



## Hydrological Assessment – River Loddon, Watercourses 1 and 2

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Land North of Arborfield Road

**Bellway Homes Limited**

SHF.1154.040.HY.R.003.A



## Contact Details:

Samuel House  
1st Floor  
5 Fox Valley Way  
Stocksbridge  
Sheffield  
S36 2AA

tel: 0114 321 5151  
www: enzygo.com

### River Loddon, Watercourses 1 and 2, Shinfield

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|-----------|----------------------------------------------------------------------|
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| Author:   | Helena Du-Roe BSc (Hons), MSc, MCIWEM, C.WEM - Principal Hydrologist |
| Approver: | Eric O'Connor BSc (Hons), MSc, MCIWEM, C.WEM - Associate Director    |

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Enzygo Limited Registered in England No. 6525159

Registered Office Gresham House, 5-7 St. Pauls Street, Leeds, England, LS1 2JG

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## 1.0 Introduction

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### 1.1 Background

- 1.1.1 Enzygo Ltd were commissioned by Bellway Homes Limited to undertake a hydraulic modelling exercise to inform a hydraulic model of the River Loddon, Watercourses 1 and 2 in support of a proposed development on land north of Arborfield Road, Shinfield, RG2 9ST. The Site is centred on National Grid Reference (NGR) 473691, 168064.
- 1.1.2 An initial desktop study identified three watercourses located inside the chosen model domain. The watercourses are detailed below:
- River Loddon – The River Loddon and its wider floodplain is located on the downstream side of the A327. The River Loddon flows south west to north east, approximately 640m to the east of the Site. Watercourses 1 and 2 enter the wider River Loddon floodplain on the downstream side of the culverts under the A327.
  - Watercourse 1 – Originates within the Site on its western boundary and flows east towards the A327 before entering a culvert with a flapped outfall under the A327. Watercourse 1 then enters the wider River Loddon floodplain.
  - Watercourse 2 – Enters the Site on its north western boundary and flows east towards the A327 before entering a culvert with a flapped outfall under the A327. Watercourse 2 then enters the wider River Loddon floodplain.
- 1.1.3 An existing hydraulic model of the River Loddon is available from the Environment Agency (completed in 2009 and updated in 2021). As per Environment Agency guidance it was deemed that the existing model is not fit for purpose for a present day modelling study. Enzygo Ltd therefore undertook a hydraulic modelling exercise to produce fluvial flood outlines for the watercourses in the model domain, including up to date peak flow estimates.

### 1.2 Purpose of the Report

- 1.2.1 The purpose of this report (SHF.1154.040.HY.R.003.A, November 2025) details the methodology and results of a hydrological assessment, which represent the peak flow inputs to the Watercourses 1 and 2 hydraulic model (inclusive of a section of the River Loddon). This Hydrological Assessment report is included as Appendix 1 of the Hydraulic Modelling report (SHF.1154.040.HY.R.004.A, November 2025).
- 1.2.2 The Environment Agency Flood Estimation Calculation Report Template (LIT 65087) has been reviewed and been used to influence this hydrological assessment. This report discusses the following methods of flood estimation:
- The FEH statistical method - An “improved” set of procedures has replaced most of the original 1999 FEH statistical methods for ungauged sites; and
  - The Revitalised Flood Hydrograph (ReFH2) method - This has replaced the original 1999 FEH rainfall-runoff method for most applications. ReFH2 uses a similar rainfall-runoff model as ReFH1 but with improved procedures for estimating model parameters and defining the design storm.

### **1.3 Initial Choices of Approach**

- 1.3.1 Based off modeller experience the methodology assumed to provide the most representative flows for all catchments in question (River Loddon, Watercourses 1 and 2) will be the FEH statistical method. This is due to being able to introduce a donor gauging station to assist with flow derivation, while taking into account a number of catchment descriptors (these will be checked to ensure they are representative of the catchment).
- 1.3.2 Hydrograph shapes will be derived from ReFH2, given that observed data is not available for this catchment at the detailed inflow locations.
- 1.3.3 The ReFH2 method will also be used to derive peak flow estimate for comparison against the FEH statistical flows.

## 2.0 Hydrological Assessment

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### 2.1 Catchment Hydrology

#### *River Basin District*

- 2.1.1 The Site resides within the Thames River Basin District (RBD) and the Loddon and Tributaries Management Catchment. The climate change allowances within the Loddon and Tributaries Management Catchment are 14% ('Central' estimate), 23% ('Higher' estimate) and 46% ('Upper' estimate) for the Total Potential Change anticipated by the 2080's<sup>1</sup>.

#### *Catchment Boundary*

- 2.1.2 The FEH Webservice has been used to establish the catchment boundaries for the River Loddon, Watercourses 1 and 2 at the approximate downstream input location within the model domain. The sub catchment splits for Watercourses 1 and 2 (due to the split caused by the Eastern Relief Road) will be detailed in Section 2.7. The River Loddon will be implemented as a lumped inflow at the upstream extent of the model run.
- 2.1.3 The FEH Webservice catchment at the model downstream boundary for the River Loddon (NGR 474950, 168300) encompasses an area of 549.60km<sup>2</sup>. Watercourse 1 (NGR 474800, 168300) encompasses an area of 0.90km<sup>2</sup>. Watercourse 2 (NGR 474550, 168500) encompasses an area of 1.18km<sup>2</sup>. The catchments are shown in Figures 2.1, 2.2 and 2.3.
- 2.1.4 The FEH Webservice catchment boundary has been checked against 1m DTM LiDAR data (as this is more detailed than the 50m grid resolution from the Integrated Hydrological Digital Terrain Model (IHDTM) used for the calculation of the FEH web service catchment boundaries), and OS mapping. It should always be ensured that the catchment be checked and accordingly adjusted to provide the most accurate assessment of catchment hydrology. It should also be noted in this instance that LiDAR is not available for the eastern extent of the catchments from the Environment Agency on line service and have been left as per default.
- 2.1.5 The catchments were assessed and areas amended to the following:
- River Loddon - Original Catchment Area: 551.18km<sup>2</sup>, Amended Catchment Area: 550.10km<sup>2</sup>.
  - Watercourse 1 - Original Catchment Area: 0.91km<sup>2</sup>, Amended Catchment Area: 0.74km<sup>2</sup>.
  - Watercourse 2 - Original Catchment Area: 1.18km<sup>2</sup>, Amended Catchment Area: 0.63km<sup>2</sup>.
- 2.1.6 It was assessed that the updated catchment areas should be carried forward for this assessment. The adjusted catchments are shown in Drawing 0001.

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<sup>1</sup> <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Figure 2.1: Original Catchment Boundaries

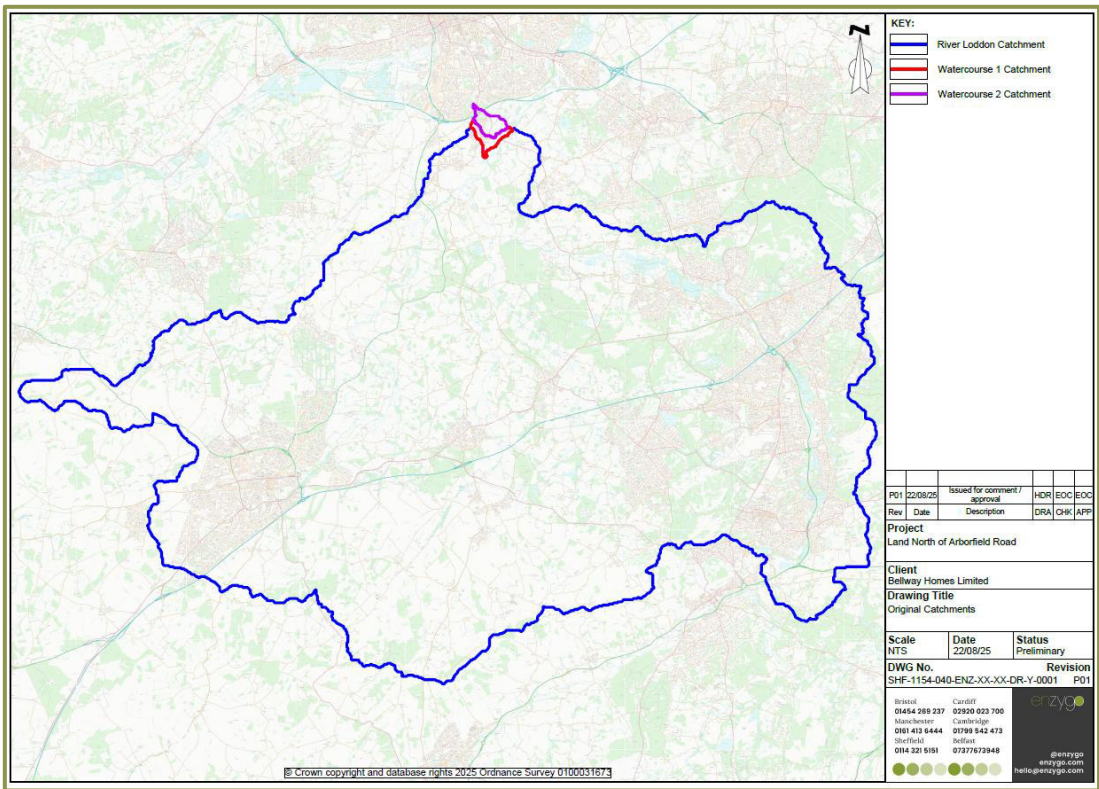
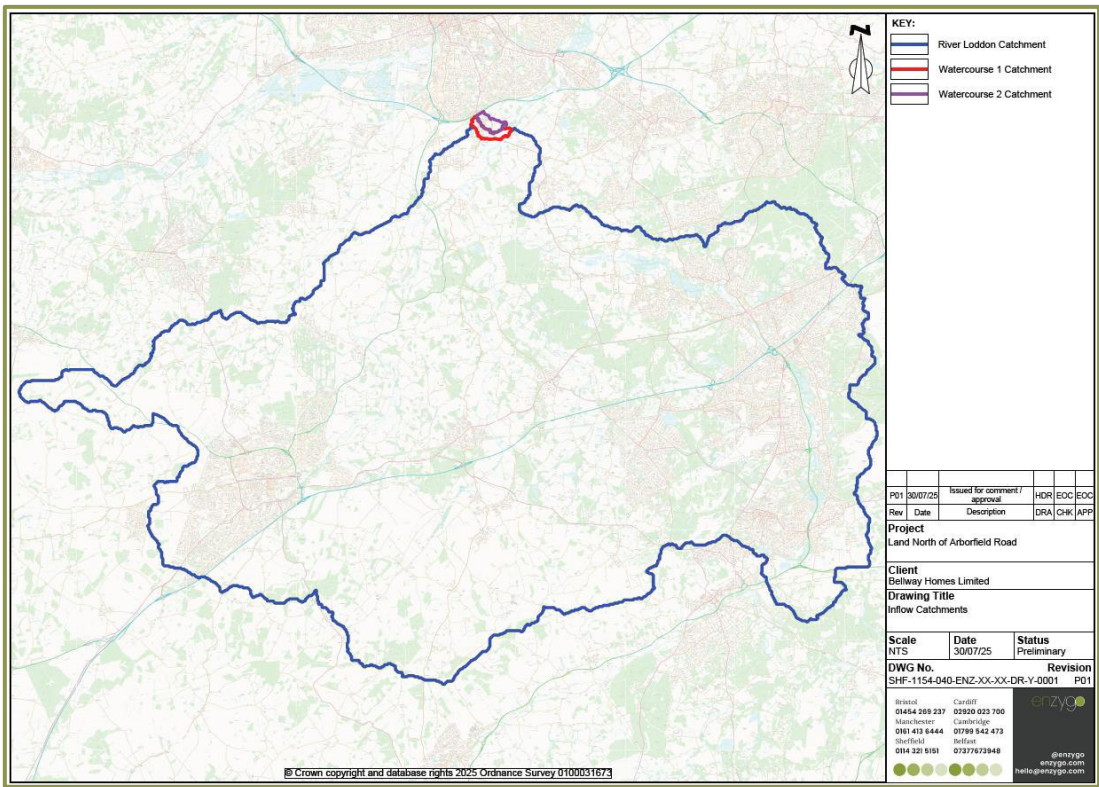
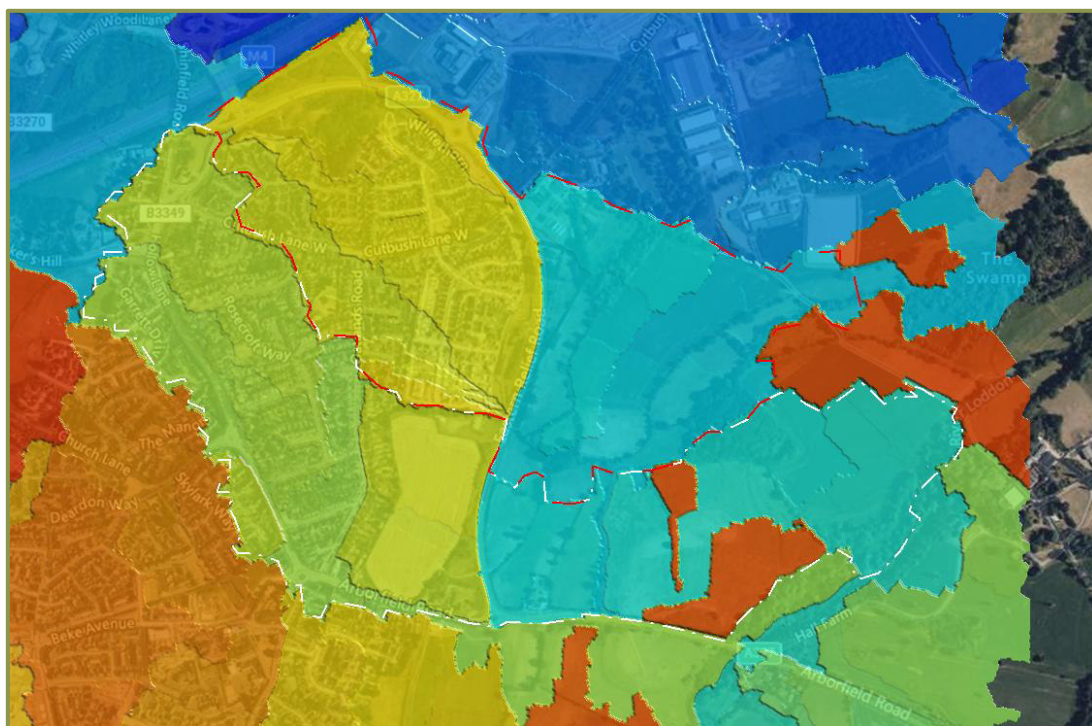


Figure 2.2: Adjusted Catchment Boundaries



**Figure 2.3: Watercourses 1 and 2 Adjusted Catchment Boundaries and Watershed Analysis**

**White Dashed:** Watercourse 1 Catchment **Red Dashed:** Watercourse 2 Catchment **Red Star:** Downstream extent of the identified catchments.

### Catchment Descriptors

- 2.1.7 Analysis of the FEH Webservice catchment descriptors (Table 2.1) for the 550.10km<sup>2</sup>, 0.74km<sup>2</sup> and 0.63km<sup>2</sup> catchments were undertaken.
- 2.1.8 A discussion of the catchment descriptors downloaded from the FEH Webservice (Table 2.1), and how key catchment descriptors have been checked through a desktop study is provided below.

**Table 2.1: Catchment Descriptors from the FEH Webservice Catchment**

| Catchment Descriptor | River Loddon - Value      | Watercourse 1 - Value | Watercourse 2 - Value | Catchment Descriptor | River Loddon - Value | Watercourse 1 - Value | Watercourse 2 - Value   |
|----------------------|---------------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|-------------------------|
| AREA                 | 551.18<br><b>(550.10)</b> | 0.91 <b>(0.74)</b>    | 1.18 <b>(0.63)</b>    | SPRHOST              | 26.95                | 31.20                 | 36.10                   |
| ALTBAR               | 89                        | 46                    | 51                    | URBCONC1990          | 0.66                 | 0.673                 | 0.458                   |
| ASPBAR               | 9                         | 117                   | 116                   | URBEXT1990           | 0.0586               | 0.0712                | 0.0527                  |
| ASPVAR               | 0.21                      | 0.75                  | 0.73                  | URBLOC1990           | 1.115                | 1.437                 | 1.483                   |
| BFIHOST              | 0.613                     | 0.558                 | 0.459                 | URBCONC2000          | 0.86                 | 0.798                 | 0.803                   |
| BFIHOST19            | 0.665                     | 0.618                 | 0.488                 | URBEXT2000           | 0.115                | 0.135 <b>(0.27)</b>   | 0.0928<br><b>(0.24)</b> |
| DPLBAR               | 24.71                     | 1.59                  | 1                     | URBLOC2000           | 1.118                | 1.444                 | 1.534                   |
| DPSBAR               | 32                        | 12.1                  | 21.5                  | C                    | -0.02708             | -0.02927              | -0.02927                |
| FARL                 | 0.908                     | 1                     | 1                     | D1                   | 0.3114               | 0.26981               | 0.027119                |
| FPEXT                | 0.1253                    | 0.3863                | 0.1941                | D2                   | 0.26764              | 0.272                 | 0.27165                 |
| FPDBAR               | 0.868                     | 3.26                  | 1.257                 | D3                   | 0.33798              | 0.32802               | 0.32863                 |
| FPLOC                | 0.879                     | 0.592                 | 0.414                 | E                    | 0.30122              | 0.30552               | 0.30613                 |

| Catchment Descriptor | River Loddon - Value | Watercourse 1 - Value | Watercourse 2 - Value | Catchment Descriptor | River Loddon - Value | Watercourse 1 - Value | Watercourse 2 - Value |
|----------------------|----------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|
| LDP                  | 41.58                | 3.07                  | 2.06                  | F                    | 2.59127              | 2.60328               | 2.06101               |
| PROPWET              | 0.32                 | 0.29                  | 0.29                  | C(1 km)              | -0.023               | -0.029                | -0.029                |
| RMED-1H              | 11.6                 | 11.4                  | 11.4                  | D1(1 km)             | 0.263                | 0.263                 | 0.263                 |
| RMED-1D              | 32.1                 | 29.1                  | 29.1                  | D2(1 km)             | 0.264                | 0.264                 | 0.264                 |
| RMED-2D              | 41.2                 | 36.2                  | 36.2                  | D3(1 km)             | 0.331                | 0.331                 | 0.331                 |
| SAAR                 | 716                  | 639                   | 638                   | E(1 km)              | 0.303                | 0.303                 | 0.303                 |
| SAAR4170             | 725                  | 644                   | 647                   | F(1 km)              | 2.621                | 2.621                 | 2.621                 |

Adjusted values are in **red**

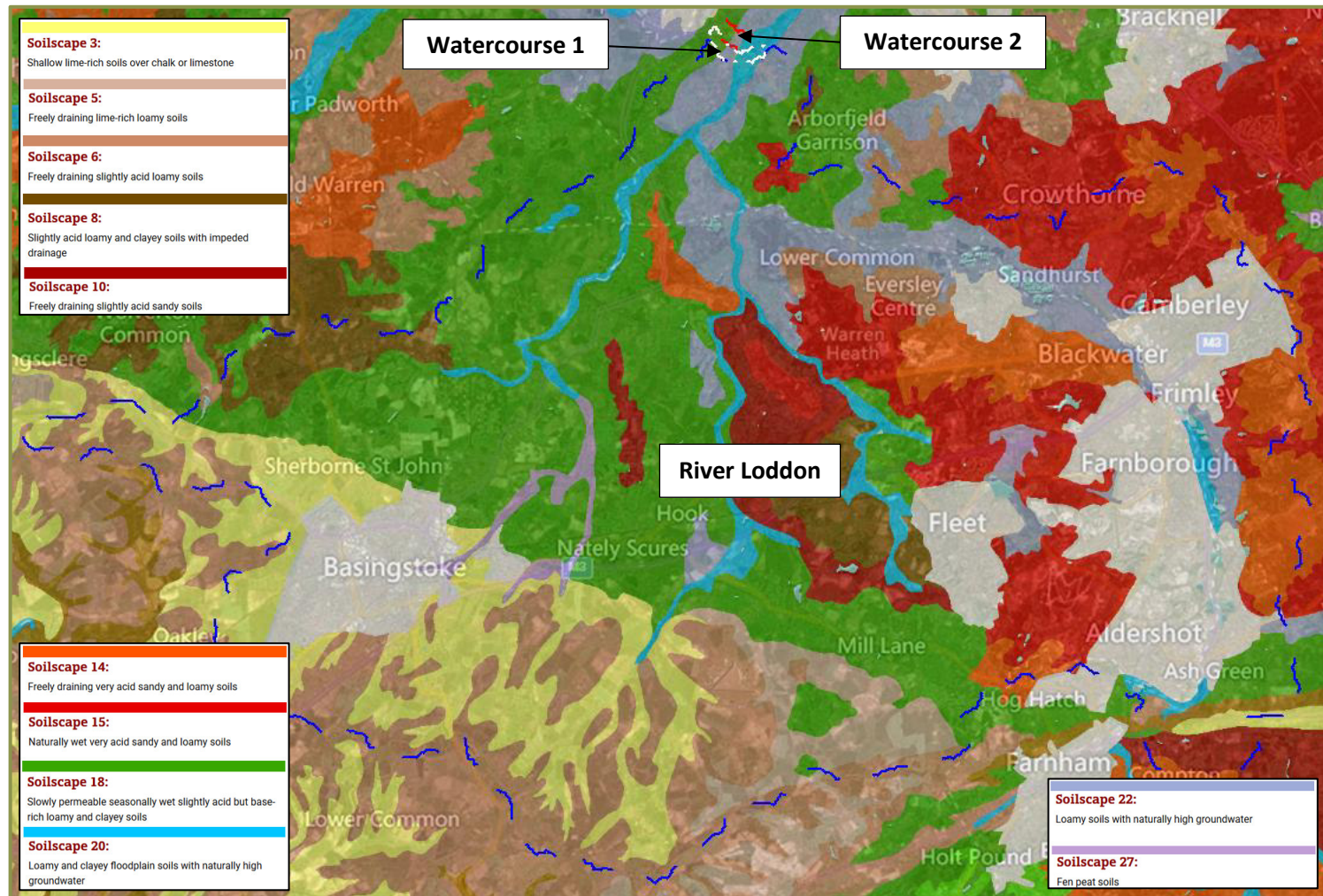
- 2.1.9 Based on the identified BFIHOST values, any that are >0.65 are deemed to be a highly permeable catchment (River Loddon). As per available Environment Agency guidance (Technical Report LIT 1832), it is stated that ReFH2 is suitable for estimating deign flood hydrographs on highly permeable catchments.

#### *BFIHOST/BFIHOST19*

- 2.1.10 BFIHOST is the baseflow index developed using the Hydrology of Soil Types (HOST) classification and is the baseflow proportion of the flow on average. It is estimated based on daily mean flow data. Baseflow comprises water entering the watercourse through shallow subsurface flow and groundwater flow (mechanisms other than direct surface runoff); hence permeable soils and geology tend to yield a higher baseflow.
- 2.1.11 A new catchment descriptor called BFIHOST19 is now available in FEH Webservice datasets. BFIHOST19 addresses a number of issues associated with the original BFIHOST descriptor<sup>2</sup>.
- 2.1.12 BFIHOST19 includes revised regression methods used to estimate BFIHOST and also has improved classification of rare soil types.
- 2.1.13 The catchments have been overlain the Cranfield Soil and Agrifood Institute Soilscales mapping using the web mapping service function in MapInfo. The National Soils Resources Institute (Cranfield University) HOST mapping (Figure 2.4) was reviewed to verify the BFIHOST and BFIHOST19 value.

<sup>2</sup> <https://fehweb.ceh.ac.uk/News/Article/bfihost19nowavailable>

Figure 2.4 Soils Mapping



**Blue Dashed:** River Loddon Downstream Catchment **White Dashed:** Watercourse 1 Catchment **Red Dashed:** Watercourse 2 Catchment Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2025].

- 2.1.14 The standard values from the FEH Webservice for BFIHOST and BFIHOST19 will be carried forward as representative of the catchments.

#### *SPRHOST*

- 2.1.15 The SPRHOST parameter reflects the amount of surface runoff in a catchment and is also based on the HOST soils classifications. The SPRHOST values of 26.95 (River Loddon), 31.20 (Watercourse 1) and 36.10 (Watercourse 2) reflects the variable soils underlying the catchment.
- 2.1.16 SPRHOST was verified by a review of the HOST mapping. The standard values from the FEH Webservice are considered appropriate based on the desktop study of geological mapping and will be carried forward in this assessment.

#### *PROPWET*

- 2.1.17 PROPWET describes the proportion of time that soils are wet. PROPWET values for the UK range from approximately 0.80 in Northern Scotland where there is high annual rainfall, to 0.20 in East Anglia where annual rainfall is much lower.
- 2.1.18 Low PROPWET values tend to inhibit flooding, as the catchment is not saturated prior to a flood event and there is higher capacity for infiltration, the opposite is true for catchments with higher PROPWET values. The PROPWET values ranging between 0.29 and 0.32 for the adjusted catchments is moderate, and may be explained by the following factors:
- Wet spells only occur at a low frequency and tend to be of a relatively short duration (supported by the SAAR figures below).
  - The catchments are in southern England where rainfall levels are lower compared to the north and west. As stated above, low PROPWET values are representative of non-saturated catchments with high capacity for infiltration. The BFIHOST values, repressurising a permeable catchment, support the low PROPWET value.
- 2.1.19 The PROPWET values taken from the FEH Webservice are considered representative of the adjusted catchments.

#### *FARL*

- 2.1.20 The FARL value is a measure of flow attenuation caused by reservoirs and lakes, and ranges from 0 (total attenuation) to 1.0 (no discernible attenuation). The River Loddon has a FARL value between 0.908 due to the following attenuation in the catchment:
- Ewhurst Pond
  - The Lake
  - Dogmersfield Lake
  - Tundry Pond
  - Fleet Pond
  - Hawley Lake
  - Gold Valley Lakes
  - Lakeside Park
  - Hollybush Park

- The Yateley Lakes

- 2.1.21 A FARL value of 1 indicates no attenuation due to reservoirs or lakes. Scrutiny of OS mapping did not highlight any waterbodies within the adjusted Watercourses 1 and 2 adjusted catchment.
- 2.1.22 The FARL values of 0.908 and 1 taken from the FEH Webservice data are therefore considered representative of the adjusted catchments.

#### URBEXT

##### i. River Loddon

- 2.1.23 The Urban Extent URBEXT1990 outputs of 0.0586 indicates an 'Moderately Urbanised' catchment. The FEH catchment descriptor URBEXT2000 was calculated to be 0.115 indicates an 'Moderately Urbanised' catchment.
- 2.1.24 The urban extents from URBEXT2000 are similar to the extents shown on up-to-date OS mapping and aerial photography with no significant variations between the two datasets.
- 2.1.25 As no significant development has occurred, a national average adjustment to the year 2025 is considered appropriate.

##### ii. Watercourse 1

- 2.1.26 The Urban Extent URBEXT1990 outputs of 0.0458 indicates a 'Slightly Urbanised' catchment. The FEH catchment descriptor URBEXT2000 was calculated to be 0.0928 and indicates a 'Moderately Urbanised' catchment. shows a slight increase in urbanisation has occurred during the intervening period, however, the change is minor/negligible.
- 2.1.27 Within the catchment there has been two areas of development identified that need to be accounted for. These are two residential developments (Figure 2.5). The two areas account for an increase in 0.31km<sup>2</sup> when digital imagery from 2003 and 2025 is compared using Google Earth.

**Figure 2.5: Areas of Increased Urbanisation**



**Left: January 2003 Right: May 2025**

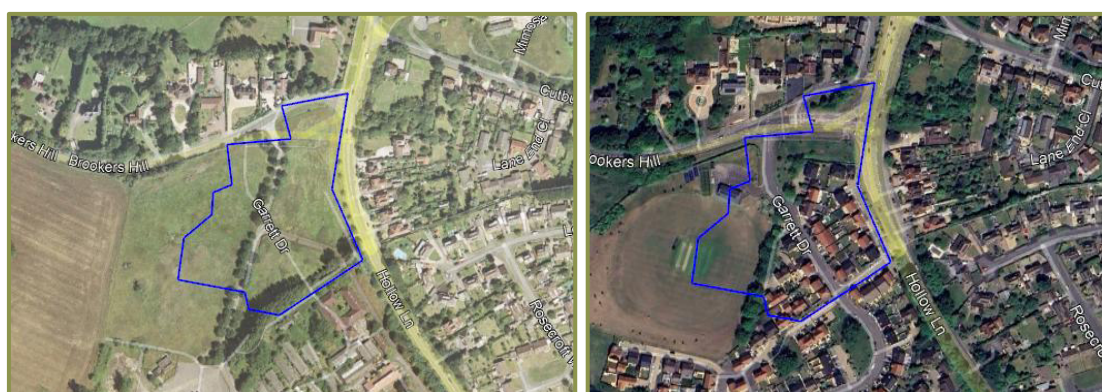
- 2.1.28 In order to establish the 'new' URBEXT value, the existing catchment descriptors have been entered into ReH2 and the urbanisation value altered on the urbanisation tab to update the existing URBEXT value. The updated value (0.27) indicates a 'Very Heavily Urbanised'

catchment. These updated URBEXT values will be carried forward for the FEH statistical methodology and the RFeH2 methodology.

### iii. Watercourse 2

- 2.1.29 The Urban Extent URBEXT1990 outputs of 0.0527 indicates 'Moderately Urbanised' catchment. The FEH catchment descriptor URBEXT2000 was calculated to be 0.0928 shows a slight increase in urbanisation has occurred during the intervening 10-year period, however, the change is minor/negligible.
- 2.1.30 Within the catchment there has been two areas of development identified that need to be accounted for. These are two residential developments (Figure 2.6). The two areas account for an increase in 0.236km<sup>2</sup> when digital imagery from 2003 and 2025 is compared using Google Earth.

**Figure 2.6: Areas of Increased Urbanisation**



**Left: January 2003 Right: May 2025**

- 2.1.31 In order to establish the 'new' URBEXT value, the existing catchment descriptors have been entered into ReH2 and the urbanisation value altered on the urbanisation tab to update the existing URBEXT value. The updated value (0.24) indicates a 'Heavily Urbanised' catchment. These updated URBEXT values will be carried forward for the FEH statistical methodology and the RFeH2 methodology.

### SAAR

- 2.1.32 SAAR values within the FEH represent standard average annual rainfall data for the standard period 1961-1990.
- 2.1.33 The catchment is in the south west of England where rainfall levels are lower. Catchments in the south of England are drier for a greater proportion of the time reflecting the decrease in reliable frontal rainfall and higher evapotranspiration rates.
- 2.1.34 A SAAR values of 716mm, 639mm and 647mm indicates a moderately dry catchment. Given the catchment locations within the south of England and at a relatively low altitude, the SAAR values taken from the FEH Webservice are considered representative and will be carried forward in this assessment.

## DPSBAR

2.1.35 The Drainage Path Slope (DPSBAR) shows a values of 32, 12.1 and 21.5, which indicates a moderate catchment. This is supported by a review of OS mapping and LiDAR. The DPSBAR value taken from the FEH Webservice is considered representative of the catchments.

2.1.36 The FEH Webservice DPSBAR values are considered representative.

## 2.2 FEH Statistical Method

### Introduction

2.2.1 To determine the most appropriate hydrological methodology for the catchments, the peak flood flows from FEH Statistical and ReFH2 methodologies were assessed for the catchment, inclusive of adjustments to BFIHOST, SPRHOST and AREA.

2.2.2 Following the FEH Statistical and ReFH2 assessments, justification will be provided for the carry forward method to be utilised for peak flow assessments for the compartmentalised catchments.

2.2.3 The FEH Statistical Method is based on an Index Flood, which is the median annual maximum flood from Catchment Descriptors and then improving this using data from an appropriate Gauging Station (if available). This reduces the error associated with the estimation of QMED using only Catchment Descriptors. QMED is formally defined as the middle-ranking value in the series of annual maximum floods, where the annual maximum series comprises, the largest flow observed in each year. QMED is the flood that is exceeded on average “every other year” and can therefore loosely be attributed a return period of 1 in 2-years.

### QMED Estimation using Donor Stations

#### i. River Loddon

2.2.4 The study catchment is not directly gauged at the catchment outlet; however, WINFAP FEH identified the following gauging stations are being suitable for QMED estimation for the River Loddon catchment:

- **39022 – Loddon at Sheepbridge:** Station 39022 has a catchment area of 176.77km<sup>2</sup> and is listed as being suitable for QMED<sup>3</sup>, with a 58-year record.
- **39011 – Wey at Tiford:** Station 39011 has a catchment area of 391.32km<sup>2</sup> and is listed as being suitable for QMED<sup>4</sup>, with a 69-year record.
- **42009 – Candover Stream at Borough Bridge:** Station 42009 has a catchment area of 72.06km<sup>2</sup> and is listed as being suitable for QMED<sup>5</sup>, with a 52-year record.
- **42007 – Alre at Drove Lane Alresford:** Station 42007 has a catchment area of 57.44km<sup>2</sup> and is listed as being suitable for QMED<sup>6</sup>, with a 44-year record.
- **39025 – Enborne at Brimpton:** Station 39025 has a catchment area of 142.01km<sup>2</sup> and is listed as being suitable for QMED<sup>7</sup>, with a 56-year record.

<sup>3</sup> <https://nrfa.ceh.ac.uk/data/station/info/39022>

<sup>4</sup> <https://nrfa.ceh.ac.uk/data/station/info/39011>

<sup>5</sup> <https://nrfa.ceh.ac.uk/data/station/info/42009>

<sup>6</sup> <https://nrfa.ceh.ac.uk/data/station/info/42007>

<sup>7</sup> <https://nrfa.ceh.ac.uk/data/station/info/39025>

- **42010 – Itchen at Highbridge and Allbrook Total:** Station 42010 has a catchment area of 339.90km<sup>2</sup> and is listed as being suitable for QMED<sup>8</sup>, with a 65-year record.

2.2.5 A comparison of key catchment descriptors for the gauging stations (obtained from the NRFA web page) are presented in Table 2.2.

**Table 2.2: River Loddon Catchment Descriptors Comparison**

| Catchment Descriptor | River Loddon              | Loddon at Sheepbridge | Wey at Tilford | Candover Stream at Borough Bridge |
|----------------------|---------------------------|-----------------------|----------------|-----------------------------------|
| AREA                 | 551.18<br><b>(550.10)</b> | 176.77                | 391.32         | 72.06                             |
| BFIHOST              | 0.613                     | 0.594                 | 0.795          | 0.951                             |
| BFIHOST19            | 0.665                     | 0.664                 | 0.773          | 0.924                             |
| FARL                 | 0.908                     | 0.947                 | 0.957          | 0.930                             |
| PROPWET              | 0.32                      | 0.33                  | 0.35           | 0.34                              |
| SAAR                 | 716                       | 735                   | 855            | 819                               |
| SPRHOST              | 26.95                     | 26.40                 | 18.28          | 6.06                              |
| URBEXT2000           | 0.115                     | 0.087                 | 0.053          | 0.11                              |

| Catchment Descriptor | River Loddon              | Alre at Drove Lane Alresford | Enborne at Brimpton | Itchen at Highbridge and Allbrook Total |
|----------------------|---------------------------|------------------------------|---------------------|-----------------------------------------|
| AREA                 | 551.18<br><b>(550.10)</b> | 57.44                        | 142.01              | 339.90                                  |
| BFIHOST              | 0.613                     | 0.964                        | 0.500               | 0.949                                   |
| BFIHOST19            | 0.665                     | 0.933                        | 0.563               | 0.921                                   |
| FARL                 | 0.908                     | 0.864                        | 0.978               | 0.949                                   |
| PROPWET              | 0.32                      | 0.34                         | 0.32                | 0.34                                    |
| SAAR                 | 716                       | 857                          | 789                 | 834                                     |
| SPRHOST              | 26.95                     | 4.85                         | 32.78               | 6.09                                    |
| URBEXT2000           | 0.115                     | 0.016                        | 0.020               | 0.029                                   |

*Adjusted values are shown in red*

2.2.6 FEH statistical software provided a number of additional donor stations to consider for the flow calculations for the catchment. These are listed below with reasons for acceptance or refusal also detailed:

- 39022 – Loddon at Sheepbridge – **Accepted**.
- 39011 – Wey at Tiford – **Accepted**.
- 42009 – Candover Stream at Borough Bridge – **Accepted**.
- 42007 – Alre at Drove Lane Alresford – **Accepted**.
- 39025 – Enborne at Brimpton – **Accepted**.
- 42010 – Itchen at Highbridge and Allbrook Total – **Accepted**.
- 41011 – Rother at Iping Mill – **Rejected**. The upstream mill complex affects flow regimes at this location. Drowning of gauging also occurs due to build up of sediment. As such, the station has been rejected.

<sup>8</sup> <https://nrfa.ceh.ac.uk/data/station/info/42010>

- 39027 – Pang at Pangbour – **Rejected**. There is greater uncertainty in flows at stages above 0.4m and below 0.1m. As such, the station has been rejected.
- 42008 – Cheriton Stream at Swards Bridge – **Rejected**. No confidence in validity of bankfull flows. As such, the station has been rejected.
- 41022 – Lod at Halfway Bridge – **Rejected**. Bypassing of gauge occurs during high/extreme flows. As such, the station has been rejected.

ii. *Watercourse 1*

2.2.7 The study catchment is not directly gauged at the catchment outlet; however, WINFAP FEH identified the following gauging stations are being suitable for QMED estimation for the Watercourse 1 catchment.

- **39007 – Blackwater at Swallowfield**: Station 39007 has a catchment area of 359.81km<sup>2</sup> and is listed as being suitable for QMED <sup>9</sup>, with a 70-year record.

2.2.8 A comparison of key catchment descriptors for the gauging stations (obtained from the NRFA web page) are presented in Table 2.3.

**Table 2.3: Blackwater at Swallowfield Catchment Descriptors Comparison**

| Catchment Descriptor | Watercourse 1       | Blackwater at Swallowfield |
|----------------------|---------------------|----------------------------|
| AREA                 | 0.91 <b>(0.74)</b>  | 359.81                     |
| BFIHOST              | 0.558               | 0.630                      |
| BFIHOST19            | 0.618               | 0.674                      |
| FARL                 | 1                   | 0.886                      |
| PROPWET              | 0.29                | 0.32                       |
| SAAR                 | 639                 | 708                        |
| SPRHOST              | 31.20               | 26.79                      |
| URBEXT2000           | 0.135 <b>(0.27)</b> | 0.1323                     |

*Adjusted values are shown in red*

2.2.9 FEH statistical software provided a number of additional donor stations to consider for the flow calculations for the catchment. These are listed below with reasons for acceptance or refusal also detailed:

- 39007 – Blackwater at Swallowfield – **Accepted**.
- 39052 – The Cut at Binfield – **Rejected**. AMAX flows under estimated across the its range. As such, the station has been rejected.
- 39022 – Loddon at Sheepbridge – **Rejected**. Significant weed growth upstream of the gauge can influence flow estimates. As such, the station has been rejected.
- 39027 – Pang at Pangbourne – **Rejected**. There is greater uncertainty in flows at stages above 0.40m and below 0.10m. As such, the station has been rejected.
- 39001 – Thames at Kingston – **Rejected**. Issues with deriving flows when less than 5 cumecs. As such, the station has been rejected.

<sup>9</sup> <https://nrfa.ceh.ac.uk/data/station/info/39007>

- 39025 – Enborne at Brimpton - **Rejected**. No adjustments have been made to the historical record to account for out of bank flows. As such, the station has been rejected.
- 39023 – Wye at Bourne End Hedsor - **Rejected**. **Channel cross sectional area changes based upon build-up of sediment within the catchment, which influences flows**. As such, the station has been rejected.
- 42009 – Candover Stream at Borough Bridge – **Rejected**. BFIHOST value not comparable to adjusted catchment. As such, the station has been rejected.
- 39033 – Winterbourne Stream at Bangor - **Rejected**. FARL value not comparable to adjusted catchment. As such, the station has been rejected.
- 39011 – Wey at Tilford - **Rejected**. URBEXT2000 value not comparable to adjusted catchment. As such, the station has been rejected.

### iii. Watercourse 2

2.2.10 The study catchment is not directly gauged at the catchment outlet; however, WINFAP FEH identified the following gauging stations are being suitable for QMED estimation for the Watercourse 2 catchment.

- **39052 – The Cut at Binfield:** Station 39052 has a catchment area of 49.99km<sup>2</sup> and is listed as being suitable for QMED<sup>10</sup>, with a 66-year record.

2.2.11 A comparison of key catchment descriptors for the gauging stations (obtained from the NRFA web page) are presented in Table 2.4.

**Table 2.4: The Cut at Binfield Catchment Descriptors Comparison**

| Catchment Descriptor | Watercourse 2        | The Cut at Binfield |
|----------------------|----------------------|---------------------|
| AREA                 | 1.18 <b>(0.63)</b>   | 49.99               |
| BFIHOST              | 0.459                | 0.355               |
| BFIHOST19            | 0.488                | 0.366               |
| FARL                 | 1                    | 0.939               |
| PROPWET              | 0.29                 | 0.29                |
| SAAR                 | 638                  | 676                 |
| SPRHOST              | 36.10                | 41.54               |
| URBEXT2000           | 0.0928 <b>(0.24)</b> | 0.2374              |

*Adjusted values are shown in red*

2.2.12 FEH statistical software provided a number of additional donor stations to consider for the flow calculations for the catchment. These are listed below with reasons for acceptance or refusal also detailed:

- 39052 – The Cut at Binfield – **Accepted**.
- 39007 – Blackwater at Swallowfield – **Rejected**. BFIHOST value not comparable to adjusted catchment. As such, the station has been rejected.
- 39022 – Loddon at Sheepbridge - **Rejected**. Significant weed growth upstream of the gauge can influence flow estimates. As such, the station has been rejected.

<sup>10</sup> <https://nrfa.ceh.ac.uk/data/station/info/39052>

- 39027 – Pang at Pangbourne - **Rejected**. There is greater uncertainty in flows at stages above 0.40m and below 0.10m. As such, the station has been rejected.
- 39001 – Thames at Kingston – **Rejected**. Issues with deriving flows when less than 5 cumecs. As such, the station has been rejected.
- 39025 – Enborne at Brimpton - **Rejected**. No adjustments have been made to the historical record to account for out of bank flows. As such, the station has been rejected.
- 39023 – Wye at Bourne End Hedsor – **Rejected**. Channel cross sectional area changes based upon build-up of sediment within the catchment, which influences flows. As such, the station has been rejected.
- 39033 – Winterbourne Stream at Bangor – **Rejected**. FARL value not comparable to adjusted catchment. As such, the station has been rejected.
- 42009 – Candover Stream at Borough Bridge – **Rejected**. BFIHOST value not comparable to adjusted catchment. As such, the station has been rejected.
- 39011 – Wey at Tilford – **Rejected**. URBEXT2000 value not comparable to adjusted catchment. As such, the station has been rejected.

#### QMED Comparison

- 2.2.13 Figure 2.7 shows the comparison for QMED from donor stations and catchment descriptors for River Loddon and the Watercourses 1 and 2 catchments.
- 2.2.14 It can be seen that for the River Loddon catchment, QMED from donor stations is 4.45% greater than from catchment descriptors.
- 2.2.15 For the Watercourse 1 catchment, QMED from donor stations is 7.83% greater than from catchment descriptors.
- 2.2.16 For the Watercourse 2 catchment, QMED from donor stations is 7.56% greater than from catchment descriptors.

**Figure 2.7: QMED Comparison**

| QMED                            | QMED                            |
|---------------------------------|---------------------------------|
| Rural: 25.075 m <sup>3</sup> /s | Rural: 23.957 m <sup>3</sup> /s |
| Urban: 30.181 m <sup>3</sup> /s | Urban: 28.835 m <sup>3</sup> /s |

**Left:** River Loddon Upstream Donor Station QMED **Right:** River Loddon Upstream Catchment Descriptors QMED

| QMED                           | QMED                           |
|--------------------------------|--------------------------------|
| Rural: 0.114 m <sup>3</sup> /s | Rural: 0.106 m <sup>3</sup> /s |
| Urban: 0.166 m <sup>3</sup> /s | Urban: 0.153 m <sup>3</sup> /s |

**Left:** Watercourse 1 Donor Station QMED **Right:** Watercourse 1 Catchment Descriptors QMED

| QMED                           | QMED                           |
|--------------------------------|--------------------------------|
| Rural: 0.143 m <sup>3</sup> /s | Rural: 0.132 m <sup>3</sup> /s |
| Urban: 0.185 m <sup>3</sup> /s | Urban: 0.171 m <sup>3</sup> /s |

**Left:** Watercourse 2 Donor Station QMED **Right:** Watercourse 2 Catchment Descriptors QMED

#### *QMED Choice Going Forwards*

- 2.2.17 When comparing QMED from catchment descriptors and from donor stations, it can be seen that donor stations result in higher values. In order to undertake a conservative assessment of flows, QMED from donor stations will be carried forward.

#### *Pooling Group Analysis*

- 2.2.18 The pooling group analysis and QMED estimation (based on Catchment Descriptors) is described below. WINFAP FEH v5 software (Version 5.2.9046 [26106]) and the NRFA Peak Flow v13.0.2 dataset was used to undertake the assessment. Outputs from FEH statistical can be viewed in Appendix 2.
- 2.2.19 To estimate the magnitude of the statistical flood events occurring within the ungauged (adjusted) catchment, it is necessary to determine a flood growth curve and a flood frequency curve. This is done by forming a pooling group, which is a group of hydrologically similar catchments across the UK which have gauged records covering a statistically adequate number of years to obtain reliable flood estimates and subjecting this group to statistical analysis.
- 2.2.20 To calculate reliable flood estimates, the FEH recommends that a pooling group should contain five times as many station-years as the target return period (5T) however, the 'Improved Statistical Method' (2008) recommends that a fixed pooling group size of at least 500 annual maxima events should be used for all return period events. This revised advice has been adopted in this instance.
- 2.2.21 The FEH Webservice Catchment Descriptors in Table 2.1 imported into the WINFAP-FEH v5 and a pooling group of 503 years of data for the River Loddon, 523 years of data for Watercourse 1 and 532 years of data for Watercourse 2 (Figure 2.8).
- 2.2.22 It should be noted that URBEXT has been applied as per default to the pooling groups, as per available Environment Agency guidance. With the default Urban Adjustment Factor (UAF) being applied as per that calculated in the FEH statistical software. The urban adjustment procedures in WINFAP are based on those published by Kjeldsen<sup>11</sup> (2010).
- 2.2.23 The initial pooling groups were identified as 'heterogenous' and a review of the pooling groups is 'desirable'.

<sup>11</sup> Kjeldsen, T.R. 2010. Modelling the impact of urbanization on flood frequency relationships in the UK. Hydrology Research, Volume 41, Issue 5, 391-405

Figure 2.8: Initial Pooling Group

| Pooling group AM data              |          |               |         |               |                  |                 |                    |
|------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                            | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 28015 (Idle @ Mattersey)           | 0.208    | 37            | 9.520   | 0.197         | <b>0.206</b>     | 0.148           | <b>0.137</b>       |
| 39104 (Mole @ Esher)               | 0.422    | 23            | 53.760  | 0.281         | <b>0.301</b>     | 0.273           | <b>0.252</b>       |
| 68001 (Weaver @ Ashbrook)          | 0.500    | 86            | 46.677  | 0.207         | <b>0.210</b>     | 0.207           | <b>0.203</b>       |
| 39021 (Cherwell @ Enslow Mill)     | 0.572    | 56            | 19.300  | 0.271         | <b>0.275</b>     | 0.509           | <b>0.504</b>       |
| 31004 (Welland @ Tallington Total) | 0.616    | 56            | 34.799  | 0.297         | <b>0.300</b>     | 0.201           | <b>0.198</b>       |
| 43009 (Stour @ Hammoon)            | 0.629    | 55            | 110.352 | 0.182         | <b>0.183</b>     | 0.100           | <b>0.098</b>       |
| 27062 (Nidd @ Skp Bridge)          | 0.650    | 22            | 92.391  | 0.248         | <b>0.252</b>     | 0.400           | <b>0.393</b>       |
| 31005 (Welland @ Tixover)          | 0.668    | 60            | 36.908  | 0.295         | <b>0.297</b>     | 0.273           | <b>0.270</b>       |
| 28024 (Weake @ Syston Mill)        | 0.674    | 55            | 34.366  | 0.315         | <b>0.320</b>     | 0.316           | <b>0.312</b>       |
| 33034 (Little Ouse @ Abbey Heath)  | 0.712    | 53            | 15.200  | 0.265         | <b>0.268</b>     | 0.164           | <b>0.161</b>       |
| <b>Total</b>                       |          | <b>503</b>    |         |               |                  |                 |                    |

| Pooling group AM data                           |          |               |         |               |                  |                 |                    |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 76011 (Coal Bum @ Coalburn)                     | 1.667    | 46            | 1.826   | 0.170         | <b>0.170</b>     | 0.296           | <b>0.296</b>       |
| 27073 (Brompton Beck @ Snainton Ings)           | 1.921    | 43            | 0.812   | 0.212         | <b>0.213</b>     | 0.033           | <b>0.032</b>       |
| 23018 (Ouse Burn @ Wolsington)                  | 2.075    | 32            | 3.287   | 0.273         | <b>0.290</b>     | 0.192           | <b>0.175</b>       |
| 27051 (Oimle @ Burn Bridge)                     | 2.075    | 51            | 4.564   | 0.217         | <b>0.217</b>     | 0.142           | <b>0.141</b>       |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.472    | 26            | 0.100   | 0.318         | <b>0.318</b>     | 0.253           | <b>0.253</b>       |
| 25019 (Leven @ Easby)                           | 2.500    | 45            | 5.090   | 0.341         | <b>0.342</b>     | 0.373           | <b>0.372</b>       |
| 45816 (Haddeo @ Upton)                          | 2.536    | 30            | 3.352   | 0.288         | <b>0.289</b>     | 0.408           | <b>0.407</b>       |
| 68021 (Arrowe Brook @ Acton Lane)               | 2.561    | 17            | 3.976   | 0.269         | <b>0.298</b>     | 0.428           | <b>0.393</b>       |
| 30013 (Heighington Beck @ Heighington)          | 2.753    | 47            | 0.643   | 0.361         | <b>0.378</b>     | 0.442           | <b>0.426</b>       |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.793    | 37            | 2.470   | 0.253         | <b>0.289</b>     | 0.246           | <b>0.207</b>       |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.813    | 13            | 4.072   | 0.274         | <b>0.275</b>     | 0.295           | <b>0.294</b>       |
| 28033 (Dove @ Hollinsdough)                     | 2.841    | 48            | 4.138   | 0.235         | <b>0.235</b>     | 0.367           | <b>0.367</b>       |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.847    | 41            | 9.420   | 0.224         | <b>0.224</b>     | 0.293           | <b>0.293</b>       |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.871    | 56            | 7.855   | 0.348         | <b>0.350</b>     | 0.107           | <b>0.106</b>       |
| <b>Total</b>                                    |          | <b>532</b>    |         |               |                  |                 |                    |

| Pooling group AM data                           |          |               |         |               |                  |                 |                    |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 76011 (Coal Bum @ Coalburn)                     | 1.723    | 46            | 1.826   | 0.170         | <b>0.170</b>     | 0.296           | <b>0.296</b>       |
| 27073 (Brompton Beck @ Snainton Ings)           | 2.047    | 43            | 0.812   | 0.212         | <b>0.213</b>     | 0.033           | <b>0.032</b>       |
| 27051 (Oimle @ Burn Bridge)                     | 2.194    | 51            | 4.564   | 0.217         | <b>0.217</b>     | 0.142           | <b>0.141</b>       |
| 23018 (Ouse Burn @ Wolsington)                  | 2.202    | 32            | 3.287   | 0.273         | <b>0.290</b>     | 0.192           | <b>0.175</b>       |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.568    | 26            | 0.100   | 0.318         | <b>0.318</b>     | 0.253           | <b>0.253</b>       |
| 25019 (Leven @ Easby)                           | 2.623    | 45            | 5.090   | 0.341         | <b>0.342</b>     | 0.373           | <b>0.372</b>       |
| 45816 (Haddeo @ Upton)                          | 2.628    | 30            | 3.352   | 0.288         | <b>0.289</b>     | 0.408           | <b>0.407</b>       |
| 68021 (Arrowe Brook @ Acton Lane)               | 2.687    | 17            | 3.976   | 0.269         | <b>0.298</b>     | 0.428           | <b>0.393</b>       |
| 30013 (Heighington Beck @ Heighington)          | 2.880    | 47            | 0.643   | 0.361         | <b>0.378</b>     | 0.442           | <b>0.426</b>       |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.920    | 37            | 2.470   | 0.253         | <b>0.289</b>     | 0.246           | <b>0.207</b>       |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.926    | 13            | 4.072   | 0.274         | <b>0.275</b>     | 0.295           | <b>0.294</b>       |
| 28033 (Dove @ Hollinsdough)                     | 2.930    | 48            | 4.138   | 0.235         | <b>0.235</b>     | 0.367           | <b>0.367</b>       |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.964    | 41            | 9.420   | 0.224         | <b>0.224</b>     | 0.293           | <b>0.293</b>       |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.998    | 56            | 7.855   | 0.348         | <b>0.350</b>     | 0.107           | <b>0.106</b>       |
| <b>Total</b>                                    |          | <b>532</b>    |         |               |                  |                 |                    |

**Top: River Loddon Middle: Watercourse 1 Bottom: Watercourse 2**

- 2.2.24 A review of the pooling group was undertaken starting with the stations with the highest discordancy. Station flow data, gauging method/type, catchment descriptions and photos provided on the NRFA website were assessed for each station.
- 2.2.25 The review highlighted multiple stations for consideration for each catchment being assessed, of which are detailed below.

