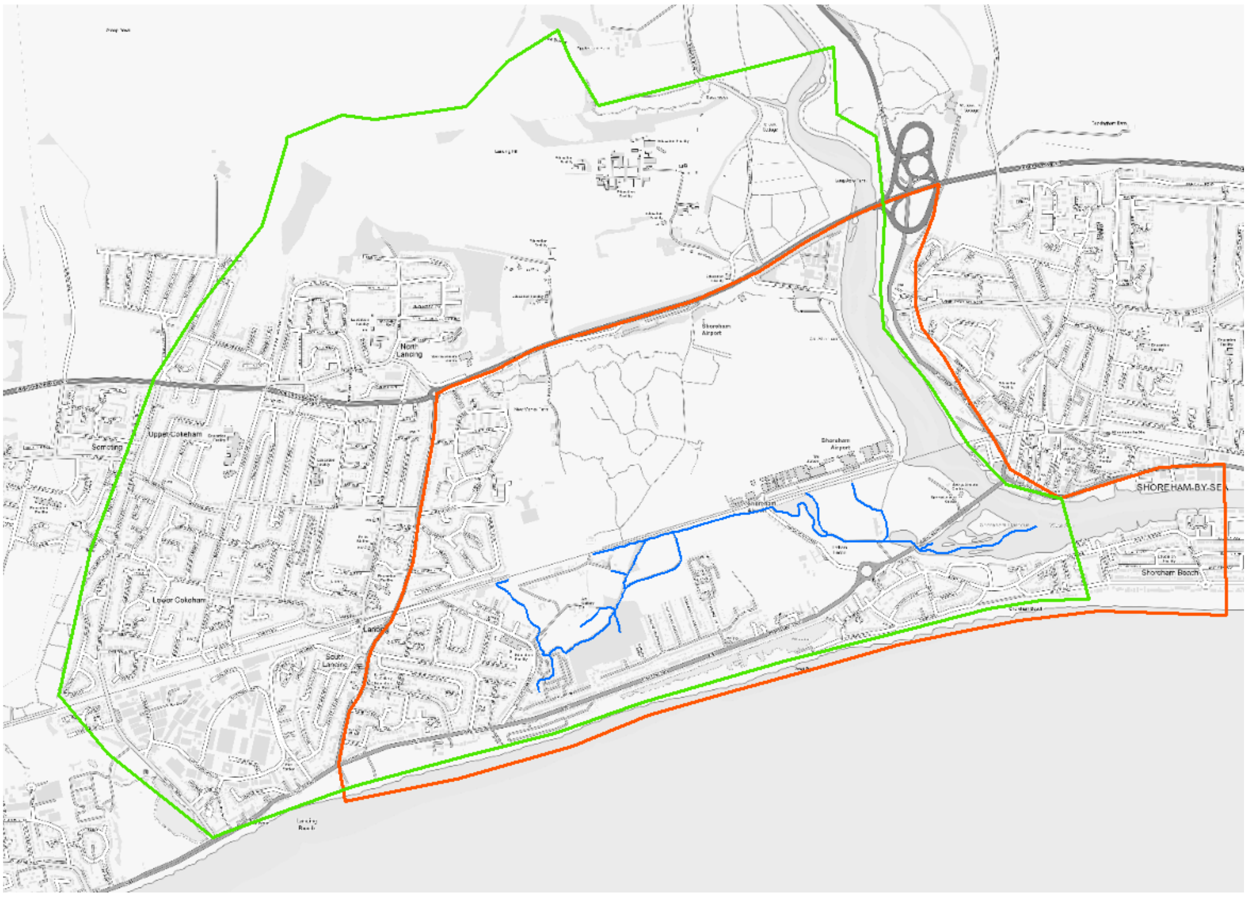
00::03:29	7.67	7.67	7.67	14.30
00::03:30	7.61	7.61	7.61	14.18
00::03:31	7.51	7.51	7.51	14.00
00::03:32	7.51	7.51	7.51	14.00
00::03:33	7.29	7.29	7.29	13.60
00::03:34	7.20	7.20	7.20	13.42
00::03:35	7.20	7.20	7.20	13.42
00::03:36	7.04	7.04	7.04	13.13

B Sensitivity test on contributing area

To test the assumption of contributing area for the direct rainfall approach a larger extent model was developed. The design model domain is shown on the figure below in red. The sensitivity model domain is shown in green. The Design domain was increased in area from 6.7km^2 to approximately 11.6km^2. Both the design model domain and the sensitivity model domain were run 2D only (without any embedded 1D channels or culverts) for the 1:100 AEP event with runoff based on SPRHOST throughout the active domain.

This sensitivity test was undertaken to identify flow paths into the contributing area that may not have been accounted for within the original design domain.

Figure B1 – Design domain and sensitivity domain.



As can be seen in Figure B2 below four flow paths have been identified. Two of these (shown in purple) have been identified to drain outside of the previous domain. Two flow paths (shown in red) have been identified to drain to inside the previous domain.