### *River Loddon*

2.2.26 The stations are detailed below:

- **39021: Cherwell at Enslow Mill** (56 years) removed as FARL value not comparable to adjusted catchment.
- **28024: Wreake at Syston Mill** (55 years) removed as BFIHOST19 value not comparable to adjusted catchment.

2.2.27 Following the review 39021 and 28024 were removed, as per the reasons stated above. The following stations were added to maintain a minimum 500 years of data within the pooling group. The stations are chosen as per default from FEH statistical software.

- 33005: Bedford Ouse at Thornborough Mill
- 205004: Lagan at Newforge
- 28026: Anker at Polesworth

### *Watercourse 1*

2.2.28 The stations are detailed below:

- **76011: Coal Burn at Coalburn** (46 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **45816: Haddeo at Upton** (30 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **49005: Bollingey Stream at Bolingey Cocks Bridge** (13 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **28033: Dove at Hollinsclough** (48 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **44008: South Winterbourne at Winterbourne Steepleton** (32 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **26014: Water Forlornes at Driffield** (25 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **84035: Kittoch Water at Waterside** (32 years) removed as BFIHOST19 value not comparable to adjusted catchment.
- **39086: Gatwick Stream at Gatwick Link** (48 years) removed as FARL value not comparable to adjusted catchment.

2.2.29 Following the review 76011, 45816, 49005, 28033, 44008, 26014, 84035 and 39086 were removed, as per the reasons stated above. The following stations were added to maintain a minimum 500 years of data within the pooling group. The stations are chosen as per default from FEH statistical software.

- 44008: South Winterbourne at Winterbourne Steepleton
- 26014: Water Forlornes at Driffield
- 84035: Kittoch Water at Waterside
- 39086: Gatwick Stream at Gatwick Link
- 7009: Mosset Burn at Wardend Bridge
- 36011: Stour Brook at Sturmer

- 38020: Cobbins Brook at Sewardstone Road

#### *Watercourse 2*

2.2.30 The stations are detailed below:

- **76011: Coal Burn at Coalburn** (46 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **45816: Haddeo at Upton** (30 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **30013: Heighington Beck at Heighington** (47 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **49005: Bollingey Stream at Bolingey Cocks Bridge** (13 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **28033: Dove at Hollinsclough** (48 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **44008: South Winterbourne at Winterbourne Steepleton** (32 years) removed as URBEXT2000 value not comparable to adjusted catchment.
- **39086: Gatwick Stream at Gatwick Link** (48 years) removed as FARL value not comparable to adjusted catchment.

2.2.31 Following the review 76011, 45816, 30013, 49005, 28033, 44008 and 39086 were removed, as per the reasons stated above. The following stations were added to maintain a minimum 500 years of data within the pooling group. The stations are chosen as per default from FEH statistical software.

- 44008: South Winterbourne at Winterbourne Steepleton
- 39086: Gatwick Stream at Gatwick Link
- 7009: Mosset Burn at Wardend Bridge
- 26014: Water Forlornes at Driffild
- 36011: Stour Brook at Sturmer
- 38020: Cobbins Brook at Sewardstone Road

#### *Final Pooling Groups*

2.2.32 The reviewed pooling groups for the River Loddon, Watercourse 1 and Watercourse 2 can be viewed in Figure 2.9.

Figure 2.9: Reviewed Pooling Group

| Pooling group AM data                   |          |               |         |               |                  |                 |                    |
|-----------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                                 | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 28015 (Idle @ Mattersey)                | 0.208    | 37            | 9.520   | 0.197         | 0.206            | 0.148           | 0.137              |
| 39104 (Mole @ Esher)                    | 0.422    | 23            | 53.760  | 0.281         | 0.301            | 0.273           | 0.252              |
| 68001 (Weaver @ Ashbrook)               | 0.500    | 86            | 46.677  | 0.207         | 0.210            | 0.207           | 0.203              |
| 31004 (Welland @ Tallington Total)      | 0.616    | 56            | 34.799  | 0.297         | 0.300            | 0.201           | 0.198              |
| 43009 (Stour @ Hammoon)                 | 0.629    | 55            | 110.352 | 0.182         | 0.183            | 0.100           | 0.098              |
| 27062 (Nidd @ Skip Bridge)              | 0.650    | 22            | 92.391  | 0.248         | 0.252            | 0.400           | 0.393              |
| 31005 (Welland @ Tixover)               | 0.668    | 60            | 36.908  | 0.295         | 0.297            | 0.273           | 0.270              |
| 33034 (Little Ouse @ Abbey Heath)       | 0.712    | 53            | 15.200  | 0.265         | 0.268            | 0.164           | 0.161              |
| 33005 (Bedford Ouse @ Thomborough Mill) | 0.721    | 28            | 21.800  | 0.178         | 0.180            | -0.112          | -0.113             |
| 205004 (Lagan @ Newforge)               | 0.753    | 51            | 75.107  | 0.196         | 0.200            | 0.247           | 0.241              |
| 28026 (Anker @ Polesworth)              | 0.760    | 56            | 46.049  | 0.279         | 0.292            | 0.168           | 0.155              |
| <b>Total</b>                            |          | <b>527</b>    |         |               |                  |                 |                    |

| Pooling group AM data                    |          |               |         |               |                  |                 |                    |
|------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                                  | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 27073 (Brompton Beck @ Snainton Ings)    | 1.921    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 23018 (Ouse Burn @ Wolsington)           | 2.075    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 27051 (Crimple @ Burn Bridge)            | 2.075    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 2.472    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                    | 2.500    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 68021 (Arrowe Brook @ Acton Lane)        | 2.561    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)   | 2.753    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 2.793    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 27010 (Hodge Beck @ Bransdale Weir)      | 2.847    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)    | 2.871    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| 7009 (Mosset Burn @ Wardend Bridge)      | 2.956    | 25            | 7.053   | 0.365         | 0.365            | 0.329           | 0.329              |
| 36011 (Stour Brook @ Sturmer)            | 3.042    | 53            | 6.780   | 0.282         | 0.300            | 0.179           | 0.162              |
| 38020 (Cobbins Brook @ Sewardstone Road) | 3.134    | 52            | 7.402   | 0.325         | 0.335            | 0.331           | 0.321              |
| <b>Total</b>                             |          | <b>525</b>    |         |               |                  |                 |                    |

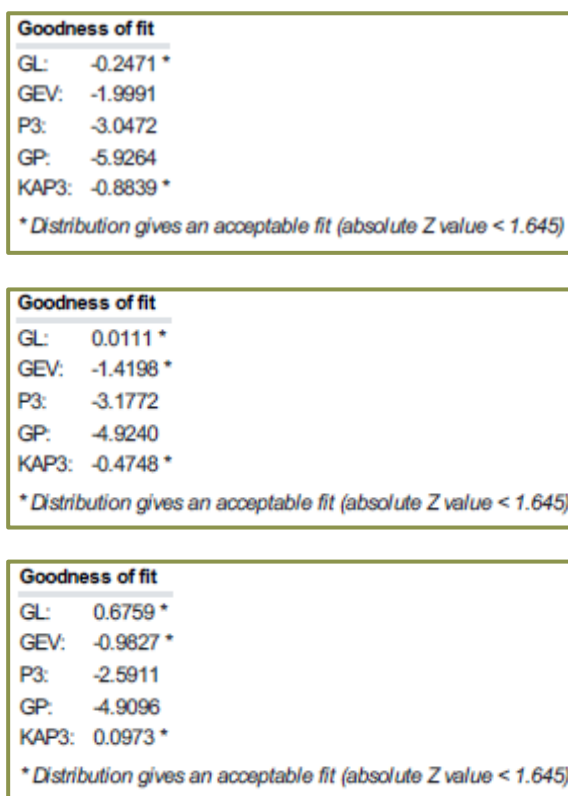
| Pooling group AM data                    |          |               |         |               |                  |                 |                    |
|------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| Station                                  | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
| 27073 (Brompton Beck @ Snainton Ings)    | 2.047    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 27051 (Crimple @ Burn Bridge)            | 2.194    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 23018 (Ouse Burn @ Wolsington)           | 2.202    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 2.598    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                    | 2.623    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 68021 (Arrowe Brook @ Acton Lane)        | 2.687    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 2.920    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 27010 (Hodge Beck @ Bransdale Weir)      | 2.964    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)    | 2.998    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| 7009 (Mosset Burn @ Wardend Bridge)      | 3.081    | 25            | 7.053   | 0.365         | 0.365            | 0.329           | 0.329              |
| 26014 (Water Forlomes @ Driffild)        | 3.137    | 25            | 0.424   | 0.318         | 0.319            | 0.205           | 0.204              |
| 36011 (Stour Brook @ Sturmer)            | 3.168    | 53            | 6.780   | 0.282         | 0.300            | 0.179           | 0.162              |
| 38020 (Cobbins Brook @ Sewardstone Road) | 3.261    | 52            | 7.402   | 0.325         | 0.335            | 0.331           | 0.321              |
| <b>Total</b>                             |          | <b>503</b>    |         |               |                  |                 |                    |

**Top:** River Loddon **Middle:** Watercourse 1 **Bottom:** Watercourse 2

- 2.2.33 Following the review, the pooling group for the River Loddon has been identified as 'homogenous' and a review of the pooling group is 'not required'.
- 2.2.34 The pooling group for Watercourse 1 has been identified as 'possibly heterogeneous' and a review of the pooling group is 'optional'. The pooling group has been checked, and no further stations have been removed.
- 2.2.35 The pooling group for Watercourse 2 has been identified as 'possibly heterogeneous' and a review of the pooling group is 'optional'. The pooling group has been checked, and no further stations have been removed.

- 2.2.36 As such, the reviewed pooling groups have been carried forward with no further reviews.
- 2.2.37 Generalised Logistic (GL), Generalised Extreme Value (GEV), Pearson Type III (PTIII), and Generalised Pareto (GP) fittings were used to determine goodness of fit (Figure 2.10).

**Figure 2.10: Goodness of Fit**



**Top:** River Loddon **Middle:** Watercourse 1 **Bottom:** Watercourse 2

- 2.2.38 The FEH recommends the (GL) distribution as the most suitable for fitting pooled growth curves to UK flood data and this recommendation has been adhered to in this assessment. The results can vary slightly, depending on the chosen distribution for the statistical analysis. The Pooling Group growth curve fittings and flood frequency curve fittings are included below in Tables 2.5 and 2.6.

**Table 2.5: Pooled Group Growth Fittings Comparison**

| Return period | Growth Fittings – River Loddon | Growth Fittings – Watercourse 1 | Growth Fittings – Watercourse 2 |
|---------------|--------------------------------|---------------------------------|---------------------------------|
| 2             | 1.000                          | 1.000                           | 1.000                           |
| 5             | 1.366                          | 1.428                           | 1.427                           |
| 10            | 1.633                          | 1.771                           | 1.761                           |
| 30            | 2.101                          | 2.433                           | 2.390                           |
| 50            | 2.349                          | 2.812                           | 2.742                           |
| 100           | 2.726                          | 3.420                           | 3.300                           |
| 200           | 3.155                          | 4.160                           | 3.967                           |
| 1000          | 4.409                          | 6.573                           | 6.082                           |

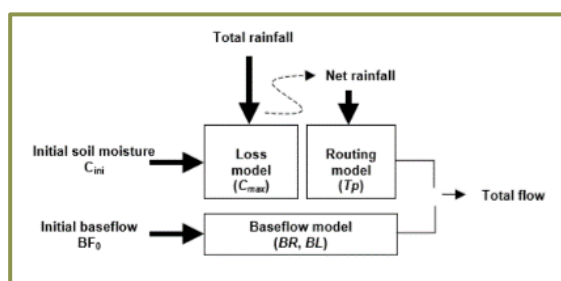
**Table 2.6: Flood Frequency**

| Return period | Peak Flow (m <sup>3</sup> /s) – River Loddon | Peak Flow (m <sup>3</sup> /s) – Watercourse 1 | Peak Flow (m <sup>3</sup> /s) – Watercourse 2 |
|---------------|----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| 2             | 30.18                                        | 0.16                                          | 0.17                                          |
| 5             | 41.24                                        | 0.23                                          | 0.24                                          |
| 10            | 49.27                                        | 0.29                                          | 0.30                                          |
| 30            | 63.41                                        | 0.40                                          | 0.40                                          |
| 50            | 70.90                                        | 0.46                                          | 0.46                                          |
| 100           | 82.26                                        | 0.56                                          | 0.56                                          |
| 200           | 95.23                                        | 0.68                                          | 0.67                                          |
| 1000          | 133.08                                       | 1.08                                          | 1.03                                          |

## 2.3 ReFH2 Method

### *Introduction*

- 2.3.1 The Revitalised Rainfall-runoff (ReFH) model was first published in 2005 as an update to the previous FEH rainfall-runoff method, the FSR/FEH rainfall-runoff method. ReFH was based on robust hydrological modelling techniques and was an improvement over the FEH/FSR Rainfall Runoff method (FEH), as described in the FEH. The method uses catchment descriptors from the FEH Webservice, to generate design flood events of specific return periods.
- 2.3.2 ReFH2 was released in early 2015, with a significant update (Version 2.1), published in November 2015. ReFH2 includes an extension of the ReFH model to represent urban catchments and is compatible with FEH2022 rainfall frequency statistics.
- 2.3.3 The ReFH model has three components: a loss model ( $C_{max}$ ), a routing model ( $T_p$ ) and a base flow model (BR, BL) (Table 2.7). The loss model uses a soil moisture accounting approach to define the amount of rainfall occurring over the catchment that is converted to direct runoff. The rainfall losses are derived as the event unfolds, rather than being defined by a fixed value of percentage runoff. The routing component of ReFH uses the unit hydrograph concept, adopting a 'kinked' triangle as the standard shape. Finally, the base flow model is based on the linear reservoir concept with its characteristic recession defined by an exponential decay controlled by the recession constant termed base flow lag (Figure 2.11).

**Figure 2.11: Schematic Representation of the ReFH Model**

Source: Wallingford HydroSolutions Ltd 2016. *The Revitalised Flood Hydrograph Model ReFH2.2: Technical Guidance.*

**Table 2.7: Summary of the Six ReFH Model Parameters**

| Name      | Parameter or Initial Condition | Description                                |
|-----------|--------------------------------|--------------------------------------------|
| $T_p$     | Model parameter                | Unit hydrograph time to peak (hours)       |
| $B_L$     | Model parameter                | Baseflow recession constant or lag (hours) |
| $B_R$     | Model parameter                | Baseflow recharge                          |
| $C_{Max}$ | Model parameter                | Maximum soil moisture capacity (mm)        |
| $C_{ini}$ | Initial condition              | Initial moisture content (mm)              |
| $BF_0$    | Initial condition              | Initial baseflow ( $m^3s^{-1}$ )           |

Source: Wallingford HydroSolutions Ltd 2016. *The Revitalised Flood Hydrograph Model ReFH2.2: Technical Guidance.*

- 2.3.4 The ReFH2 calculations were undertaken within the ReFH2 standalone software to calculate peak flow estimates from catchment descriptors as provided in Table 2.1.

#### *Storm Duration Estimation*

##### *i. River Loddon*

- 2.3.5 A storm duration of 26.00 hours and a timestep of 2.00 hours were used. A Seasonal Correction Factor (SCF) of 0.72 and Areal Reduction Factor (ARF) of 0.91 were also applied.

##### *ii. Watercourse 1*

- 2.3.6 A storm duration of 7.50 hours and a timestep of 0.50 hours were used. A Seasonal Correction Factor (SCF) of 0.68 and Areal Reduction Factor (ARF) of 0.98 were also applied.

##### *iii. Watercourse 2*

- 2.3.7 A storm duration of 4.50 hours and a timestep of 0.50 hours were used. A Seasonal Correction Factor (SCF) of 0.65 and Areal Reduction Factor (ARF) of 0.98 were also applied.

#### *Peak Flow Estimation*

- 2.3.8 In line with ReFH2 Method guidance, a winter seasonality (default storm profile) was selected, and flows were estimated for each required return period.

- 2.3.9 The model parameters for the ReFH2 method should ideally be based on actual flood event data comprising rainfall and flow records rather than Catchment Descriptors alone. However, due to the lack of available flow data for the catchment, the ReFH2 design standards have been adopted in this instance based on the technical guidance. The key ReFH2 model parameter values are provided in Table 2.8. The peak flows calculated using the ReFH2 Method are summarised in Table 2.9.

**Table 2.8: ReFH2 Parameters**

| Parameter | Unit             | River Loddon | Watercourse 1 | Watercourse 2 |
|-----------|------------------|--------------|---------------|---------------|
| $T_p$     | Hours (hrs)      | 14.63        | 4.639         | 2.96          |
| $B_L$     | Hours (hrs)      | 82.04        | 45.113        | 35.33         |
| $B_R$     | -                | 2.52         | 2.26          | 2.72          |
| $C_{Max}$ | Millimetres (mm) | 635.10       | 573.90        | 409.43        |
| $C_{ini}$ | Millimetres (mm) | 75.20        | 83.16         | 103.70        |

| Parameter       | Unit              | River Loddon | Watercourse 1 | Watercourse 2 |
|-----------------|-------------------|--------------|---------------|---------------|
| BF <sub>0</sub> | m <sup>3</sup> /s | 5.82         | 0.01          | 0.01          |

**Table 2.9: ReFH2 Method Peak Flows (Winter Profile)**

| Return Period | Peak Flow (m <sup>3</sup> /s) – River Loddon | Peak Flow (m <sup>3</sup> /s) – Watercourse 1 | Peak Flow (m <sup>3</sup> /s) – Watercourse 2 |
|---------------|----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| 2             | 33.94                                        | 0.13                                          | 0.20                                          |
| 5             | 45.46                                        | 0.19                                          | 0.29                                          |
| 10            | 53.66                                        | 0.23                                          | 0.35                                          |
| 30            | 67.21                                        | 0.29                                          | 0.46                                          |
| 50            | 74.14                                        | 0.33                                          | 0.51                                          |
| 100           | 84.83                                        | 0.38                                          | 0.59                                          |
| 200           | 97.74                                        | 0.43                                          | 0.67                                          |
| 1000          | 140.95                                       | 0.61                                          | 0.93                                          |

*Summary of Results*

2.3.10 Table 2.10 displays a comparison of results for the catchment using the two identified hydrological methodologies. Figure 2.12 details a comparison of FEH statistical and ReFH2 flows, alongside the hydrographs for the ReFH2 calculations, which will be scaled to FEH statistical peak flows where appropriate (full ReFH2 hydrographs can viewed in Appendix 4).

**Table 2.10: Summary of Results**

| River Loddon  |                                                                |                                  |                      |
|---------------|----------------------------------------------------------------|----------------------------------|----------------------|
| Return Period | FEH Statistical method (Pooled Group Analysis – Adjusted QMED) | ReFH2 Method (m <sup>3</sup> /s) | Percentage Variation |
| 2             | 30.18                                                          | 33.94                            | +12                  |
| 5             | 41.24                                                          | 45.46                            | +10                  |
| 10            | 49.27                                                          | 53.66                            | +9                   |
| 30            | 63.41                                                          | 67.21                            | +6                   |
| 50            | 70.90                                                          | 74.14                            | +5                   |
| 100           | 82.26                                                          | 84.83                            | +3                   |
| 200           | 95.23                                                          | 97.74                            | +3                   |
| 1000          | 133.08                                                         | 140.95                           | +6                   |
| *100+14%CC    | 93.77                                                          | 96.70                            | +3                   |
| *100+23%CC    | 101.17                                                         | 104.34                           | +3                   |
| *100+46%CC    | 120.09                                                         | 123.85                           | +3                   |

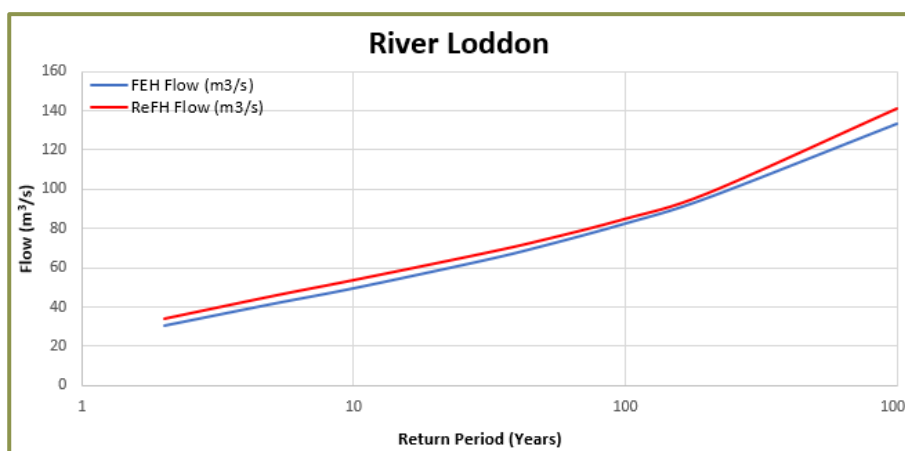
| Watercourse 1 |                                                                |                                  |                      |
|---------------|----------------------------------------------------------------|----------------------------------|----------------------|
| Return Period | FEH Statistical method (Pooled Group Analysis – Adjusted QMED) | ReFH2 Method (m <sup>3</sup> /s) | Percentage Variation |
| 2             | 0.16                                                           | 0.13                             | -19                  |
| 5             | 0.23                                                           | 0.19                             | -17                  |
| 10            | 0.29                                                           | 0.23                             | -21                  |
| 30            | 0.40                                                           | 0.29                             | -28                  |
| 50            | 0.46                                                           | 0.33                             | -28                  |
| 100           | 0.56                                                           | 0.38                             | -32                  |
| 200           | 0.68                                                           | 0.43                             | -52                  |
| 1000          | 1.08                                                           | 0.61                             | -44                  |
| *100+14%CC    | 0.63                                                           | 0.43                             | -32                  |
| *100+23%CC    | 0.68                                                           | 0.46                             | -32                  |

| Watercourse 1 |                                                                |                                  |                      |
|---------------|----------------------------------------------------------------|----------------------------------|----------------------|
| Return Period | FEH Statistical method (Pooled Group Analysis – Adjusted QMED) | ReFH2 Method (m <sup>3</sup> /s) | Percentage Variation |
| *100+46%CC    | 0.81                                                           | 0.55                             | -32                  |

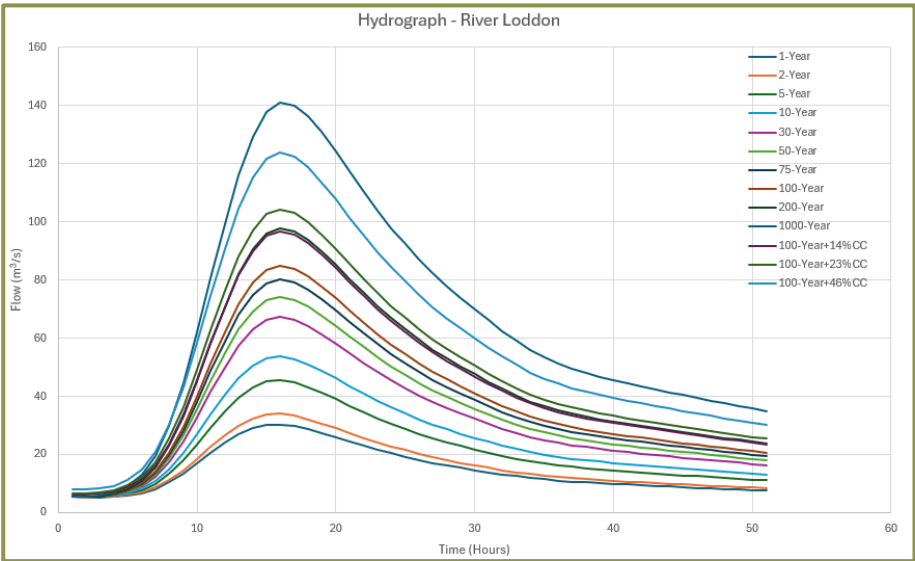
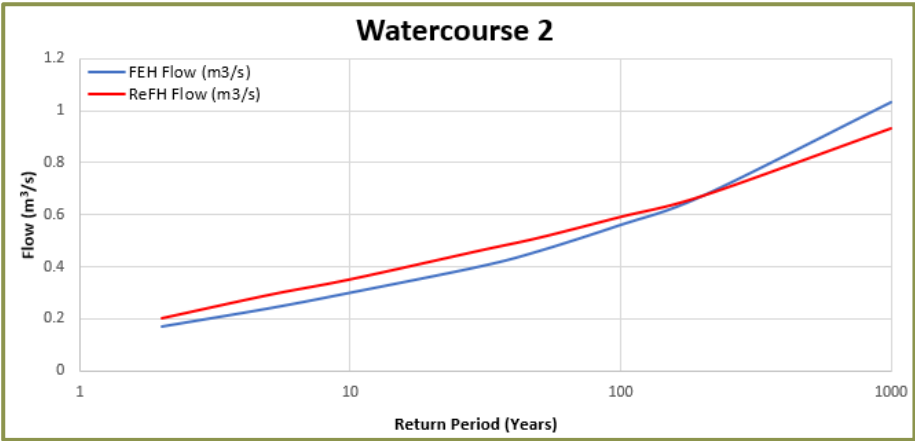
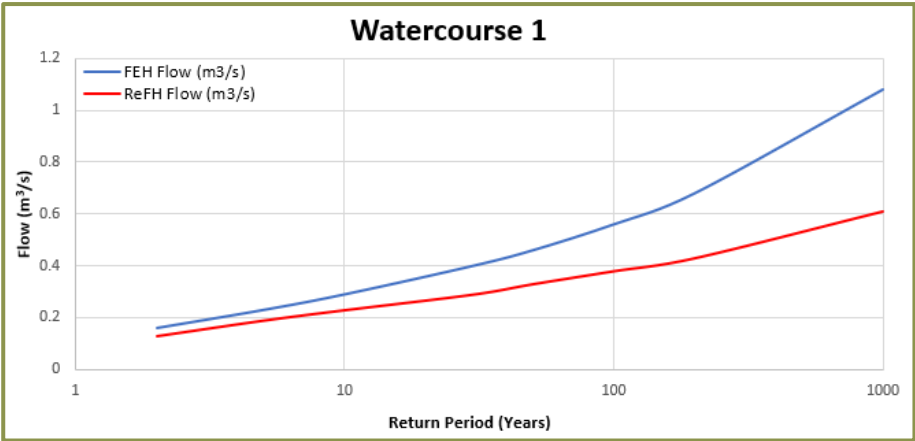
| Watercourse 2 |                                                                |                                  |                      |
|---------------|----------------------------------------------------------------|----------------------------------|----------------------|
| Return Period | FEH Statistical method (Pooled Group Analysis – Adjusted QMED) | ReFH2 Method (m <sup>3</sup> /s) | Percentage Variation |
| 2             | 0.17                                                           | 0.20                             | +18                  |
| 5             | 0.24                                                           | 0.29                             | +21                  |
| 10            | 0.30                                                           | 0.35                             | +17                  |
| 30            | 0.40                                                           | 0.46                             | +15                  |
| 50            | 0.46                                                           | 0.51                             | +11                  |
| 100           | 0.56                                                           | 0.59                             | +5                   |
| 200           | 0.67                                                           | 0.67                             | ±0                   |
| 1000          | 1.03                                                           | 0.93                             | -10                  |
| *100+14%CC    | 0.63                                                           | 0.67                             | +6                   |
| *100+23%CC    | 0.68                                                           | 0.72                             | +6                   |
| *100+46%CC    | 0.81                                                           | 0.86                             | +6                   |

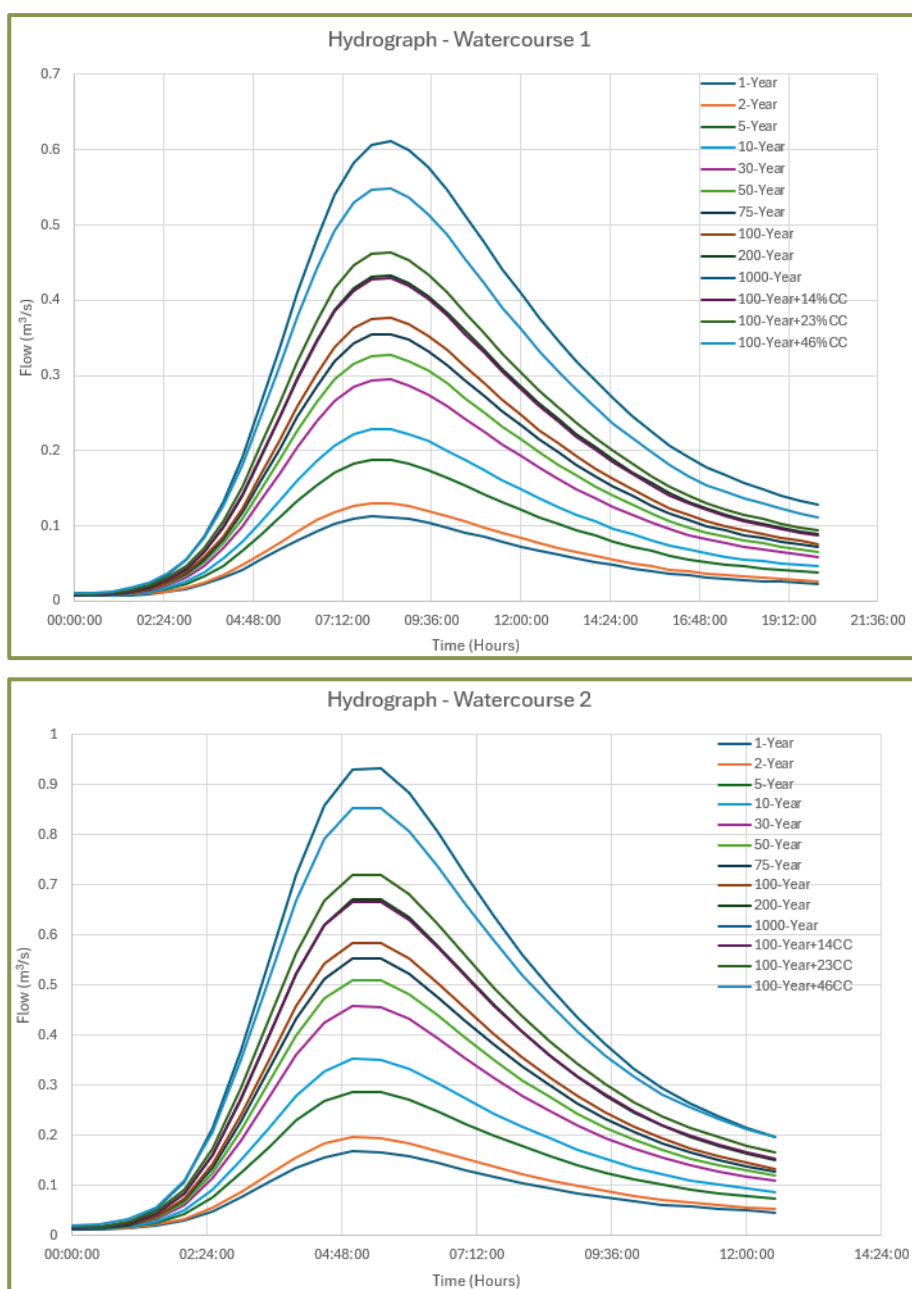
\* Dorset Management Catchment 14% ('Central' estimate), 23% ('Higher' estimate) and 46% ('Upper' estimate) for the Total Potential Change anticipated by the 2080's<sup>12</sup>. Climate change allowances for peak flows have been obtained by adding an uplift to the 100-year peak flow.

**Figure 2.12: Graph Summary of Results**



<sup>12</sup> <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>



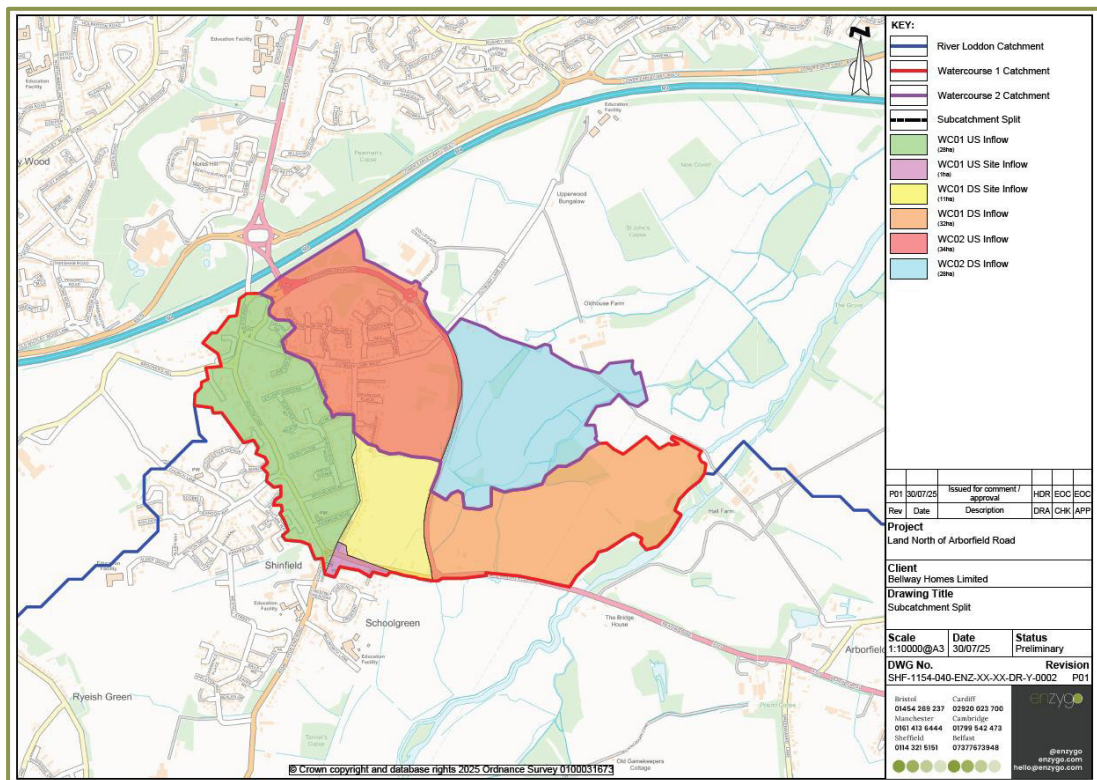


## 2.4 Sub-Catchment Split

2.4.1 To better represent flows within the Watercourse 1 and 2 catchments further analysis has been undertaken which looks to further split the catchments into a total of 6 sub-catchments. The delineation of sub-catchments has been undertaken using the 'Watershed' plugin in QGIS and analysis of LiDAR using KeyTerra-FIRMA software. These sub-catchments better represent the dynamics of the catchments within this study.

2.4.2 The sub catchment split for Watercourses 1 and 2 is shown in Figure 2.13 and Drawing 0002.

**Figure 2.13: Watercourse 1 and 2 Sub-Catchments**



## 2.5 Inflow Locations

2.2.1 Hydrological peak flows have been input into the model at seven lumped locations at the upstream extent of the 1D model domain using layer '1d\_bc\_ARB\_BNDY\_001'. Flows have been input as 'QT' boundaries (Flow Time). The inflows have been named the following (Figure 2.14):

- Loddon Inflow
- WC01 US Inflow
- WC01 US Site Inflow
- WC01 DS Site Inflow
- WC01 DS Inflow
- WC02 US Inflow
- WC02 DS Inflow

**Figure 2.14: Model Inflow Locations**



## 2.6 Limitations

2.5.1 The following limitations are associated with this study:

- Pooling groups are representative of study catchments.
- Catchments included in pooling groups are statistically homogeneous/heterogeneous so that their (standardised) AMAX flows can be fitted by a single distribution. For pooling group analysis undertaken for permeable catchments, a number of stations included in the pooling group were less permeable and therefore may differ in their flood generating characteristics.
- That the ReH2 flows for the adjusted catchments are not spatially consistent, though this is not expected to affect overall results.

2.5.2 The design peak flow estimates and hydrographs have been derived for the purposes of this modelling study. If peak flow estimates and hydrographs are required for different purposes it is recommended that, at a minimum, a review of the results is carried out and any recent flow data incorporated into the calculations.

## 2.6 Analysis of Peak Flow and Choice Going Forward

### *Analysis of Peak Flow*

- 2.7.1 It is expected that results using the different methods will vary. In urban catchments, the ReFH2 method normally gives larger estimates than the FEH Statistical (Pooled Group) method, which typically underestimates peak flows.
- 2.7.2 For the River Loddon the ReFH2 peak flows are between 3% to 12% greater than those derived from FEH statistical for all return events.
- 2.7.3 For Watercourse 1 the FEH statistical peak flows are between 17% to 52% greater than those derived from ReFH2 than for all return events.
- 2.7.4 For Watercourse 2 the ReFH2 peak flows are between 0% to 21% greater than those derived from FEH statistical for all return events, apart from the 1000-year in which FEH statistical provides higher flows.
- 2.7.5 Below is a summary of the advantages and disadvantages associated with each of the methodologies.

### *FEH Statistical Method*

- 2.7.6 Below is a summary of the advantages to using the Statistical Method within this study's catchments:
- The method is based on a larger dataset than the ReFH2 method.
  - Has undergone more direct calibration to reproduce flood frequency in the UK than the other methods.
- 2.7.7 Below is a summary of the disadvantages to using the Statistical Method within this study's catchments:
- The catchment is less than 1000km<sup>2</sup>, therefore the Statistical Method has no advantage over the ReFH2 method.

### *ReFH2 Method*

- 2.7.8 Below is a summary of the advantages to using the ReFH2 Method within this study catchment:
- The ReFH2 method is based on Catchment Descriptors specific to the study catchment, with Catchment Descriptors being verified or updated (i.e. AREA, and URBEXT updated to URBEXT2019).
  - There are no continuous flow records as the Study Site is not directly gauged, and there are no gauges located within the vicinity of the Study Site.
  - The return period is long, for example 1000 years.

### Choice Going Forward

2.7.9 The assessment has identified the chosen approach for the model:

#### River Loddon

- The ReFH2 peak flows are to be utilised for this study for all return periods, due to the flows being more conservative.
- Peak flows for the River Loddon catchment that are to be used within the hydraulic model are shown in Table 2.11.

**Table 2.11: Summary of Results**

| Return Period | Input Flows (m <sup>3</sup> /s) |
|---------------|---------------------------------|
| 30            | 67.21                           |
| 100           | 84.83                           |
| 1000          | 140.95                          |
| *100+14%CC    | 96.70                           |
| *100+23%CC    | 104.34                          |
| *100+46%CC    | 123.85                          |

*\* Loddon and tributaries Management Catchment 14% ('Central' estimate), 23% ('Higher' estimate) and 46% ('Upper' estimate) for the Total Potential Change anticipated by the 2080's<sup>13</sup>. Climate change allowances for peak flows have been obtained by adding an uplift to the 100-year peak flow.*

#### Watercourse 1

- The FEH Statistical peak flows are to be utilised Watercourse 1 for this study for all return periods, due to the flows being more conservative.
- Peak flows for the Watercourse 1 catchment that are to be used within the hydraulic model are shown in Table 2.12.

**Table 2.12: Summary of Results**

| Return Period | Input Flows (m <sup>3</sup> /s) |
|---------------|---------------------------------|
| 30            | 0.40                            |
| 100           | 0.56                            |
| 1000          | 1.08                            |
| *100+14%CC    | 0.63                            |
| *100+23%CC    | 0.68                            |
| *100+46%CC    | 0.81                            |

*\* Loddon and tributaries Management Catchment 14% ('Central' estimate), 23% ('Higher' estimate) and 46% ('Upper' estimate) for the Total Potential Change anticipated by the 2080's<sup>14</sup>. Climate change allowances for peak flows have been obtained by adding an uplift to the 100-year peak flow.*

#### Watercourse 2

- The ReFH2 peak flows are to be utilised for the Watercourse 2 catchment for all return periods up to and including the 100-year (inclusive of climate change allowances), due to the flows being more conservative. The FEH Statistical peak flows are to be utilised for the 1000-year return period.

<sup>13</sup> <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>

<sup>14</sup> <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>

- Peak flows for the Watercourse 2 catchment that are to be used within the hydraulic model are shown in Table 2.13.

**Table 2.13: Summary of Results**

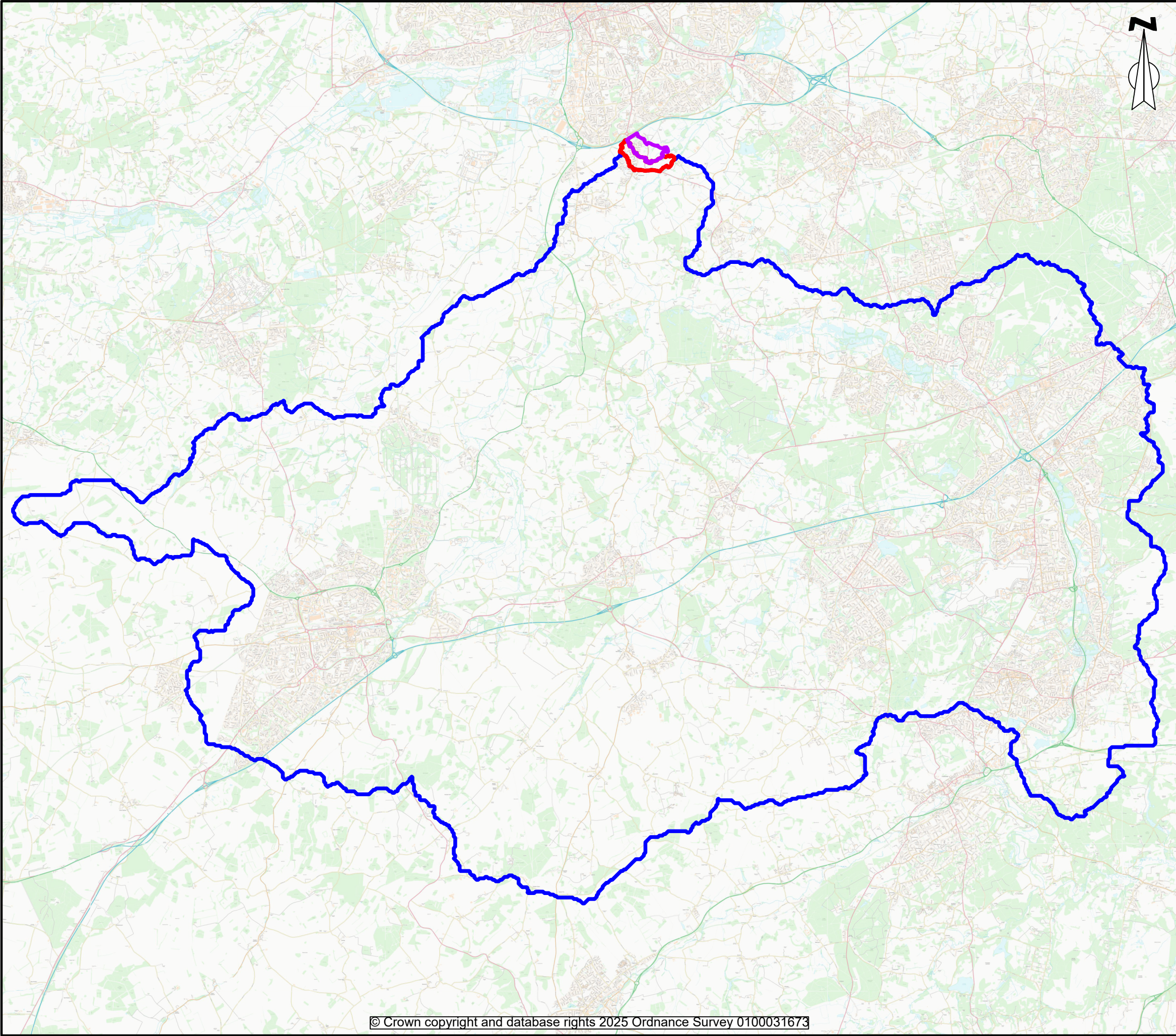
| Return Period | Input Flows (m <sup>3</sup> /s) |
|---------------|---------------------------------|
| 30            | 0.46                            |
| 100           | 0.59                            |
| 1000          | 0.93                            |
| *100+14%CC    | 0.67                            |
| *100+23%CC    | 0.72                            |
| *100+46%CC    | 0.86                            |

*\* Loddon and tributaries Management Catchment 14% ('Central' estimate), 23% ('Higher' estimate) and 46% ('Upper' estimate) for the Total Potential Change anticipated by the 2080's<sup>15</sup>. Climate change allowances for peak flows have been obtained by adding an uplift to the 100-year peak flow.*

- 2.7.10 As stated within the Flood Estimation Guidelines (LIT 11832) produced by the Environment Agency (December 2022) *'By its very nature, flood estimation is an uncertain science, and this uncertainty is probably greater than many hydrologists realise. Even many weeks of work won't produce a definitive statement on the magnitude of a 1% probability flood or the rarity of an observed event. These guidelines offer advice on identifying sources of uncertainty. They provide methods for calculating confidence limits for flood estimates derived using standard FEH methods'*. As such, the methods used within this report are deemed to be the most suitable at the time the document was completed and deemed to be appropriate for the study that is being undertaken.

<sup>15</sup> <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>





**KEY:**

River Loddon Catchment

Watercourse 1 Catchment

Watercourse 2 Catchment

|     |          |                               |     |     |     |
|-----|----------|-------------------------------|-----|-----|-----|
|     |          |                               |     |     |     |
| P01 | 30/07/25 | Issued for comment / approval | HDR | EOC | EOC |
| Rev | Date     | Description                   | DRA | CHK | APP |

**Project**  
Land North of Arborfield Road

**Client**  
Bellway Homes Limited

**Drawing Title**  
Inflow Catchments

|                     |                         |                              |
|---------------------|-------------------------|------------------------------|
| <b>Scale</b><br>NTS | <b>Date</b><br>30/07/25 | <b>Status</b><br>Preliminary |
|---------------------|-------------------------|------------------------------|

|                                                    |                        |
|----------------------------------------------------|------------------------|
| <b>DWG No.</b><br>SHF-1154-040-ENZ-XX-XX-DR-Y-0001 | <b>Revision</b><br>P01 |
|----------------------------------------------------|------------------------|

Bristol

01454 269 237

Manchester

0161 413 6444

Sheffield

0114 321 5151

Cardiff

02920 023 700

Cambridge

01799 542 473

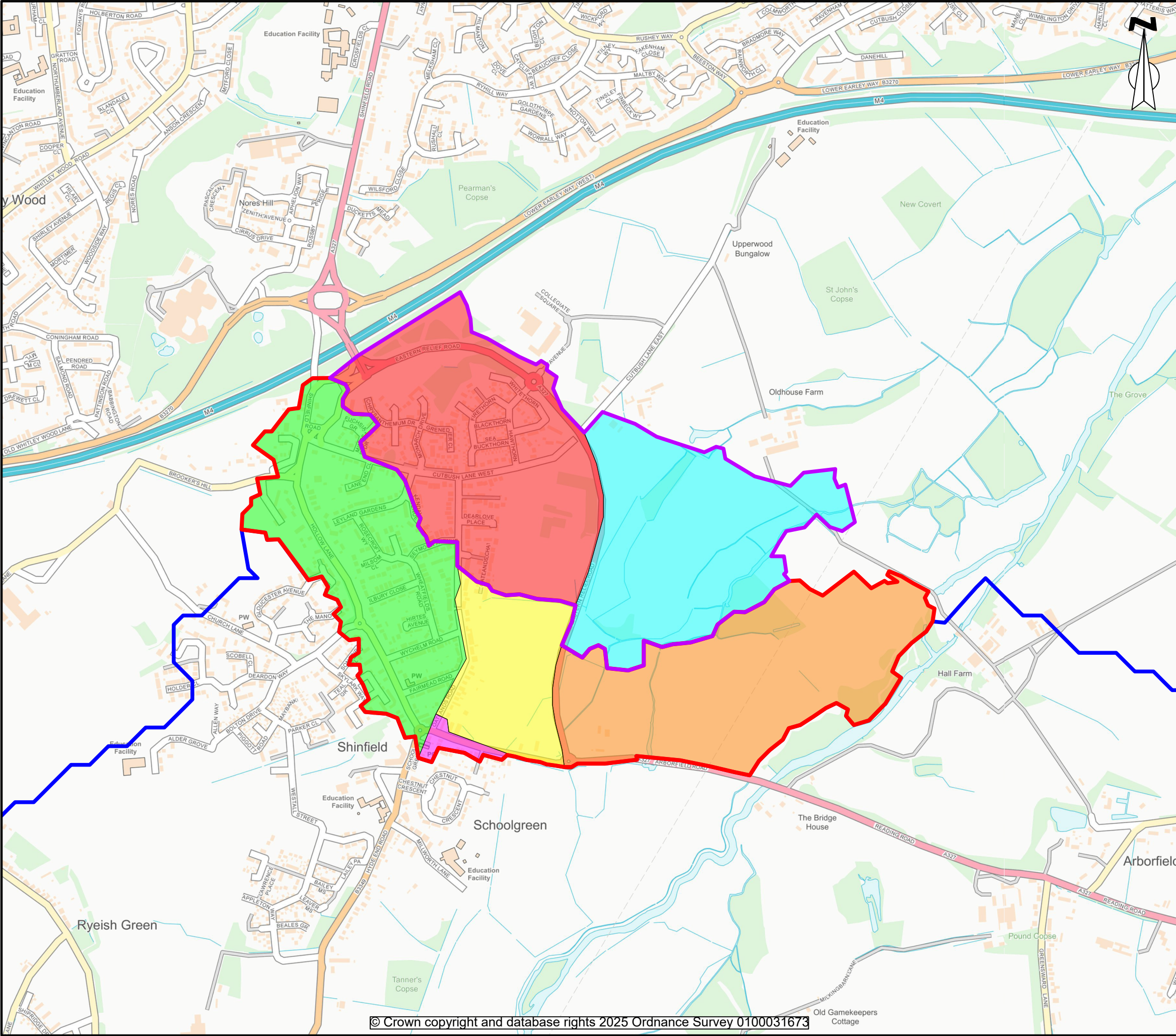
Belfast

07377673948

enzygo

@enzygo  
enzygo.com  
hello@enzygo.com

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**KEY:**

- River Loddon Catchment
- Watercourse 1 Catchment
- Watercourse 2 Catchment
- Subcatchment Split
- WC01 US Inflow (28ha)
- WC01 US Site Inflow (1ha)
- WC01 DS Site Inflow (11ha)
- WC01 DS Inflow (32ha)
- WC02 US Inflow (34ha)
- WC02 DS Inflow (28ha)

|     |          |                               |     |     |     |
|-----|----------|-------------------------------|-----|-----|-----|
| P01 | 30/07/25 | Issued for comment / approval | HDR | EOC | EOC |
| Rev | Date     | Description                   | DRA | CHK | APP |

**Project**  
Land North of Arborfield Road

**Client**  
Bellway Homes Limited

**Drawing Title**  
Subcatchment Split

|                            |                         |                              |
|----------------------------|-------------------------|------------------------------|
| <b>Scale</b><br>1:10000@A3 | <b>Date</b><br>30/07/25 | <b>Status</b><br>Preliminary |
|----------------------------|-------------------------|------------------------------|

**DWG No.**  
SHF-1154-040-ENZ-XX-XX-DR-Y-0002

**Revision**  
P01

Bristol  
01454 269 237  
Manchester  
0161 413 6444  
Sheffield  
0114 321 5151

Cardiff  
02920 023 700  
Cambridge  
01799 542 473  
Belfast  
07377673948

**enzygo**

@enzygo  
enzygo.com  
hello@enzygo.com

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## Appendix 1 – FEH Statistical Outputs

---

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:04:53  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 1907896827  
Site name: FBH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1  
Site location: SU 74950 68300  
Easting: 474950  
Northing: 168300  
Catchment area: 550.10 km<sup>2</sup>  
SAAR: 716 mm  
BFHHOST19: 0.665  
FPEXT: 0.125  
FARL: 0.908  
URBEXT2000: 0.1156

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 99.65 km²  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.20363

#### Growth curve settings

Distance Measure Method: Standard  
Pooling group URBEXT2000 Threshold: 0.116  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Catchment Descriptors

### Growth curve data and results

#### Pooling group AM data

| Station                            | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 28015 (Idle @ Mattersey)           | 0.208    | 37            | 9.520   | 0.197         | 0.206            | 0.148           | 0.137              |
| 39104 (Mole @ Esher)               | 0.422    | 23            | 53.760  | 0.281         | 0.301            | 0.273           | 0.252              |
| 68001 (Weaver @ Ashbrook)          | 0.500    | 86            | 46.677  | 0.207         | 0.210            | 0.207           | 0.203              |
| 39021 (Cherwell @ Enslow Mill)     | 0.572    | 56            | 19.300  | 0.271         | 0.275            | 0.509           | 0.504              |
| 31004 (Welland @ Tallington Total) | 0.616    | 56            | 34.799  | 0.297         | 0.300            | 0.201           | 0.198              |
| 43009 (Stour @ Hammoon)            | 0.629    | 55            | 110.352 | 0.182         | 0.183            | 0.100           | 0.098              |
| 27062 (Nidd @ Skip Bridge)         | 0.650    | 22            | 92.391  | 0.248         | 0.252            | 0.400           | 0.393              |
| 31005 (Welland @ Tixover)          | 0.668    | 60            | 36.908  | 0.295         | 0.297            | 0.273           | 0.270              |
| 28024 (Wreake @ Syston Mill)       | 0.674    | 55            | 34.366  | 0.315         | 0.320            | 0.316           | 0.312              |
| 33034 (Little Ouse @ Abbey Heath)  | 0.712    | 53            | 15.200  | 0.265         | 0.268            | 0.164           | 0.161              |
| Total                              |          | 503           |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                            | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 28015 (Idle @ Mattersey)           | Yes                  | Yes                     | 37    | 0               | 0.00                       | -0.77             | None                | 0.683       |          |
| 39104 (Mole @ Esher)               | Yes                  | Yes                     | 23    | 2               | 8.70                       |                   |                     | 0.367       |          |
| 68001 (Weaver @ Ashbrook)          | Yes                  | Yes                     | 86    | 1               | 1.16                       | -1.48             | None                | 0.717       |          |
| 39021 (Cherwell @ Enslow Mill)     | Yes                  | Yes                     | 56    | 2               | 3.57                       | -1.81             | 10                  | 2.258       |          |
| 31004 (Welland @ Tallington Total) | Yes                  | Yes                     | 56    | 6               | 10.71                      | -2.52             | 5                   | 0.806       |          |
| 43009 (Stour @ Hammoon)            | Yes                  | Yes                     | 55    | 5               | 9.09                       | -0.65             | None                | 1.802       |          |
| 27062 (Nidd @ Skip Bridge)         | Yes                  | Yes                     | 22    | 0               | 0.00                       |                   |                     | 1.371       |          |
| 31005 (Welland @ Tixover)          | Yes                  | Yes                     | 60    | 4               | 6.67                       | 0.17              | None                | 0.379       |          |
| 28024 (Wreake @ Syston Mill)       | Yes                  | Yes                     | 55    | 5               | 9.09                       | -2.91             | 5                   | 1.073       |          |
| 33034 (Little Ouse @ Abbey Heath)  | Yes                  | Yes                     | 53    | 7               | 13.21                      | -2.33             | 5                   | 0.544       |          |

### Pooling group catchment descriptors

| Station                            | Area    | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------|---------|------|-------|-------|------------|-----------|
| 28015 (Idle @ Mattersey)           | 528.183 | 650  | 0.119 | 0.904 | 0.070      | 0.738     |
| 39104 (Mole @ Esher)               | 471.358 | 760  | 0.146 | 0.948 | 0.113      | 0.510     |
| 68001 (Weaver @ Ashbrook)          | 622.680 | 732  | 0.158 | 0.955 | 0.027      | 0.533     |
| 39021 (Cherwell @ Enslow Mill)     | 555.447 | 664  | 0.094 | 0.976 | 0.024      | 0.558     |
| 31004 (Welland @ Tallington Total) | 708.005 | 632  | 0.087 | 0.925 | 0.018      | 0.478     |
| 43009 (Stour @ Hammoon)            | 518.745 | 849  | 0.123 | 0.992 | 0.010      | 0.434     |
| 27062 (Nidd @ Skip Bridge)         | 523.472 | 945  | 0.102 | 0.950 | 0.031      | 0.417     |
| 31005 (Welland @ Tixover)          | 419.623 | 636  | 0.098 | 0.971 | 0.013      | 0.352     |
| 28024 (Wreake @ Syston Mill)       | 417.012 | 634  | 0.088 | 0.953 | 0.022      | 0.388     |
| 33034 (Little Ouse @ Abbey Heath)  | 707.750 | 607  | 0.163 | 0.959 | 0.017      | 0.730     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.259 | Urban L-CV:       | 0.242 |
| Rural L-Skewness: | 0.246 | Urban L-Skewness: | 0.267 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.260 | -0.246 |        | -0.055 |
| GEV          | 0.861    | 0.372 | -0.116 |        | -2.358 |
| KAP3         | 0.929    | 0.310 | -0.188 | -0.400 | -0.720 |

### Goodness of fit

|       |         |
|-------|---------|
| GL:   | -2.7344 |
| GEV:  | -3.9343 |
| P3:   | -5.5129 |
| GP:   | -6.9047 |
| KAP3: | -3.1382 |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 1.4167

The pooling group is possibly heterogeneous and a review of the pooling group is optional.

### Standardised growth curves

#### Rural

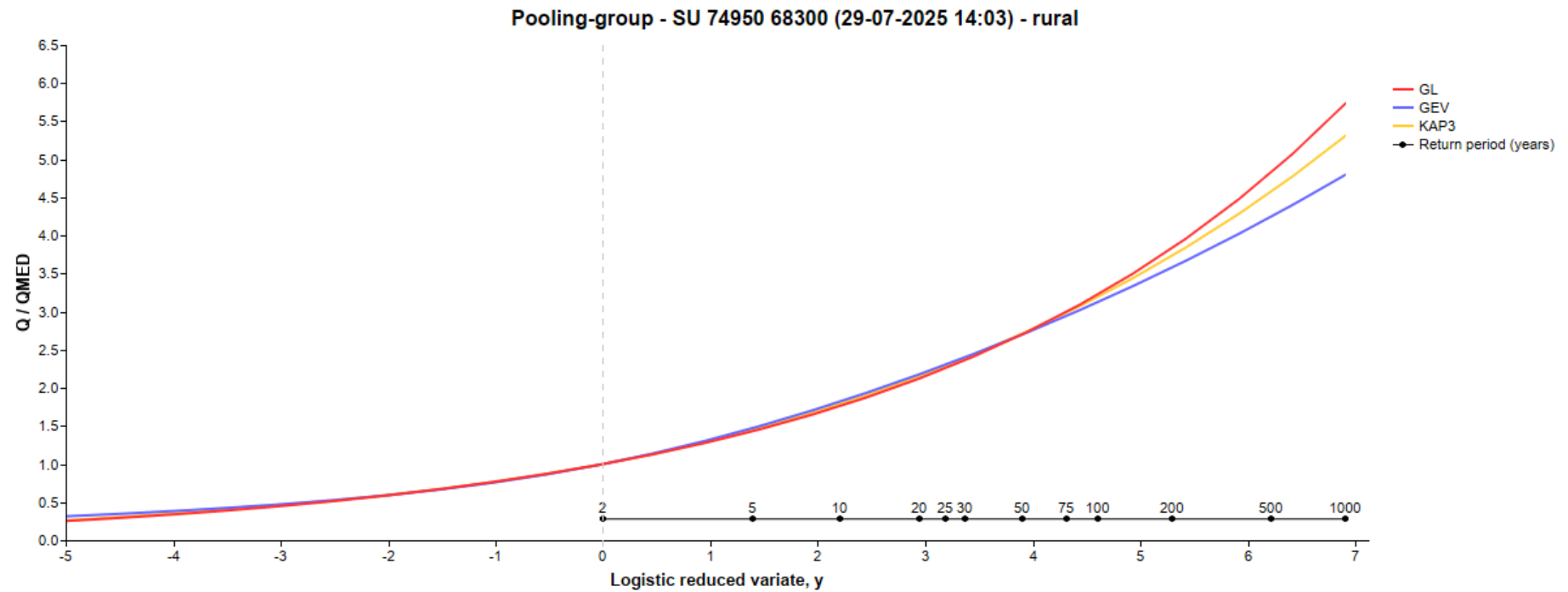
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.430 | 1.470 | 1.447 |
| 10            | 1.758 | 1.818 | 1.786 |
| 20            | 2.125 | 2.180 | 2.154 |
| 25            | 2.255 | 2.302 | 2.281 |
| 30            | 2.365 | 2.403 | 2.389 |
| 50            | 2.699 | 2.697 | 2.707 |
| 75            | 2.993 | 2.941 | 2.982 |
| 100           | 3.220 | 3.122 | 3.189 |
| 200           | 3.835 | 3.581 | 3.735 |
| 500           | 4.824 | 4.246 | 4.573 |
| 1000          | 5.735 | 4.798 | 5.310 |

#### Urban

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.401 | 1.437 | 1.415 |
| 10            | 1.714 | 1.768 | 1.738 |
| 20            | 2.069 | 2.122 | 2.096 |
| 25            | 2.196 | 2.243 | 2.221 |
| 30            | 2.304 | 2.343 | 2.327 |
| 50            | 2.635 | 2.640 | 2.646 |
| 75            | 2.929 | 2.890 | 2.923 |
| 100           | 3.158 | 3.076 | 3.134 |
| 200           | 3.784 | 3.557 | 3.697 |
| 500           | 4.808 | 4.272 | 4.579 |
| 1000          | 5.767 | 4.880 | 5.371 |

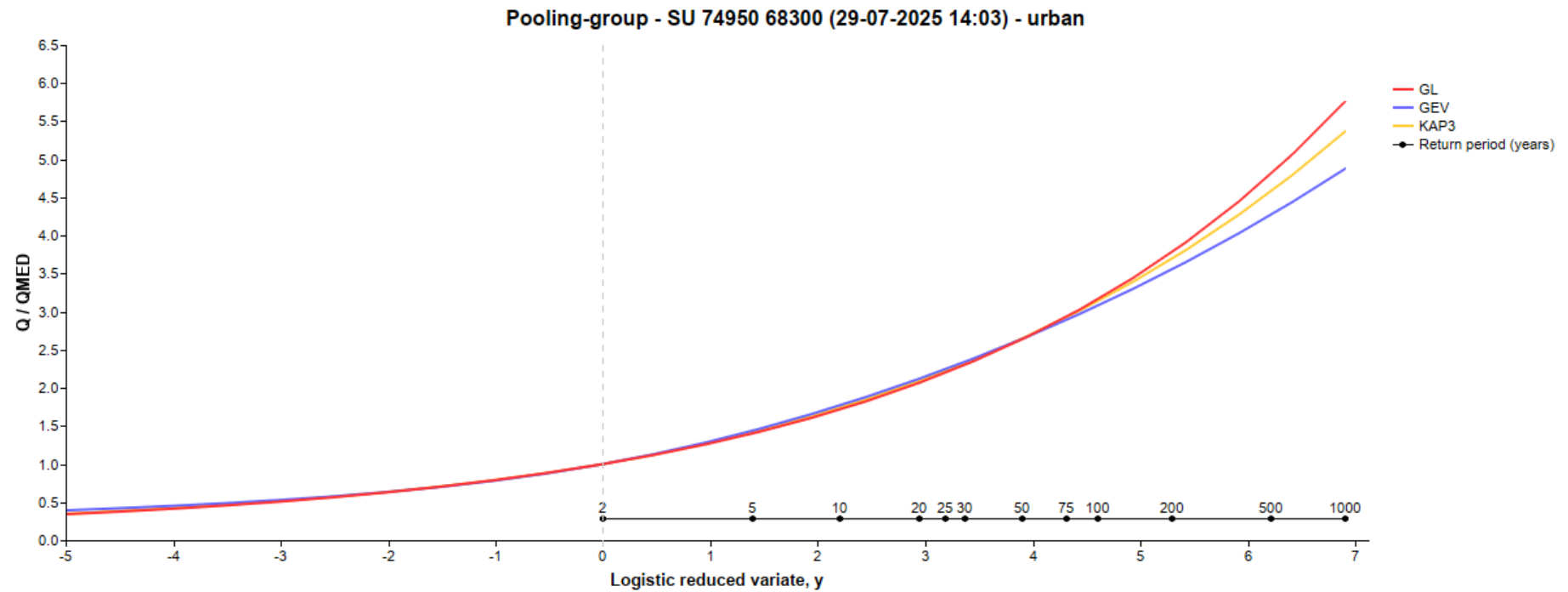
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### QMED

Rural: 23.957 m<sup>3</sup>/s

Urban: 28.835 m<sup>3</sup>/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

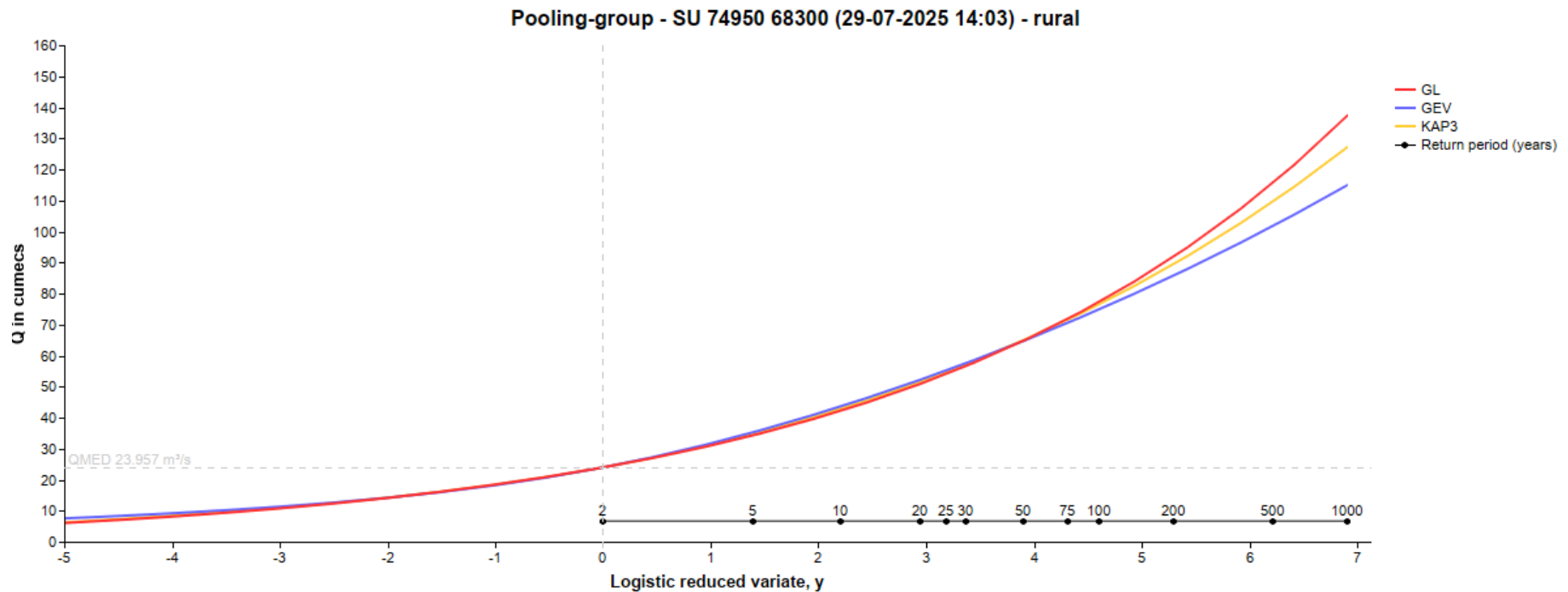
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 23.957    | 23.957     | 23.957      |
| 5             | 34.255    | 35.227     | 34.661      |
| 10            | 42.128    | 43.545     | 42.782      |
| 20            | 50.915    | 52.231     | 51.607      |
| 25            | 54.011    | 55.141     | 54.651      |
| 30            | 56.653    | 57.566     | 57.221      |
| 50            | 64.655    | 64.605     | 64.863      |
| 75            | 71.712    | 70.469     | 71.436      |
| 100           | 77.144    | 74.791     | 76.398      |
| 200           | 91.878    | 85.793     | 89.482      |
| 500           | 115.580   | 101.730    | 109.564     |
| 1000          | 137.393   | 114.949    | 127.205     |

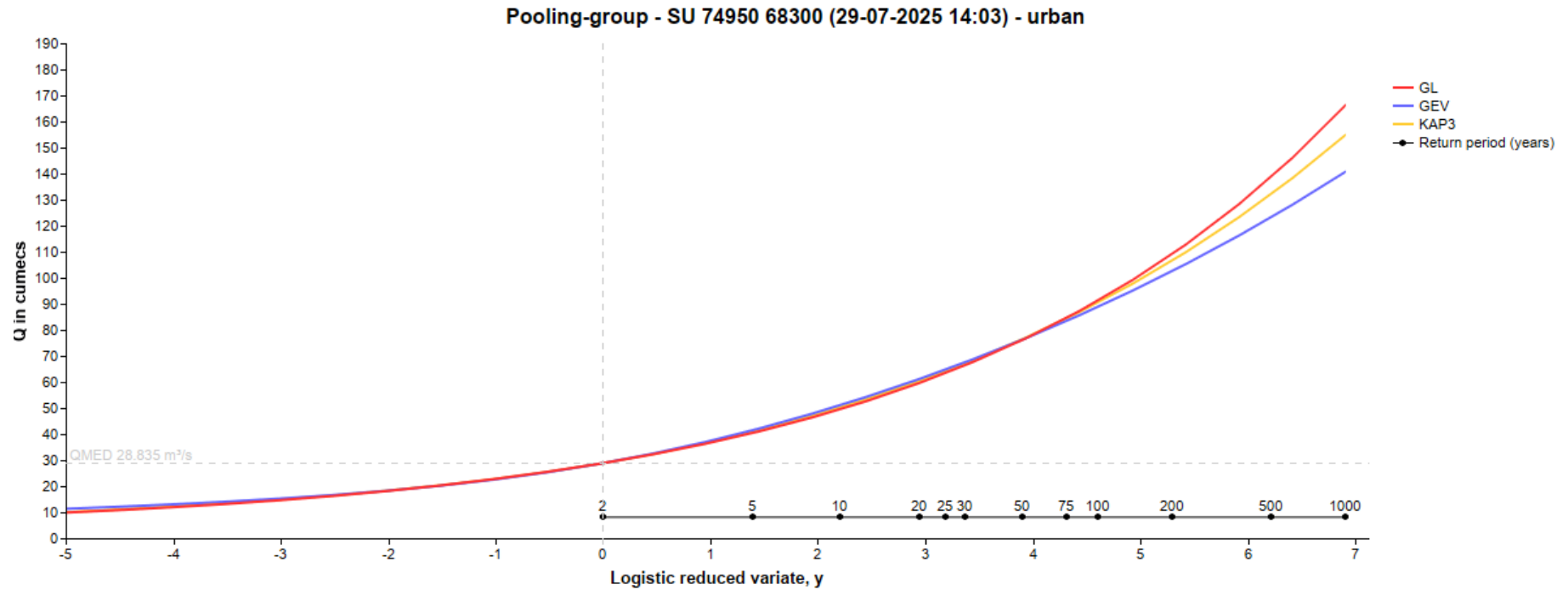
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 28.835    | 28.835     | 28.835      |
| 5             | 40.389    | 41.427     | 40.813      |
| 10            | 49.420    | 50.987     | 50.130      |
| 20            | 59.666    | 61.197     | 60.451      |
| 25            | 63.312    | 64.666     | 64.054      |
| 30            | 66.438    | 67.575     | 67.113      |
| 50            | 75.975    | 76.111     | 76.289      |
| 75            | 84.468    | 83.325     | 84.275      |
| 100           | 91.053    | 88.697     | 90.357      |
| 200           | 109.106   | 102.581    | 106.601     |
| 500           | 138.643   | 123.196    | 132.052     |
| 1000          | 166.285   | 140.718    | 154.869     |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



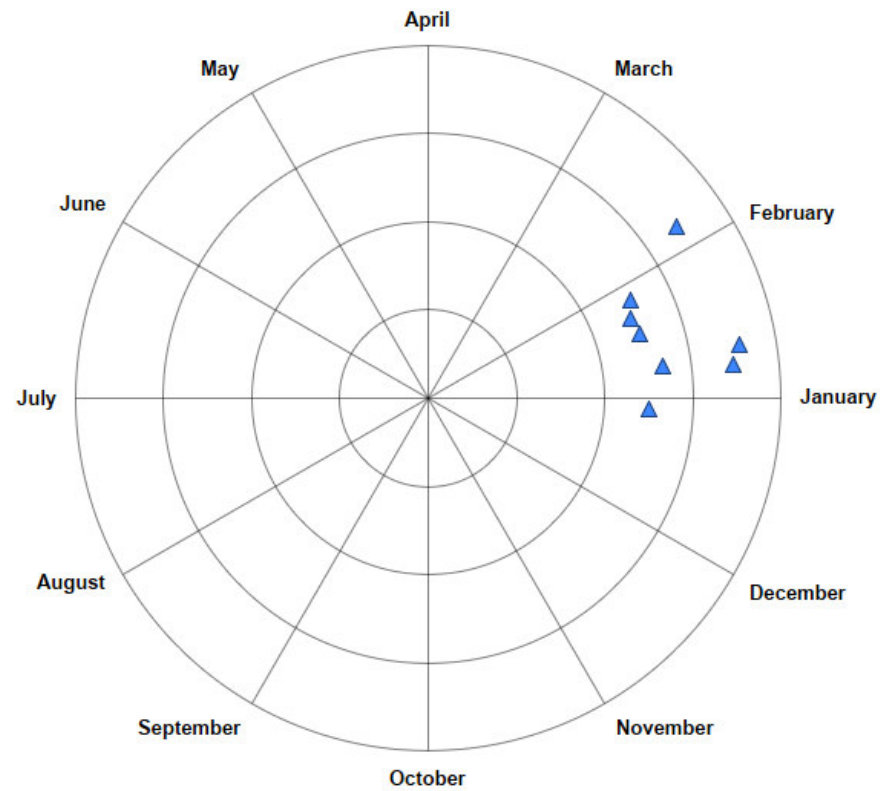
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

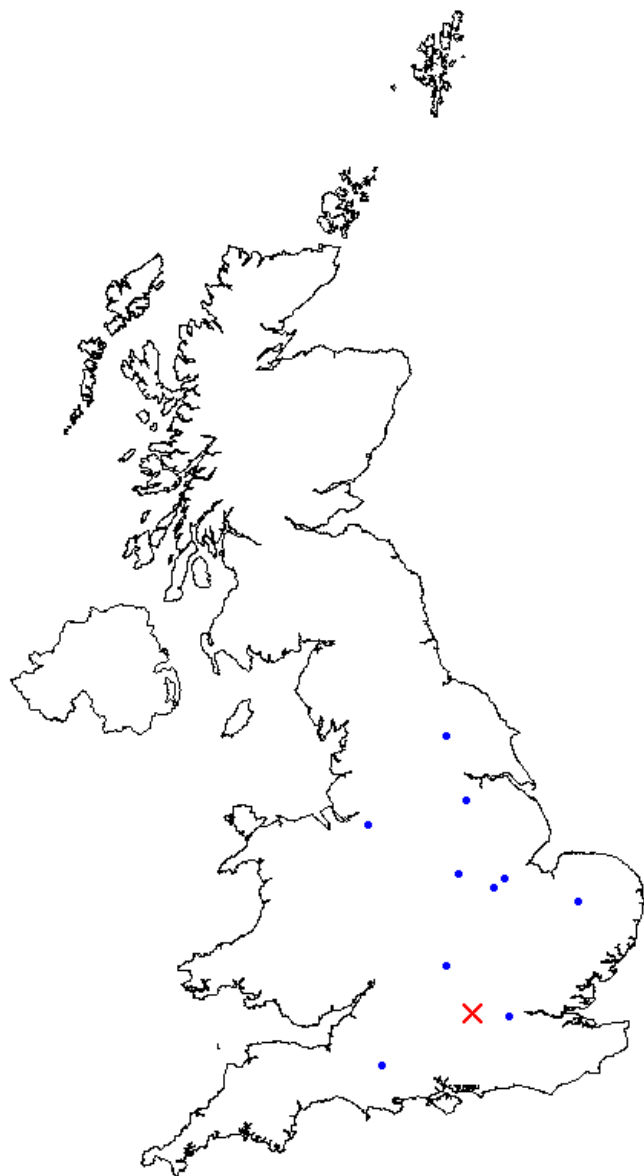
#### Station record parameters

Flood seasonality: SU 74950 68300 (29-07-2025 14:03) - urban



# UK Design Flood Estimation

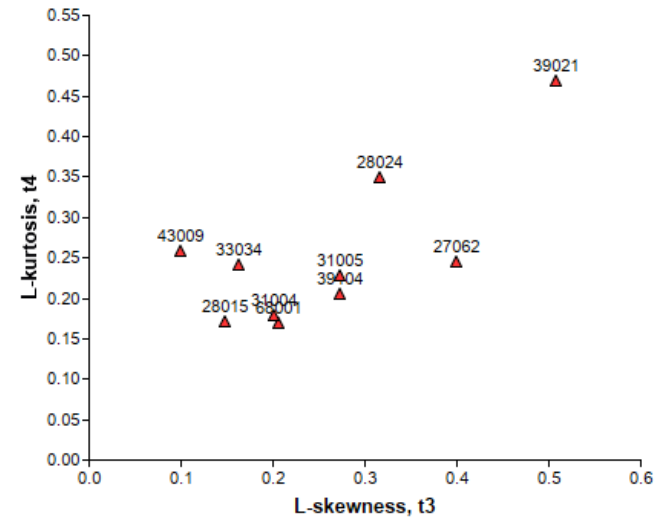
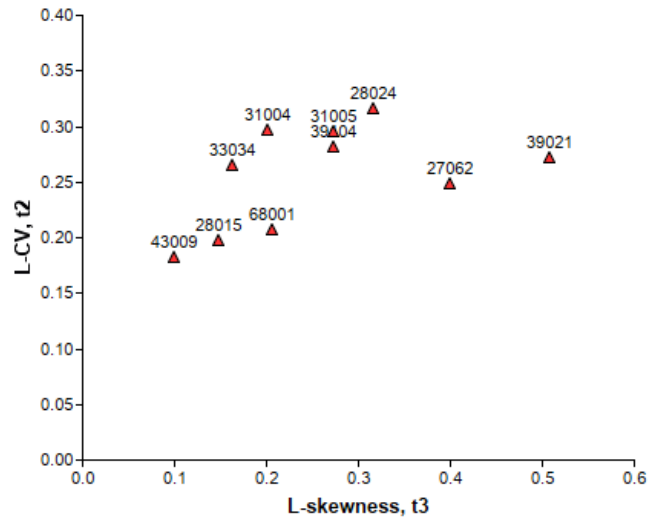
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

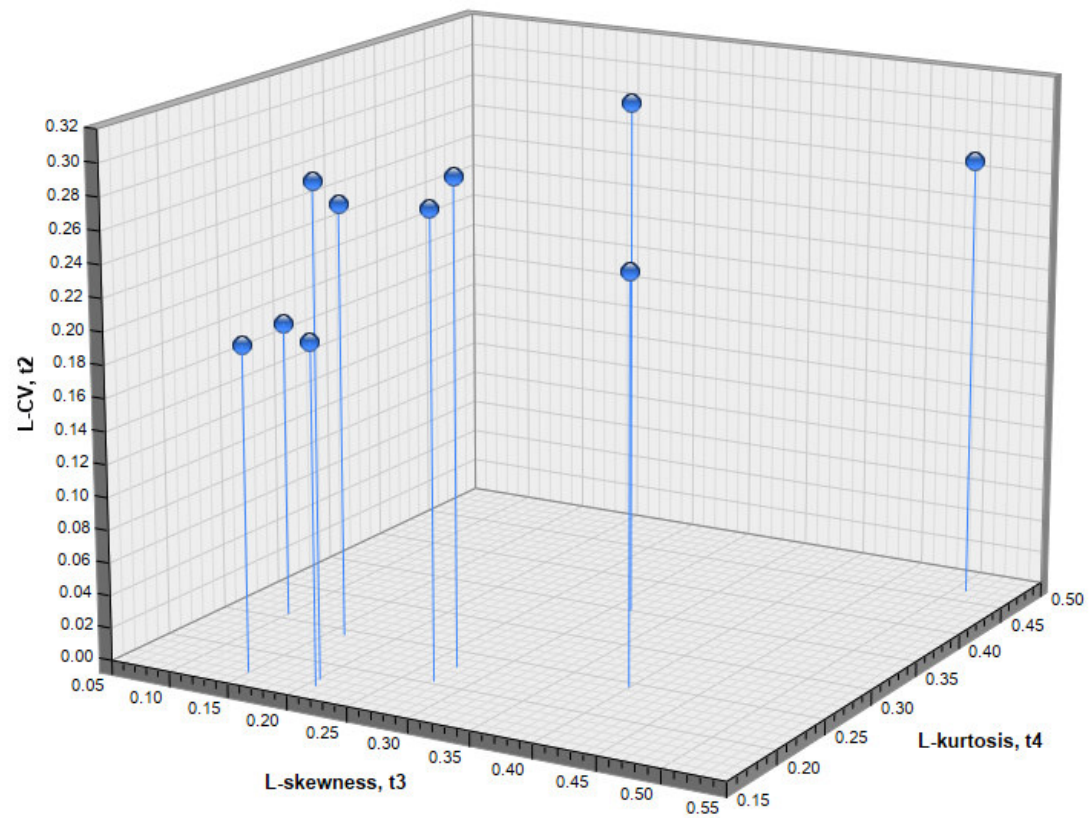
L-moment ratios - SU 74950 68300 (29-07-2025 14:03) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

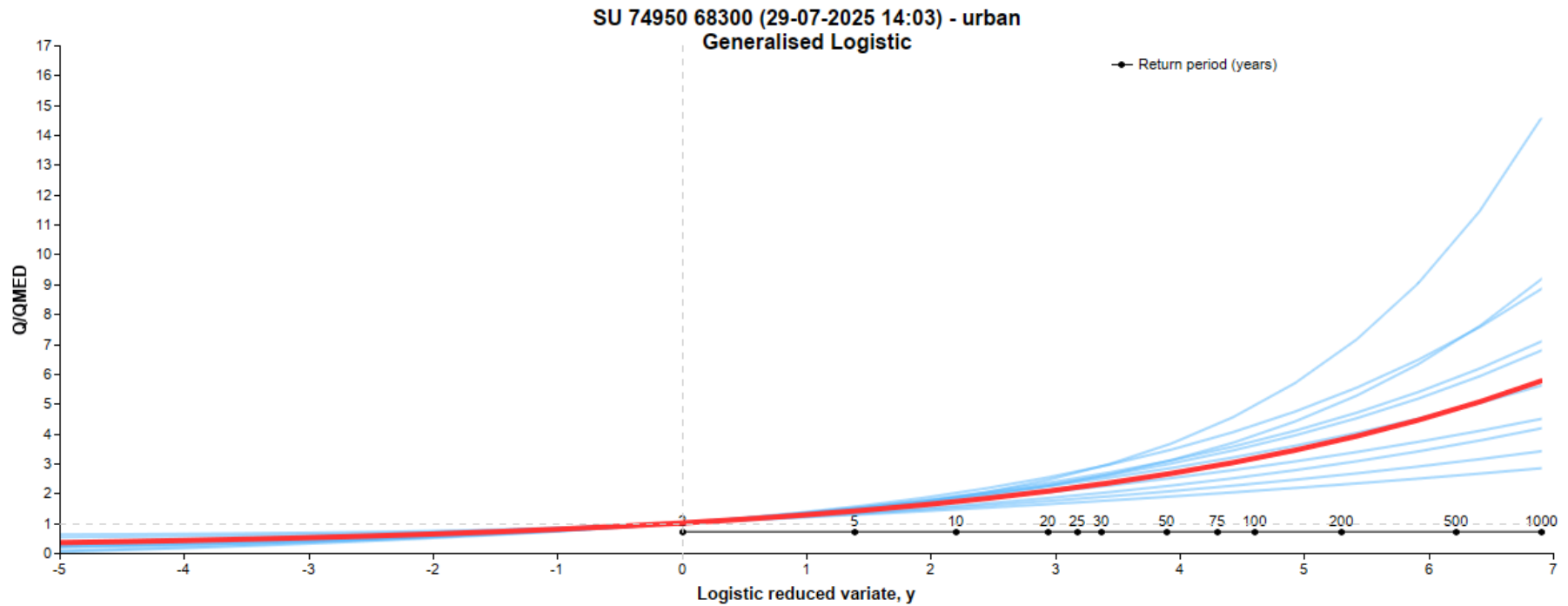
L-moment ratios - SU 74950 68300 (29-07-2025 14:03) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

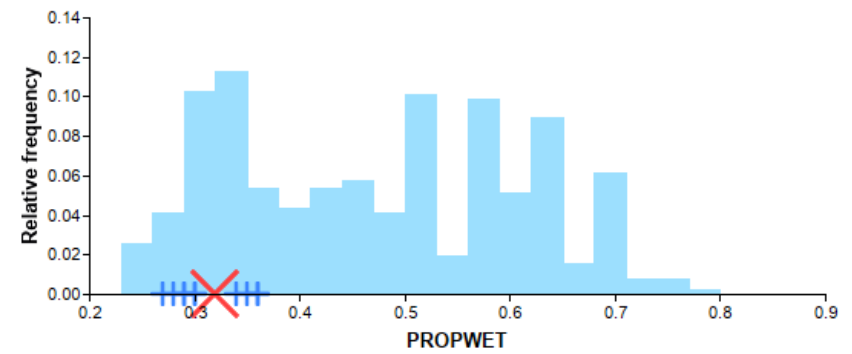
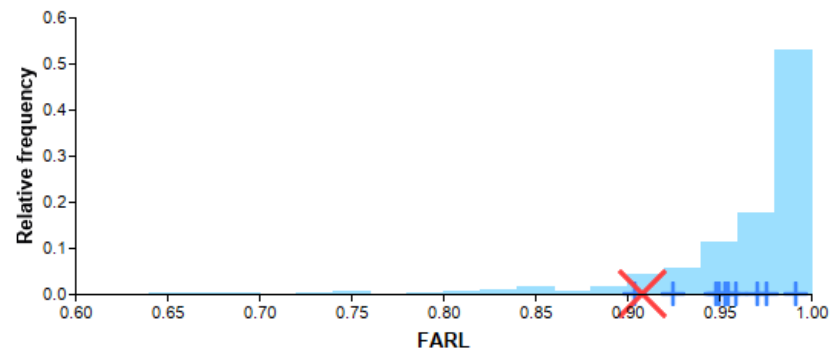
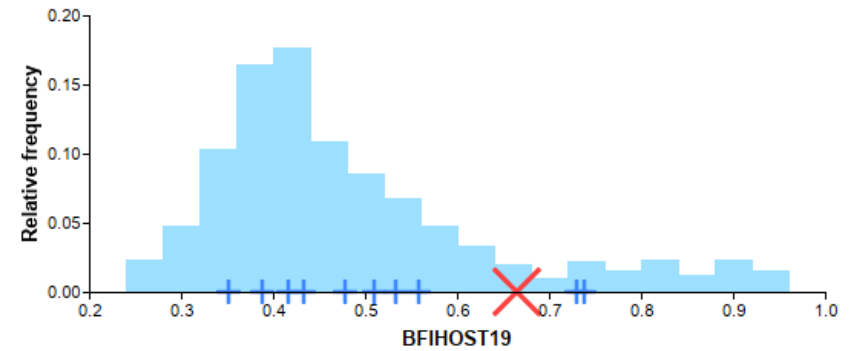
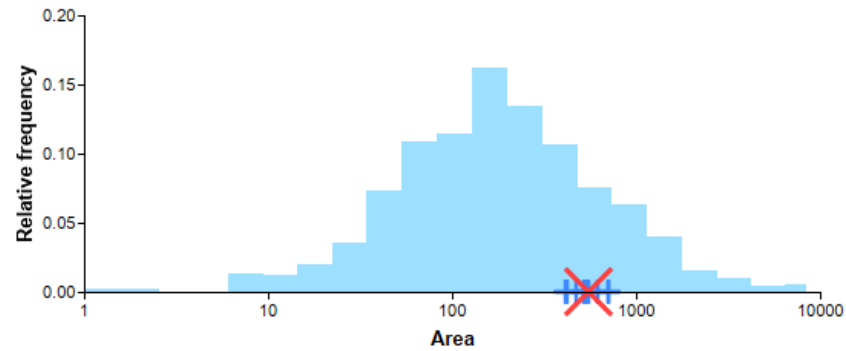
Pooling group growth curves



# UK Design Flood Estimation

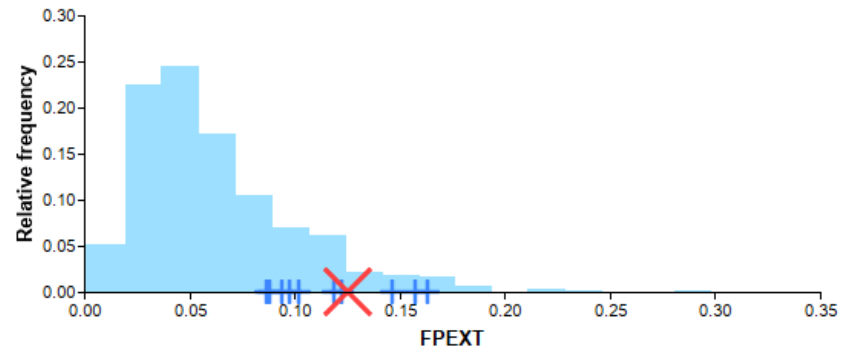
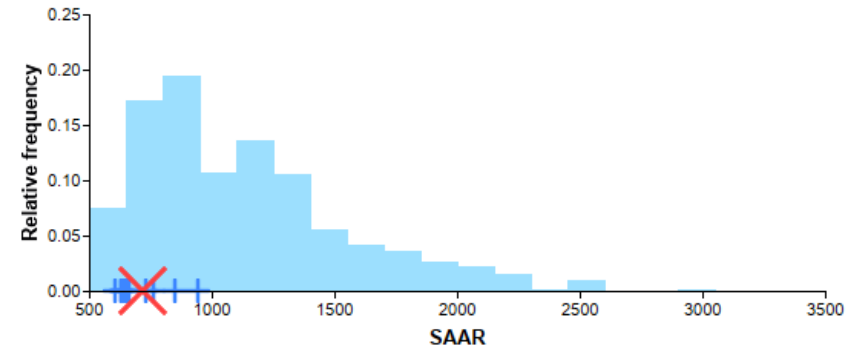
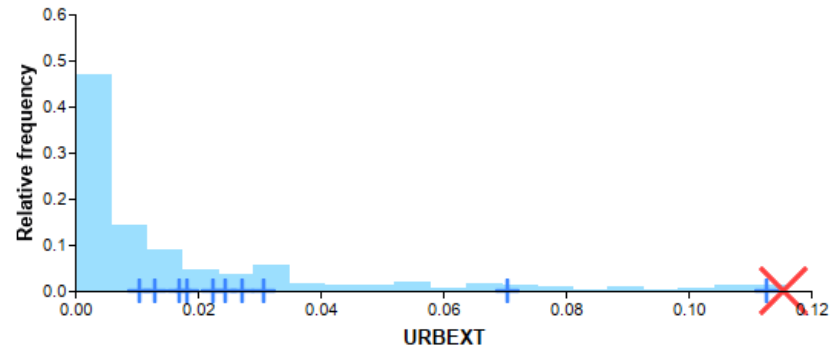
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:04:06  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 1907896827  
Site name: FBH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1  
Site location: SU 74950 68300  
Easting: 474950  
Northing: 168300  
Catchment area: 550.10 km<sup>2</sup>  
SAAR: 716 mm  
BFHHOST19: 0.665  
FPEXT: 0.125  
FARL: 0.908  
URBEXT2000: 0.1156

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 99.65 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.20363

#### Growth curve settings

Distance Measure Method: Standard  
Pooling group URBEXT2000 Threshold: 0.116  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                            | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 28015 (Idle @ Mattersey)           | 0.208    | 37            | 9.520   | 0.197         | <b>0.206</b>     | 0.148           | <b>0.137</b>       |
| 39104 (Mole @ Esher)               | 0.422    | 23            | 53.760  | 0.281         | <b>0.301</b>     | 0.273           | <b>0.252</b>       |
| 68001 (Weaver @ Ashbrook)          | 0.500    | 86            | 46.677  | 0.207         | <b>0.210</b>     | 0.207           | <b>0.203</b>       |
| 39021 (Cherwell @ Enslow Mill)     | 0.572    | 56            | 19.300  | 0.271         | <b>0.275</b>     | 0.509           | <b>0.504</b>       |
| 31004 (Welland @ Tallington Total) | 0.616    | 56            | 34.799  | 0.297         | <b>0.300</b>     | 0.201           | <b>0.198</b>       |
| 43009 (Stour @ Hammoon)            | 0.629    | 55            | 110.352 | 0.182         | <b>0.183</b>     | 0.100           | <b>0.098</b>       |
| 27062 (Nidd @ Skip Bridge)         | 0.650    | 22            | 92.391  | 0.248         | <b>0.252</b>     | 0.400           | <b>0.393</b>       |
| 31005 (Welland @ Tixover)          | 0.668    | 60            | 36.908  | 0.295         | <b>0.297</b>     | 0.273           | <b>0.270</b>       |
| 28024 (Wreake @ Syston Mill)       | 0.674    | 55            | 34.366  | 0.315         | <b>0.320</b>     | 0.316           | <b>0.312</b>       |
| 33034 (Little Ouse @ Abbey Heath)  | 0.712    | 53            | 15.200  | 0.265         | <b>0.268</b>     | 0.164           | <b>0.161</b>       |
| <b>Total</b>                       |          | <b>503</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                            | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 28015 (Idle @ Mattersey)           | Yes                  | Yes                     | 37    | 0               | 0.00                       | -0.77             | None                | 0.683       |          |
| 39104 (Mole @ Esher)               | Yes                  | Yes                     | 23    | 2               | 8.70                       |                   |                     | 0.367       |          |
| 68001 (Weaver @ Ashbrook)          | Yes                  | Yes                     | 86    | 1               | 1.16                       | -1.48             | None                | 0.717       |          |
| 39021 (Cherwell @ Enslow Mill)     | Yes                  | Yes                     | 56    | 2               | 3.57                       | -1.81             | 10                  | 2.258       |          |
| 31004 (Welland @ Tallington Total) | Yes                  | Yes                     | 56    | 6               | 10.71                      | -2.52             | 5                   | 0.806       |          |
| 43009 (Stour @ Hammoon)            | Yes                  | Yes                     | 55    | 5               | 9.09                       | -0.65             | None                | 1.802       |          |
| 27062 (Nidd @ Skip Bridge)         | Yes                  | Yes                     | 22    | 0               | 0.00                       |                   |                     | 1.371       |          |
| 31005 (Welland @ Tixover)          | Yes                  | Yes                     | 60    | 4               | 6.67                       | 0.17              | None                | 0.379       |          |
| 28024 (Wreake @ Syston Mill)       | Yes                  | Yes                     | 55    | 5               | 9.09                       | -2.91             | 5                   | 1.073       |          |
| 33034 (Little Ouse @ Abbey Heath)  | Yes                  | Yes                     | 53    | 7               | 13.21                      | -2.33             | 5                   | 0.544       |          |

### Pooling group catchment descriptors

| Station                            | Area    | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------|---------|------|-------|-------|------------|-----------|
| 28015 (Idle @ Mattersey)           | 528.183 | 650  | 0.119 | 0.904 | 0.070      | 0.738     |
| 39104 (Mole @ Esher)               | 471.358 | 760  | 0.146 | 0.948 | 0.113      | 0.510     |
| 68001 (Weaver @ Ashbrook)          | 622.680 | 732  | 0.158 | 0.955 | 0.027      | 0.533     |
| 39021 (Cherwell @ Enslow Mill)     | 555.447 | 664  | 0.094 | 0.976 | 0.024      | 0.558     |
| 31004 (Welland @ Tallington Total) | 708.005 | 632  | 0.087 | 0.925 | 0.018      | 0.478     |
| 43009 (Stour @ Hammoon)            | 518.745 | 849  | 0.123 | 0.992 | 0.010      | 0.434     |
| 27062 (Nidd @ Skip Bridge)         | 523.472 | 945  | 0.102 | 0.950 | 0.031      | 0.417     |
| 31005 (Welland @ Tixover)          | 419.623 | 636  | 0.098 | 0.971 | 0.013      | 0.352     |
| 28024 (Wreake @ Syston Mill)       | 417.012 | 634  | 0.088 | 0.953 | 0.022      | 0.388     |
| 33034 (Little Ouse @ Abbey Heath)  | 707.750 | 607  | 0.163 | 0.959 | 0.017      | 0.730     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.259 | Urban L-CV:       | 0.242 |
| Rural L-Skewness: | 0.246 | Urban L-Skewness: | 0.267 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.260 | -0.246 |        | -0.055 |
| GEV          | 0.861    | 0.372 | -0.116 |        | -2.358 |
| KAP3         | 0.929    | 0.310 | -0.188 | -0.400 | -0.720 |

### Goodness of fit

|       |         |
|-------|---------|
| GL:   | -2.8382 |
| GEV:  | -4.0279 |
| P3:   | -5.5931 |
| GP:   | -6.9730 |
| KAP3: | -3.2386 |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 1.5269

The pooling group is possibly heterogeneous and a review of the pooling group is optional.