Of these, the southern flow path flowing Monks Avenue, has potential to contribute a small volume of additional flow to the top of Brook in this location. This brook drains to the south and then passes east across the study site. An enlargement of the flow path can be found in Figure B3. Given the small area concerned and the noted presence of urban drainage infrastructure in this area connected to soakaways (Chapter 5 of Surface Water Management Plan) it is considered that the additional volume of flow this are may contribute to flooding at the site to be negligible. It is recommended that the results of sensitivity test to runoff coefficient should be reviewed to allow model results users to understand the probable outcomes of increase flood volumes.

The second red flow path runs parallel to the south of the A27 carriageway. This flow path runs east and crosses Marsh Barn Lane where it would be picked up by the network of brooks to the west of Shoreham Airport. These brooks continue to drain east and outfall to the estuary. They do not flow though study site, therefore their omission from the model domain is considered immaterial.

Figure B2 – Sensitivity test results.

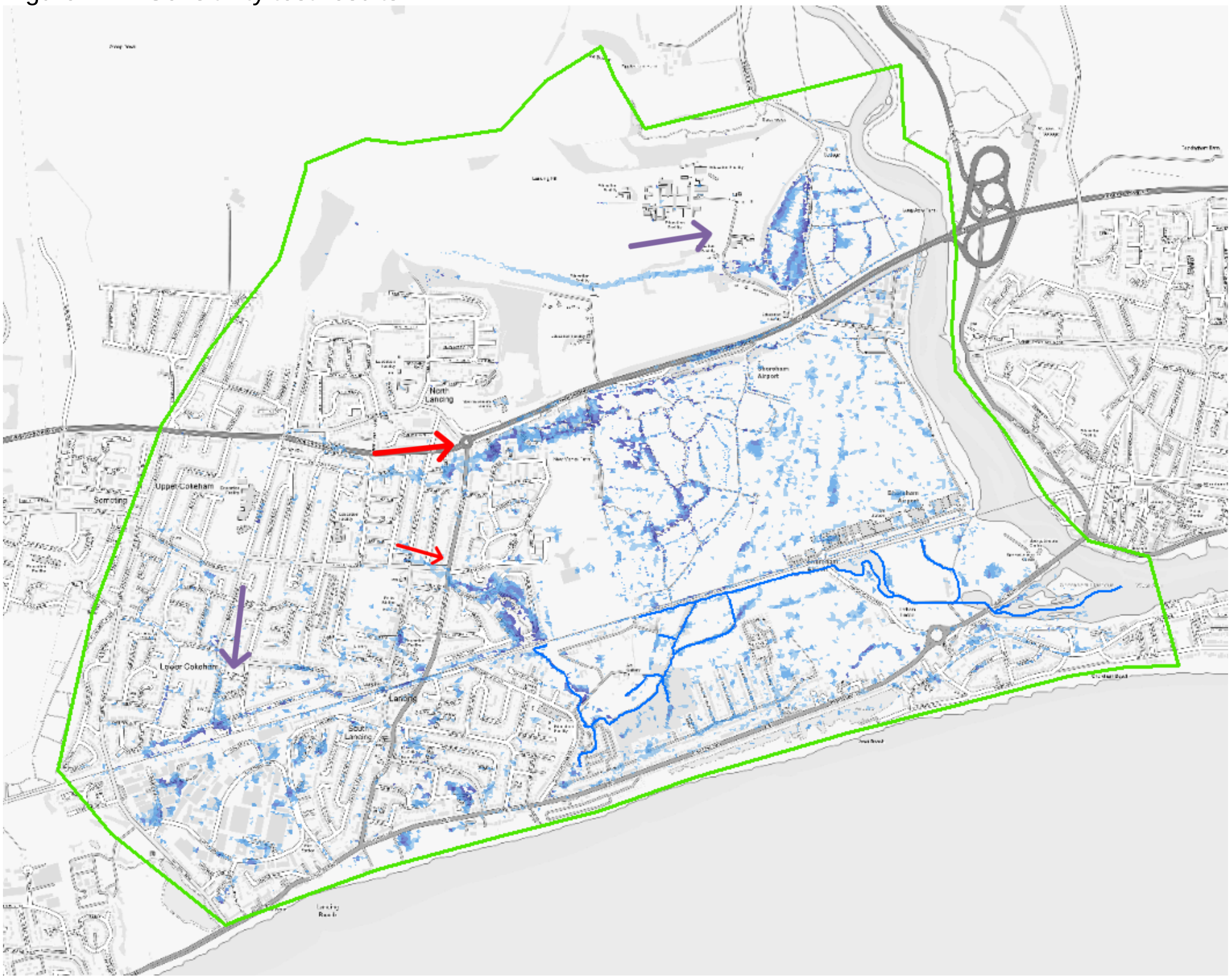


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Figure B3 – Monks Avenue Flow path

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Figure B4 – A27 Flow path

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