### Standardised growth curves

#### Rural

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.430 | 1.470 | 1.447 |
| 10            | 1.758 | 1.818 | 1.786 |
| 20            | 2.125 | 2.180 | 2.154 |
| 25            | 2.255 | 2.302 | 2.281 |
| 30            | 2.365 | 2.403 | 2.389 |
| 50            | 2.699 | 2.697 | 2.707 |
| 75            | 2.993 | 2.941 | 2.982 |
| 100           | 3.220 | 3.122 | 3.189 |
| 200           | 3.835 | 3.581 | 3.735 |
| 500           | 4.824 | 4.246 | 4.573 |
| 1000          | 5.735 | 4.798 | 5.310 |

#### Urban

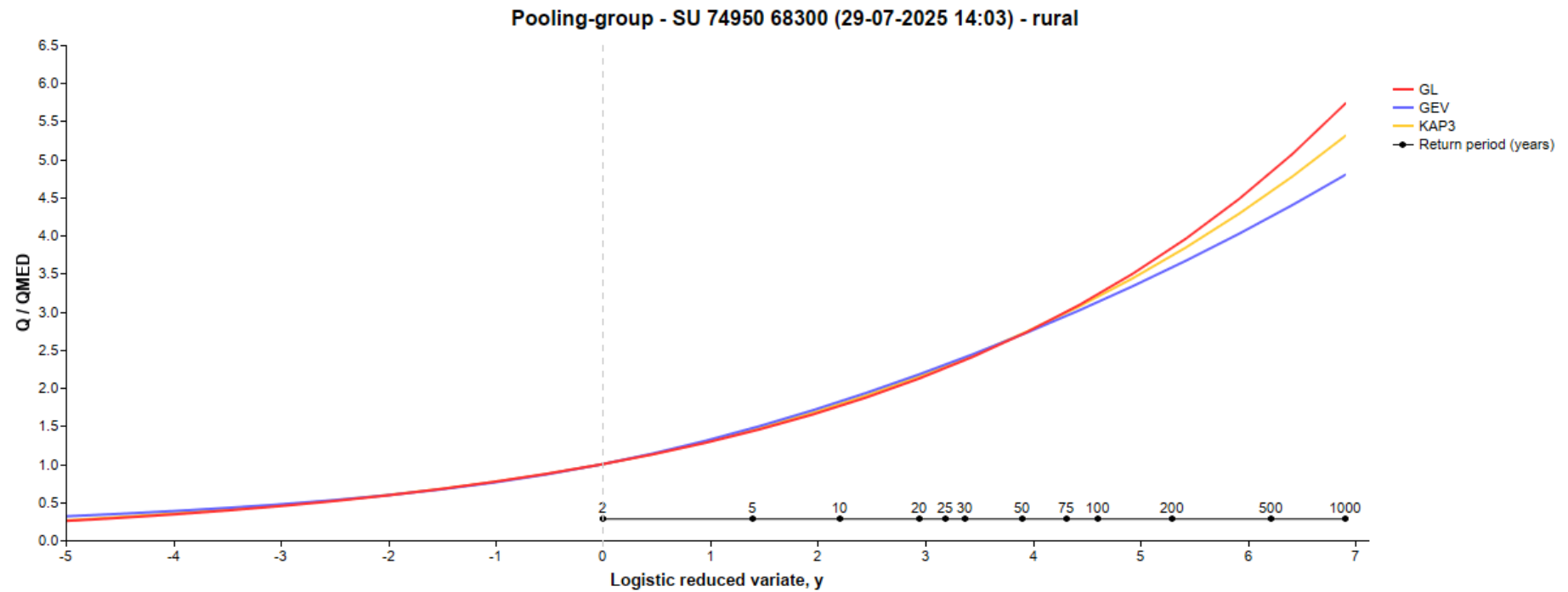
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.401 | 1.437 | 1.415 |
| 10            | 1.714 | 1.768 | 1.738 |
| 20            | 2.069 | 2.122 | 2.096 |
| 25            | 2.196 | 2.243 | 2.221 |
| 30            | 2.304 | 2.343 | 2.327 |
| 50            | 2.635 | 2.640 | 2.646 |
| 75            | 2.929 | 2.890 | 2.923 |
| 100           | 3.158 | 3.076 | 3.134 |
| 200           | 3.784 | 3.557 | 3.697 |
| 500           | 4.808 | 4.272 | 4.579 |
| 1000          | 5.767 | 4.880 | 5.371 |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.239 | -0.267 |        | 0.107  |
| GEV          | 0.874    | 0.336 | -0.146 |        | -1.424 |
| KAP3         | 0.935    | 0.281 | -0.213 | -0.400 | -0.386 |

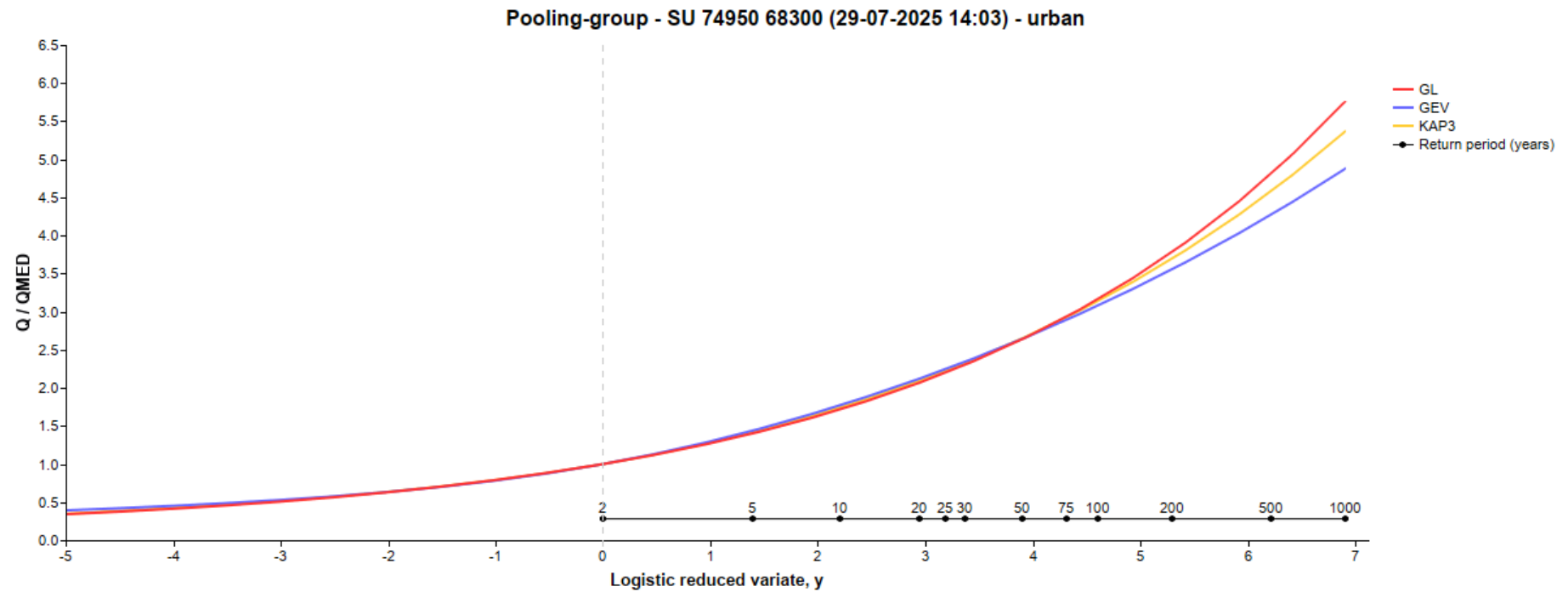
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
URBEXT2000: <0.116  
Donor adjusted FSE: 1.370  
No. of donors: 6

#### Donor stations

| Station                                      | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|----------------------------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39022 (Loddon @ Sheepbridge)                 | 9.99     | Yes                      | 16.350   | 14.203           | 13.034         | 11.322         |
| 39011 (Wey @ Tilford)                        | 17.75    | Yes                      | 25.800   | 22.877           | 22.987         | 20.383         |
| 42009 (Candover Stream @ Borough Bridge)     | 19.58    | Yes                      | 1.065    | 1.011            | 1.806          | 1.806          |
| 42007 (Alre @ Drove Lane Alresford)          | 24.75    | Yes                      | 2.491    | 2.292            | 1.215          | 1.215          |
| 39025 (Enborne @ Brimpton)                   | 26.80    | Yes                      | 16.700   | 16.271           | 18.310         | 18.310         |
| 42010 (Itchen @ Highbridge & Allbrook Total) | 28.36    | Yes                      | 9.479    | 8.274            | 7.681          | 7.681          |

#### Donor suitability

| Station                                      | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|----------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39022 (Loddon @ Sheepbridge)                 | Yes                  | Yes                     | 58    | 2               | 3.45                       | -1.10              | None                 |          |
| 39011 (Wey @ Tilford)                        | Yes                  | No                      | 69    | 3               | 4.35                       | -2.16              | 10                   |          |
| 42009 (Candover Stream @ Borough Bridge)     | Yes                  | Yes                     | 52    | 3               | 5.77                       | 2.45               | 5                    |          |
| 42007 (Alre @ Drove Lane Alresford)          | Yes                  | Yes                     | 44    | 0               | 0.00                       | 2.15               | 5                    |          |
| 39025 (Enborne @ Brimpton)                   | Yes                  | Yes                     | 56    | 0               | 0.00                       | -1.11              | None                 |          |
| 42010 (Itchen @ Highbridge & Allbrook Total) | Yes                  | Yes                     | 65    | 1               | 1.54                       | 1.22               | None                 |          |

#### Donor catchment descriptors

| Station                                                           | Area    | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------------------------|---------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474950_168300_v5_0_1 @ SU 74950 68300) | 550.100 | 474837     | 155108     | 716  | 0.125 | 0.908 | 0.116      | 0.665     |
| 39022 (Loddon @ Sheepbridge)                                      | 176.773 | 464845     | 154923     | 735  | 0.102 | 0.947 | 0.087      | 0.664     |
| 39011 (Wey @ Tilford)                                             | 391.325 | 477280     | 137531     | 855  | 0.055 | 0.957 | 0.053      | 0.773     |
| 42009 (Candover Stream @ Borough Bridge)                          | 72.062  | 460964     | 141288     | 819  | 0.039 | 0.930 | 0.011      | 0.924     |
| 42007 (Alre @ Drove Lane Alresford)                               | 57.447  | 462212     | 133819     | 857  | 0.028 | 0.864 | 0.016      | 0.933     |
| 39025 (Enborne @ Brimpton)                                        | 142.010 | 448695     | 160991     | 789  | 0.075 | 0.978 | 0.020      | 0.563     |
| 42010 (Itchen @ Highbridge & Allbrook Total)                      | 339.900 | 457279     | 132838     | 834  | 0.051 | 0.949 | 0.029      | 0.921     |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Unused Donor stations

| Station                                     | Distance | URBEXT | Use QMED obs<br>deurbanised | QMED<br>obs | QMED<br>deurbanised | QMED CDs<br>urban | QMED CDs<br>rural | Centroid<br>X | Centroid<br>Y | Area    | SAAR | BFIHOST19 | FARL  | Years<br>of data | QMED<br>suitability | Pooling<br>suitability |
|---------------------------------------------|----------|--------|-----------------------------|-------------|---------------------|-------------------|-------------------|---------------|---------------|---------|------|-----------|-------|------------------|---------------------|------------------------|
| 41011 (Rother @ Iping Mill)                 | 30.25    | 0.029  | Yes                         | 30.060      | 28.823              | 22.708            | 22.708            | 477886        | 125009        | 156.935 | 921  | 0.616     | 0.973 | 56               | Yes                 | No                     |
| 39027 (Pang @ Pangbourne)                   | 30.28    | 0.012  | Yes                         | 2.140       | 2.081               | 6.817             | 6.817             | 453633        | 176722        | 175.683 | 694  | 0.782     | 0.996 | 55               | Yes                 | No                     |
| 42008 (Cheriton Stream @<br>Sewards Bridge) | 30.73    | 0.009  | Yes                         | 1.367       | 1.312               | 2.871             | 2.871             | 461729        | 127315        | 74.338  | 885  | 0.918     | 0.995 | 52               | Yes                 | Yes                    |
| 41022 (Lod @ Halfway Bridge)                | 32.73    | 0.009  | Yes                         | 16.600      | 16.453              | 12.981            | 12.981            | 491432        | 126899        | 52.438  | 857  | 0.428     | 0.951 | 53               | Yes                 | Yes                    |

### QMED

Rural: 25.075 m<sup>3</sup>/s

Urban: 30.181 m<sup>3</sup>/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

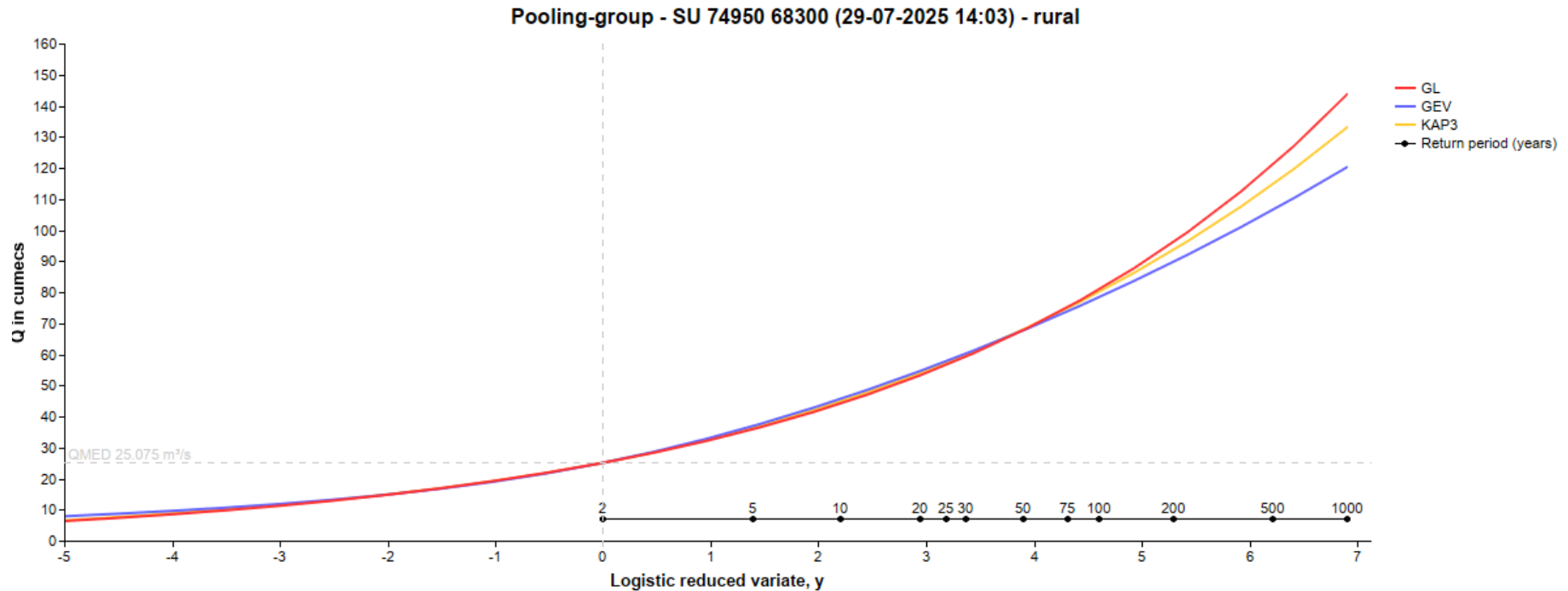
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 25.075    | 25.075     | 25.075      |
| 5             | 35.854    | 36.871     | 36.279      |
| 10            | 44.094    | 45.577     | 44.778      |
| 20            | 53.291    | 54.669     | 54.015      |
| 25            | 56.532    | 57.715     | 57.201      |
| 30            | 59.298    | 60.253     | 59.892      |
| 50            | 67.673    | 67.620     | 67.891      |
| 75            | 75.058    | 73.758     | 74.770      |
| 100           | 80.744    | 78.282     | 79.964      |
| 200           | 96.166    | 89.797     | 93.658      |
| 500           | 120.974   | 106.478    | 114.678     |
| 1000          | 143.806   | 120.314    | 133.142     |

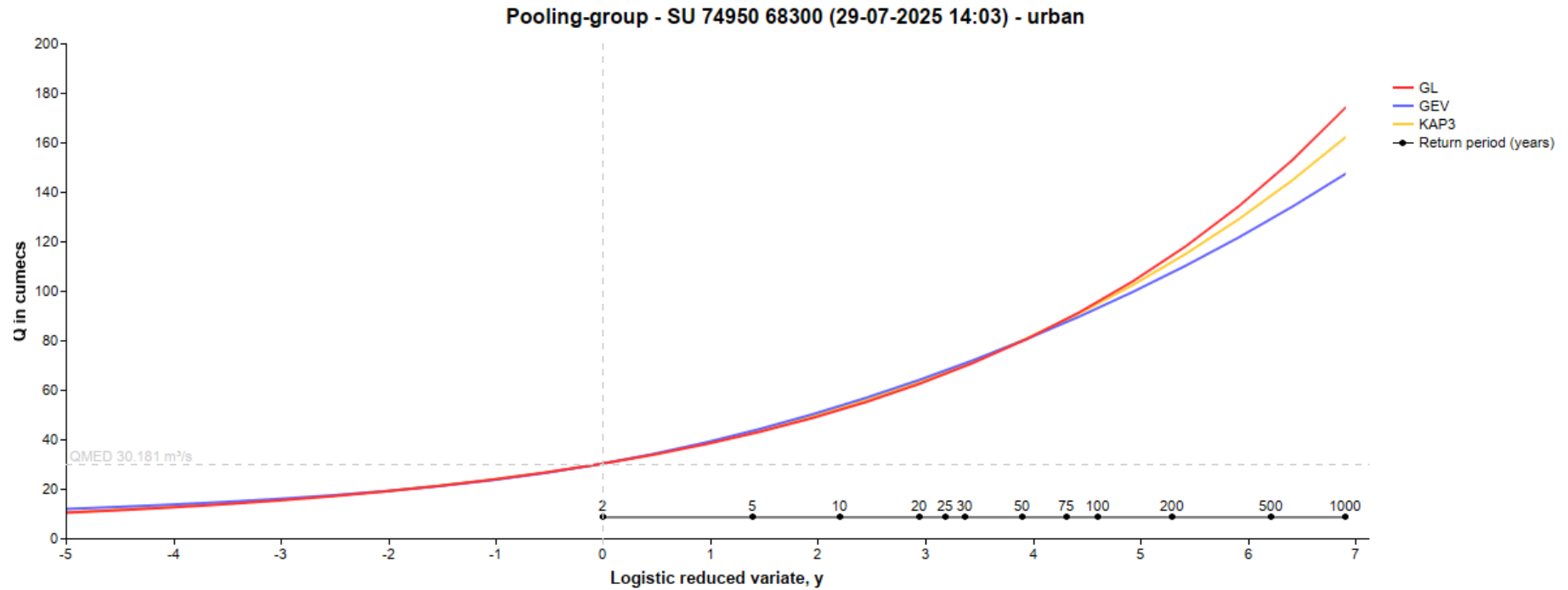
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 30.181    | 30.181     | 30.181      |
| 5             | 42.274    | 43.360     | 42.718      |
| 10            | 51.727    | 53.366     | 52.470      |
| 20            | 62.451    | 64.053     | 63.273      |
| 25            | 66.267    | 67.684     | 67.044      |
| 30            | 69.539    | 70.729     | 70.245      |
| 50            | 79.521    | 79.664     | 79.850      |
| 75            | 88.410    | 87.214     | 88.208      |
| 100           | 95.303    | 92.837     | 94.575      |
| 200           | 114.198   | 107.369    | 111.576     |
| 500           | 145.114   | 128.946    | 138.215     |
| 1000          | 174.046   | 147.285    | 162.097     |



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



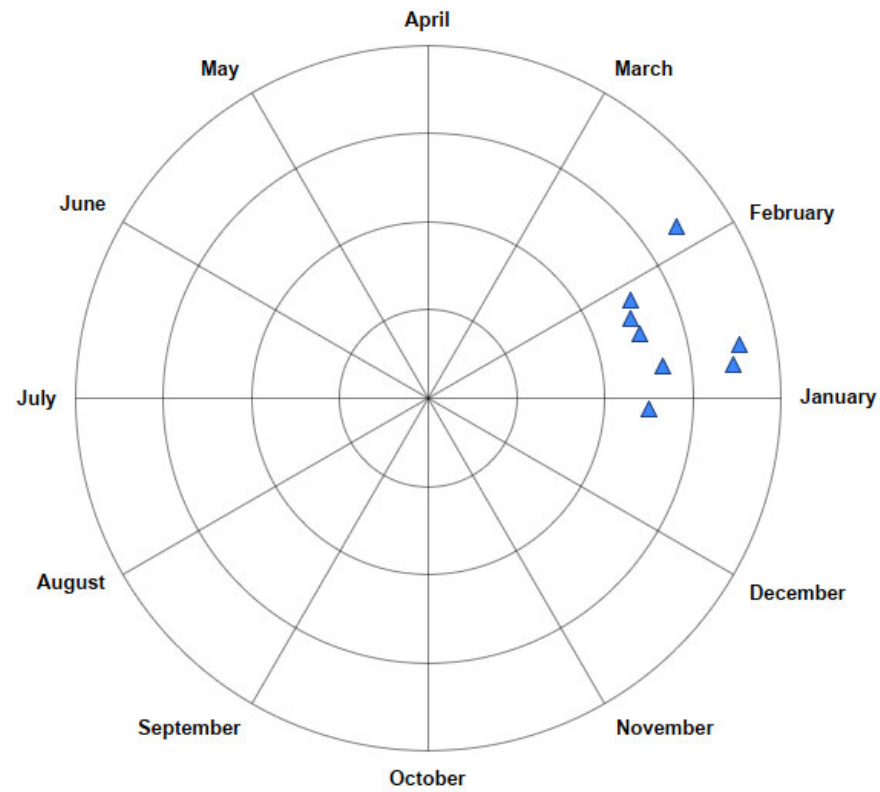
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

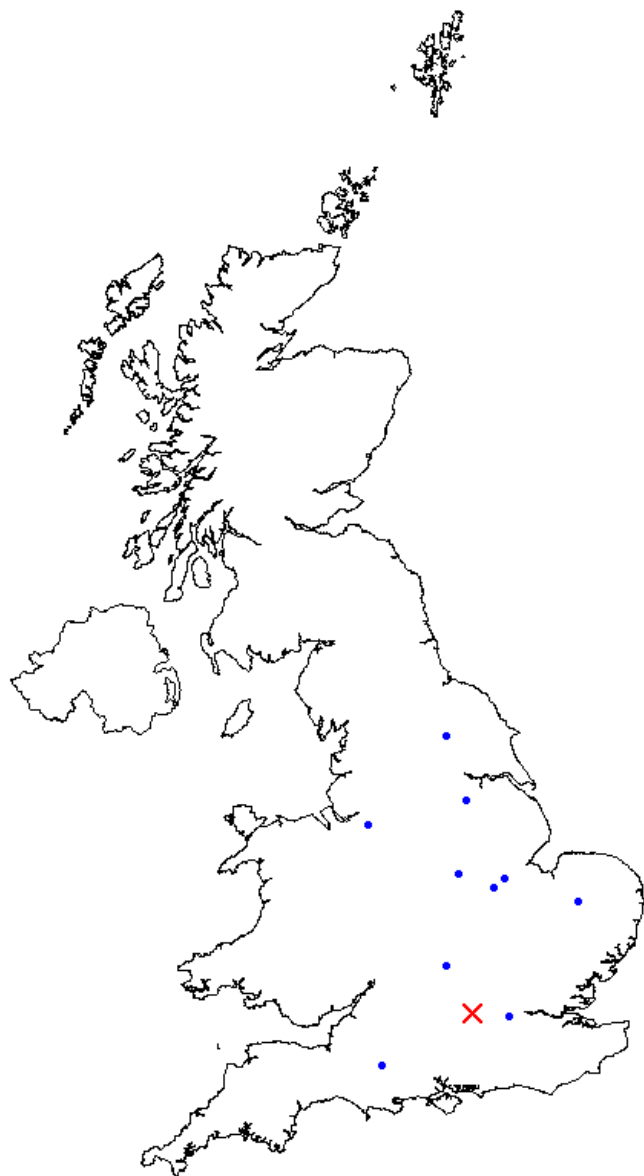
#### Station record parameters

Flood seasonality: SU 74950 68300 (29-07-2025 14:03) - rural



# UK Design Flood Estimation

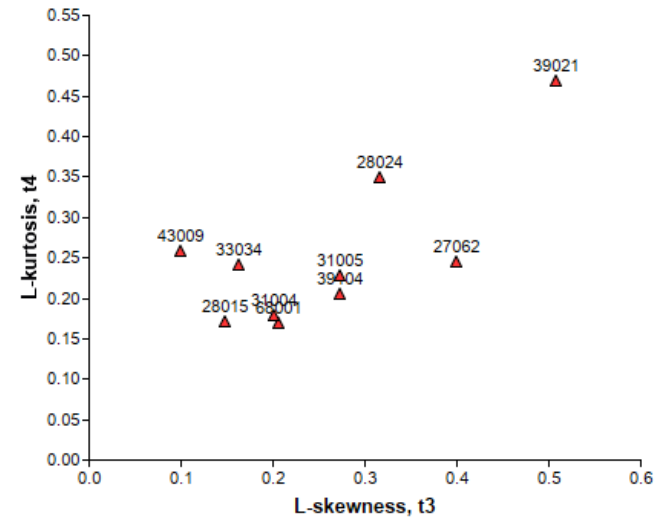
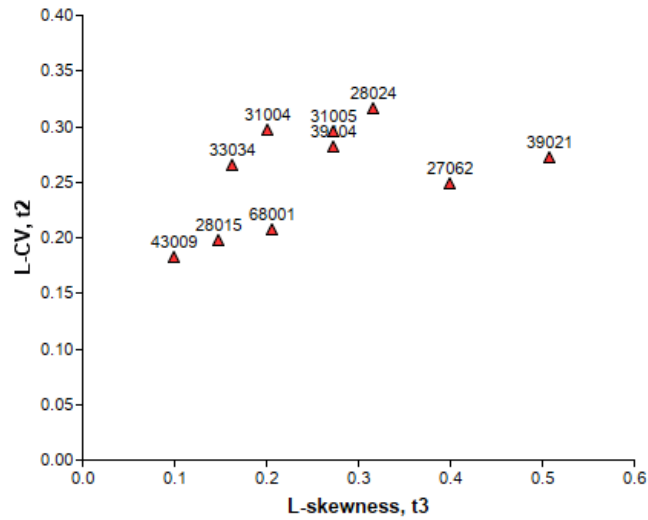
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

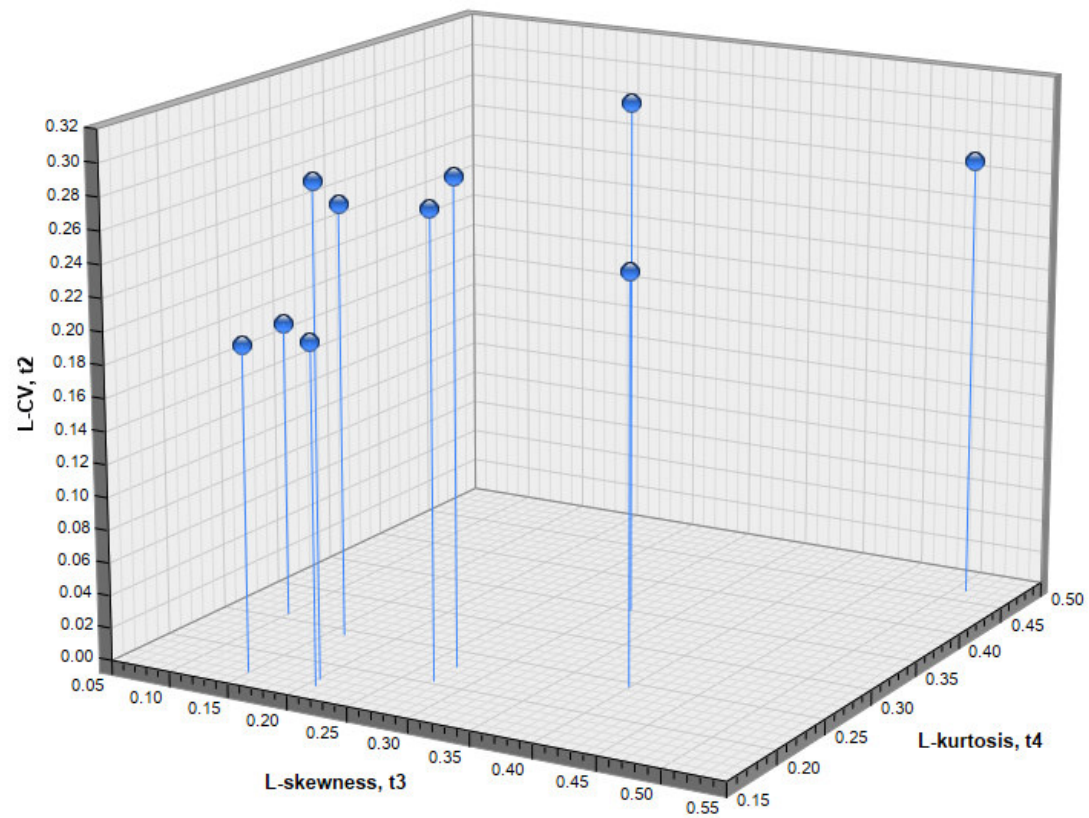
L-moment ratios - SU 74950 68300 (29-07-2025 14:03) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

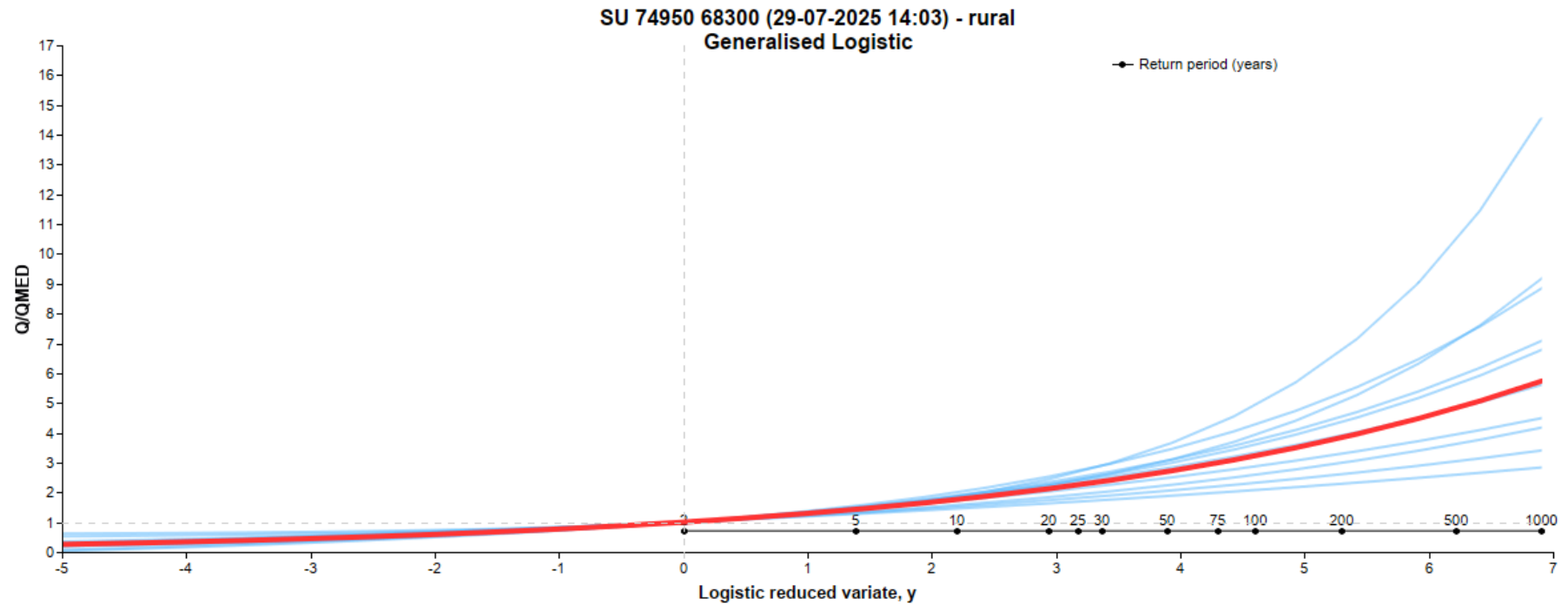
L-moment ratios - SU 74950 68300 (29-07-2025 14:03) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

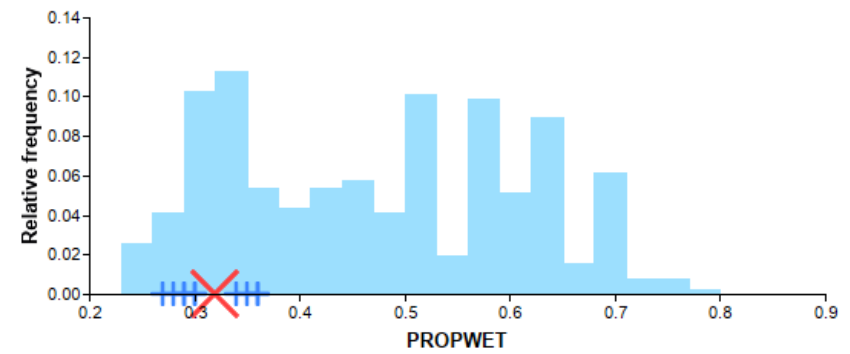
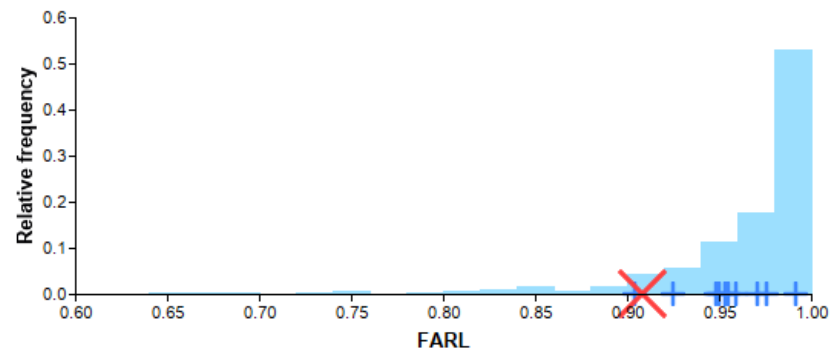
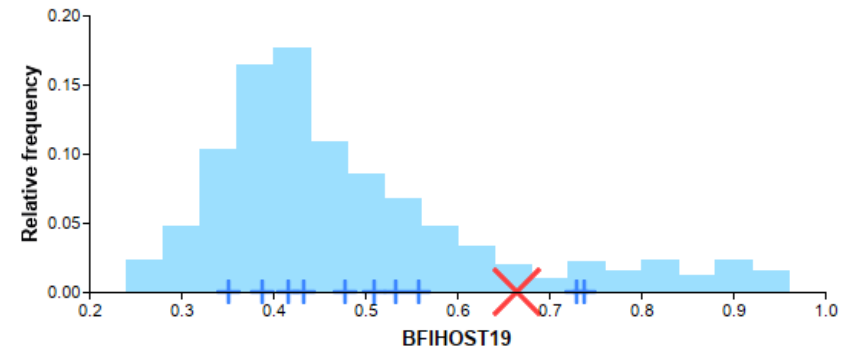
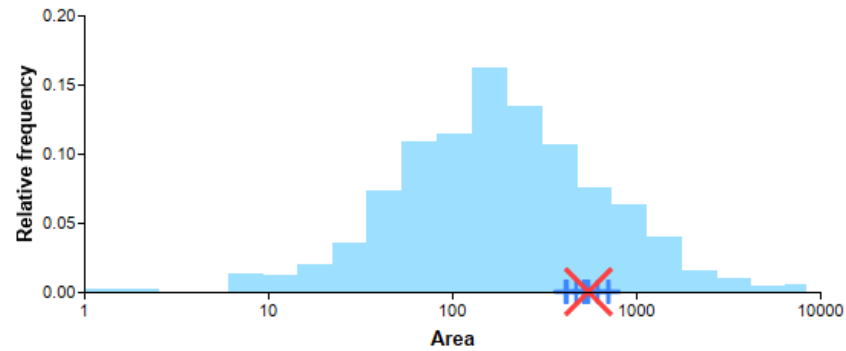
Pooling group growth curves



# UK Design Flood Estimation

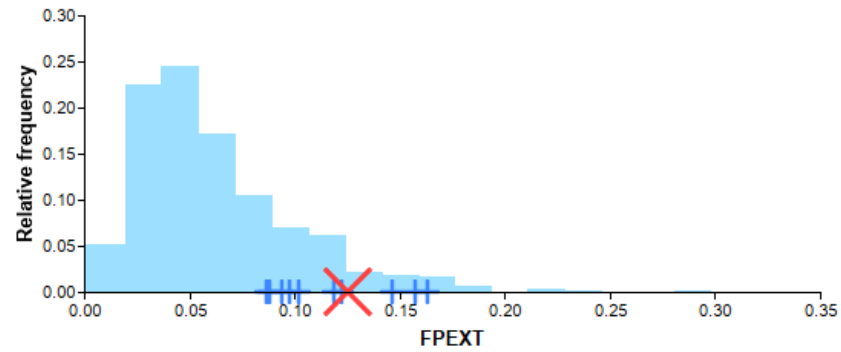
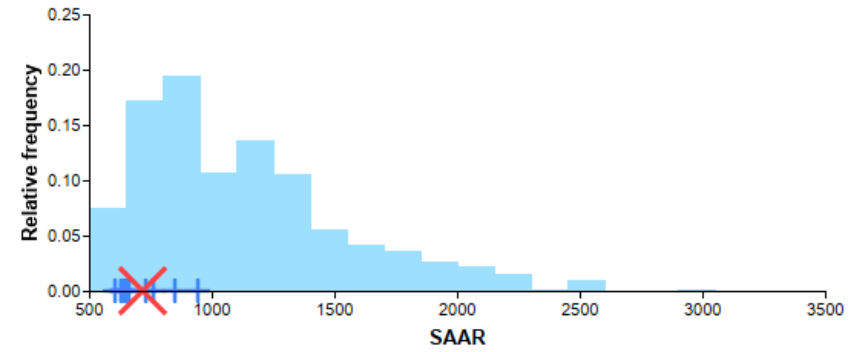
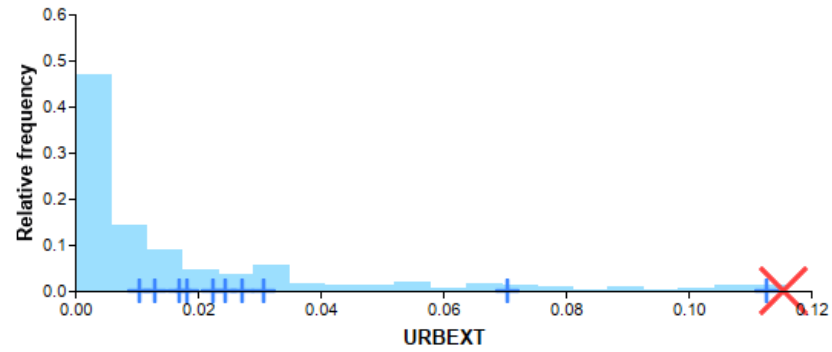
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:10:26  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 1907896827  
Site name: FBH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1  
Site location: SU 74950 68300  
Easting: 474950  
Northing: 168300  
Catchment area: 550.10 km<sup>2</sup>  
SAAR: 716 mm  
BFHHOST19: 0.665  
FPEXT: 0.125  
FARL: 0.908  
URBEXT2000: 0.1156

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 99.65 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.20363

#### Growth curve settings

Distance Measure Method: Standard  
Pooling group URBEXT2000 Threshold: 0.116  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                                  | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 28015 (Idle @ Mattersey)                 | 0.208    | 37            | 9.520   | 0.197         | <b>0.206</b>     | 0.148           | <b>0.137</b>       |
| 39104 (Mole @ Esher)                     | 0.422    | 23            | 53.760  | 0.281         | <b>0.301</b>     | 0.273           | <b>0.252</b>       |
| 68001 (Weaver @ Ashbrook)                | 0.500    | 86            | 46.677  | 0.207         | <b>0.210</b>     | 0.207           | <b>0.203</b>       |
| 31004 (Welland @ Tallington Total)       | 0.616    | 56            | 34.799  | 0.297         | <b>0.300</b>     | 0.201           | <b>0.198</b>       |
| 43009 (Stour @ Hammoon)                  | 0.629    | 55            | 110.352 | 0.182         | <b>0.183</b>     | 0.100           | <b>0.098</b>       |
| 27062 (Nidd @ Skip Bridge)               | 0.650    | 22            | 92.391  | 0.248         | <b>0.252</b>     | 0.400           | <b>0.393</b>       |
| 31005 (Welland @ Tixover)                | 0.668    | 60            | 36.908  | 0.295         | <b>0.297</b>     | 0.273           | <b>0.270</b>       |
| 33034 (Little Ouse @ Abbey Heath)        | 0.712    | 53            | 15.200  | 0.265         | <b>0.268</b>     | 0.164           | <b>0.161</b>       |
| 33005 (Bedford Ouse @ Thornborough Mill) | 0.721    | 28            | 21.800  | 0.178         | <b>0.180</b>     | -0.112          | <b>-0.113</b>      |
| 205004 (Lagan @ Newforge)                | 0.753    | 51            | 75.107  | 0.196         | <b>0.200</b>     | 0.247           | <b>0.241</b>       |
| 28026 (Anker @ Polesworth)               | 0.760    | 56            | 46.049  | 0.279         | <b>0.292</b>     | 0.168           | <b>0.155</b>       |
| <b>Total</b>                             |          | <b>527</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                  | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 28015 (Idle @ Mattersey)                 | Yes                  | Yes                     | 37    | 0               | 0.00                       | -0.77             | None                | 0.539       |          |
| 39104 (Mole @ Esher)                     | Yes                  | Yes                     | 23    | 2               | 8.70                       |                   |                     | 0.329       |          |
| 68001 (Weaver @ Ashbrook)                | Yes                  | Yes                     | 86    | 1               | 1.16                       | -1.48             | None                | 0.612       |          |
| 31004 (Welland @ Tallington Total)       | Yes                  | Yes                     | 56    | 6               | 10.71                      | -2.52             | 5                   | 0.770       |          |
| 43009 (Stour @ Hammoon)                  | Yes                  | Yes                     | 55    | 5               | 9.09                       | -0.65             | None                | 1.285       |          |
| 27062 (Nidd @ Skip Bridge)               | Yes                  | Yes                     | 22    | 0               | 0.00                       |                   |                     | 1.499       |          |
| 31005 (Welland @ Tixover)                | Yes                  | Yes                     | 60    | 4               | 6.67                       | 0.17              | None                | 0.724       |          |
| 33034 (Little Ouse @ Abbey Heath)        | Yes                  | Yes                     | 53    | 7               | 13.21                      | -2.33             | 5                   | 0.743       |          |
| 33005 (Bedford Ouse @ Thornborough Mill) | Yes                  | Yes                     | 28    | 3               | 10.71                      | -0.47             | None                | 2.054       |          |
| 205004 (Lagan @ Newforge)                | Yes                  | Yes                     | 51    | 0               | 0.00                       | -0.18             | None                | 1.019       |          |
| 28026 (Anker @ Polesworth)               | Yes                  | Yes                     | 56    | 8               | 14.29                      | -0.94             | None                | 1.427       |          |

### Pooling group catchment descriptors

| Station                                  | Area    | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------------|---------|------|-------|-------|------------|-----------|
| 28015 (Idle @ Mattersey)                 | 528.183 | 650  | 0.119 | 0.904 | 0.070      | 0.738     |
| 39104 (Mole @ Esher)                     | 471.358 | 760  | 0.146 | 0.948 | 0.113      | 0.510     |
| 68001 (Weaver @ Ashbrook)                | 622.680 | 732  | 0.158 | 0.955 | 0.027      | 0.533     |
| 31004 (Welland @ Tallington Total)       | 708.005 | 632  | 0.087 | 0.925 | 0.018      | 0.478     |
| 43009 (Stour @ Hammoon)                  | 518.745 | 849  | 0.123 | 0.992 | 0.010      | 0.434     |
| 27062 (Nidd @ Skip Bridge)               | 523.472 | 945  | 0.102 | 0.950 | 0.031      | 0.417     |
| 31005 (Welland @ Tixover)                | 419.623 | 636  | 0.098 | 0.971 | 0.013      | 0.352     |
| 33034 (Little Ouse @ Abbey Heath)        | 707.750 | 607  | 0.163 | 0.959 | 0.017      | 0.730     |
| 33005 (Bedford Ouse @ Thornborough Mill) | 387.665 | 655  | 0.111 | 0.983 | 0.014      | 0.466     |
| 205004 (Lagan @ Newforge)                | 493.145 | 916  | 0.098 | 0.983 | 0.032      | 0.439     |
| 28026 (Anker @ Polesworth)               | 371.577 | 653  | 0.140 | 0.982 | 0.078      | 0.442     |

### Pooling Group Rejected Stations

| Station                        | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|--------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
| 39021 (Cherwell @ Enslow Mill) | 0.572    | 56            | 19.300  | 0.271         | 0.275            | 0.509           | 0.504              |          |
| 28024 (Wreake @ Syston Mill)   | 0.674    | 55            | 34.366  | 0.315         | 0.320            | 0.316           | 0.312              |          |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

Rural L-CV: 0.243      Urban L-CV: 0.227  
Rural L-Skewness: 0.180      Urban L-Skewness: 0.199

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound   |
|--------------|----------|-------|--------|--------|---------|
| GL           | 1.000    | 0.248 | -0.180 |        | -0.382  |
| GEV          | 0.862    | 0.375 | -0.015 |        | -24.313 |
| KAP3         | 0.931    | 0.304 | -0.105 | -0.400 | -1.968  |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.229 | -0.199 |        | -0.151 |
| GEV          | 0.874    | 0.341 | -0.045 |        | -6.676 |
| KAP3         | 0.937    | 0.279 | -0.130 | -0.400 | -1.213 |

### Goodness of fit

GL: -0.2471 \*  
GEV: -1.9991  
P3: -3.0472  
GP: -5.9264  
KAP3: -0.8839 \*

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 0.6509

The pooling group is acceptably homogeneous and a review of the pooling group is not required.

### Standardised growth curves

#### Rural

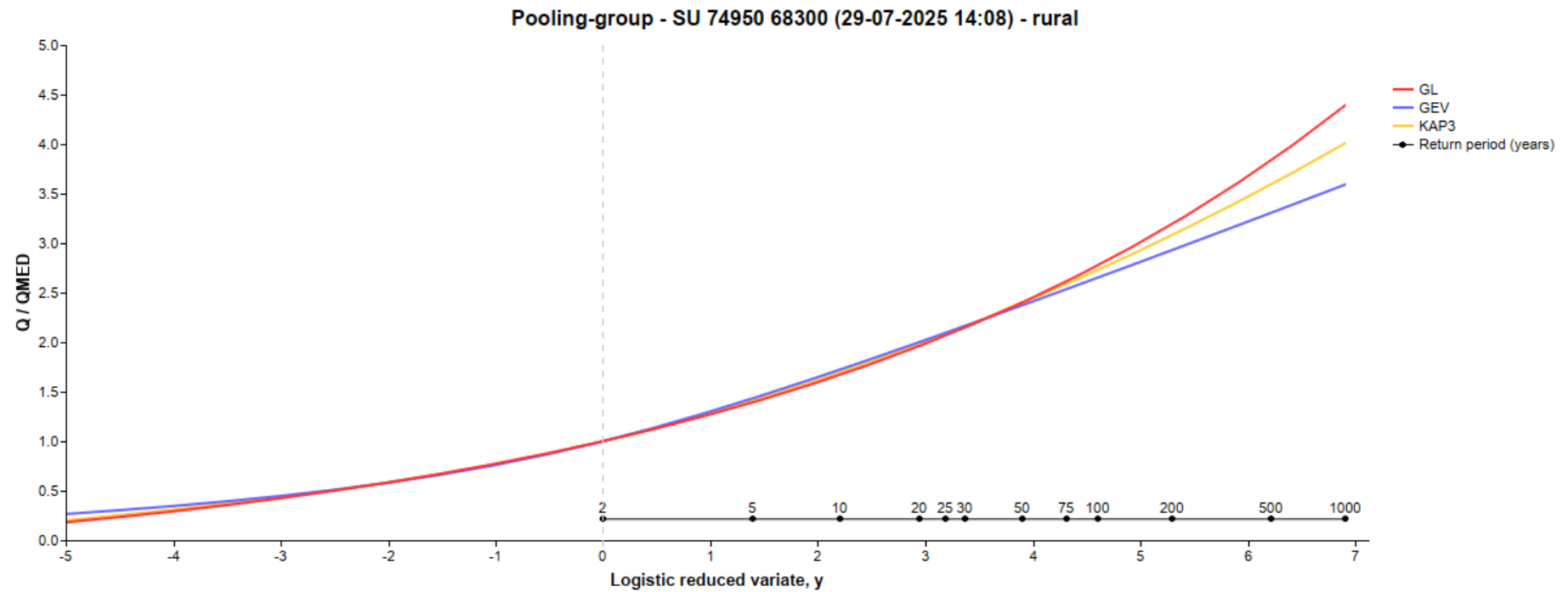
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.391 | 1.431 | 1.409 |
| 10            | 1.668 | 1.721 | 1.694 |
| 20            | 1.963 | 2.002 | 1.985 |
| 25            | 2.063 | 2.092 | 2.082 |
| 30            | 2.148 | 2.165 | 2.162 |
| 50            | 2.398 | 2.370 | 2.394 |
| 75            | 2.611 | 2.533 | 2.586 |
| 100           | 2.772 | 2.649 | 2.726 |
| 200           | 3.193 | 2.930 | 3.082 |
| 500           | 3.835 | 3.306 | 3.592 |
| 1000          | 4.394 | 3.593 | 4.012 |

#### Urban

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.366 | 1.403 | 1.382 |
| 10            | 1.633 | 1.682 | 1.656 |
| 20            | 1.919 | 1.958 | 1.941 |
| 25            | 2.018 | 2.048 | 2.037 |
| 30            | 2.101 | 2.121 | 2.117 |
| 50            | 2.349 | 2.330 | 2.349 |
| 75            | 2.564 | 2.498 | 2.543 |
| 100           | 2.726 | 2.618 | 2.687 |
| 200           | 3.155 | 2.915 | 3.055 |
| 500           | 3.820 | 3.321 | 3.595 |
| 1000          | 4.409 | 3.640 | 4.047 |

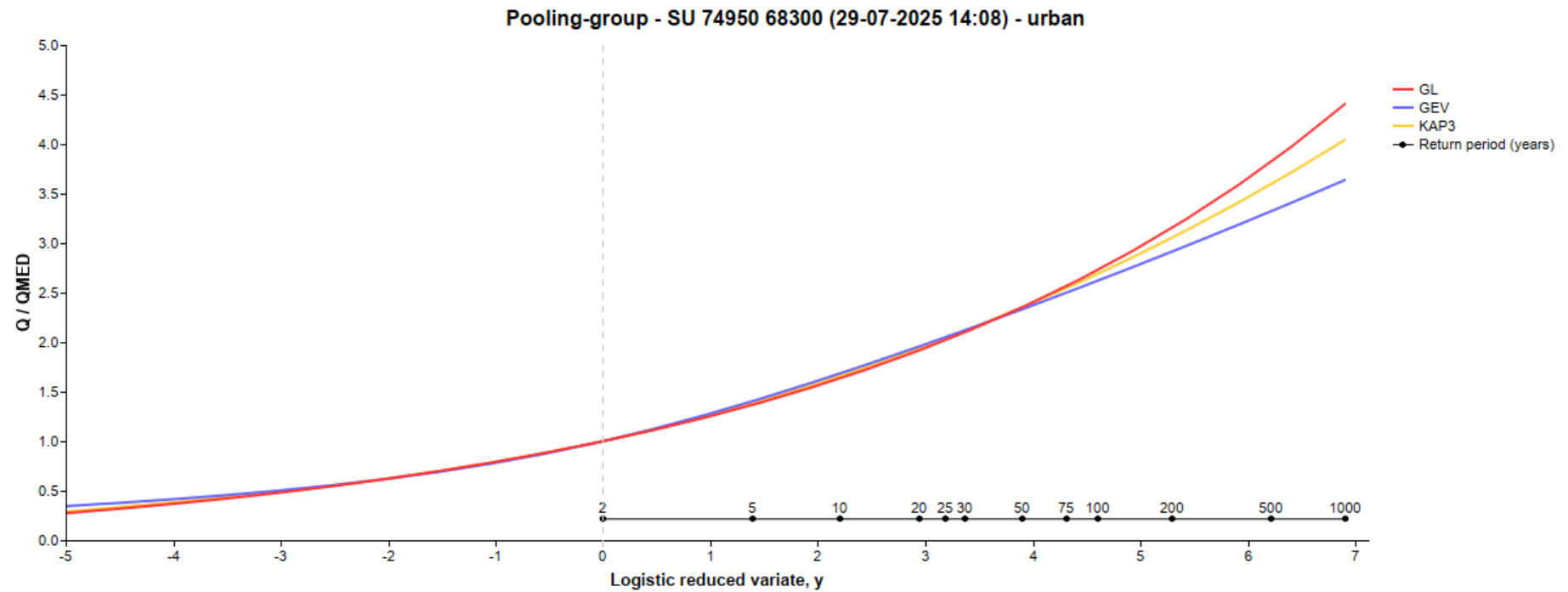
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
URBEXT2000: <0.116  
Donor adjusted FSE: 1.370  
No. of donors: 6

#### Donor stations

| Station                                      | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|----------------------------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39022 (Loddon @ Sheepbridge)                 | 9.99     | Yes                      | 16.350   | 14.203           | 13.034         | 11.322         |
| 39011 (Wey @ Tilford)                        | 17.75    | Yes                      | 25.800   | 22.877           | 22.987         | 20.383         |
| 42009 (Candover Stream @ Borough Bridge)     | 19.58    | Yes                      | 1.065    | 1.011            | 1.806          | 1.806          |
| 42007 (Alre @ Drove Lane Alresford)          | 24.75    | Yes                      | 2.491    | 2.292            | 1.215          | 1.215          |
| 39025 (Enborne @ Brimpton)                   | 26.80    | Yes                      | 16.700   | 16.271           | 18.310         | 18.310         |
| 42010 (Itchen @ Highbridge & Allbrook Total) | 28.36    | Yes                      | 9.479    | 8.274            | 7.681          | 7.681          |

#### Donor suitability

| Station                                      | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|----------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39022 (Loddon @ Sheepbridge)                 | Yes                  | Yes                     | 58    | 2               | 3.45                       | -1.10              | None                 |          |
| 39011 (Wey @ Tilford)                        | Yes                  | No                      | 69    | 3               | 4.35                       | -2.16              | 10                   |          |
| 42009 (Candover Stream @ Borough Bridge)     | Yes                  | Yes                     | 52    | 3               | 5.77                       | 2.45               | 5                    |          |
| 42007 (Alre @ Drove Lane Alresford)          | Yes                  | Yes                     | 44    | 0               | 0.00                       | 2.15               | 5                    |          |
| 39025 (Enborne @ Brimpton)                   | Yes                  | Yes                     | 56    | 0               | 0.00                       | -1.11              | None                 |          |
| 42010 (Itchen @ Highbridge & Allbrook Total) | Yes                  | Yes                     | 65    | 1               | 1.54                       | 1.22               | None                 |          |

#### Donor catchment descriptors

| Station                                                           | Area    | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------------------------|---------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474950_168300_v5_0_1 @ SU 74950 68300) | 550.100 | 474837     | 155108     | 716  | 0.125 | 0.908 | 0.116      | 0.665     |
| 39022 (Loddon @ Sheepbridge)                                      | 176.773 | 464845     | 154923     | 735  | 0.102 | 0.947 | 0.087      | 0.664     |
| 39011 (Wey @ Tilford)                                             | 391.325 | 477280     | 137531     | 855  | 0.055 | 0.957 | 0.053      | 0.773     |
| 42009 (Candover Stream @ Borough Bridge)                          | 72.062  | 460964     | 141288     | 819  | 0.039 | 0.930 | 0.011      | 0.924     |
| 42007 (Alre @ Drove Lane Alresford)                               | 57.447  | 462212     | 133819     | 857  | 0.028 | 0.864 | 0.016      | 0.933     |
| 39025 (Enborne @ Brimpton)                                        | 142.010 | 448695     | 160991     | 789  | 0.075 | 0.978 | 0.020      | 0.563     |
| 42010 (Itchen @ Highbridge & Allbrook Total)                      | 339.900 | 457279     | 132838     | 834  | 0.051 | 0.949 | 0.029      | 0.921     |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Unused Donor stations

| Station                                     | Distance | URBEXT | Use QMED obs<br>deurbanised | QMED<br>obs | QMED<br>deurbanised | QMED CDs<br>urban | QMED CDs<br>rural | Centroid<br>X | Centroid<br>Y | Area    | SAAR | BFIHOST19 | FARL  | Years<br>of data | QMED<br>suitability | Pooling<br>suitability |
|---------------------------------------------|----------|--------|-----------------------------|-------------|---------------------|-------------------|-------------------|---------------|---------------|---------|------|-----------|-------|------------------|---------------------|------------------------|
| 41011 (Rother @ Iping Mill)                 | 30.25    | 0.029  | Yes                         | 30.060      | 28.823              | 22.708            | 22.708            | 477886        | 125009        | 156.935 | 921  | 0.616     | 0.973 | 56               | Yes                 | No                     |
| 39027 (Pang @ Pangbourne)                   | 30.28    | 0.012  | Yes                         | 2.140       | 2.081               | 6.817             | 6.817             | 453633        | 176722        | 175.683 | 694  | 0.782     | 0.996 | 55               | Yes                 | No                     |
| 42008 (Cheriton Stream @<br>Sewards Bridge) | 30.73    | 0.009  | Yes                         | 1.367       | 1.312               | 2.871             | 2.871             | 461729        | 127315        | 74.338  | 885  | 0.918     | 0.995 | 52               | Yes                 | Yes                    |
| 41022 (Lod @ Halfway Bridge)                | 32.73    | 0.009  | Yes                         | 16.600      | 16.453              | 12.981            | 12.981            | 491432        | 126899        | 52.438  | 857  | 0.428     | 0.951 | 53               | Yes                 | Yes                    |

### QMED

Rural: 25.075 m<sup>3</sup>/s

Urban: 30.181 m<sup>3</sup>/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

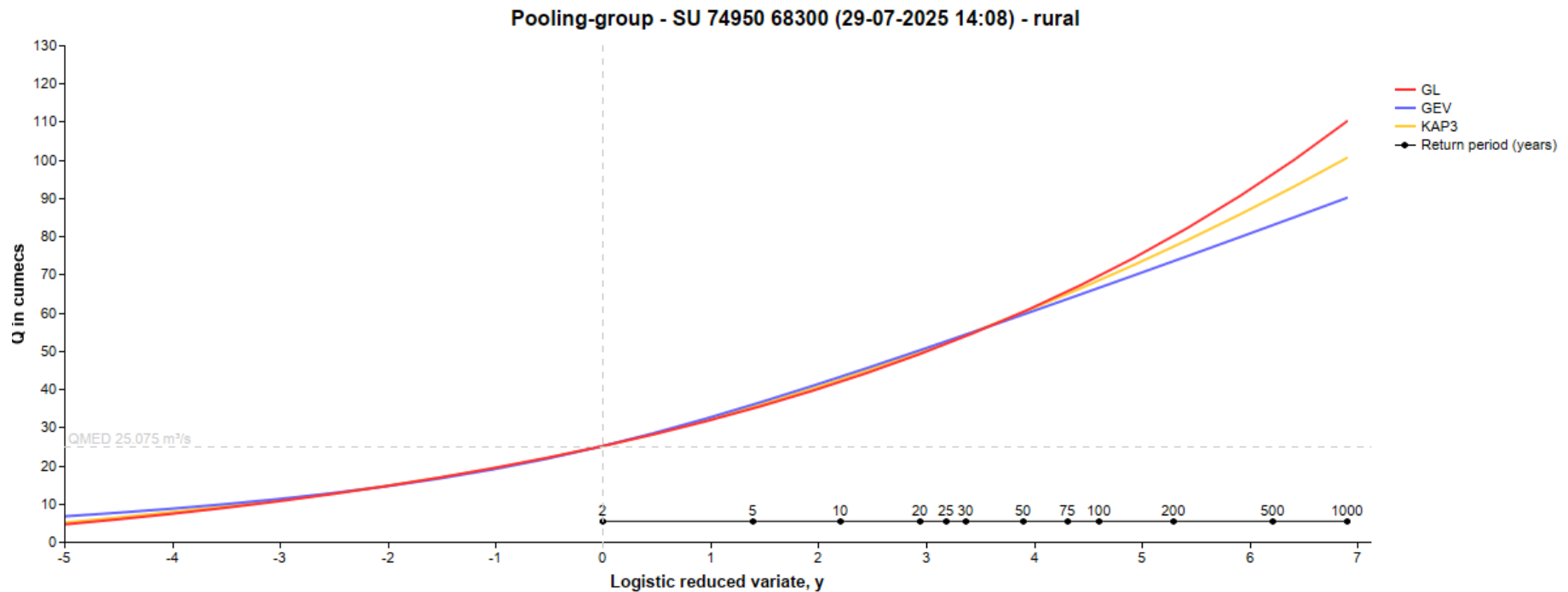
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 25.075    | 25.075     | 25.075      |
| 5             | 34.870    | 35.892     | 35.319      |
| 10            | 41.836    | 43.154     | 42.476      |
| 20            | 49.219    | 50.198     | 49.786      |
| 25            | 51.737    | 52.448     | 52.209      |
| 30            | 53.857    | 54.284     | 54.221      |
| 50            | 60.121    | 59.428     | 60.028      |
| 75            | 65.476    | 63.518     | 64.833      |
| 100           | 69.503    | 66.429     | 68.358      |
| 200           | 80.064    | 73.477     | 77.275      |
| 500           | 96.152    | 82.889     | 90.071      |
| 1000          | 110.186   | 90.087     | 100.589     |

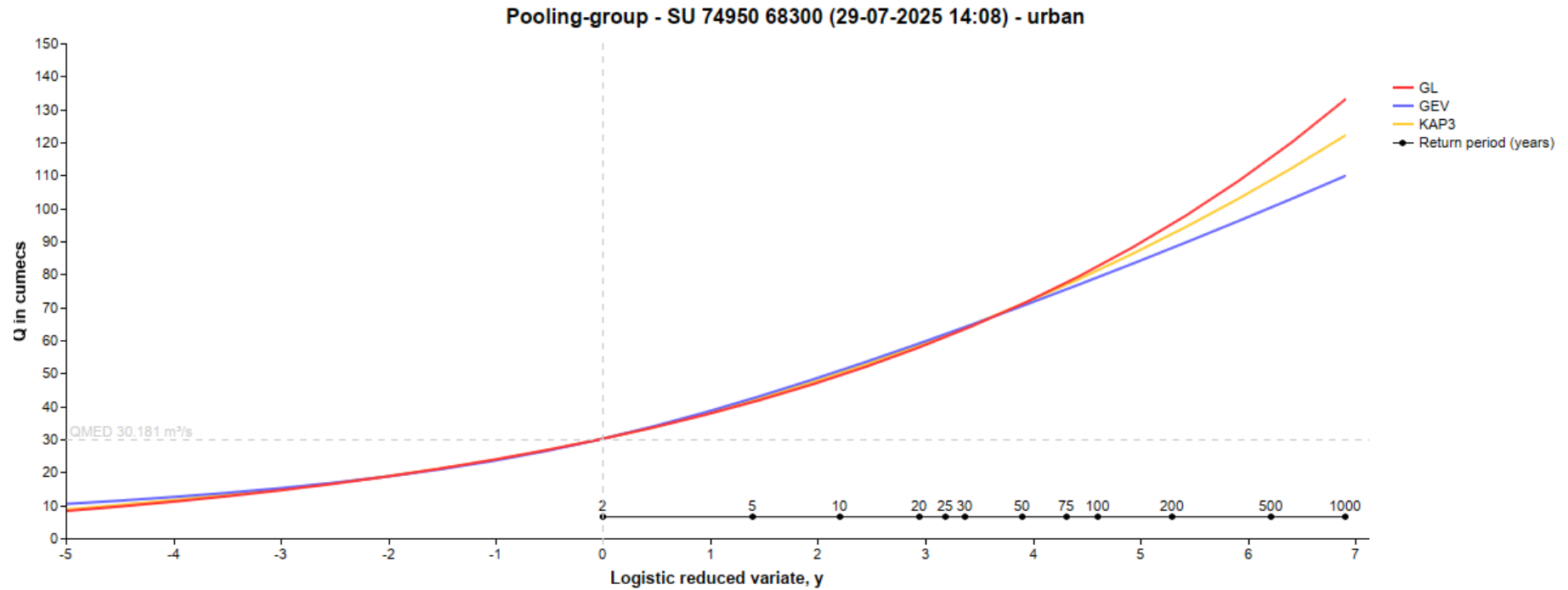
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 30.181    | 30.181     | 30.181      |
| 5             | 41.240    | 42.356     | 41.723      |
| 10            | 49.276    | 50.767     | 49.988      |
| 20            | 57.922    | 59.107     | 58.587      |
| 25            | 60.901    | 61.810     | 61.472      |
| 30            | 63.417    | 64.029     | 63.879      |
| 50            | 70.909    | 70.313     | 70.887      |
| 75            | 77.372    | 75.381     | 76.755      |
| 100           | 82.266    | 79.025     | 81.096      |
| 200           | 95.230    | 87.984     | 92.213      |
| 500           | 115.297   | 100.241    | 108.489     |
| 1000          | 133.082   | 109.849    | 122.136     |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



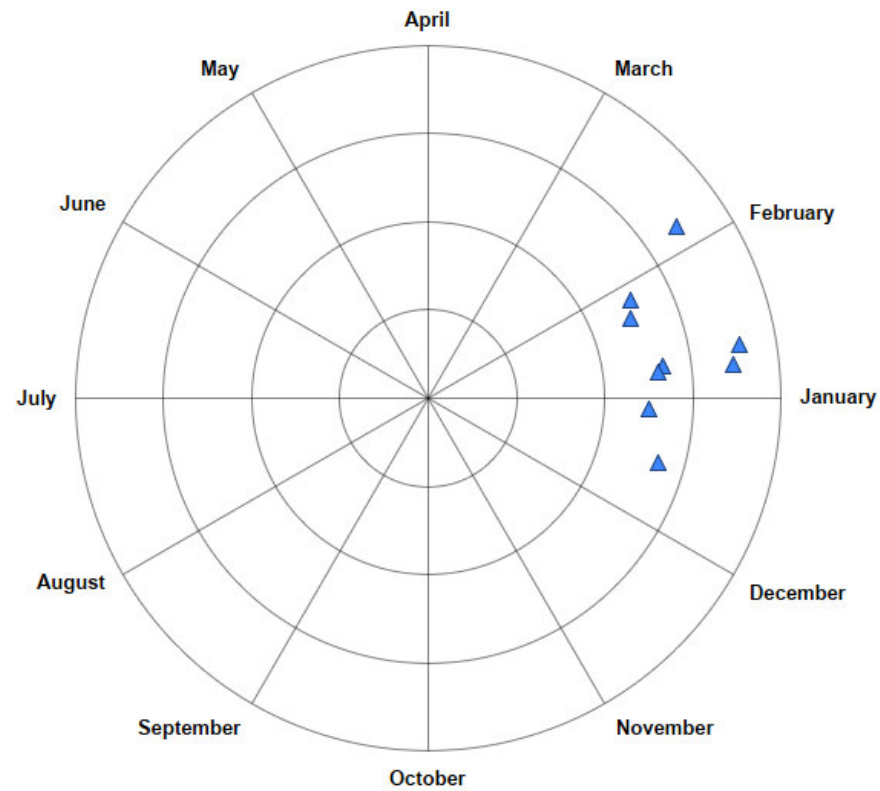
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

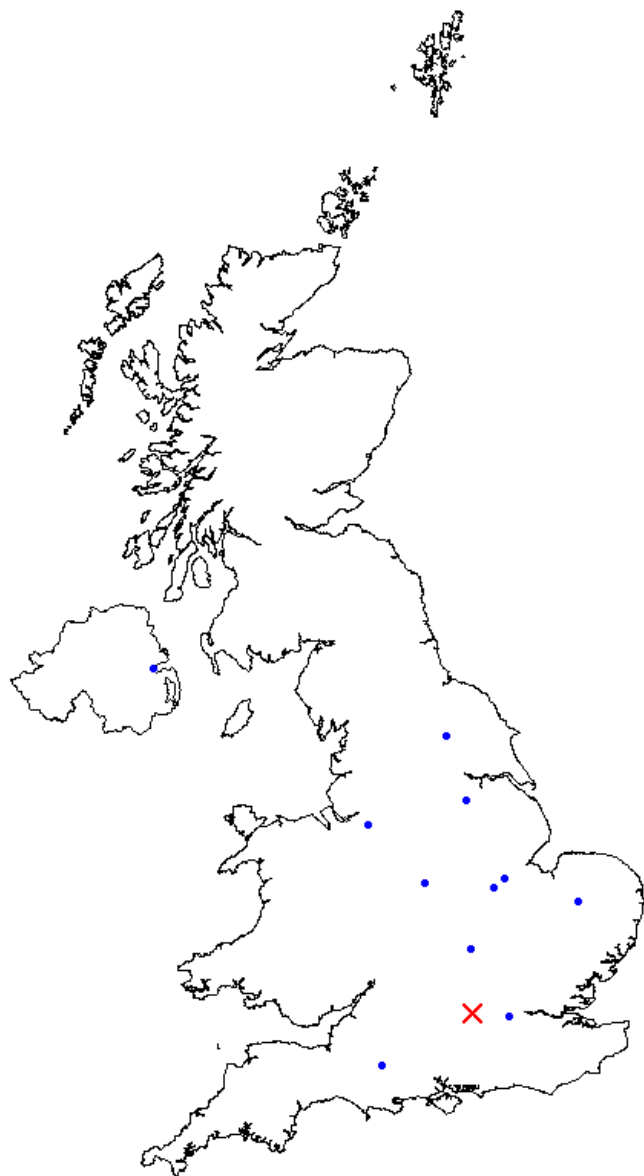
#### Station record parameters

Flood seasonality: SU 74950 68300 (29-07-2025 14:08) - rural



# UK Design Flood Estimation

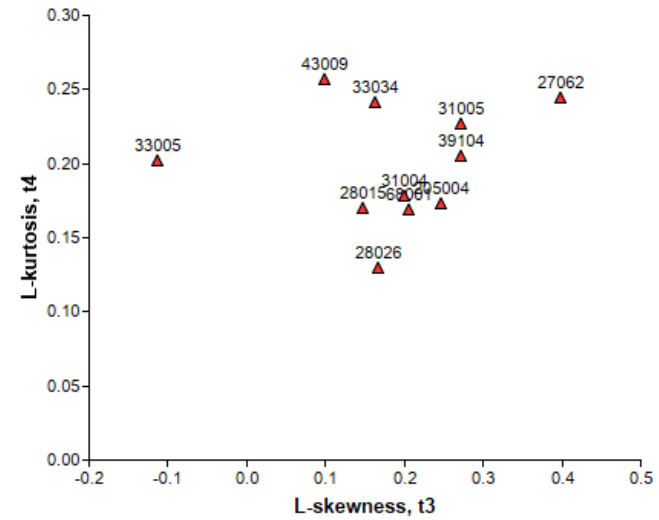
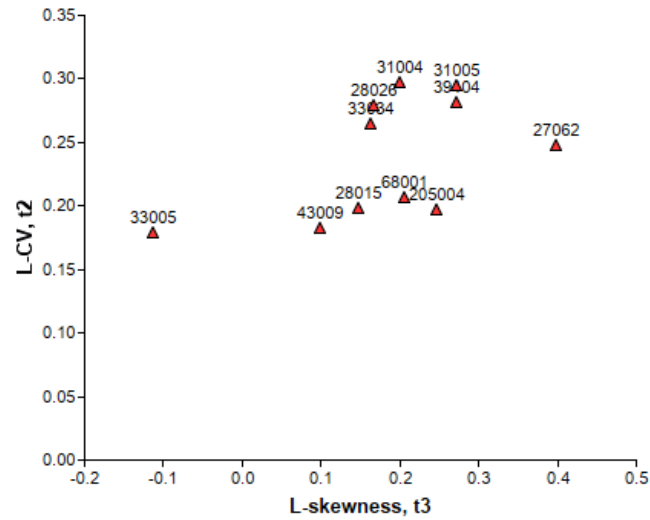
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

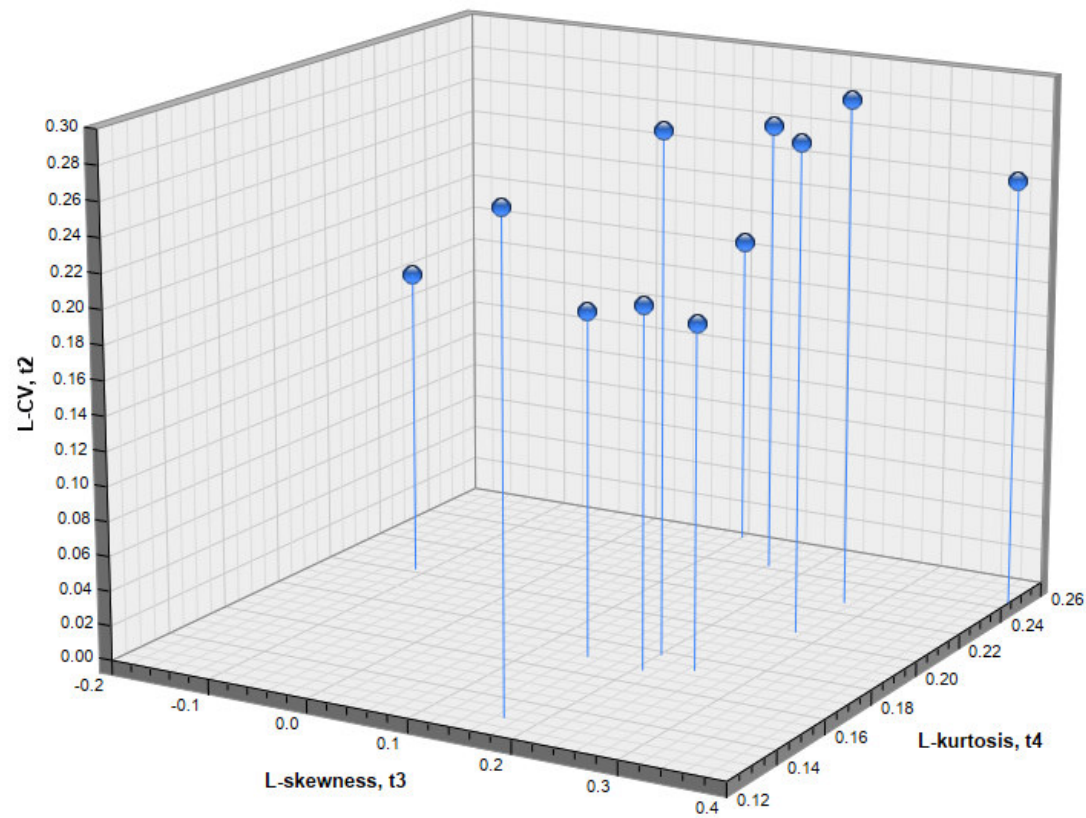
L-moment ratios - SU 74950 68300 (29-07-2025 14:08) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

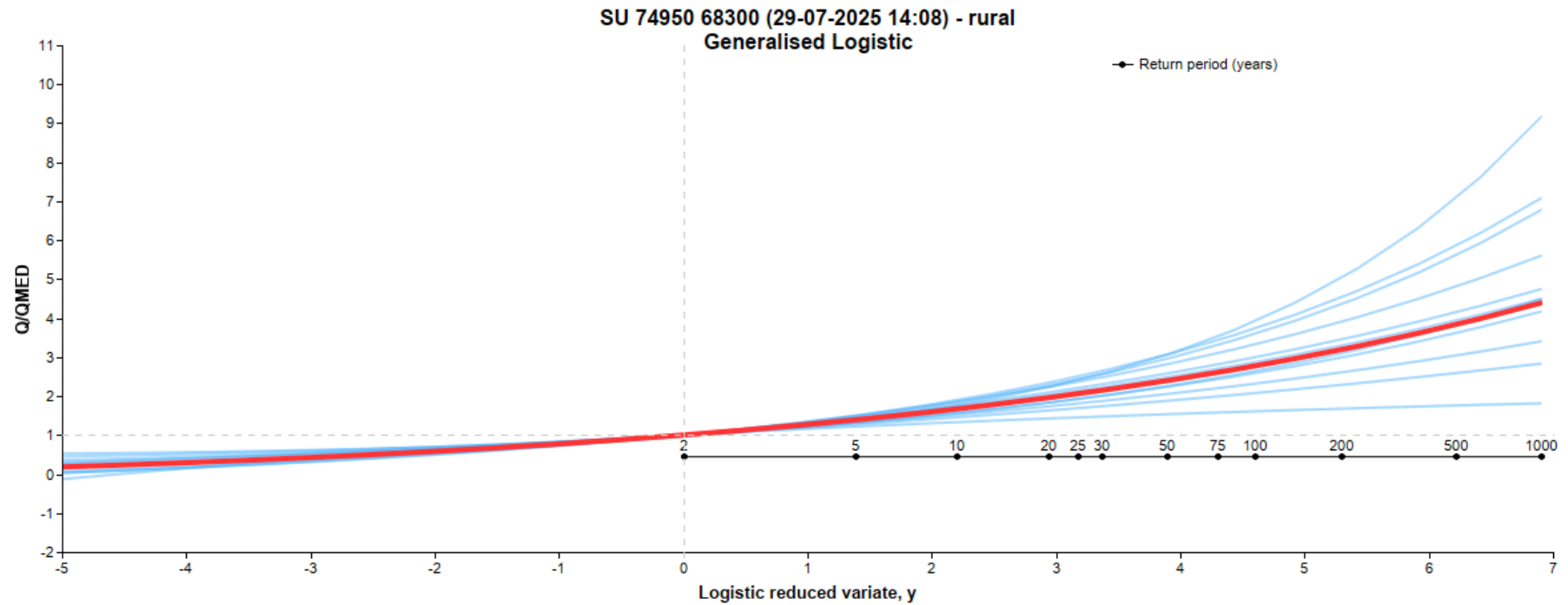
L-moment ratios - SU 74950 68300 (29-07-2025 14:08) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

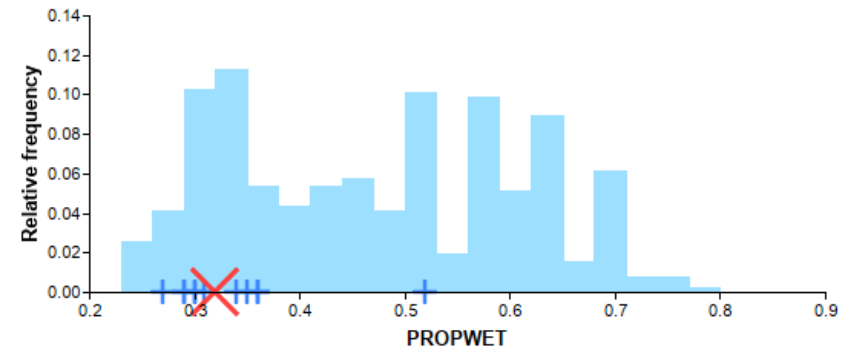
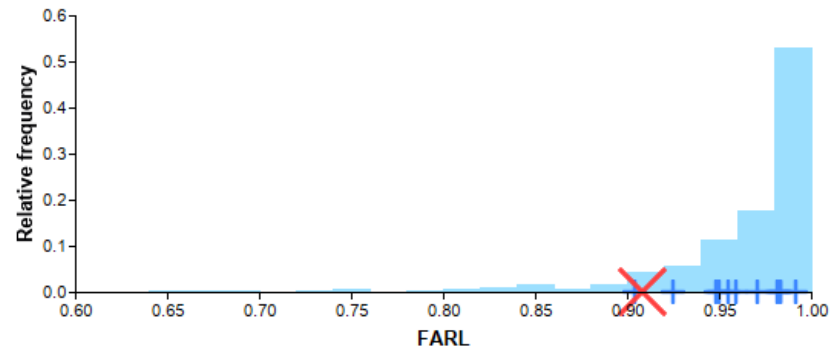
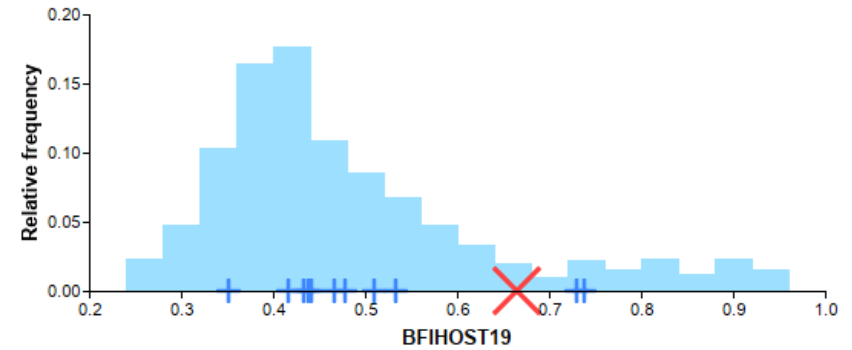
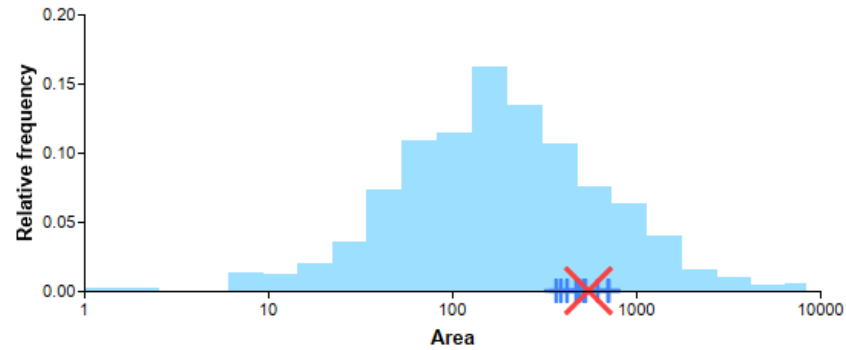
Pooling group growth curves



# UK Design Flood Estimation

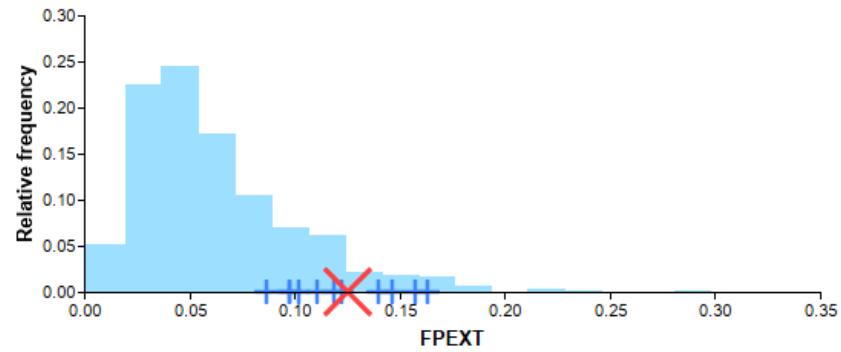
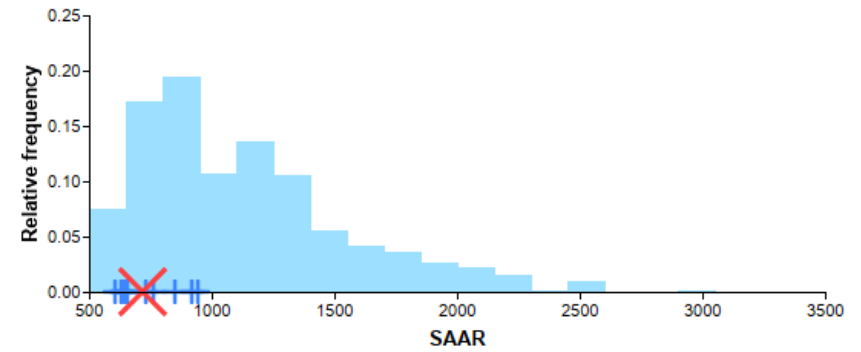
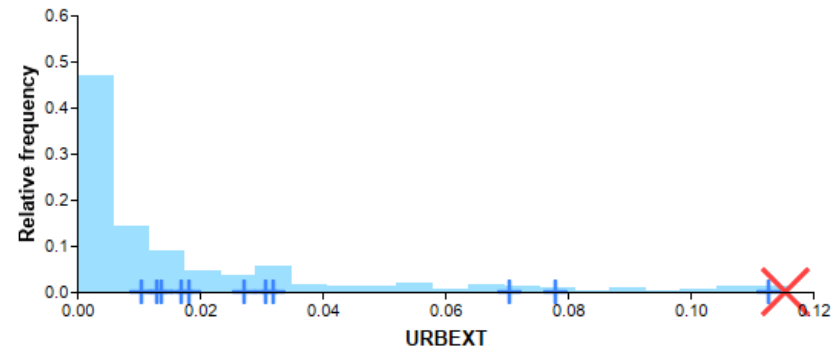
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:12:24  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 1941163354  
Site name: FBH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1  
Site location: SU 74800 68300  
Easting: 474800  
Northing: 168300  
Catchment area: 0.74 km<sup>2</sup>  
SAAR: 639 mm  
BFHHOST19: 0.618  
FPEXT: 0.386  
FARL: 1.000  
URBEXT2000: 0.2700

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.31 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.45007

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.270  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Catchment Descriptors

### Growth curve data and results

#### Pooling group AM data

| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 76011 (Coal Bum @ Coalburn)                     | 1.667    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              |
| 27073 (Brompton Beck @ Snainton Ings)           | 1.921    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 23018 (Ouse Burn @ Wolsington)                  | 2.075    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 27051 (Crimple @ Burn Bridge)                   | 2.075    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.472    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                           | 2.500    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 45816 (Haddeo @ Upton)                          | 2.536    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              |
| 68021 (Arrove Brook @ Acton Lane)               | 2.561    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)          | 2.753    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.793    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.813    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              |
| 28033 (Dove @ Hollinslough)                     | 2.841    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.847    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.871    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| <b>Total</b>                                    |          | <b>532</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                         | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|-------------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 76011 (Coal Bum @ Coalburn)                     | Yes                  | Yes                     | 46    | 0               | 0.00                       |                   |                     | 1.518       |          |
| 27073 (Brompton Beck @ Snainton Ings)           | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.474       |          |
| 23018 (Ouse Burn @ Woolsington)                 | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.285       |          |
| 27051 (Crimple @ Bum Bridge)                    | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.609       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.322       |          |
| 25019 (Leven @ Easby)                           | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.631       |          |
| 45816 (Haddeo @ Upton)                          | Yes                  | Yes                     | 30    | 1               | 3.33                       | -0.45             | None                | 0.433       |          |
| 68021 (Arrowe Brook @ Acton Lane)               | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 0.623       |          |
| 30013 (Heighington Beck @ Heighington)          | Yes                  | Yes                     | 47    | 4               | 8.51                       | 0.27              | None                | 1.531       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.044       |          |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | Yes                  | Yes                     | 13    | 0               | 0.00                       |                   |                     | 3.513       |          |
| 28033 (Dove @ Hollinslough)                     | Yes                  | Yes                     | 48    | 1               | 2.08                       |                   |                     | 0.661       |          |
| 27010 (Hodge Beck @ Bransdale Weir)             | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 0.375       |          |
| 36010 (Bumpstead Brook @ Broad Green)           | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.981       |          |

### Pooling group catchment descriptors

| Station                                         | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------|--------|------|-------|-------|------------|-----------|
| 76011 (Coal Bum @ Coalburn)                     | 1.630  | 1096 | 0.074 | 1.000 | 0.000      | 0.274     |
| 27073 (Brompton Beck @ Snainton Ings)           | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 23018 (Ouse Burn @ Woolsington)                 | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 27051 (Crimple @ Bum Bridge)                    | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                           | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 45816 (Haddeo @ Upton)                          | 6.808  | 1210 | 0.011 | 1.000 | 0.005      | 0.535     |
| 68021 (Arrowe Brook @ Acton Lane)               | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 30013 (Heighington Beck @ Heighington)          | 23.880 | 605  | 0.119 | 0.962 | 0.079      | 0.859     |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 16.080 | 1044 | 0.023 | 0.991 | 0.006      | 0.562     |
| 28033 (Dove @ Hollinslough)                     | 7.915  | 1346 | 0.007 | 1.000 | 0.000      | 0.347     |
| 27010 (Hodge Beck @ Bransdale Weir)             | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)           | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

Rural L-CV: 0.275      Urban L-CV: 0.235  
Rural L-Skewness: 0.264      Urban L-Skewness: 0.314

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.276 | -0.264 |        | -0.045 |
| GEV          | 0.853    | 0.390 | -0.142 |        | -1.894 |
| KAP3         | 0.925    | 0.326 | -0.210 | -0.400 | -0.632 |

### Goodness of fit

GL: 0.5229 \*  
GEV: -0.7914 \*  
P3: -2.7904  
GP: -4.1253  
KAP3: 0.0895 \*

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.224 | -0.314 |        | 0.287  |
| GEV          | 0.884    | 0.303 | -0.213 |        | -0.539 |
| KAP3         | 0.940    | 0.259 | -0.270 | -0.400 | -0.020 |

### Heterogeneity

Standardised test value H2: 2.4900

The pooling group is heterogeneous and a review of the pooling group is desirable.

### Standardised growth curves

#### Rural

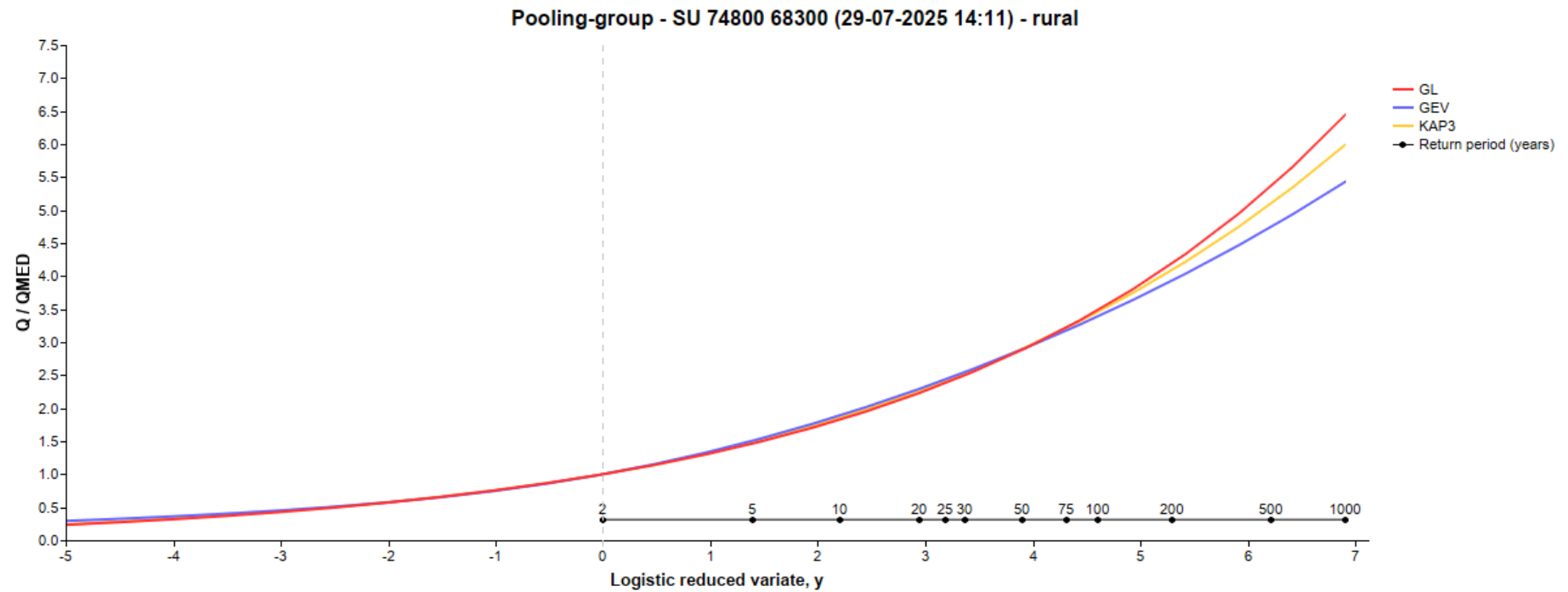
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.463 | 1.505 | 1.480 |
| 10            | 1.824 | 1.888 | 1.853 |
| 20            | 2.232 | 2.295 | 2.264 |
| 25            | 2.377 | 2.433 | 2.408 |
| 30            | 2.501 | 2.548 | 2.529 |
| 50            | 2.880 | 2.887 | 2.894 |
| 75            | 3.217 | 3.173 | 3.210 |
| 100           | 3.478 | 3.385 | 3.451 |
| 200           | 4.193 | 3.933 | 4.094 |
| 500           | 5.360 | 4.745 | 5.097 |
| 1000          | 6.449 | 5.432 | 5.994 |

#### Urban

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.389 | 1.421 | 1.402 |
| 10            | 1.710 | 1.761 | 1.732 |
| 20            | 2.086 | 2.142 | 2.114 |
| 25            | 2.224 | 2.276 | 2.250 |
| 30            | 2.342 | 2.390 | 2.368 |
| 50            | 2.711 | 2.731 | 2.728 |
| 75            | 3.046 | 3.029 | 3.050 |
| 100           | 3.311 | 3.256 | 3.299 |
| 200           | 4.053 | 3.863 | 3.986 |
| 500           | 5.316 | 4.814 | 5.112 |
| 1000          | 6.543 | 5.668 | 6.168 |

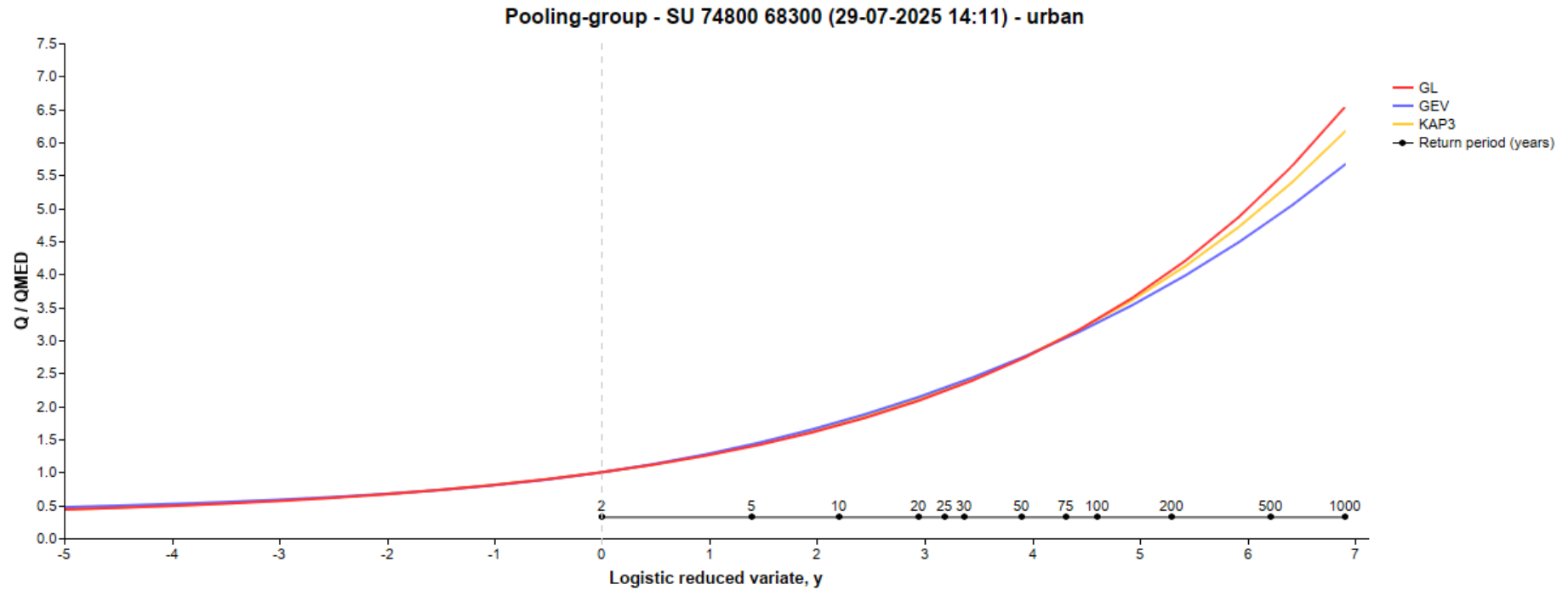
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### QMED

Rural: 0.106 m<sup>3</sup>/s

Urban: 0.153 m<sup>3</sup>/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

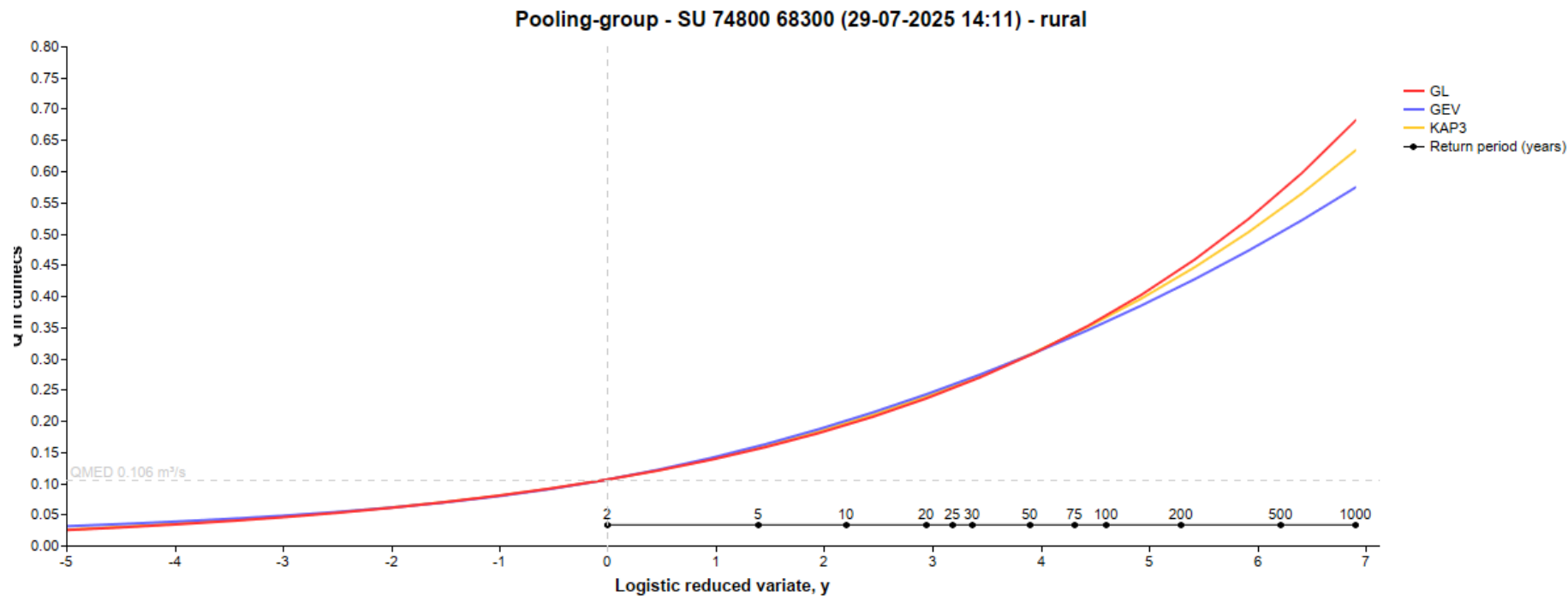
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.106     | 0.106      | 0.106       |
| 5             | 0.155     | 0.159      | 0.156       |
| 10            | 0.193     | 0.200      | 0.196       |
| 20            | 0.236     | 0.243      | 0.239       |
| 25            | 0.251     | 0.257      | 0.255       |
| 30            | 0.264     | 0.269      | 0.267       |
| 50            | 0.304     | 0.305      | 0.306       |
| 75            | 0.340     | 0.335      | 0.339       |
| 100           | 0.368     | 0.358      | 0.365       |
| 200           | 0.443     | 0.416      | 0.433       |
| 500           | 0.567     | 0.502      | 0.539       |
| 1000          | 0.682     | 0.574      | 0.634       |

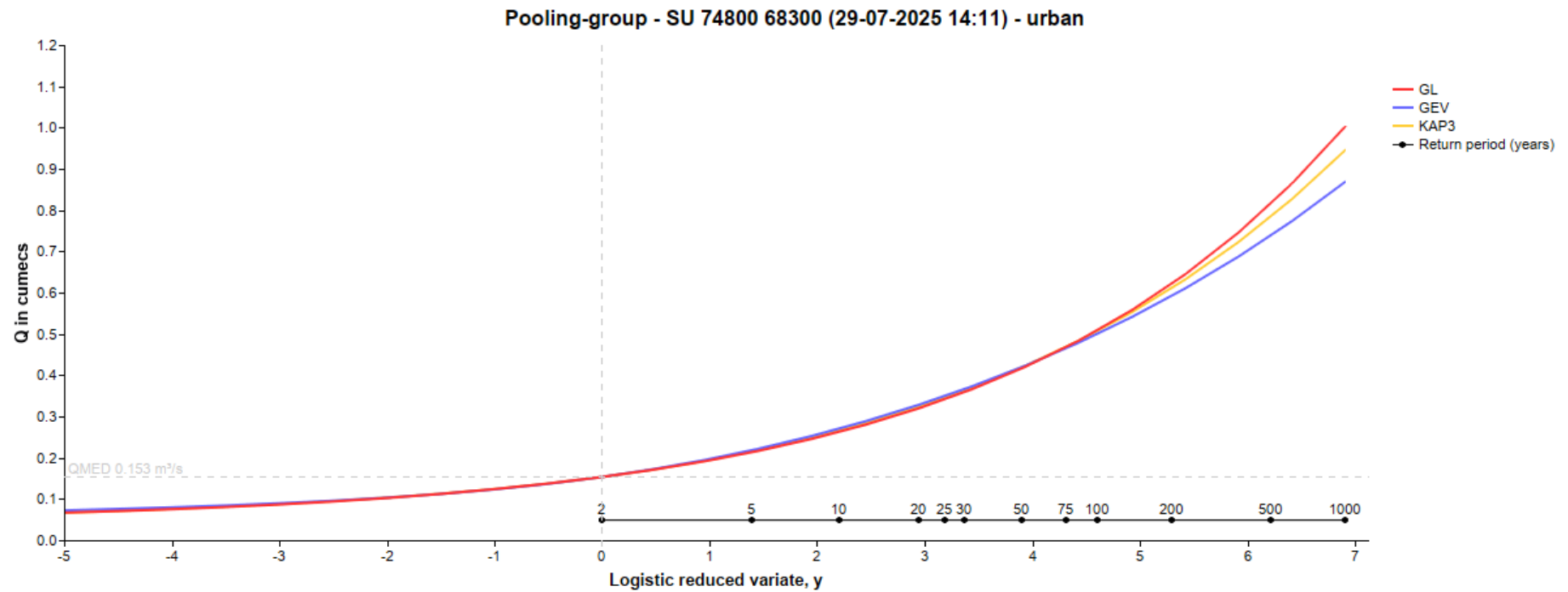
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.153     | 0.153      | 0.153       |
| 5             | 0.213     | 0.218      | 0.215       |
| 10            | 0.262     | 0.270      | 0.265       |
| 20            | 0.320     | 0.328      | 0.324       |
| 25            | 0.341     | 0.349      | 0.345       |
| 30            | 0.359     | 0.366      | 0.363       |
| 50            | 0.416     | 0.419      | 0.418       |
| 75            | 0.467     | 0.464      | 0.467       |
| 100           | 0.508     | 0.499      | 0.506       |
| 200           | 0.621     | 0.592      | 0.611       |
| 500           | 0.815     | 0.738      | 0.784       |
| 1000          | 1.003     | 0.869      | 0.946       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



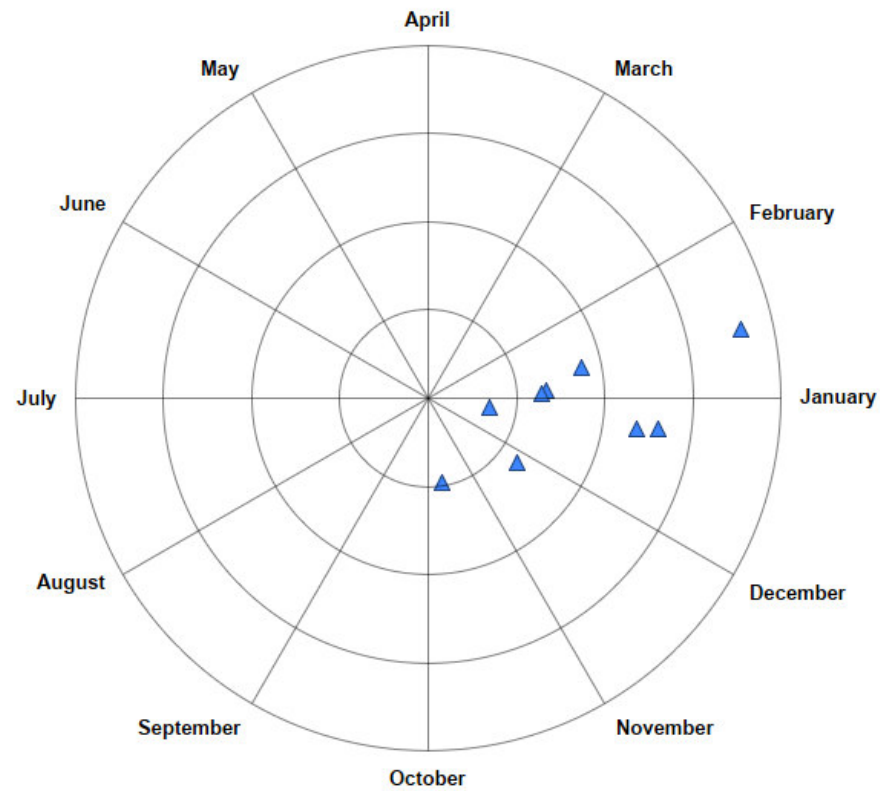
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

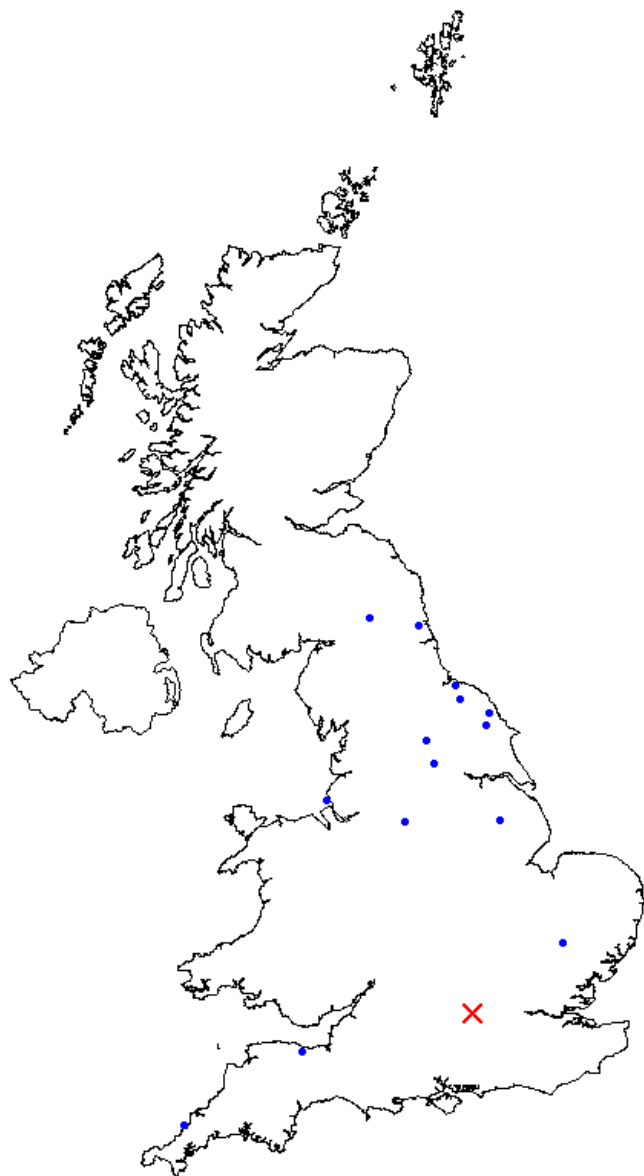
#### Station record parameters

Flood seasonality: SU 74800 68300 (29-07-2025 14:11) - rural



# UK Design Flood Estimation

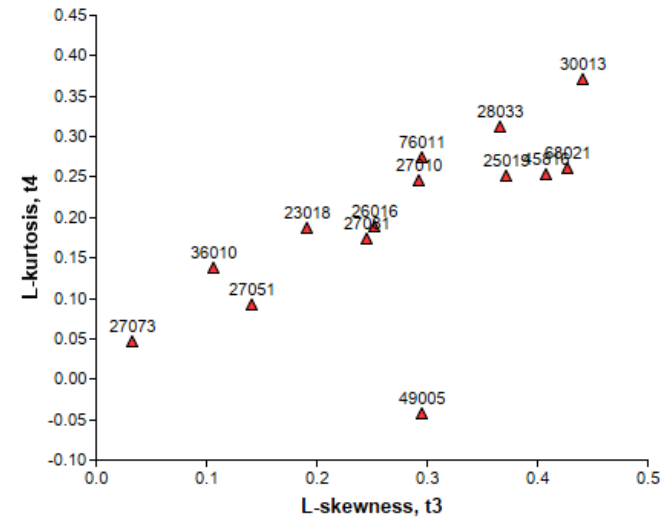
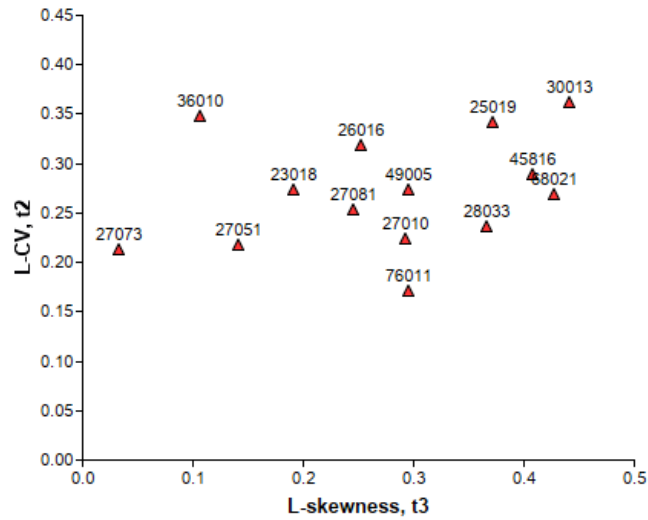
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

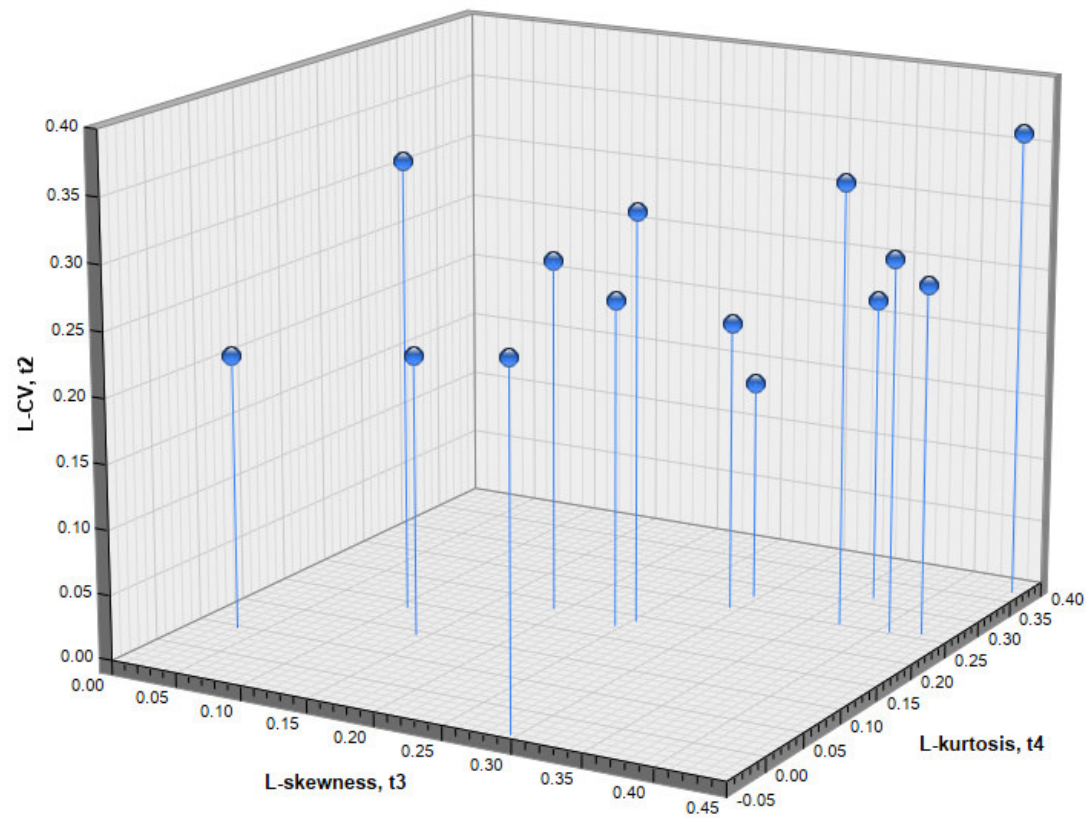
L-moment ratios - SU 74800 68300 (29-07-2025 14:11) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

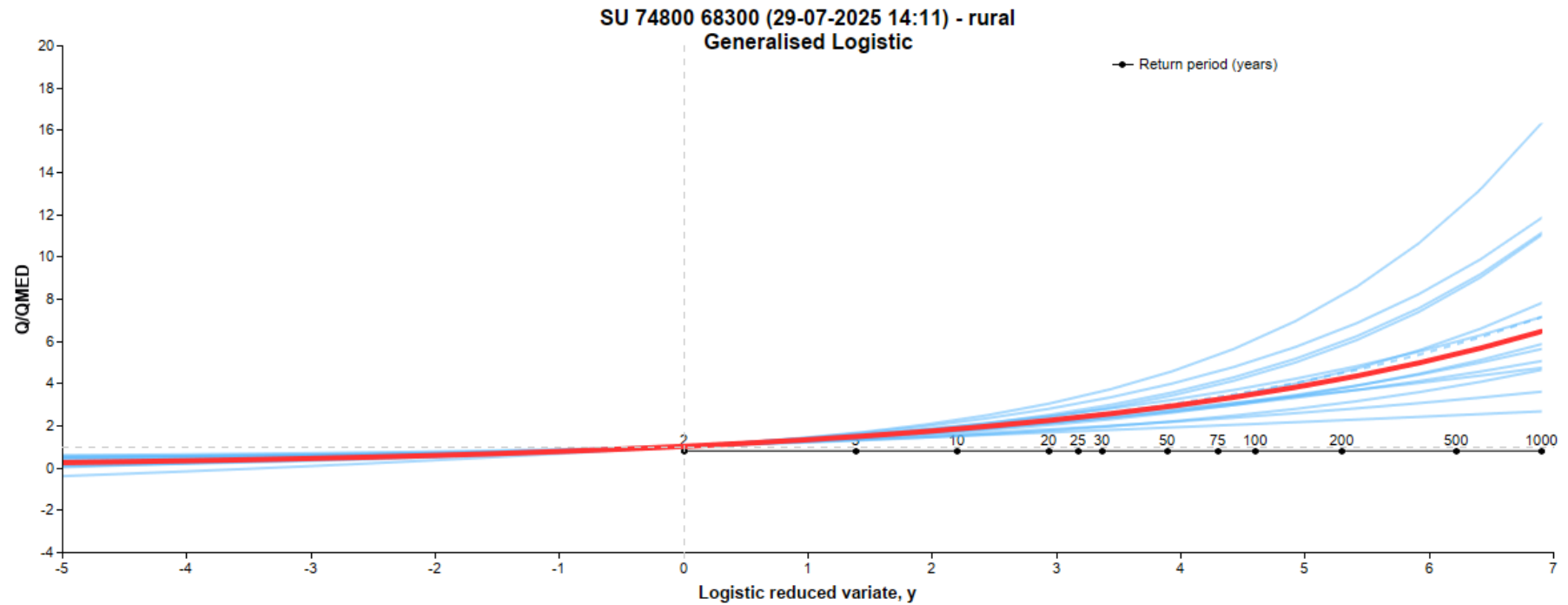
L-moment ratios - SU 74800 68300 (29-07-2025 14:11) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

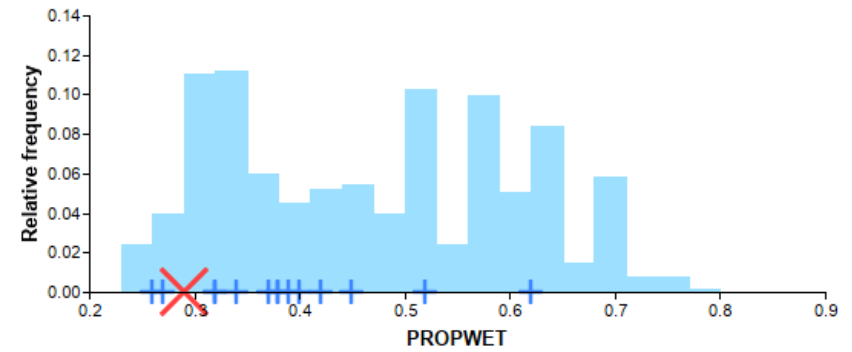
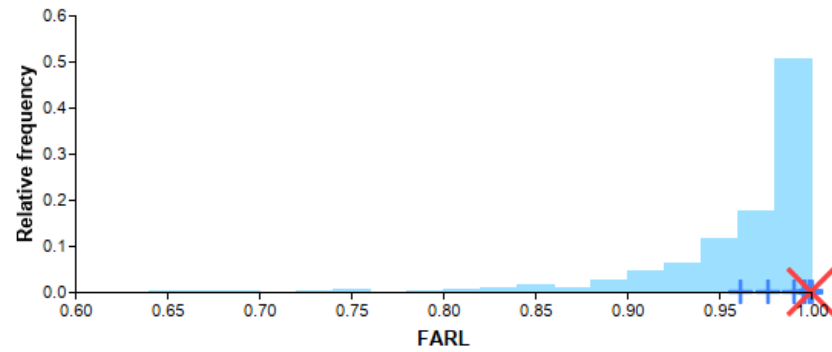
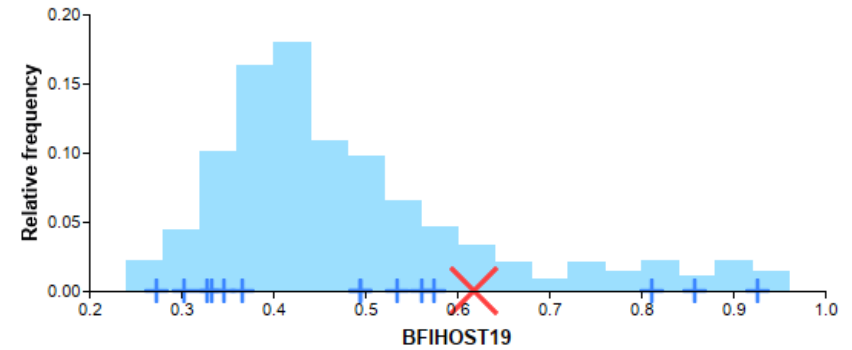
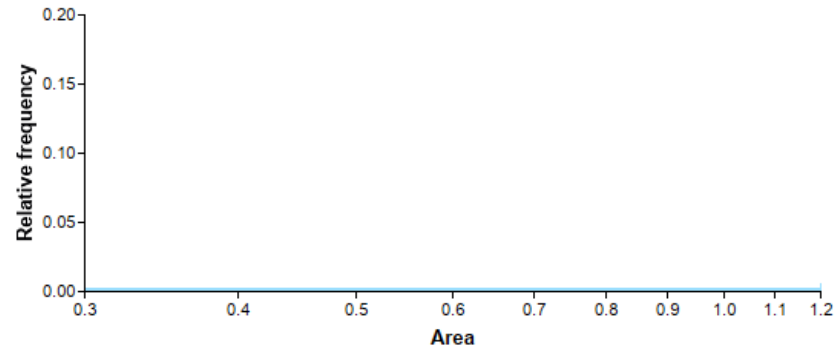
Pooling group growth curves



# UK Design Flood Estimation

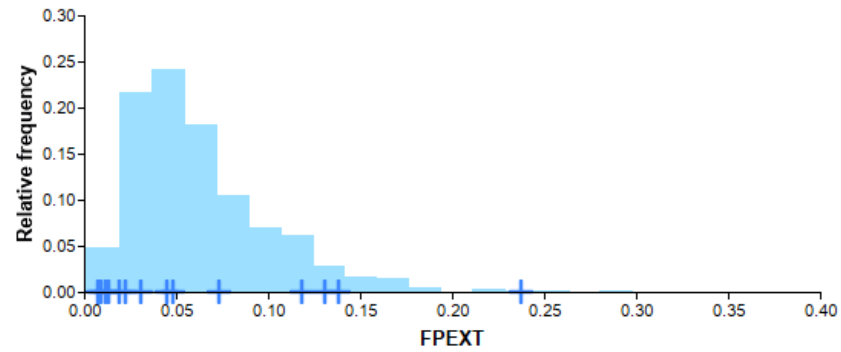
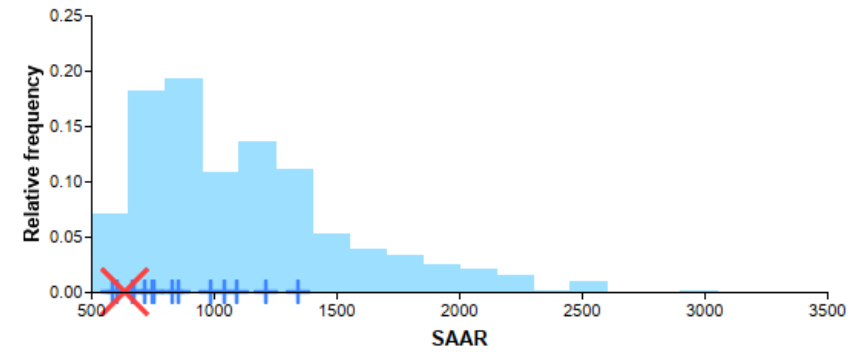
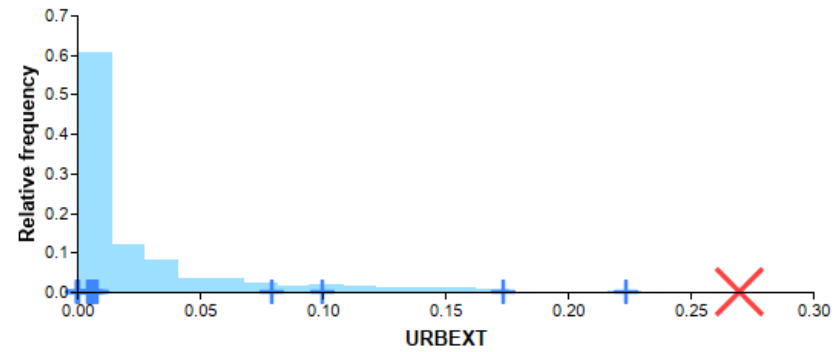
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:12:38  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 1941163354  
Site name: FBH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1  
Site location: SU 74800 68300  
Easting: 474800  
Northing: 168300  
Catchment area: 0.74 km<sup>2</sup>  
SAAR: 639 mm  
BFHHOST19: 0.618  
FPEXT: 0.386  
FARL: 1.000  
URBEXT2000: 0.2700

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.31 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.45007

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.270  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 76011 (Coal Bum @ Coalburn)                     | 1.667    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              |
| 27073 (Brompton Beck @ Snainton Ings)           | 1.921    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 23018 (Ouse Bum @ Wolsington)                   | 2.075    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 27051 (Crimple @ Bum Bridge)                    | 2.075    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.472    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                           | 2.500    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 45816 (Haddeo @ Upton)                          | 2.536    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              |
| 68021 (Arrove Brook @ Acton Lane)               | 2.561    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)          | 2.753    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.793    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.813    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              |
| 28033 (Dove @ Hollinslough)                     | 2.841    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.847    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.871    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| <b>Total</b>                                    |          | <b>532</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                         | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|-------------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 76011 (Coal Bum @ Coalburn)                     | Yes                  | Yes                     | 46    | 0               | 0.00                       |                   |                     | 1.518       |          |
| 27073 (Brompton Beck @ Snainton Ings)           | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.474       |          |
| 23018 (Ouse Burn @ Woolsington)                 | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.285       |          |
| 27051 (Crimple @ Bum Bridge)                    | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.609       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.322       |          |
| 25019 (Leven @ Easby)                           | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.631       |          |
| 45816 (Haddeo @ Upton)                          | Yes                  | Yes                     | 30    | 1               | 3.33                       | -0.45             | None                | 0.433       |          |
| 68021 (Arrowe Brook @ Acton Lane)               | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 0.623       |          |
| 30013 (Heighington Beck @ Heighington)          | Yes                  | Yes                     | 47    | 4               | 8.51                       | 0.27              | None                | 1.531       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.044       |          |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | Yes                  | Yes                     | 13    | 0               | 0.00                       |                   |                     | 3.513       |          |
| 28033 (Dove @ Hollinslough)                     | Yes                  | Yes                     | 48    | 1               | 2.08                       |                   |                     | 0.661       |          |
| 27010 (Hodge Beck @ Bransdale Weir)             | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 0.375       |          |
| 36010 (Bumpstead Brook @ Broad Green)           | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.981       |          |

### Pooling group catchment descriptors

| Station                                         | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------|--------|------|-------|-------|------------|-----------|
| 76011 (Coal Bum @ Coalburn)                     | 1.630  | 1096 | 0.074 | 1.000 | 0.000      | 0.274     |
| 27073 (Brompton Beck @ Snainton Ings)           | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 23018 (Ouse Burn @ Woolsington)                 | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 27051 (Crimple @ Bum Bridge)                    | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                           | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 45816 (Haddeo @ Upton)                          | 6.808  | 1210 | 0.011 | 1.000 | 0.005      | 0.535     |
| 68021 (Arrowe Brook @ Acton Lane)               | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 30013 (Heighington Beck @ Heighington)          | 23.880 | 605  | 0.119 | 0.962 | 0.079      | 0.859     |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 16.080 | 1044 | 0.023 | 0.991 | 0.006      | 0.562     |
| 28033 (Dove @ Hollinslough)                     | 7.915  | 1346 | 0.007 | 1.000 | 0.000      | 0.347     |
| 27010 (Hodge Beck @ Bransdale Weir)             | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)           | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

Rural L-CV: 0.275      Urban L-CV: 0.235  
Rural L-Skewness: 0.264      Urban L-Skewness: 0.314

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.276 | -0.264 |        | -0.045 |
| GEV          | 0.853    | 0.390 | -0.142 |        | -1.894 |
| KAP3         | 0.925    | 0.326 | -0.210 | -0.400 | -0.632 |

### Goodness of fit

GL: 0.5328 \*  
GEV: -0.7702 \*  
P3: -2.7520  
GP: -4.0755  
KAP3: 0.1032 \*

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.224 | -0.314 |        | 0.287  |
| GEV          | 0.884    | 0.303 | -0.213 |        | -0.539 |
| KAP3         | 0.940    | 0.259 | -0.270 | -0.400 | -0.020 |

### Heterogeneity

Standardised test value H2: 2.5270

The pooling group is heterogeneous and a review of the pooling group is desirable.

### Standardised growth curves

#### Rural

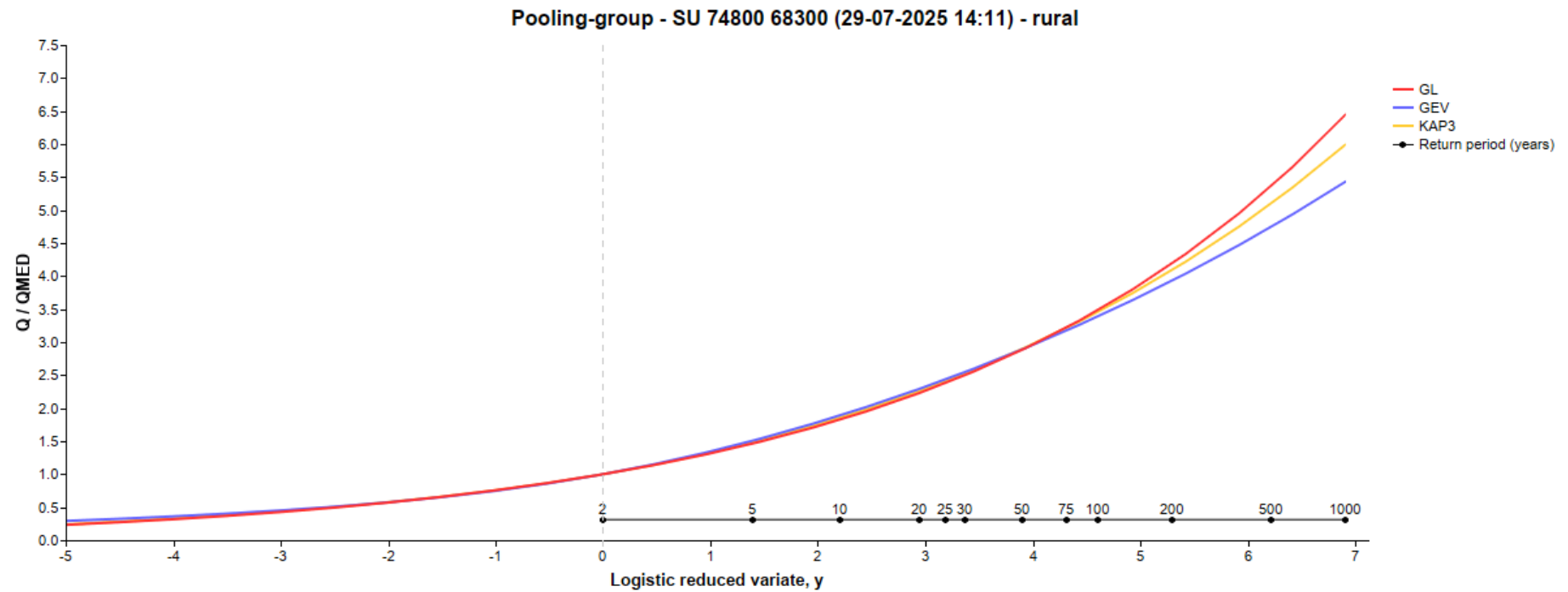
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.463 | 1.505 | 1.480 |
| 10            | 1.824 | 1.888 | 1.853 |
| 20            | 2.232 | 2.295 | 2.264 |
| 25            | 2.377 | 2.433 | 2.408 |
| 30            | 2.501 | 2.548 | 2.529 |
| 50            | 2.880 | 2.887 | 2.894 |
| 75            | 3.217 | 3.173 | 3.210 |
| 100           | 3.478 | 3.385 | 3.451 |
| 200           | 4.193 | 3.933 | 4.094 |
| 500           | 5.360 | 4.745 | 5.097 |
| 1000          | 6.449 | 5.432 | 5.994 |

#### Urban

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.389 | 1.421 | 1.402 |
| 10            | 1.710 | 1.761 | 1.732 |
| 20            | 2.086 | 2.142 | 2.114 |
| 25            | 2.224 | 2.276 | 2.250 |
| 30            | 2.342 | 2.390 | 2.368 |
| 50            | 2.711 | 2.731 | 2.728 |
| 75            | 3.046 | 3.029 | 3.050 |
| 100           | 3.311 | 3.256 | 3.299 |
| 200           | 4.053 | 3.863 | 3.986 |
| 500           | 5.316 | 4.814 | 5.112 |
| 1000          | 6.543 | 5.668 | 6.168 |

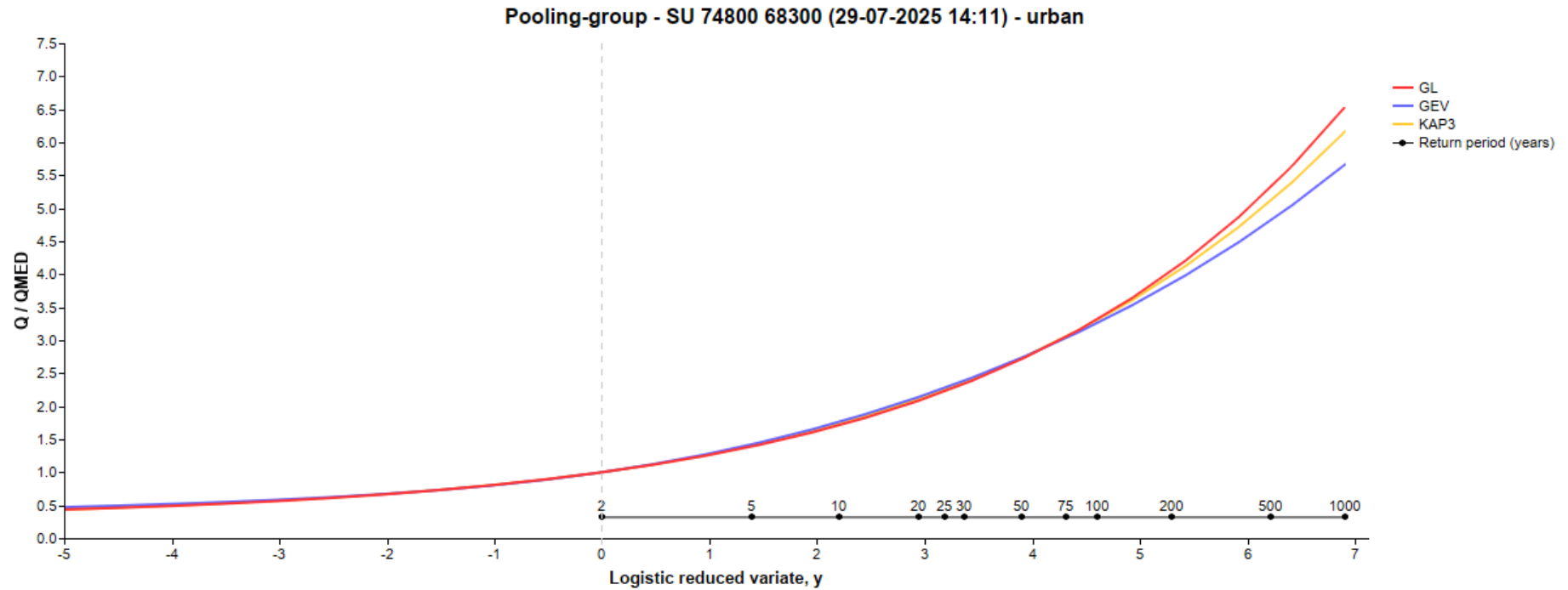
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
 URBEXT2000: <0.270  
 Donor adjusted FSE: 1.400  
 No. of donors: 1

#### Donor stations

| Station                           | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|-----------------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39007 (Blackwater @ Swallowfield) | 14.45    | Yes                      | 22.300   | <b>17.972</b>    | 17.807         | 14.351         |

#### Donor suitability

| Station                           | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|-----------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39007 (Blackwater @ Swallowfield) | Yes                  | Yes                     | 70    | 0               | 0.00                       | 1.42               | None                 |          |

#### Donor catchment descriptors

| Station                                                          | Area    | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------------------------------------|---------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474800_168300_v5_0_1 @SU 74800 68300) | 0.740   | 473792     | 167891     | 639  | 0.386 | 1.000 | 0.270      | 0.618     |
| 39007 (Blackwater @ Swallowfield)                                | 359.810 | 479802     | 154750     | 708  | 0.132 | 0.886 | 0.132      | 0.674     |

#### Unused Donor stations

| Station                                  | Distance | URBEXT | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural | Centroid X | Centroid Y | Area     | SAAR | BFIHOST19 | FARL  | Years of data | QMED suitability | Pooling suitability |
|------------------------------------------|----------|--------|--------------------------|----------|------------------|----------------|----------------|------------|------------|----------|------|-----------|-------|---------------|------------------|---------------------|
| 39052 (The Cut @ Binfield)               | 15.07    | 0.237  | Yes                      | 7.543    | <b>6.110</b>     | 9.547          | 7.733          | 488740     | 169768     | 49.998   | 676  | 0.366     | 0.939 | 66            | Yes              | No                  |
| 39022 (Loddon @ Sheepbridge)             | 15.75    | 0.087  | Yes                      | 16.350   | <b>14.203</b>    | 13.034         | 11.322         | 464845     | 154923     | 176.773  | 735  | 0.664     | 0.947 | 58            | Yes              | Yes                 |
| 39027 (Pang @ Pangbourne)                | 22.01    | 0.012  | Yes                      | 2.140    | <b>2.081</b>     | 6.817          | 6.817          | 453633     | 176722     | 175.683  | 694  | 0.782     | 0.996 | 55            | Yes              | No                  |
| 39001 (Thames @ Kingston)                | 22.74    | 0.066  | Yes                      | 316.110  | <b>282.569</b>   | 324.496        | 290.065        | 462899     | 187850     | 9930.798 | 706  | 0.679     | 0.942 | 140           | Yes              | Yes                 |
| 39025 (Enborne @ Brimpton)               | 26.03    | 0.020  | Yes                      | 16.700   | <b>16.271</b>    | 18.310         | 18.310         | 448695     | 160991     | 142.010  | 789  | 0.563     | 0.978 | 56            | Yes              | Yes                 |
| 39023 (Wye @ Bourne End Hedsor)          | 29.38    | 0.113  | Yes                      | 2.730    | <b>1.992</b>     | 6.665          | 4.864          | 483929     | 195468     | 134.183  | 755  | 0.839     | 0.984 | 59            | Yes              | Yes                 |
| 42009 (Candover Stream @ Borough Bridge) | 29.53    | 0.011  | Yes                      | 1.065    | <b>1.011</b>     | 1.806          | 1.806          | 460964     | 141288     | 72.062   | 819  | 0.924     | 0.930 | 52            | Yes              | Yes                 |
| 39033 (Winterbourne Stream @ Bagnor)     | 29.97    | 0.001  | Yes                      | 0.399    | <b>0.398</b>     | 2.053          | 2.053          | 445079     | 176491     | 45.312   | 717  | 0.812     | 1.000 | 61            | Yes              | Yes                 |
| 39011 (Wey @ Tilford)                    | 30.56    | 0.053  | Yes                      | 25.800   | <b>22.877</b>    | 22.987         | 20.383         | 477280     | 137531     | 391.325  | 855  | 0.773     | 0.957 | 69            | Yes              | No                  |

#### QMED

Rural: 0.114 m³/s  
 Urban: 0.166 m³/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

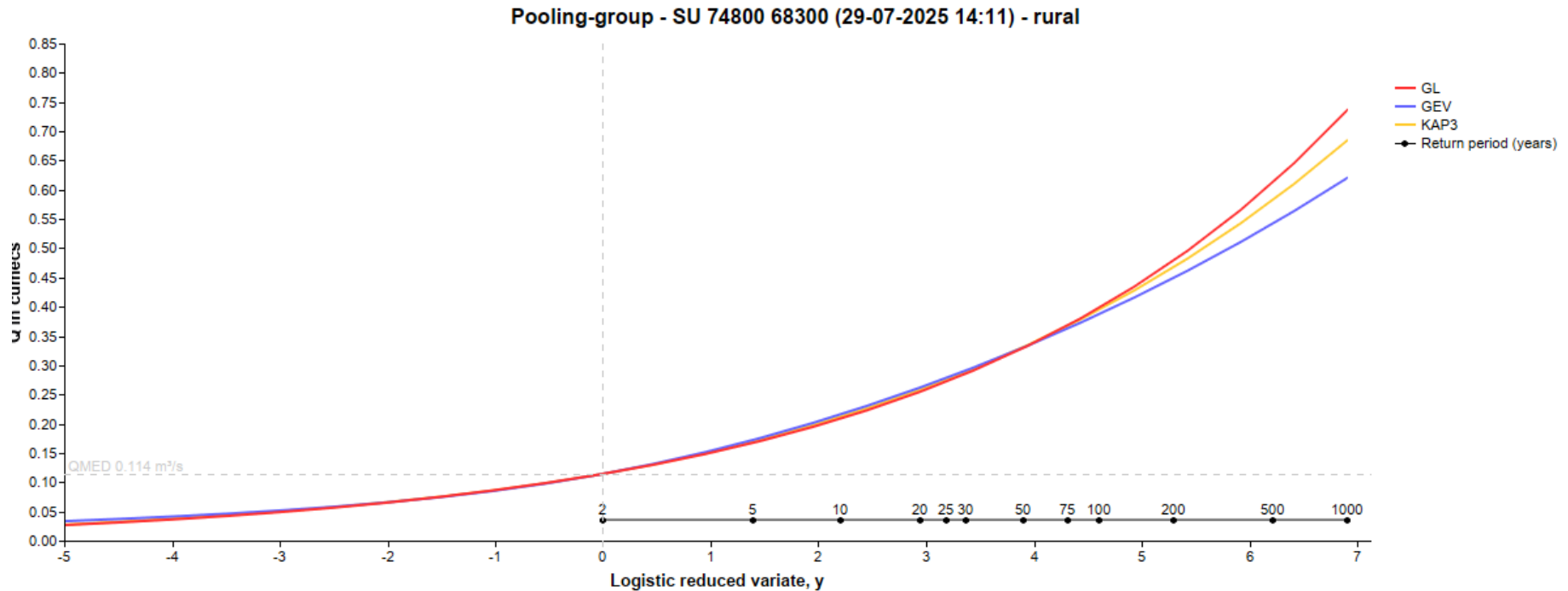
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.114     | 0.114      | 0.114       |
| 5             | 0.167     | 0.172      | 0.169       |
| 10            | 0.208     | 0.216      | 0.212       |
| 20            | 0.255     | 0.262      | 0.259       |
| 25            | 0.272     | 0.278      | 0.275       |
| 30            | 0.286     | 0.291      | 0.289       |
| 50            | 0.329     | 0.330      | 0.331       |
| 75            | 0.368     | 0.362      | 0.367       |
| 100           | 0.397     | 0.387      | 0.394       |
| 200           | 0.479     | 0.449      | 0.468       |
| 500           | 0.612     | 0.542      | 0.582       |
| 1000          | 0.737     | 0.621      | 0.685       |

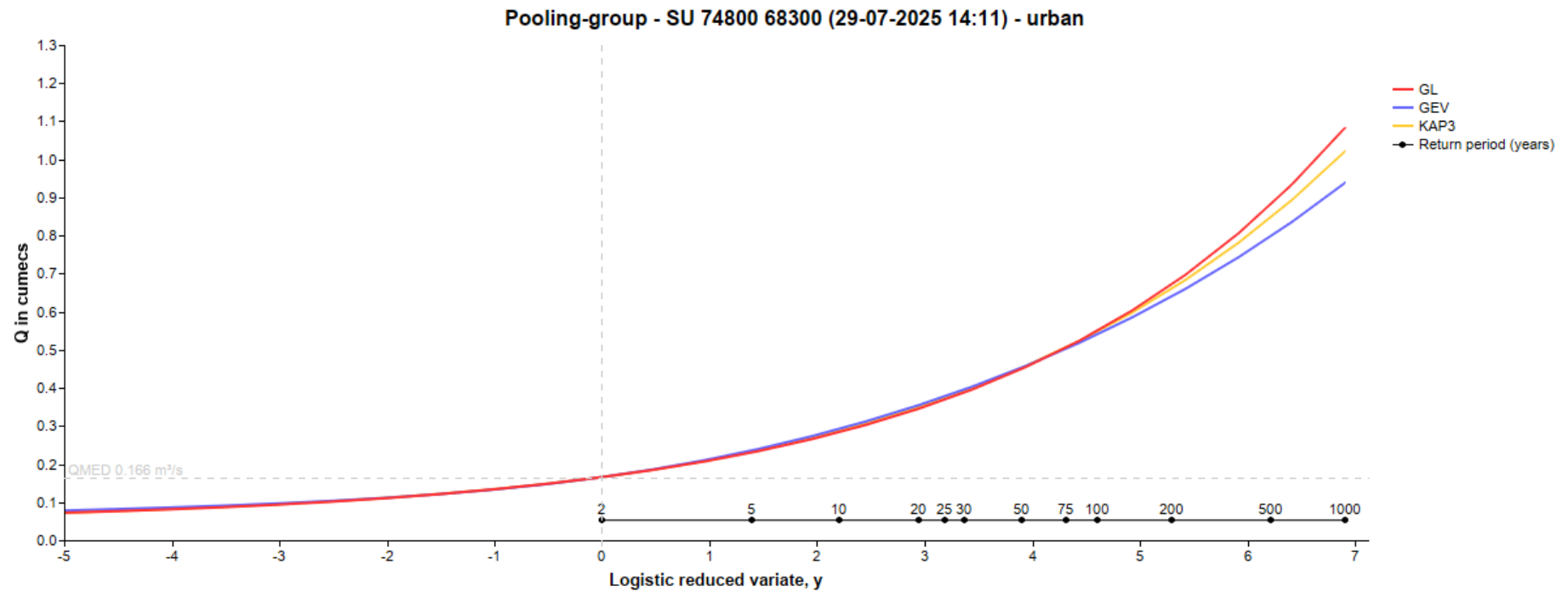
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.166     | 0.166      | 0.166       |
| 5             | 0.230     | 0.235      | 0.232       |
| 10            | 0.283     | 0.292      | 0.287       |
| 20            | 0.346     | 0.355      | 0.350       |
| 25            | 0.368     | 0.377      | 0.373       |
| 30            | 0.388     | 0.396      | 0.392       |
| 50            | 0.449     | 0.452      | 0.452       |
| 75            | 0.505     | 0.502      | 0.505       |
| 100           | 0.548     | 0.539      | 0.547       |
| 200           | 0.671     | 0.640      | 0.660       |
| 500           | 0.881     | 0.798      | 0.847       |
| 1000          | 1.084     | 0.939      | 1.022       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



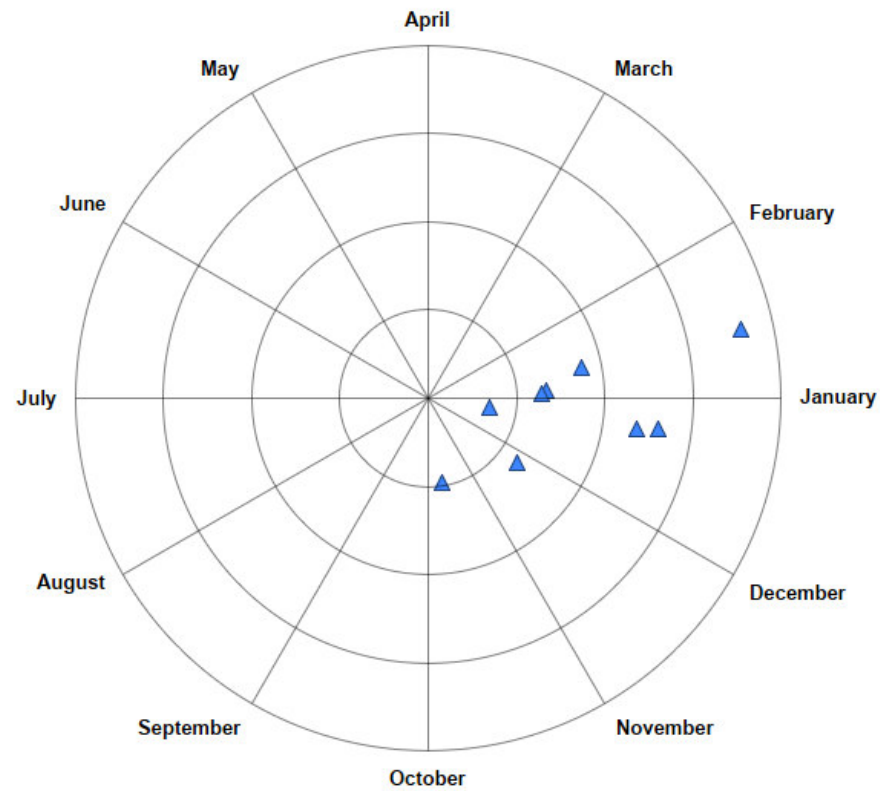
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

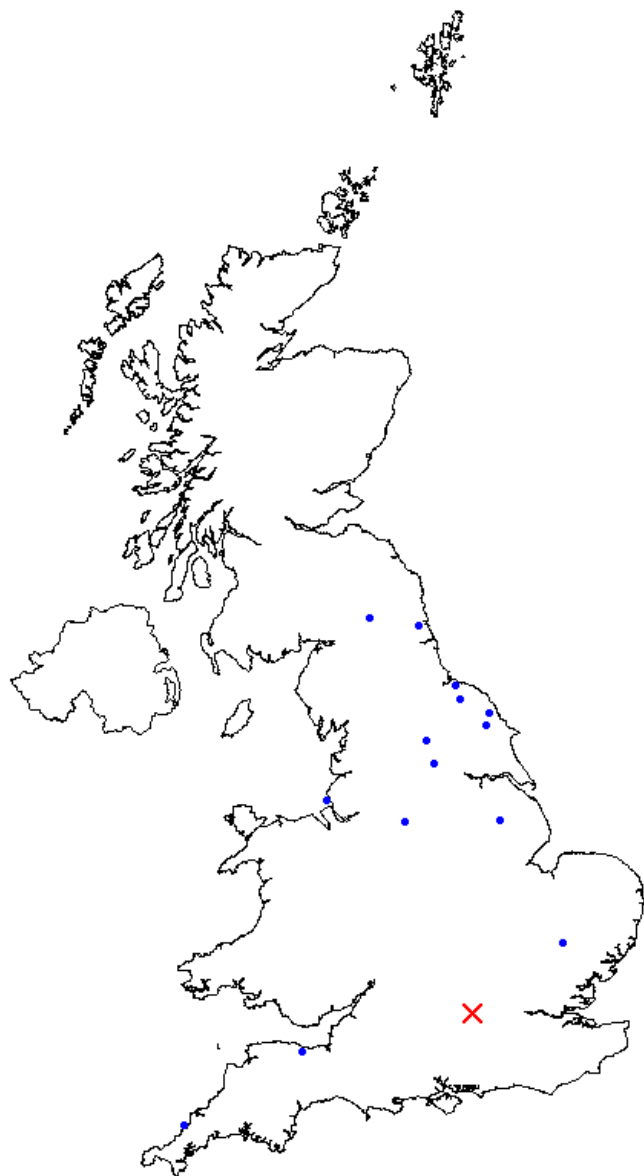
#### Station record parameters

Flood seasonality: SU 74800 68300 (29-07-2025 14:11) - rural



# UK Design Flood Estimation

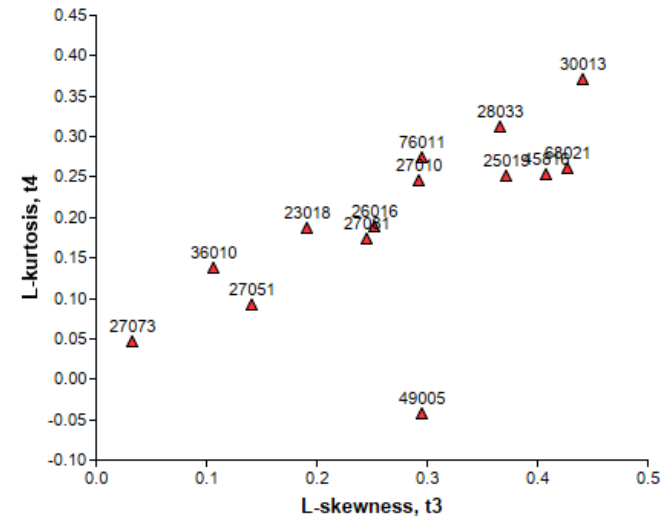
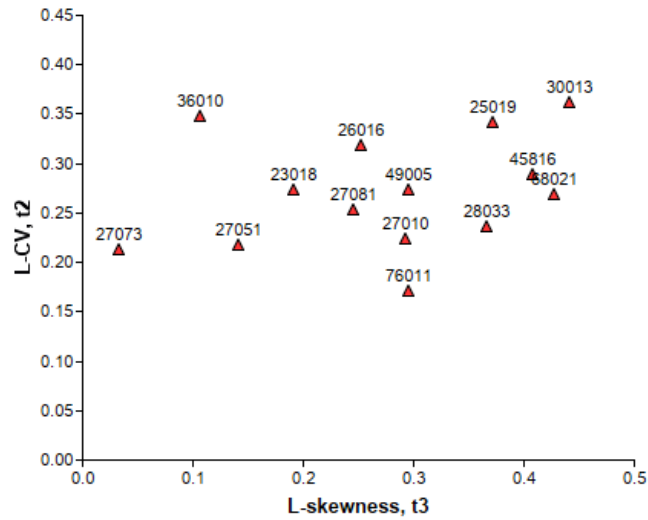
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

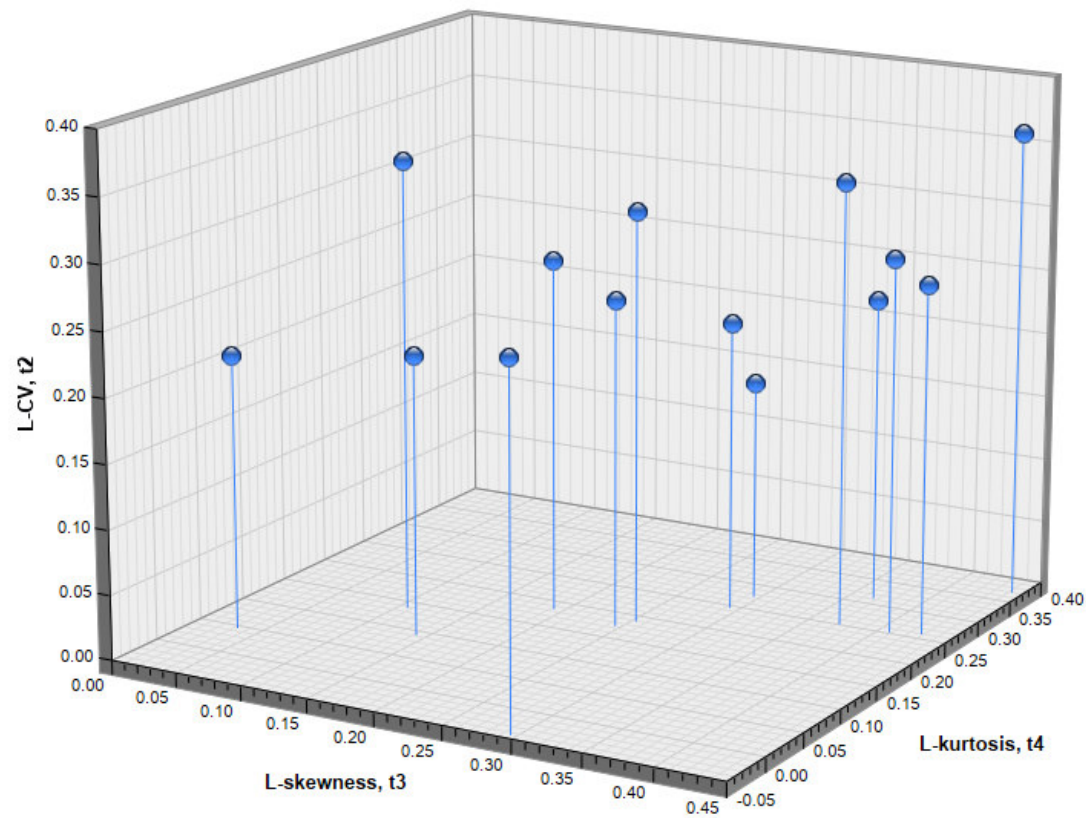
L-moment ratios - SU 74800 68300 (29-07-2025 14:11) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

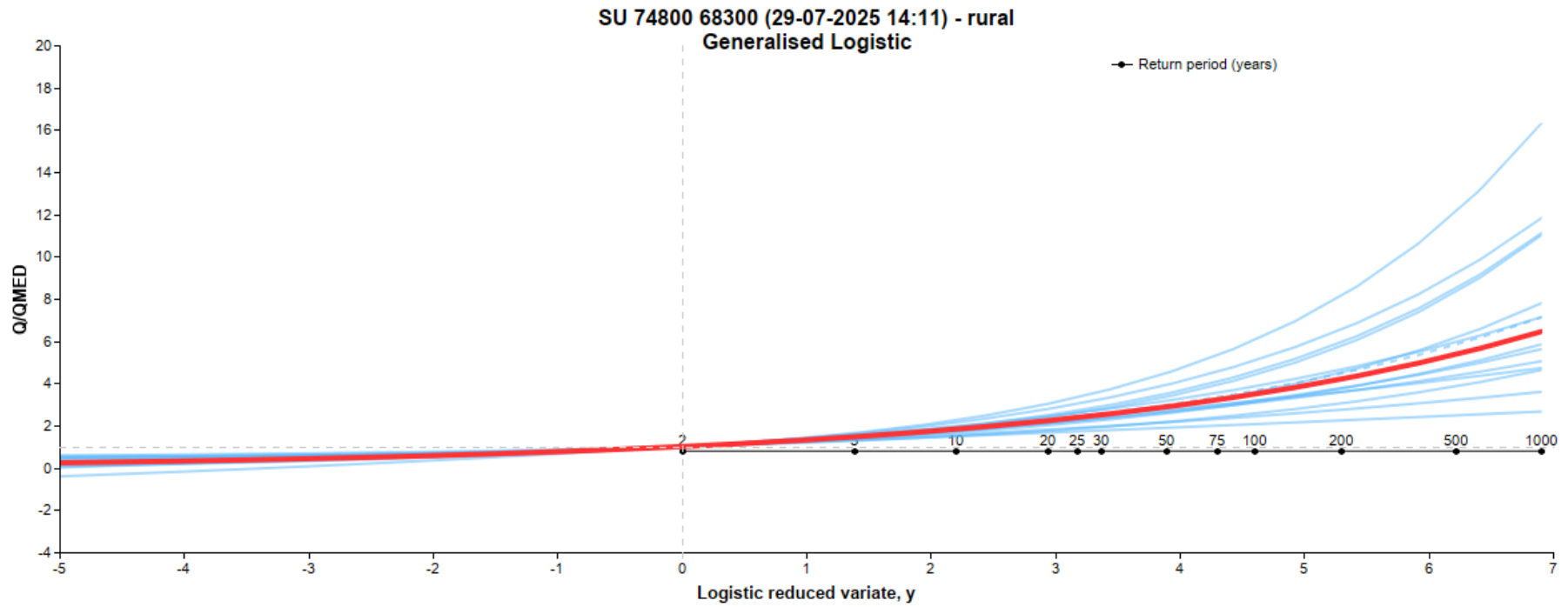
L-moment ratios - SU 74800 68300 (29-07-2025 14:11) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

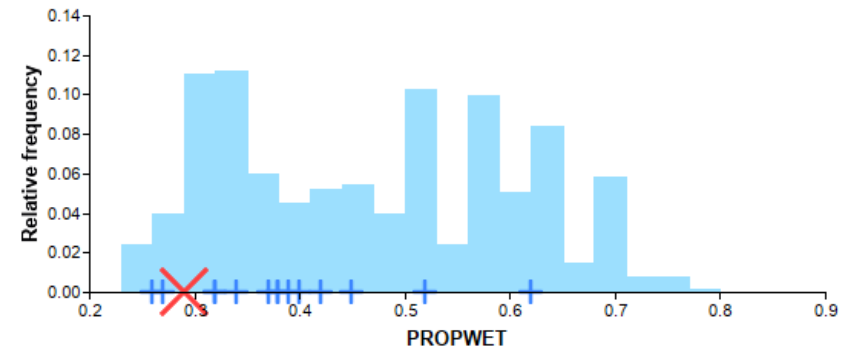
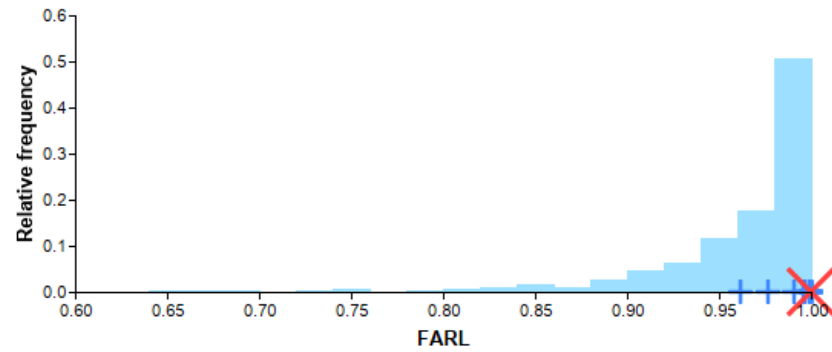
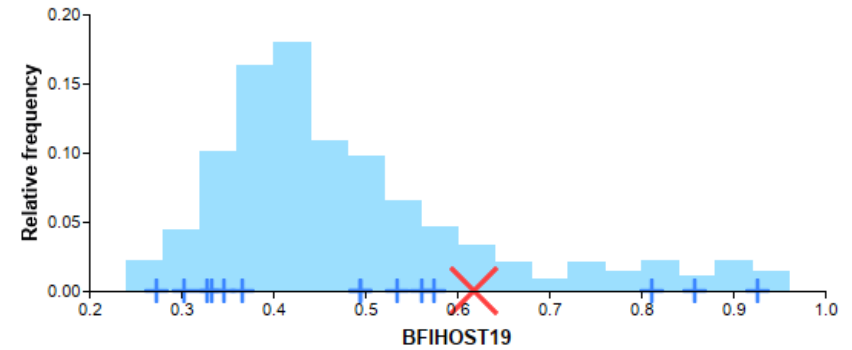
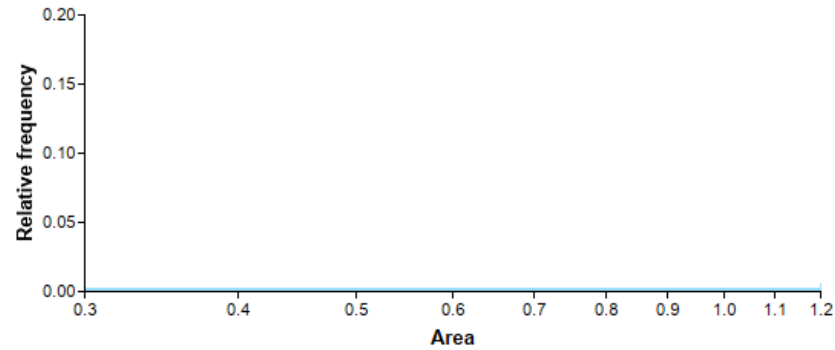
Pooling group growth curves



# UK Design Flood Estimation

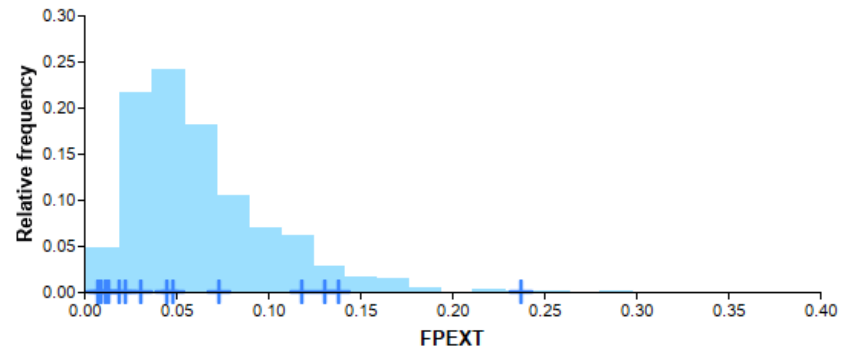
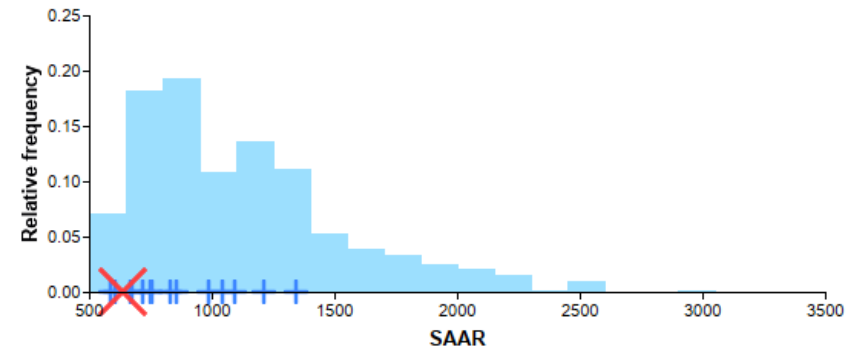
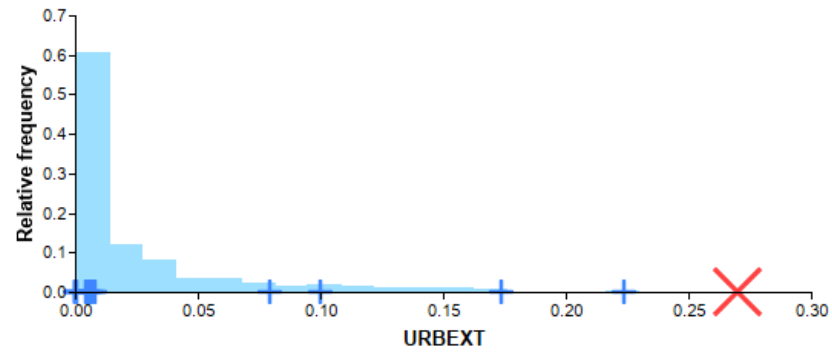
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 31-07-2025 09:08:00  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 233716416  
Site name: FBH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1  
Site location: SU 74800 68300  
Easting: 474800  
Northing: 168300  
Catchment area: 0.74 km<sup>2</sup>  
SAAR: 639 mm  
BFHHOST19: 0.618  
FPEXT: 0.386  
FARL: 1.000  
URBEXT2000: 0.2700

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.31 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.45007

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.270  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                                  | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 27073 (Brompton Beck @ Snainton Ings)    | 1.921    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 23018 (Ouse Burn @ Wolsington)           | 2.075    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 27051 (Crimple @ Burn Bridge)            | 2.075    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 2.472    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                    | 2.500    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 68021 (Arrove Brook @ Acton Lane)        | 2.561    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)   | 2.753    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 2.793    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 27010 (Hodge Beck @ Bransdale Weir)      | 2.847    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)    | 2.871    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| 7009 (Mosset Burn @ Wardend Bridge)      | 2.956    | 25            | 7.053   | 0.365         | 0.365            | 0.329           | 0.329              |
| 36011 (Stour Brook @ Stumer)             | 3.042    | 53            | 6.780   | 0.282         | 0.300            | 0.179           | 0.162              |
| 38020 (Cobbins Brook @ Sewardstone Road) | 3.134    | 52            | 7.402   | 0.325         | 0.335            | 0.331           | 0.321              |
| <b>Total</b>                             |          | <b>525</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                  | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 27073 (Brompton Beck @ Snainton Ings)    | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.393       |          |
| 23018 (Ouse Burn @ Woolsington)          | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.140       |          |
| 27051 (Crimple @ Burn Bridge)            | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.878       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.188       |          |
| 25019 (Leven @ Easby)                    | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.542       |          |
| 68021 (Arrove Brook @ Acton Lane)        | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 1.428       |          |
| 30013 (Heighington Beck @ Heighington)   | Yes                  | Yes                     | 47    | 4               | 8.51                       | 0.27              | None                | 1.187       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.266       |          |
| 27010 (Hodge Beck @ Bransdale Weir)      | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 1.026       |          |
| 36010 (Bumpstead Brook @ Broad Green)    | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.777       |          |
| 7009 (Mosset Burn @ Wardend Bridge)      | Yes                  | Yes                     | 25    | 3               | 12.00                      |                   |                     | 1.781       |          |
| 36011 (Stour Brook @ Sturmer)            | Yes                  | Yes                     | 53    | 8               | 15.09                      | 0.39              | None                | 1.232       |          |
| 38020 (Cobbins Brook @ Sewardstone Road) | Yes                  | Yes                     | 52    | 8               | 15.38                      | -1.25             | None                | 1.162       |          |

### Pooling group catchment descriptors

| Station                                  | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------------|--------|------|-------|-------|------------|-----------|
| 27073 (Brompton Beck @ Snainton Ings)    | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 23018 (Ouse Burn @ Woolsington)          | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 27051 (Crimple @ Burn Bridge)            | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                    | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 68021 (Arrove Brook @ Acton Lane)        | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 30013 (Heighington Beck @ Heighington)   | 23.880 | 605  | 0.119 | 0.962 | 0.079      | 0.859     |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 27010 (Hodge Beck @ Bransdale Weir)      | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)    | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |
| 7009 (Mosset Burn @ Wardend Bridge)      | 28.295 | 803  | 0.060 | 0.998 | 0.000      | 0.606     |
| 36011 (Stour Brook @ Sturmer)            | 34.242 | 592  | 0.060 | 0.999 | 0.100      | 0.363     |
| 38020 (Cobbins Brook @ Sewardstone Road) | 38.785 | 616  | 0.058 | 0.997 | 0.051      | 0.245     |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling Group Rejected Stations

| Station                                              | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments     |
|------------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|--------------|
| 76011 (Coal Bum @ Coalburn)                          | 1.667    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              | High BFIHOST |
| 45816 (Haddeo @ Upton)                               | 2.536    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              | High BFIHOST |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge)      | 2.813    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              | Discordant   |
| 28033 (Dove @ Hollinslough)                          | 2.841    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              | High BFIHOST |
| 44008 (South Winterbourne @ Winterbourne Steepleton) | 2.929    | 32            | 0.572   | 0.405         | 0.406            | 0.254           | 0.254              | High BFIHOST |
| 26014 (Water Fortomes @ Driffeld)                    | 3.010    | 25            | 0.424   | 0.318         | 0.319            | 0.205           | 0.204              | High BFIHOST |
| 84035 (Kittoch Water @ Waterside)                    | 3.038    | 32            | 20.128  | 0.128         | 0.150            | 0.036           | -0.002             | Low FARL     |
| 39086 (Gatwick Stream @ Gatwick Link)                | 3.088    | 48            | 9.909   | 0.148         | 0.164            | -0.010          | -0.035             | Low FARL     |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.299 | Urban L-CV:       | 0.255 |
| Rural L-Skewness: | 0.242 | Urban L-Skewness: | 0.291 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.307 | -0.242 |        | -0.266 |
| GEV          | 0.835    | 0.441 | -0.110 |        | -3.192 |
| KAP3         | 0.916    | 0.366 | -0.183 | -0.400 | -1.088 |

### Goodness of fit

|       |           |
|-------|-----------|
| GL:   | 0.0111 *  |
| GEV:  | -1.4198 * |
| P3:   | -3.1772   |
| GP:   | -4.9240   |
| KAP3: | -0.4748 * |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 1.9745

The pooling group is possibly heterogeneous and a review of the pooling group is optional.

### Standardised growth curves

#### Rural

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.505 | 1.554 | 1.526 |
| 10            | 1.890 | 1.961 | 1.923 |
| 20            | 2.318 | 2.384 | 2.353 |
| 25            | 2.468 | 2.525 | 2.501 |
| 30            | 2.597 | 2.643 | 2.625 |
| 50            | 2.985 | 2.983 | 2.996 |
| 75            | 3.326 | 3.266 | 3.313 |
| 100           | 3.589 | 3.474 | 3.553 |
| 200           | 4.299 | 4.002 | 4.182 |
| 500           | 5.438 | 4.763 | 5.145 |
| 1000          | 6.483 | 5.392 | 5.987 |

#### Urban

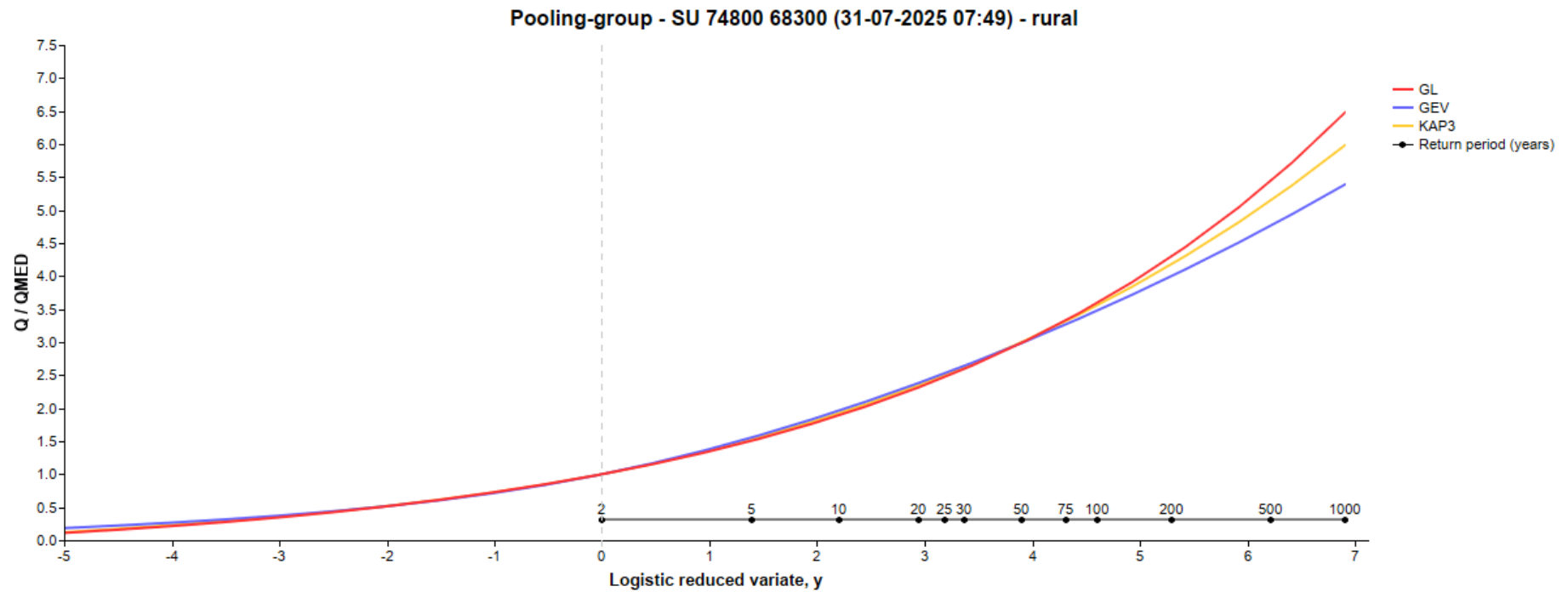
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.428 | 1.464 | 1.442 |
| 10            | 1.771 | 1.829 | 1.797 |
| 20            | 2.168 | 2.228 | 2.198 |
| 25            | 2.310 | 2.365 | 2.340 |
| 30            | 2.433 | 2.482 | 2.461 |
| 50            | 2.812 | 2.827 | 2.828 |
| 75            | 3.153 | 3.124 | 3.152 |
| 100           | 3.420 | 3.348 | 3.402 |
| 200           | 4.160 | 3.936 | 4.077 |
| 500           | 5.395 | 4.834 | 5.162 |
| 1000          | 6.573 | 5.619 | 6.156 |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.250 | -0.291 |        | 0.141  |
| GEV          | 0.869    | 0.346 | -0.181 |        | -1.044 |
| KAP3         | 0.932    | 0.292 | -0.242 | -0.400 | -0.275 |

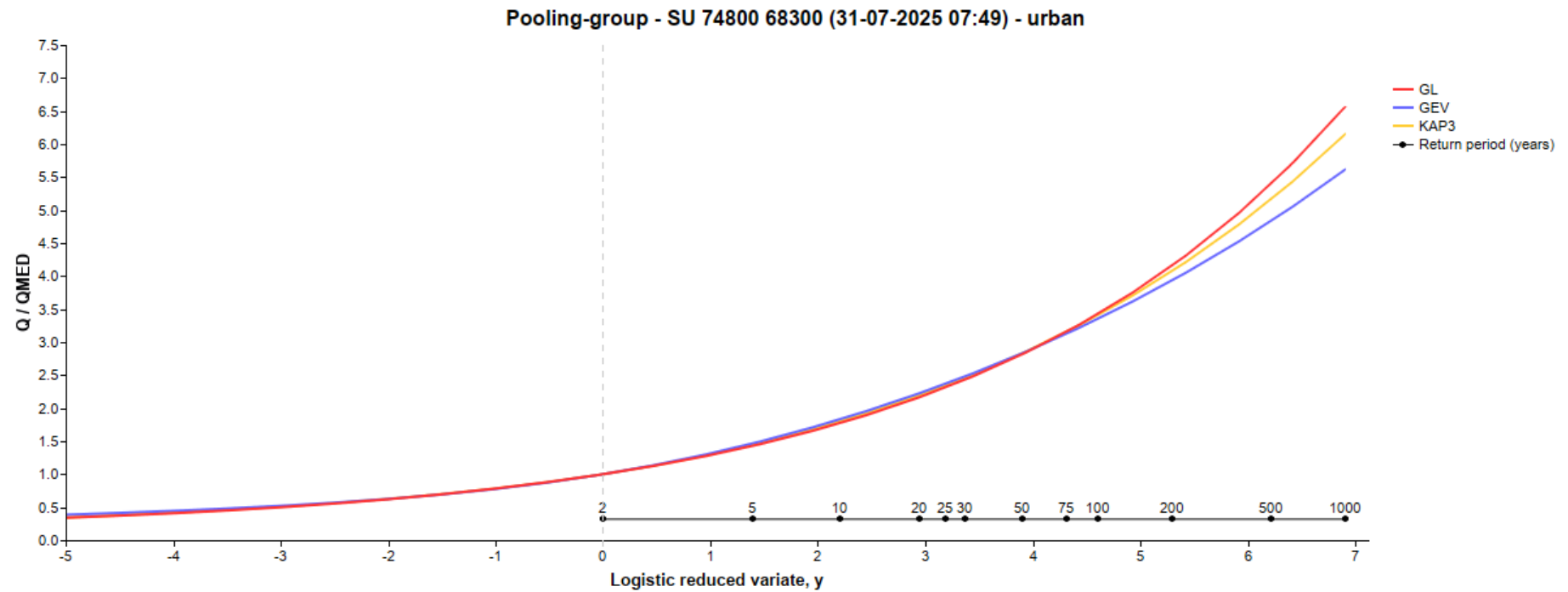
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
URBEXT2000: <0.270  
Donor adjusted FSE: 1.400  
No. of donors: 1

#### Donor stations

| Station                           | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|-----------------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39007 (Blackwater @ Swallowfield) | 14.45    | Yes                      | 22.300   | <b>17.972</b>    | 17.807         | 14.351         |

#### Donor suitability

| Station                           | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|-----------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39007 (Blackwater @ Swallowfield) | Yes                  | Yes                     | 70    | 0               | 0.00                       | 1.42               | None                 |          |

#### Donor catchment descriptors

| Station                                                           | Area    | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------------------------|---------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474800_168300_v5_0_1 @ SU 74800 68300) | 0.740   | 473792     | 167891     | 639  | 0.386 | 1.000 | 0.270      | 0.618     |
| 39007 (Blackwater @ Swallowfield)                                 | 359.810 | 479802     | 154750     | 708  | 0.132 | 0.886 | 0.132      | 0.674     |

#### Unused Donor stations

| Station                                  | Distance | URBEXT | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural | Centroid X | Centroid Y | Area     | SAAR | BFIHOST19 | FARL  | Years of data | QMED suitability | Pooling suitability |
|------------------------------------------|----------|--------|--------------------------|----------|------------------|----------------|----------------|------------|------------|----------|------|-----------|-------|---------------|------------------|---------------------|
| 39052 (The Cut @ Binfield)               | 15.07    | 0.237  | Yes                      | 7.543    | <b>6.110</b>     | 9.547          | 7.733          | 488740     | 169768     | 49.998   | 676  | 0.366     | 0.939 | 66            | Yes              | No                  |
| 39022 (Loddon @ Sheepbridge)             | 15.75    | 0.087  | Yes                      | 16.350   | <b>14.203</b>    | 13.034         | 11.322         | 464845     | 154923     | 176.773  | 735  | 0.664     | 0.947 | 58            | Yes              | Yes                 |
| 39027 (Pang @ Pangbourne)                | 22.01    | 0.012  | Yes                      | 2.140    | <b>2.081</b>     | 6.817          | 6.817          | 453633     | 176722     | 175.683  | 694  | 0.782     | 0.996 | 55            | Yes              | No                  |
| 39001 (Thames @ Kingston)                | 22.74    | 0.066  | Yes                      | 316.110  | <b>282.569</b>   | 324.496        | 290.065        | 462899     | 187850     | 9930.798 | 706  | 0.679     | 0.942 | 140           | Yes              | Yes                 |
| 39025 (Enborne @ Brimpton)               | 26.03    | 0.020  | Yes                      | 16.700   | <b>16.271</b>    | 18.310         | 18.310         | 448695     | 160991     | 142.010  | 789  | 0.563     | 0.978 | 56            | Yes              | Yes                 |
| 39023 (Wye @ Bourne End Hedsor)          | 29.38    | 0.113  | Yes                      | 2.730    | <b>1.992</b>     | 6.665          | 4.864          | 483929     | 195468     | 134.183  | 755  | 0.839     | 0.984 | 59            | Yes              | Yes                 |
| 42009 (Candover Stream @ Borough Bridge) | 29.53    | 0.011  | Yes                      | 1.065    | <b>1.011</b>     | 1.806          | 1.806          | 460964     | 141288     | 72.062   | 819  | 0.924     | 0.930 | 52            | Yes              | Yes                 |
| 39033 (Winterbourne Stream @ Bagnor)     | 29.97    | 0.001  | Yes                      | 0.399    | <b>0.398</b>     | 2.053          | 2.053          | 445079     | 176491     | 45.312   | 717  | 0.812     | 1.000 | 61            | Yes              | Yes                 |
| 39011 (Wey @ Tilford)                    | 30.56    | 0.053  | Yes                      | 25.800   | <b>22.877</b>    | 22.987         | 20.383         | 477280     | 137531     | 391.325  | 855  | 0.773     | 0.957 | 69            | Yes              | No                  |

#### QMED

Rural: 0.114 m³/s  
Urban: 0.166 m³/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

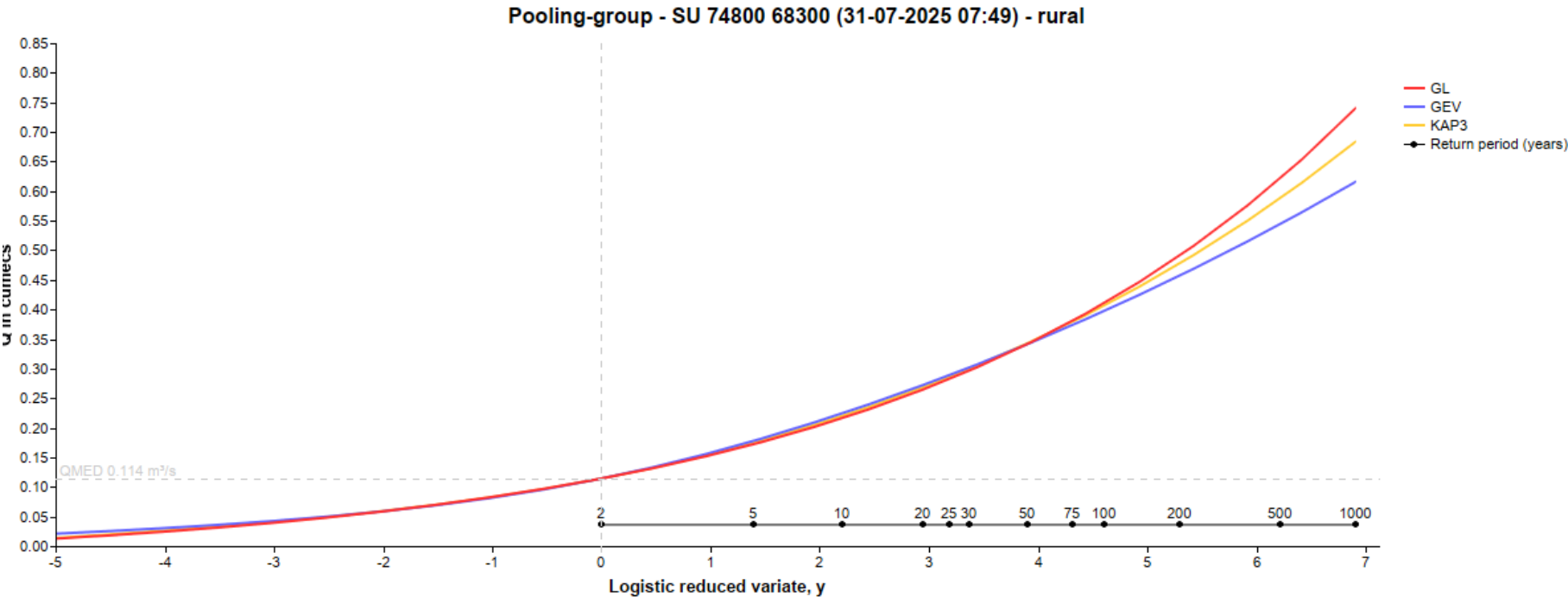
### Flood Frequency Curve

Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.114     | 0.114      | 0.114       |
| 5             | 0.172     | 0.178      | 0.174       |
| 10            | 0.216     | 0.224      | 0.220       |
| 20            | 0.265     | 0.272      | 0.269       |
| 25            | 0.282     | 0.289      | 0.286       |
| 30            | 0.297     | 0.302      | 0.300       |
| 50            | 0.341     | 0.341      | 0.342       |
| 75            | 0.380     | 0.373      | 0.379       |
| 100           | 0.410     | 0.397      | 0.406       |
| 200           | 0.491     | 0.457      | 0.478       |
| 500           | 0.621     | 0.544      | 0.588       |
| 1000          | 0.741     | 0.616      | 0.684       |

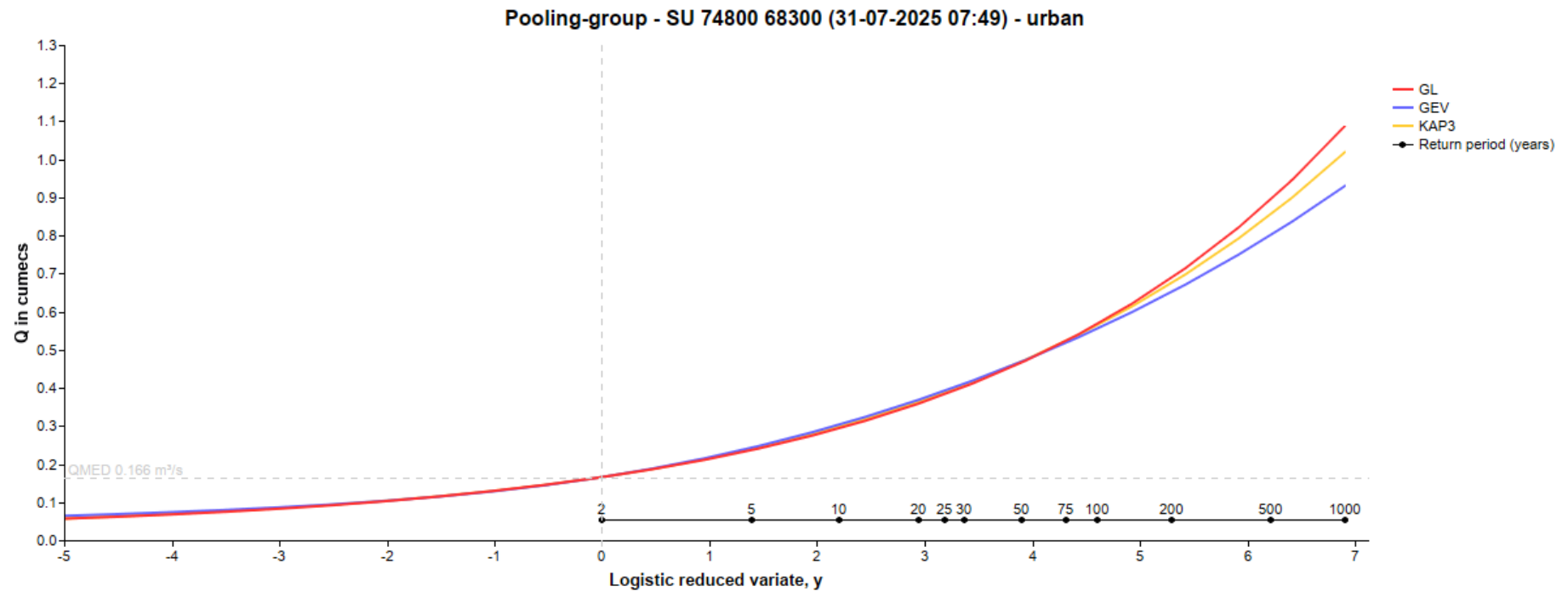
Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.166     | 0.166      | 0.166       |
| 5             | 0.237     | 0.243      | 0.239       |
| 10            | 0.293     | 0.303      | 0.298       |
| 20            | 0.359     | 0.369      | 0.364       |
| 25            | 0.383     | 0.392      | 0.388       |
| 30            | 0.403     | 0.411      | 0.408       |
| 50            | 0.466     | 0.468      | 0.469       |
| 75            | 0.522     | 0.518      | 0.522       |
| 100           | 0.567     | 0.555      | 0.564       |
| 200           | 0.689     | 0.652      | 0.675       |
| 500           | 0.894     | 0.801      | 0.855       |
| 1000          | 1.089     | 0.931      | 1.020       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



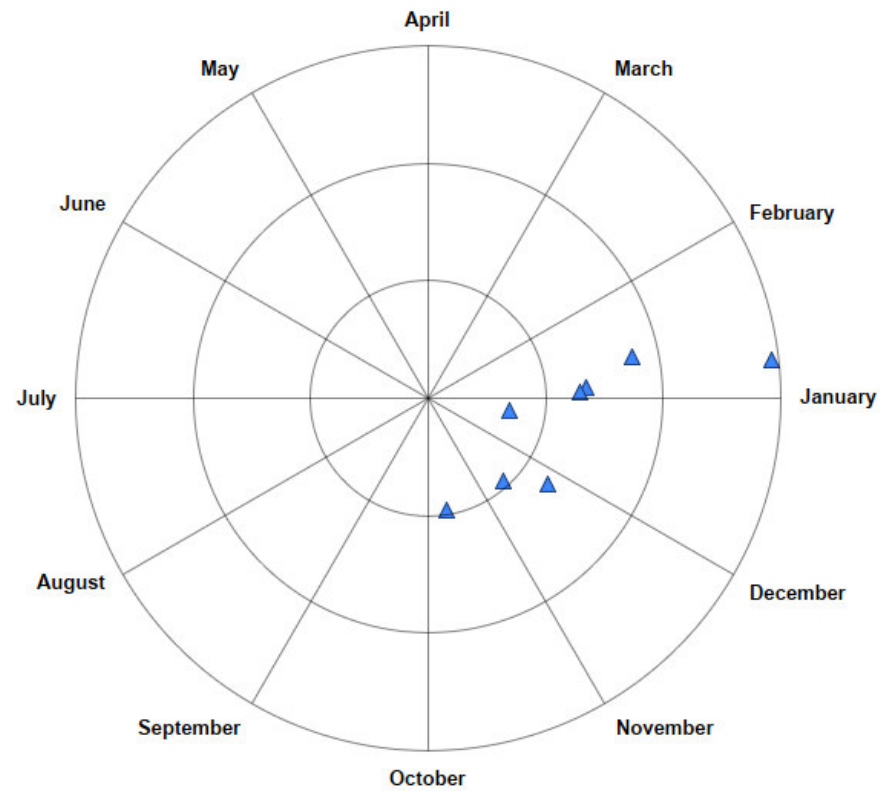
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

#### Station record parameters

Flood seasonality: SU 74800 68300 (31-07-2025 07:49) - urban



# UK Design Flood Estimation

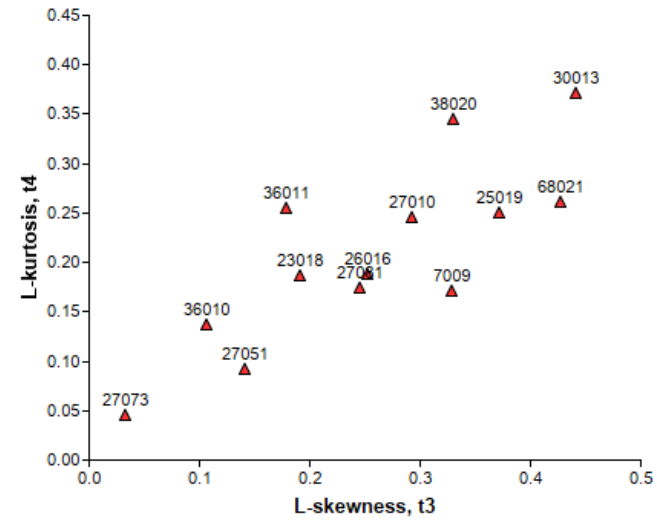
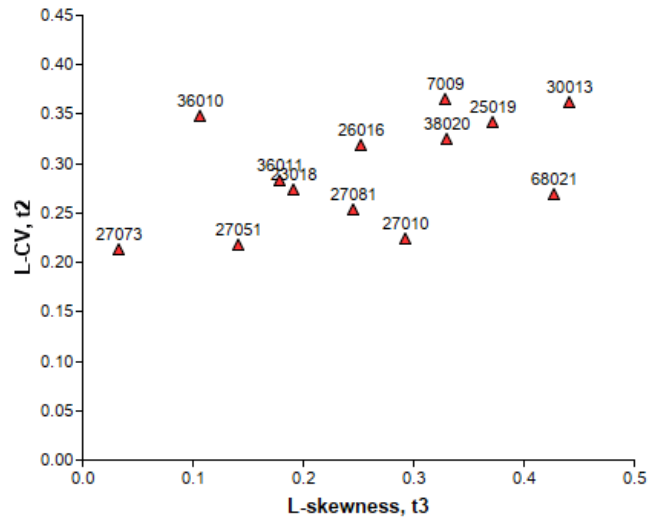
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

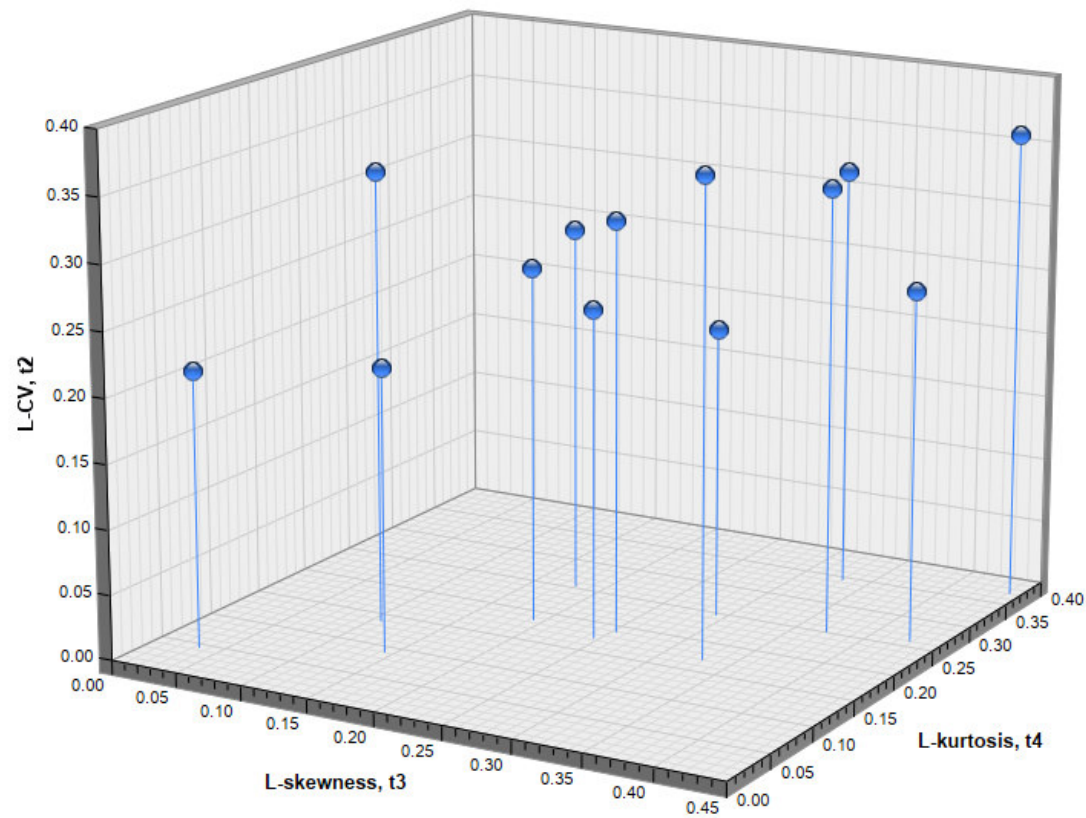
L-moment ratios - SU 74800 68300 (31-07-2025 07:49) - urban



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

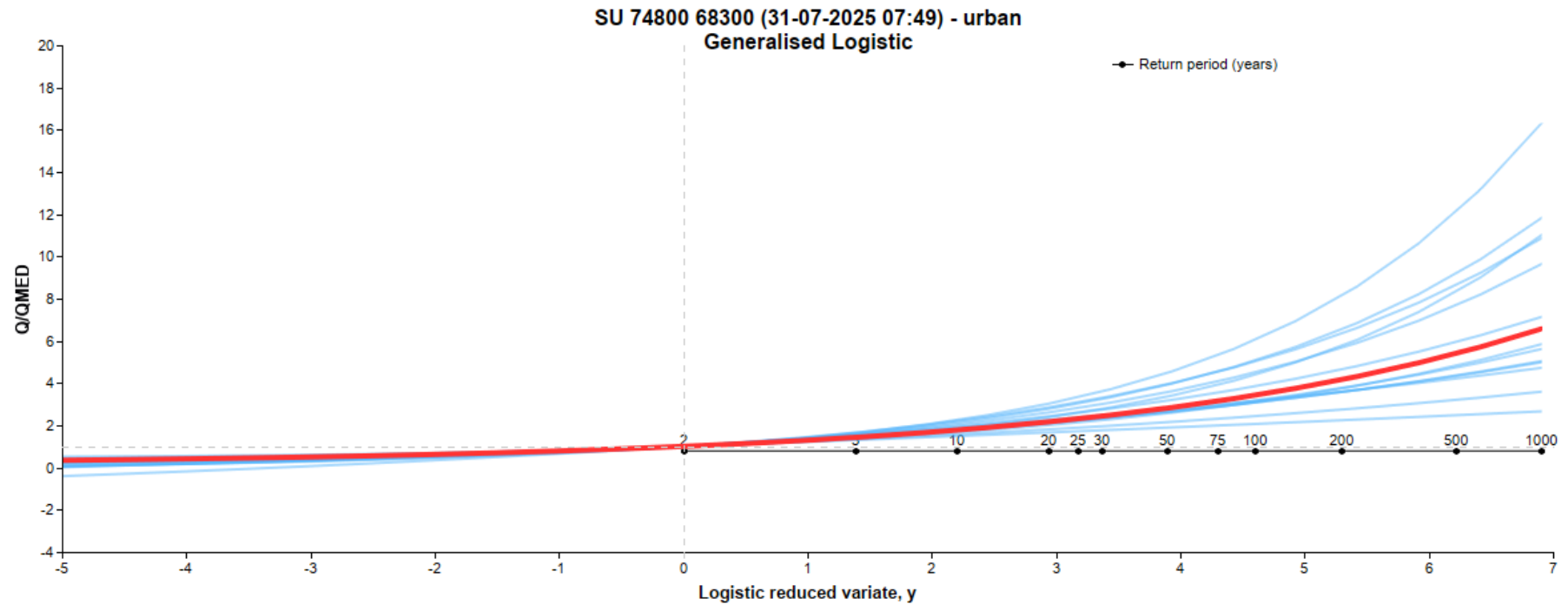
L-moment ratios - SU 74800 68300 (31-07-2025 07:49) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

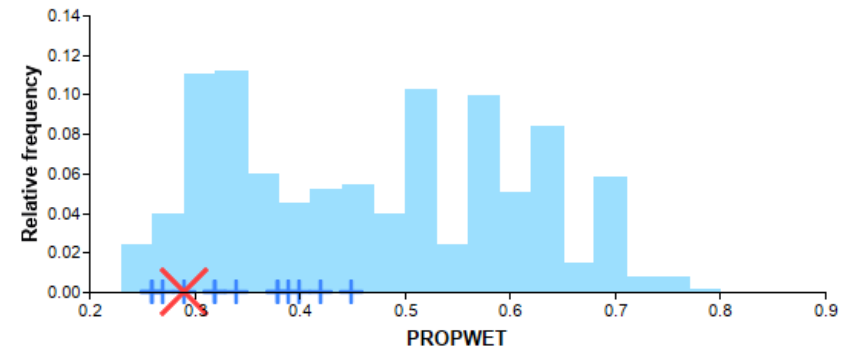
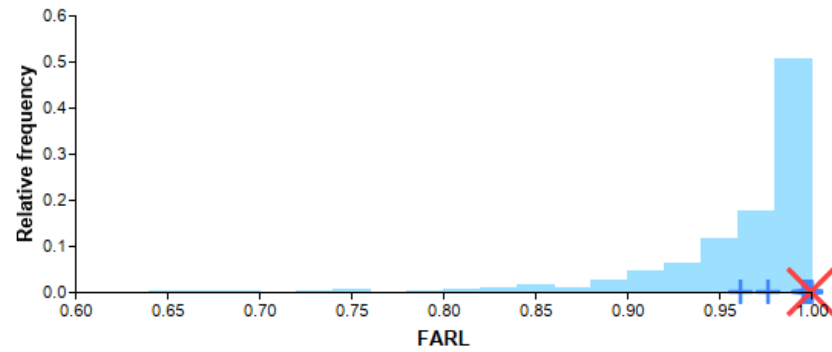
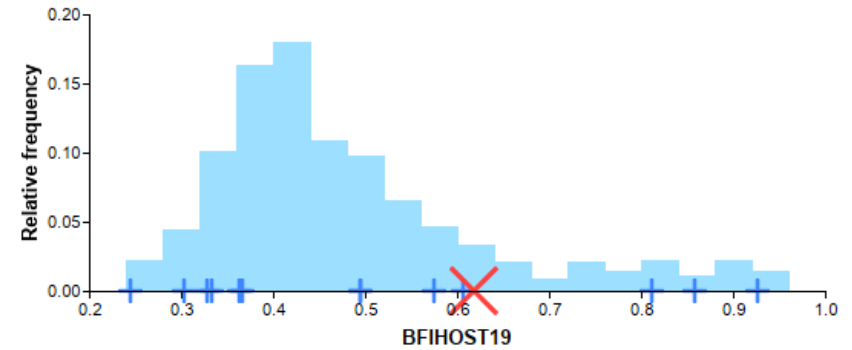
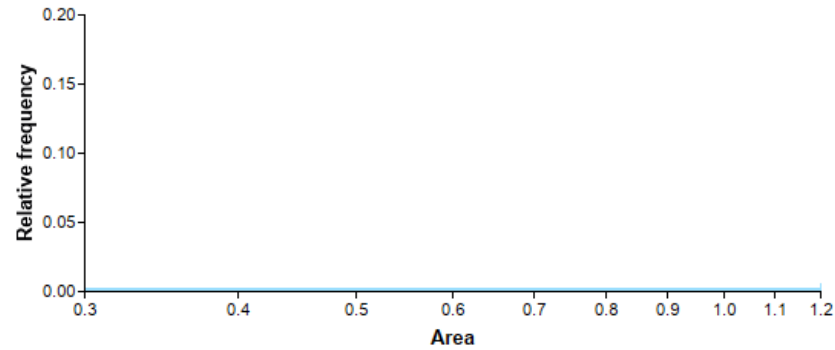
Pooling group growth curves



# UK Design Flood Estimation

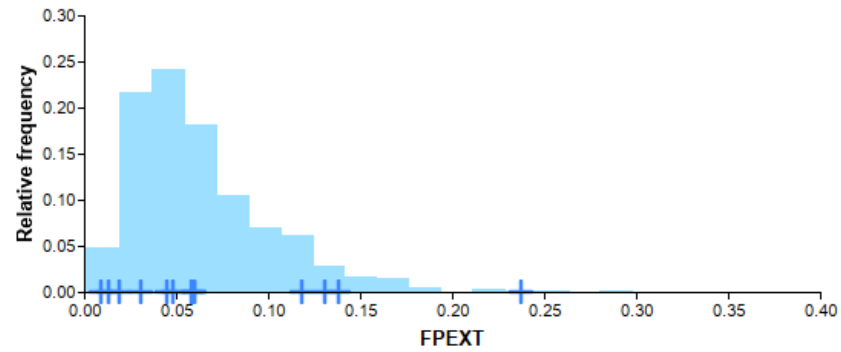
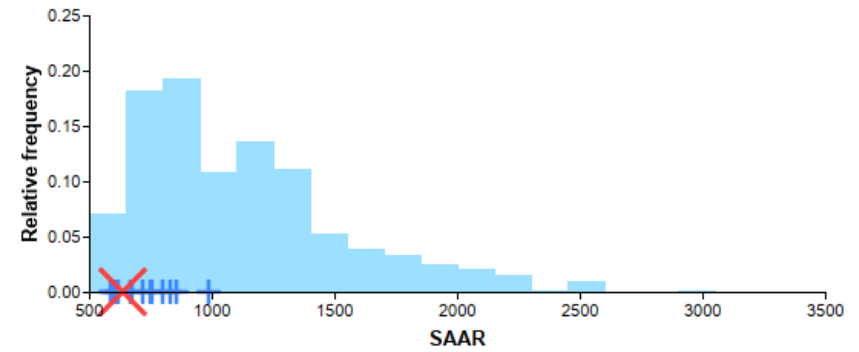
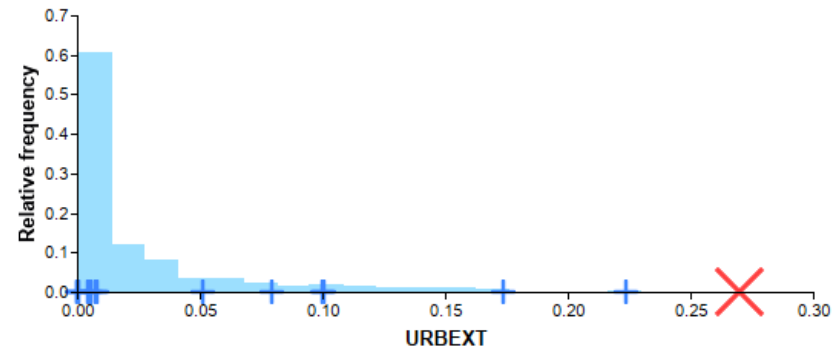
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:27:20  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 2994724023  
Site name: FBH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1  
Site location: SU 74550 68500  
Easting: 474550  
Northing: 168500  
Catchment area: 0.63 km<sup>2</sup>  
SAAR: 638 mm  
BFHHOST19: 0.488  
FPEXT: 0.194  
FARL: 1.000  
URBEXT2000: 0.2400

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.24 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.29562

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.240  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Catchment Descriptors

### Growth curve data and results

#### Pooling group AM data

| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 76011 (Coal Bum @ Coalburn)                     | 1.723    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              |
| 27073 (Brompton Beck @ Snainton Ings)           | 2.047    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 27051 (Crimple @ Burn Bridge)                   | 2.194    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 23018 (Ouse Burn @ Woolsington)                 | 2.202    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.598    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                           | 2.623    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 45816 (Haddeo @ Upton)                          | 2.628    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              |
| 68021 (Arrove Brook @ Acton Lane)               | 2.687    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)          | 2.880    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.920    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.926    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              |
| 28033 (Dove @ Hollinslough)                     | 2.930    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.964    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.998    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| Total                                           |          | 532           |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                         | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|-------------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 76011 (Coal Bum @ Coalburn)                     | Yes                  | Yes                     | 46    | 0               | 0.00                       |                   |                     | 1.518       |          |
| 27073 (Brompton Beck @ Snainton Ings)           | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.474       |          |
| 27051 (Crimple @ Bum Bridge)                    | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.609       |          |
| 23018 (Ouse Burn @ Wolsington)                  | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.285       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.322       |          |
| 25019 (Leven @ Easby)                           | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.631       |          |
| 45816 (Haddeo @ Upton)                          | Yes                  | Yes                     | 30    | 1               | 3.33                       | -0.45             | None                | 0.433       |          |
| 68021 (Arrowe Brook @ Acton Lane)               | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 0.623       |          |
| 30013 (Heighington Beck @ Heighington)          | Yes                  | Yes                     | 47    | 4               | 8.51                       | 0.27              | None                | 1.531       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.044       |          |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | Yes                  | Yes                     | 13    | 0               | 0.00                       |                   |                     | 3.513       |          |
| 28033 (Dove @ Hollinslough)                     | Yes                  | Yes                     | 48    | 1               | 2.08                       |                   |                     | 0.661       |          |
| 27010 (Hodge Beck @ Bransdale Weir)             | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 0.375       |          |
| 36010 (Bumpstead Brook @ Broad Green)           | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.981       |          |

### Pooling group catchment descriptors

| Station                                         | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------|--------|------|-------|-------|------------|-----------|
| 76011 (Coal Bum @ Coalburn)                     | 1.630  | 1096 | 0.074 | 1.000 | 0.000      | 0.274     |
| 27073 (Brompton Beck @ Snainton Ings)           | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 27051 (Crimple @ Bum Bridge)                    | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 23018 (Ouse Burn @ Wolsington)                  | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                           | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 45816 (Haddeo @ Upton)                          | 6.808  | 1210 | 0.011 | 1.000 | 0.005      | 0.535     |
| 68021 (Arrowe Brook @ Acton Lane)               | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 30013 (Heighington Beck @ Heighington)          | 23.880 | 605  | 0.119 | 0.962 | 0.079      | 0.859     |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 16.080 | 1044 | 0.023 | 0.991 | 0.006      | 0.562     |
| 28033 (Dove @ Hollinslough)                     | 7.915  | 1346 | 0.007 | 1.000 | 0.000      | 0.347     |
| 27010 (Hodge Beck @ Bransdale Weir)             | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)           | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.275 | Urban L-CV:       | 0.239 |
| Rural L-Skewness: | 0.264 | Urban L-Skewness: | 0.309 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.276 | -0.264 |        | -0.045 |
| GEV          | 0.853    | 0.390 | -0.142 |        | -1.894 |
| KAP3         | 0.925    | 0.326 | -0.210 | -0.400 | -0.632 |

### Goodness of fit

|       |           |
|-------|-----------|
| GL:   | 0.4913 *  |
| GEV:  | -0.8045 * |
| P3:   | -2.7755   |
| GP:   | -4.0917   |
| KAP3: | 0.0641 *  |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 2.5861

The pooling group is heterogeneous and a review of the pooling group is desirable.

### Standardised growth curves

#### Rural

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.463 | 1.505 | 1.480 |
| 10            | 1.824 | 1.888 | 1.853 |
| 20            | 2.232 | 2.294 | 2.264 |
| 25            | 2.377 | 2.432 | 2.407 |
| 30            | 2.501 | 2.548 | 2.529 |
| 50            | 2.880 | 2.887 | 2.893 |
| 75            | 3.217 | 3.173 | 3.210 |
| 100           | 3.478 | 3.385 | 3.451 |
| 200           | 4.193 | 3.933 | 4.093 |
| 500           | 5.359 | 4.744 | 5.097 |
| 1000          | 6.448 | 5.431 | 5.994 |

#### Urban

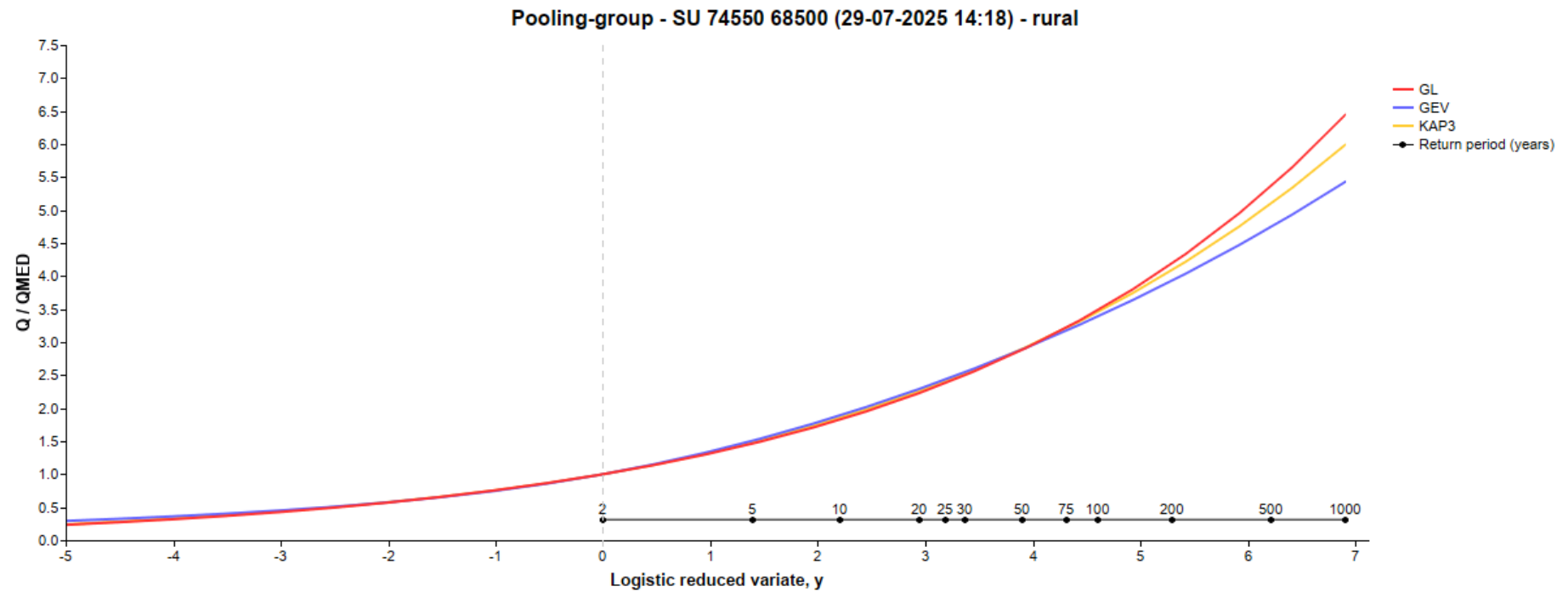
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.397 | 1.430 | 1.410 |
| 10            | 1.722 | 1.774 | 1.745 |
| 20            | 2.102 | 2.159 | 2.130 |
| 25            | 2.240 | 2.293 | 2.268 |
| 30            | 2.360 | 2.407 | 2.386 |
| 50            | 2.729 | 2.749 | 2.746 |
| 75            | 3.065 | 3.045 | 3.067 |
| 100           | 3.329 | 3.271 | 3.316 |
| 200           | 4.069 | 3.871 | 3.998 |
| 500           | 5.320 | 4.806 | 5.110 |
| 1000          | 6.531 | 5.640 | 6.148 |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.230 | -0.309 |        | 0.257  |
| GEV          | 0.881    | 0.312 | -0.205 |        | -0.640 |
| KAP3         | 0.938    | 0.266 | -0.263 | -0.400 | -0.073 |

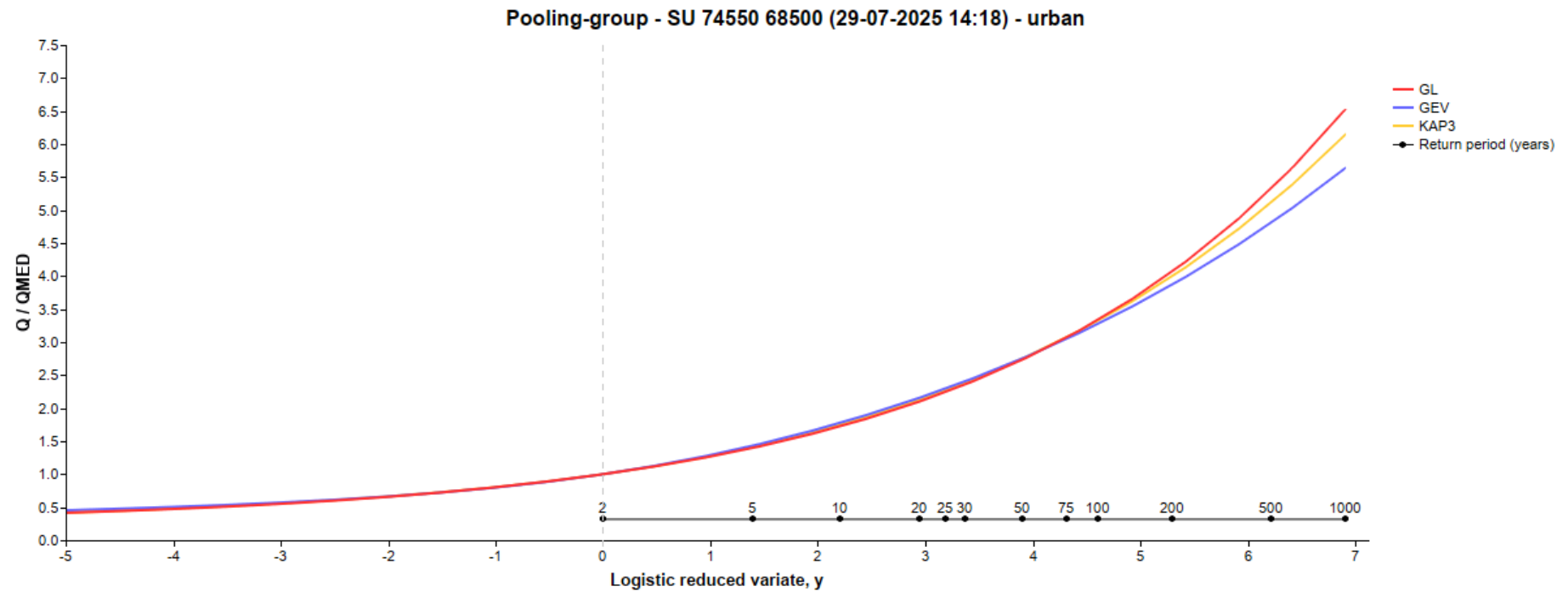
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### QMED

Rural: 0.143 m<sup>3</sup>/s

Urban: 0.185 m<sup>3</sup>/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

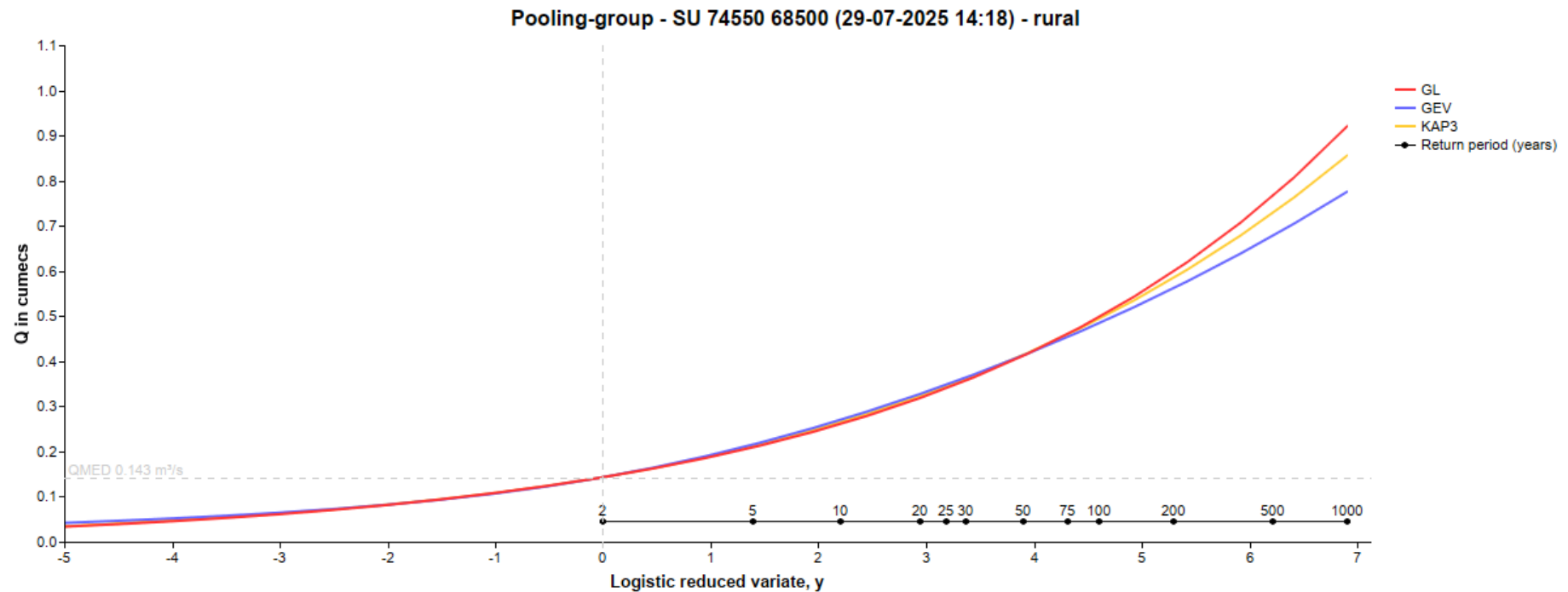
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.143     | 0.143      | 0.143       |
| 5             | 0.209     | 0.215      | 0.211       |
| 10            | 0.261     | 0.270      | 0.265       |
| 20            | 0.319     | 0.328      | 0.323       |
| 25            | 0.340     | 0.348      | 0.344       |
| 30            | 0.357     | 0.364      | 0.361       |
| 50            | 0.411     | 0.412      | 0.413       |
| 75            | 0.460     | 0.453      | 0.459       |
| 100           | 0.497     | 0.484      | 0.493       |
| 200           | 0.599     | 0.562      | 0.585       |
| 500           | 0.766     | 0.678      | 0.728       |
| 1000          | 0.921     | 0.776      | 0.856       |

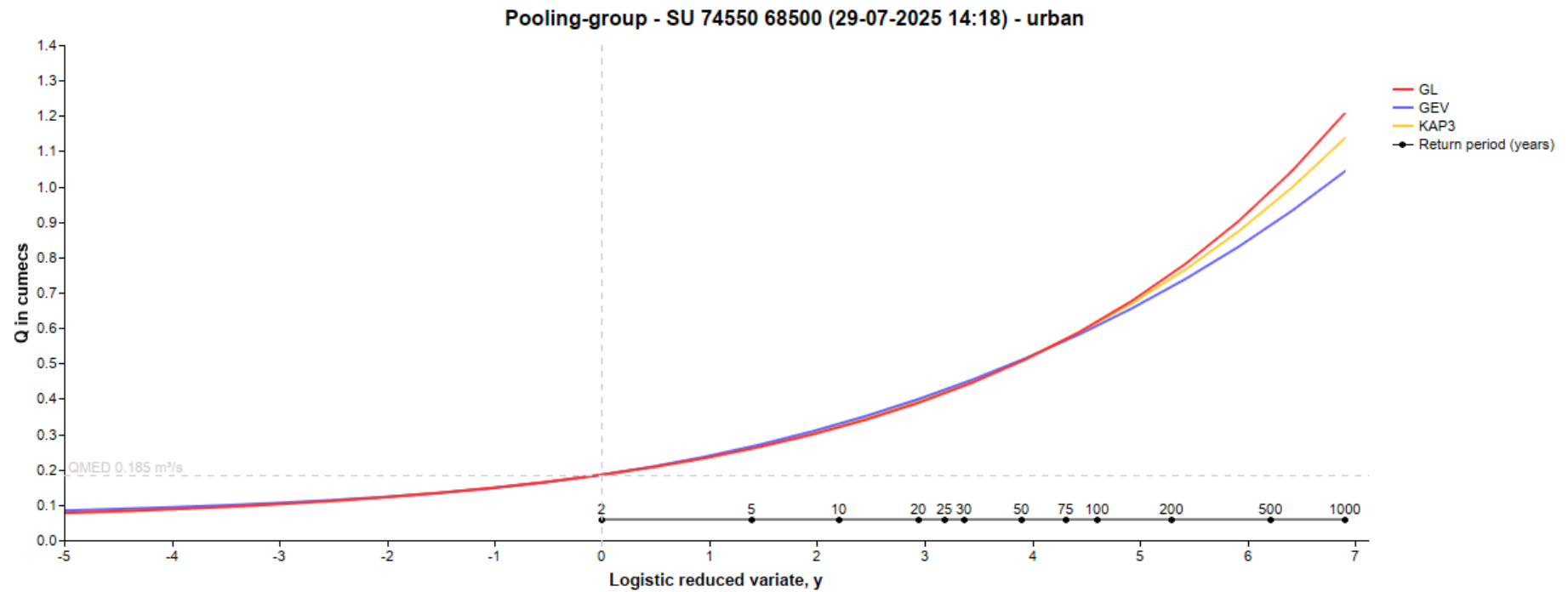
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.185     | 0.185      | 0.185       |
| 5             | 0.259     | 0.265      | 0.261       |
| 10            | 0.319     | 0.328      | 0.323       |
| 20            | 0.389     | 0.400      | 0.394       |
| 25            | 0.415     | 0.424      | 0.420       |
| 30            | 0.437     | 0.446      | 0.442       |
| 50            | 0.505     | 0.509      | 0.508       |
| 75            | 0.567     | 0.564      | 0.568       |
| 100           | 0.616     | 0.605      | 0.614       |
| 200           | 0.753     | 0.717      | 0.740       |
| 500           | 0.985     | 0.890      | 0.946       |
| 1000          | 1.209     | 1.044      | 1.138       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



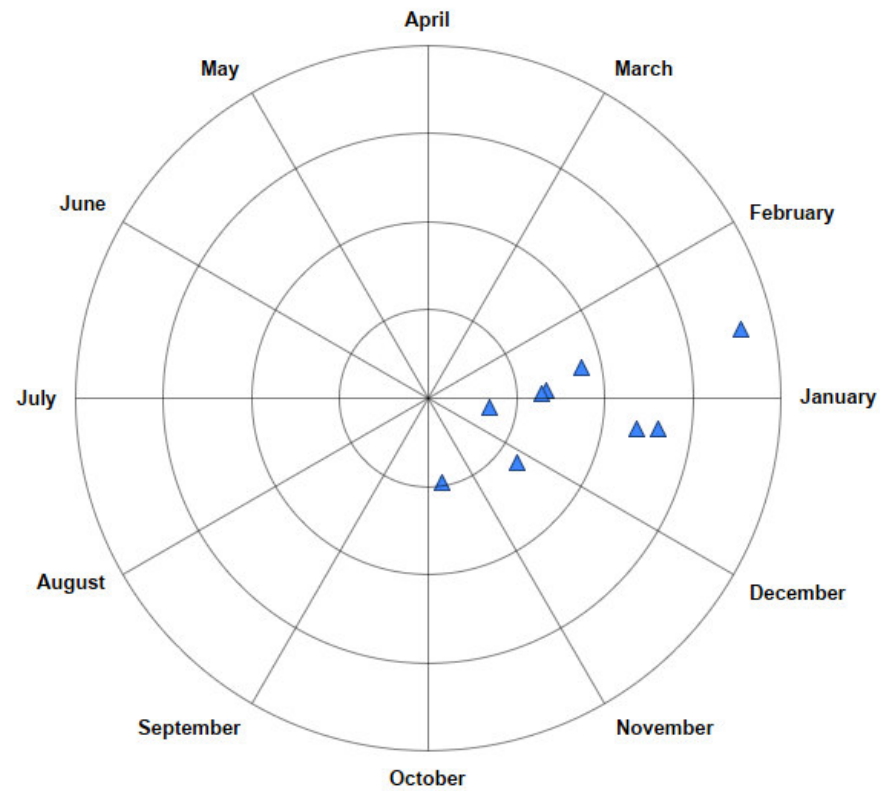
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

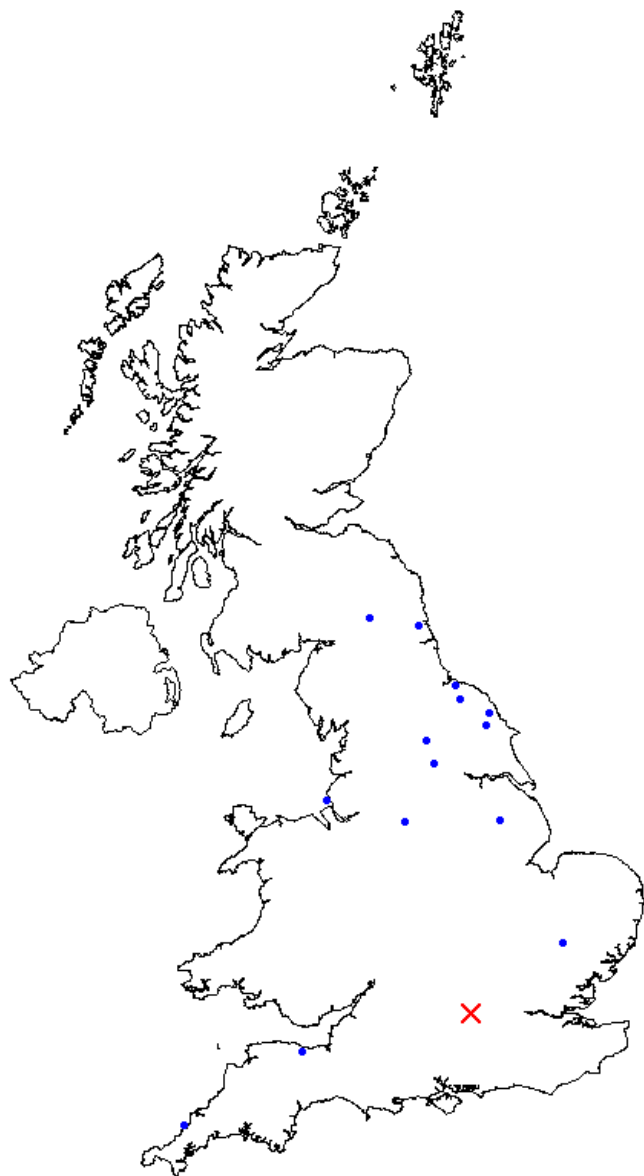
#### Station record parameters

Flood seasonality: SU 74550 68500 (29-07-2025 14:18) - rural



# UK Design Flood Estimation

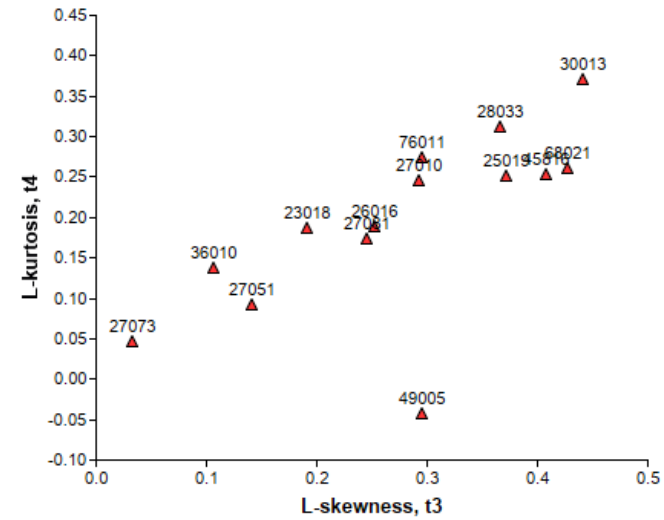
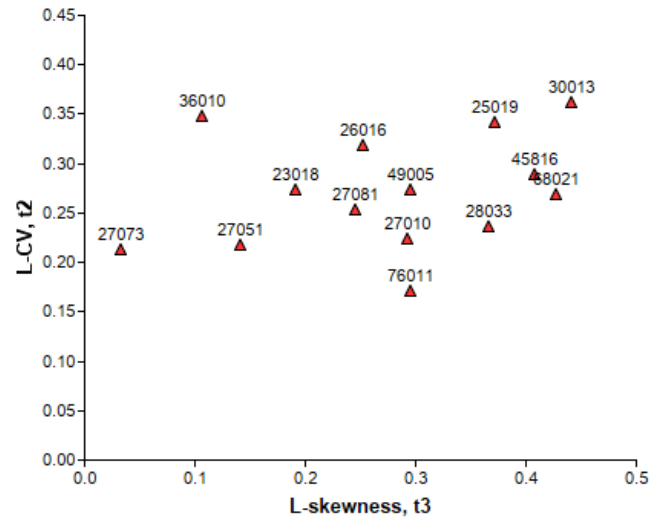
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

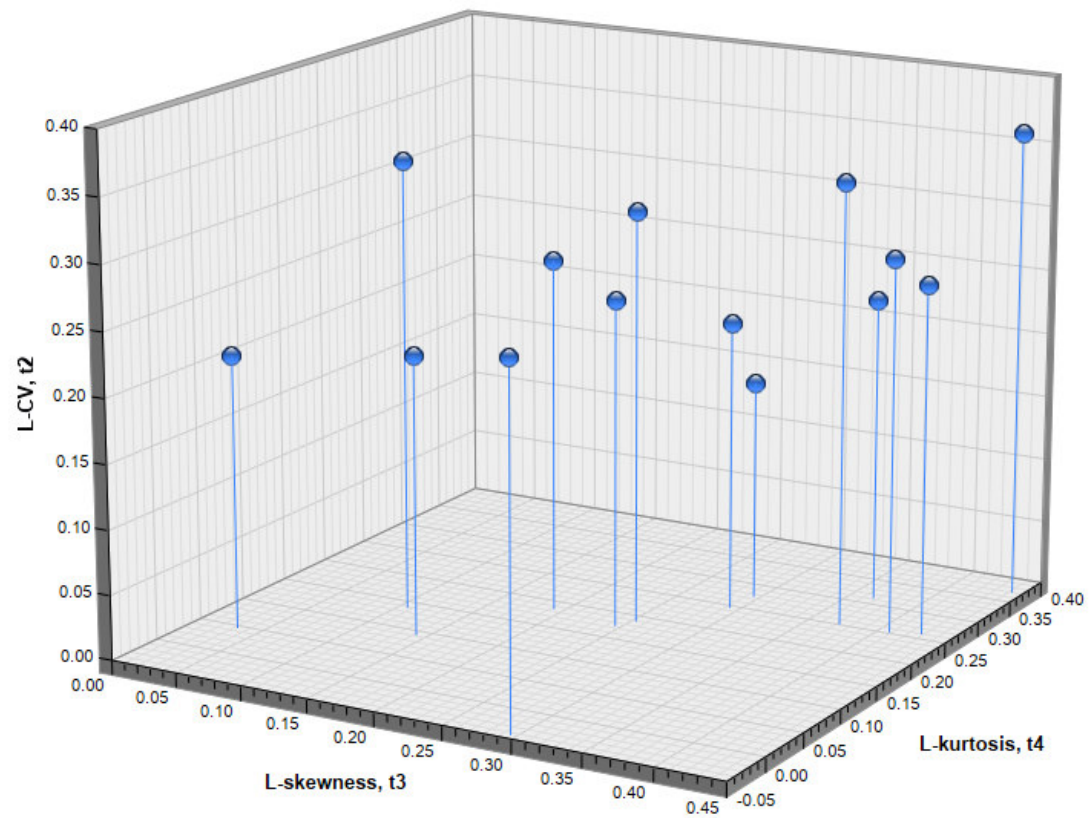
L-moment ratios - SU 74550 68500 (29-07-2025 14:18) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

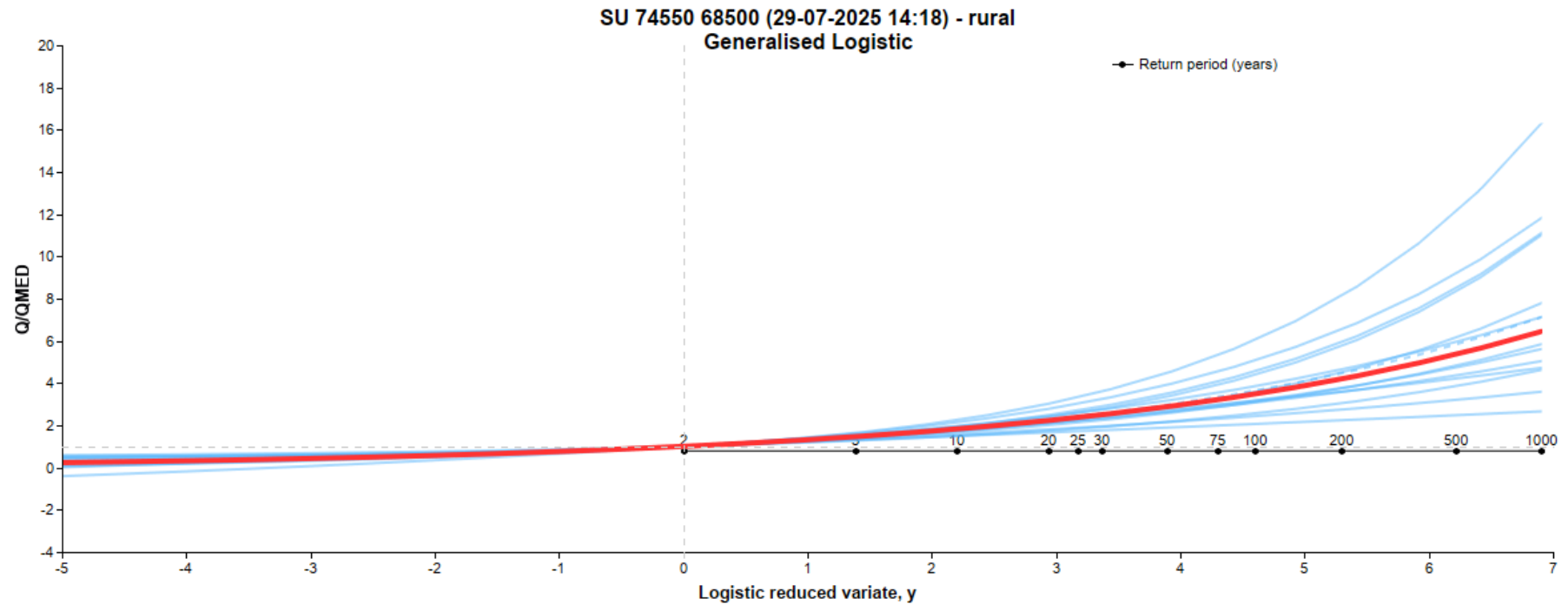
L-moment ratios - SU 74550 68500 (29-07-2025 14:18) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

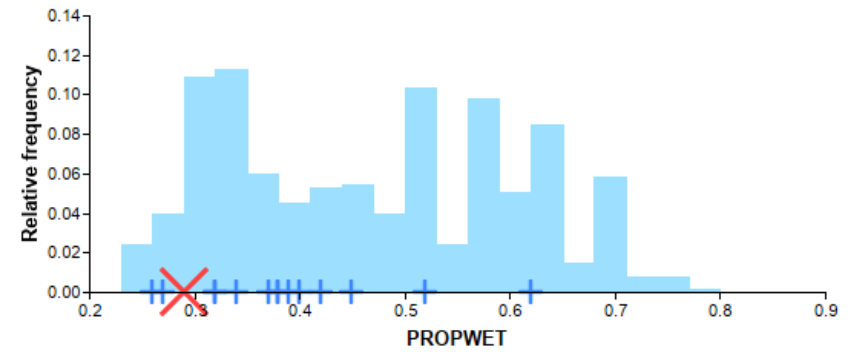
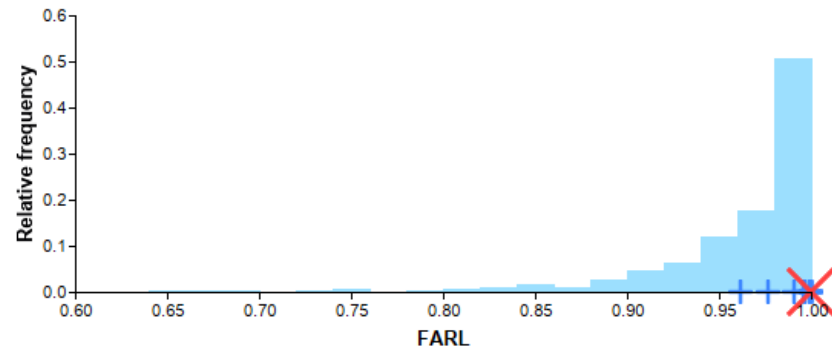
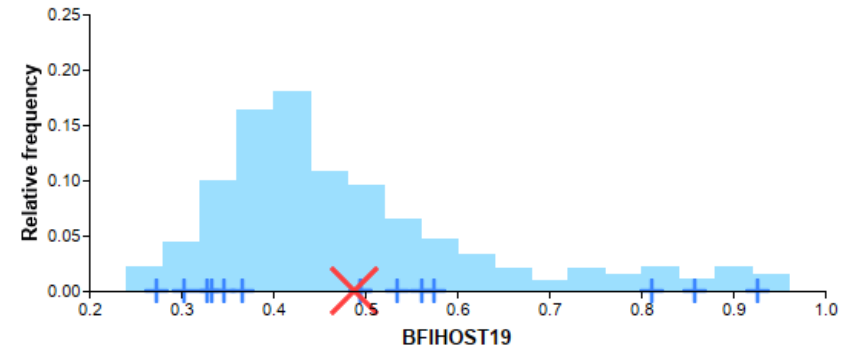
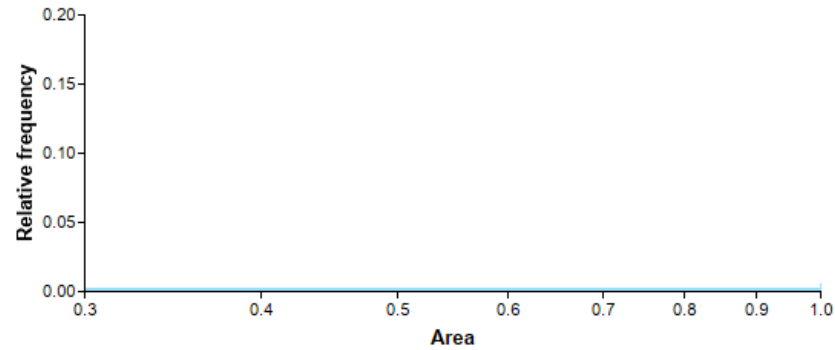
Pooling group growth curves



# UK Design Flood Estimation

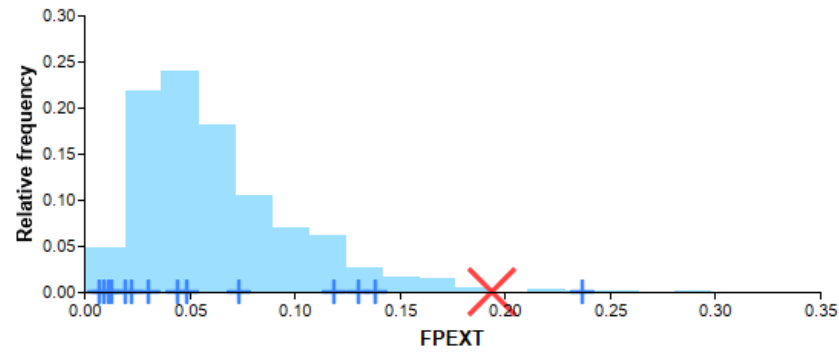
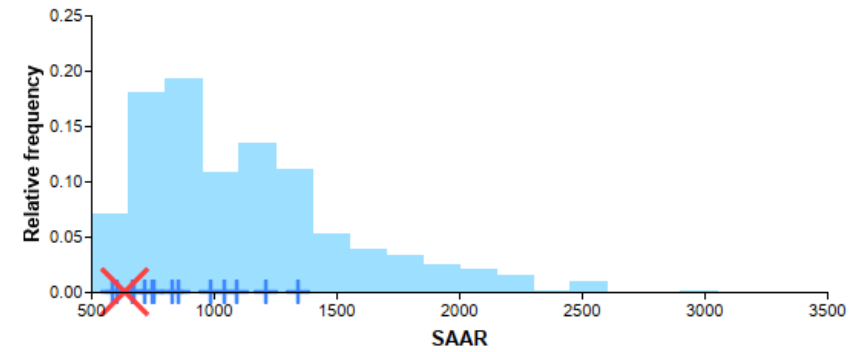
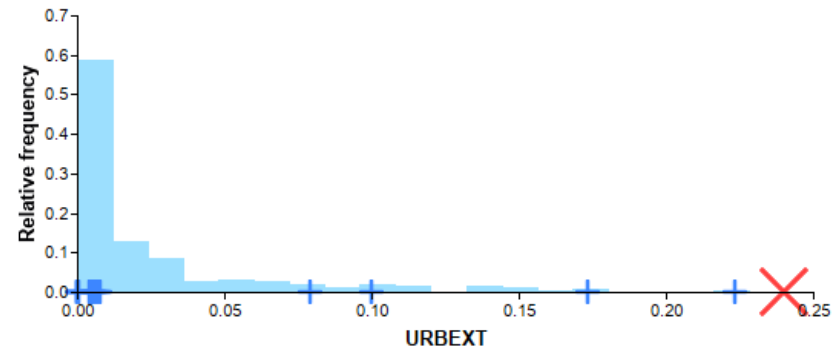
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 29-07-2025 15:27:03  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 2994724023  
Site name: FBH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1  
Site location: SU 74550 68500  
Easting: 474550  
Northing: 168500  
Catchment area: 0.63 km<sup>2</sup>  
SAAR: 638 mm  
BFHOST19: 0.488  
FPEXT: 0.194  
FARL: 1.000  
URBEXT2000: 0.2400

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.24 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.29562

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.240  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                                         | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|-------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 76011 (Coal Bum @ Coalburn)                     | 1.723    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              |
| 27073 (Brompton Beck @ Snainton Ings)           | 2.047    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 27051 (Crimple @ Burn Bridge)                   | 2.194    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 23018 (Ouse Burn @ Woolsington)                 | 2.202    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 2.598    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                           | 2.623    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 45816 (Haddeo @ Upton)                          | 2.628    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              |
| 68021 (Arrove Brook @ Acton Lane)               | 2.687    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 30013 (Heighington Beck @ Heighington)          | 2.880    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 2.920    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 2.926    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              |
| 28033 (Dove @ Hollinslough)                     | 2.930    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              |
| 27010 (Hodge Beck @ Bransdale Weir)             | 2.964    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)           | 2.998    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| <b>Total</b>                                    |          | <b>532</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                         | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|-------------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 76011 (Coal Bum @ Coalburn)                     | Yes                  | Yes                     | 46    | 0               | 0.00                       |                   |                     | 1.518       |          |
| 27073 (Brompton Beck @ Snainton Ings)           | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.474       |          |
| 27051 (Crimple @ Bum Bridge)                    | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.609       |          |
| 23018 (Ouse Burn @ Wolsington)                  | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.285       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.322       |          |
| 25019 (Leven @ Easby)                           | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.631       |          |
| 45816 (Haddeo @ Upton)                          | Yes                  | Yes                     | 30    | 1               | 3.33                       | -0.45             | None                | 0.433       |          |
| 68021 (Arrowe Brook @ Acton Lane)               | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 0.623       |          |
| 30013 (Heighington Beck @ Heighington)          | Yes                  | Yes                     | 47    | 4               | 8.51                       | 0.27              | None                | 1.531       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.044       |          |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | Yes                  | Yes                     | 13    | 0               | 0.00                       |                   |                     | 3.513       |          |
| 28033 (Dove @ Hollinslough)                     | Yes                  | Yes                     | 48    | 1               | 2.08                       |                   |                     | 0.661       |          |
| 27010 (Hodge Beck @ Bransdale Weir)             | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 0.375       |          |
| 36010 (Bumpstead Brook @ Broad Green)           | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.981       |          |

### Pooling group catchment descriptors

| Station                                         | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------|--------|------|-------|-------|------------|-----------|
| 76011 (Coal Bum @ Coalburn)                     | 1.630  | 1096 | 0.074 | 1.000 | 0.000      | 0.274     |
| 27073 (Brompton Beck @ Snainton Ings)           | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 27051 (Crimple @ Bum Bridge)                    | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 23018 (Ouse Burn @ Wolsington)                  | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 26016 (Gypsy Race @ Kirby Grindalythe)          | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                           | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 45816 (Haddeo @ Upton)                          | 6.808  | 1210 | 0.011 | 1.000 | 0.005      | 0.535     |
| 68021 (Arrowe Brook @ Acton Lane)               | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 30013 (Heighington Beck @ Heighington)          | 23.880 | 605  | 0.119 | 0.962 | 0.079      | 0.859     |
| 27081 (Oulton Beck @ Oulton Farrer Lane)        | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge) | 16.080 | 1044 | 0.023 | 0.991 | 0.006      | 0.562     |
| 28033 (Dove @ Hollinslough)                     | 7.915  | 1346 | 0.007 | 1.000 | 0.000      | 0.347     |
| 27010 (Hodge Beck @ Bransdale Weir)             | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)           | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |

### Pooling Group Rejected Stations

| Station | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments |
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|
|---------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|----------|

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.275 | Urban L-CV:       | 0.239 |
| Rural L-Skewness: | 0.264 | Urban L-Skewness: | 0.309 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.276 | -0.264 |        | -0.045 |
| GEV          | 0.853    | 0.390 | -0.142 |        | -1.894 |
| KAP3         | 0.925    | 0.326 | -0.210 | -0.400 | -0.632 |

### Goodness of fit

|       |           |
|-------|-----------|
| GL:   | 0.5051 *  |
| GEV:  | -0.8877 * |
| P3:   | -3.0060   |
| GP:   | -4.4207   |
| KAP3: | 0.0459 *  |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 2.4310

The pooling group is heterogeneous and a review of the pooling group is desirable.

### Standardised growth curves

#### Rural

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.463 | 1.505 | 1.480 |
| 10            | 1.824 | 1.888 | 1.853 |
| 20            | 2.232 | 2.294 | 2.264 |
| 25            | 2.377 | 2.432 | 2.407 |
| 30            | 2.501 | 2.548 | 2.529 |
| 50            | 2.880 | 2.887 | 2.893 |
| 75            | 3.217 | 3.173 | 3.210 |
| 100           | 3.478 | 3.385 | 3.451 |
| 200           | 4.193 | 3.933 | 4.093 |
| 500           | 5.359 | 4.744 | 5.097 |
| 1000          | 6.448 | 5.431 | 5.994 |

#### Urban

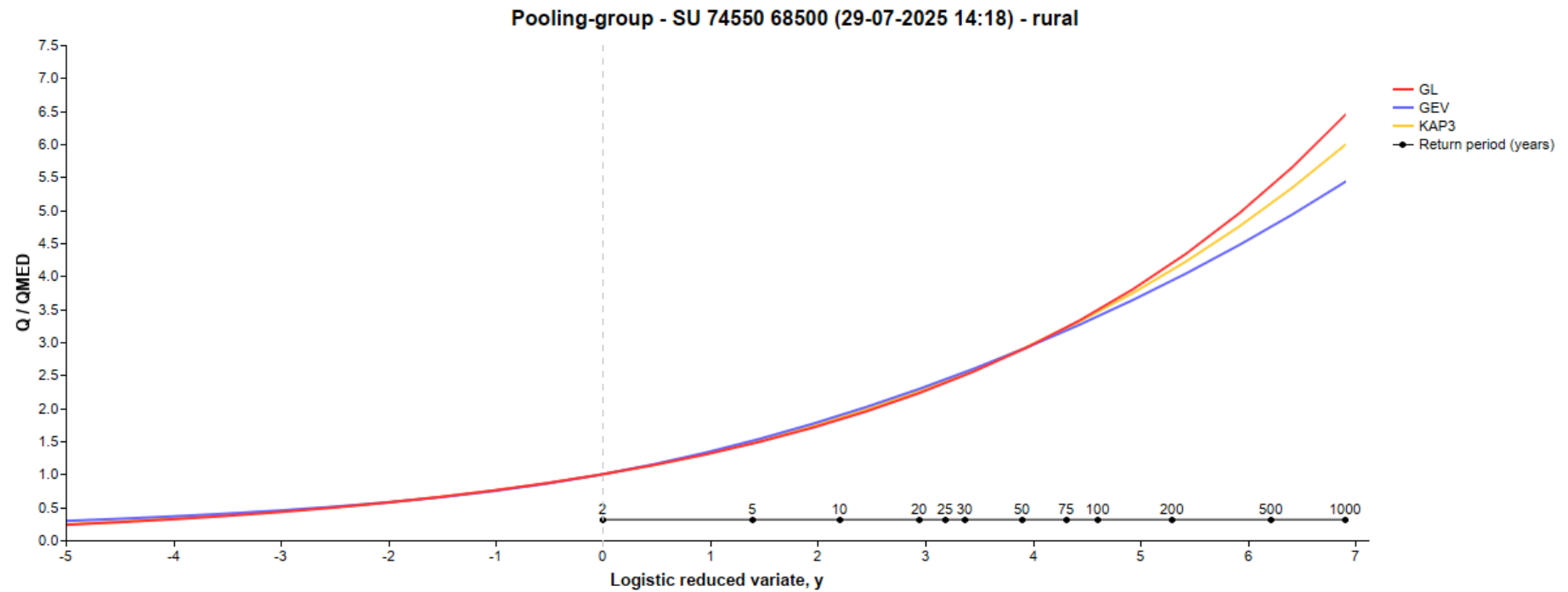
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.397 | 1.430 | 1.410 |
| 10            | 1.722 | 1.774 | 1.745 |
| 20            | 2.102 | 2.159 | 2.130 |
| 25            | 2.240 | 2.293 | 2.268 |
| 30            | 2.360 | 2.407 | 2.386 |
| 50            | 2.729 | 2.749 | 2.746 |
| 75            | 3.065 | 3.045 | 3.067 |
| 100           | 3.329 | 3.271 | 3.316 |
| 200           | 4.069 | 3.871 | 3.998 |
| 500           | 5.320 | 4.806 | 5.110 |
| 1000          | 6.531 | 5.640 | 6.148 |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.230 | -0.309 |        | 0.257  |
| GEV          | 0.881    | 0.312 | -0.205 |        | -0.640 |
| KAP3         | 0.938    | 0.266 | -0.263 | -0.400 | -0.073 |

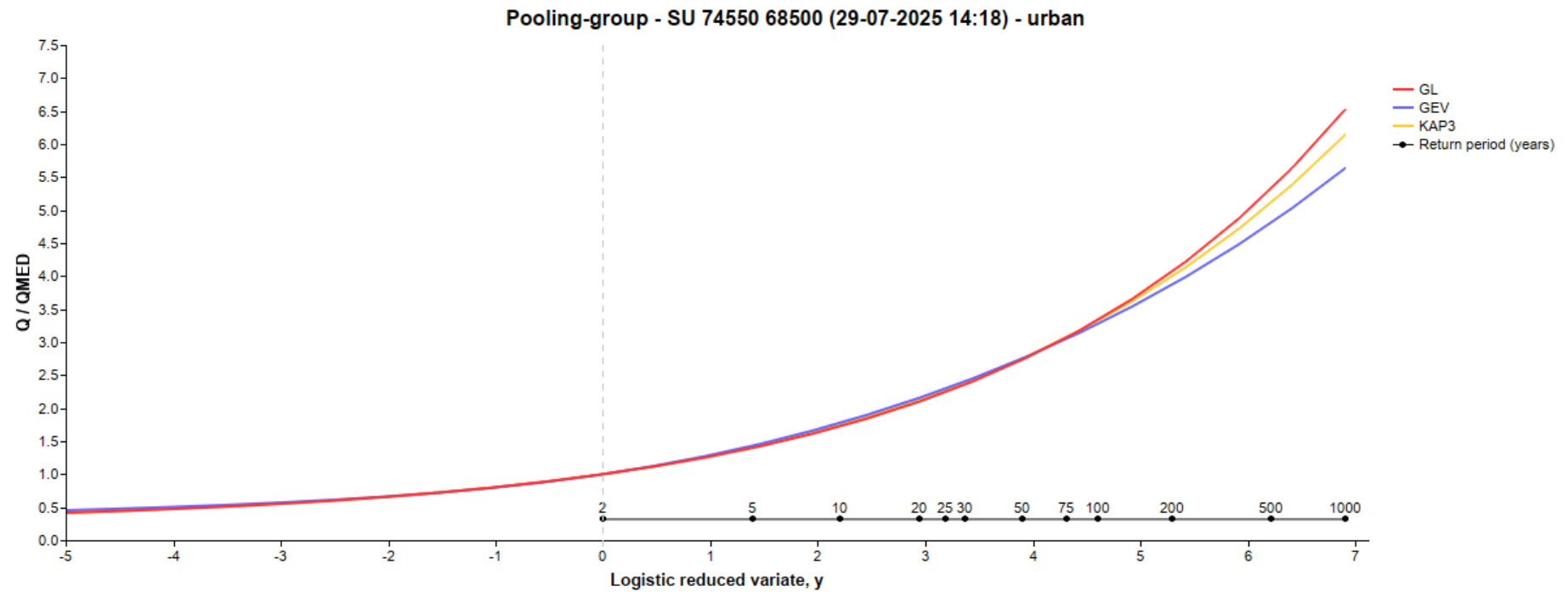
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
URBEXT2000: <0.240  
Donor adjusted FSE: 1.401  
No. of donors: 1

#### Donor stations

| Station                    | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|----------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39052 (The Cut @ Binfield) | 14.98    | Yes                      | 7.543    | 6.110            | 9.547          | 7.733          |

#### Donor suitability

| Station                    | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|----------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39052 (The Cut @ Binfield) | Yes                  | No                      | 66    | 2               | 3.03                       | 1.22               | None                 |          |

#### Donor catchment descriptors

| Station                                                           | Area   | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------------------------|--------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474550_168500_v5_0_1 @ SU 74550 68500) | 0.630  | 473809     | 168553     | 638  | 0.194 | 1.000 | 0.240      | 0.488     |
| 39052 (The Cut @ Binfield)                                        | 49.998 | 488740     | 169768     | 676  | 0.127 | 0.939 | 0.237      | 0.366     |

#### Unused Donor stations

| Station                                  | Distance | URBEXT | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural | Centroid X | Centroid Y | Area     | SAAR | BFIHOST19 | FARL  | Years of data | QMED suitability | Pooling suitability |
|------------------------------------------|----------|--------|--------------------------|----------|------------------|----------------|----------------|------------|------------|----------|------|-----------|-------|---------------|------------------|---------------------|
| 39007 (Blackwater @ Swallowfield)        | 15.05    | 0.132  | Yes                      | 22.300   | 17.972           | 17.807         | 14.351         | 479802     | 154750     | 359.810  | 708  | 0.674     | 0.886 | 70            | Yes              | Yes                 |
| 39022 (Loddon @ Sheepbridge)             | 16.31    | 0.087  | Yes                      | 16.350   | 14.203           | 13.034         | 11.322         | 464845     | 154923     | 176.773  | 735  | 0.664     | 0.947 | 58            | Yes              | Yes                 |
| 39027 (Pang @ Pangbourne)                | 21.77    | 0.012  | Yes                      | 2.140    | 2.081            | 6.817          | 6.817          | 453633     | 176722     | 175.683  | 694  | 0.782     | 0.996 | 55            | Yes              | No                  |
| 39001 (Thames @ Kingston)                | 22.17    | 0.066  | Yes                      | 316.110  | 282.569          | 324.496        | 290.065        | 462899     | 187850     | 9930.798 | 706  | 0.679     | 0.942 | 140           | Yes              | Yes                 |
| 39025 (Enborne @ Brimpton)               | 26.23    | 0.020  | Yes                      | 16.700   | 16.271           | 18.310         | 18.310         | 448695     | 160991     | 142.010  | 789  | 0.563     | 0.978 | 56            | Yes              | Yes                 |
| 39023 (Wye @ Bourne End Hedsor)          | 28.75    | 0.113  | Yes                      | 2.730    | 1.992            | 6.665          | 4.864          | 483929     | 195468     | 134.183  | 755  | 0.839     | 0.984 | 59            | Yes              | Yes                 |
| 39033 (Winterbourne Stream @ Bagnor)     | 29.81    | 0.001  | Yes                      | 0.399    | 0.398            | 2.053          | 2.053          | 445079     | 176491     | 45.312   | 717  | 0.812     | 1.000 | 61            | Yes              | Yes                 |
| 42009 (Candover Stream @ Borough Bridge) | 30.14    | 0.011  | Yes                      | 1.065    | 1.011            | 1.806          | 1.806          | 460964     | 141288     | 72.062   | 819  | 0.924     | 0.930 | 52            | Yes              | Yes                 |
| 39011 (Wey @ Tilford)                    | 31.22    | 0.053  | Yes                      | 25.800   | 22.877           | 22.987         | 20.383         | 477280     | 137531     | 391.325  | 855  | 0.773     | 0.957 | 69            | Yes              | No                  |

#### QMED

Rural: 0.132 m³/s  
Urban: 0.171 m³/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

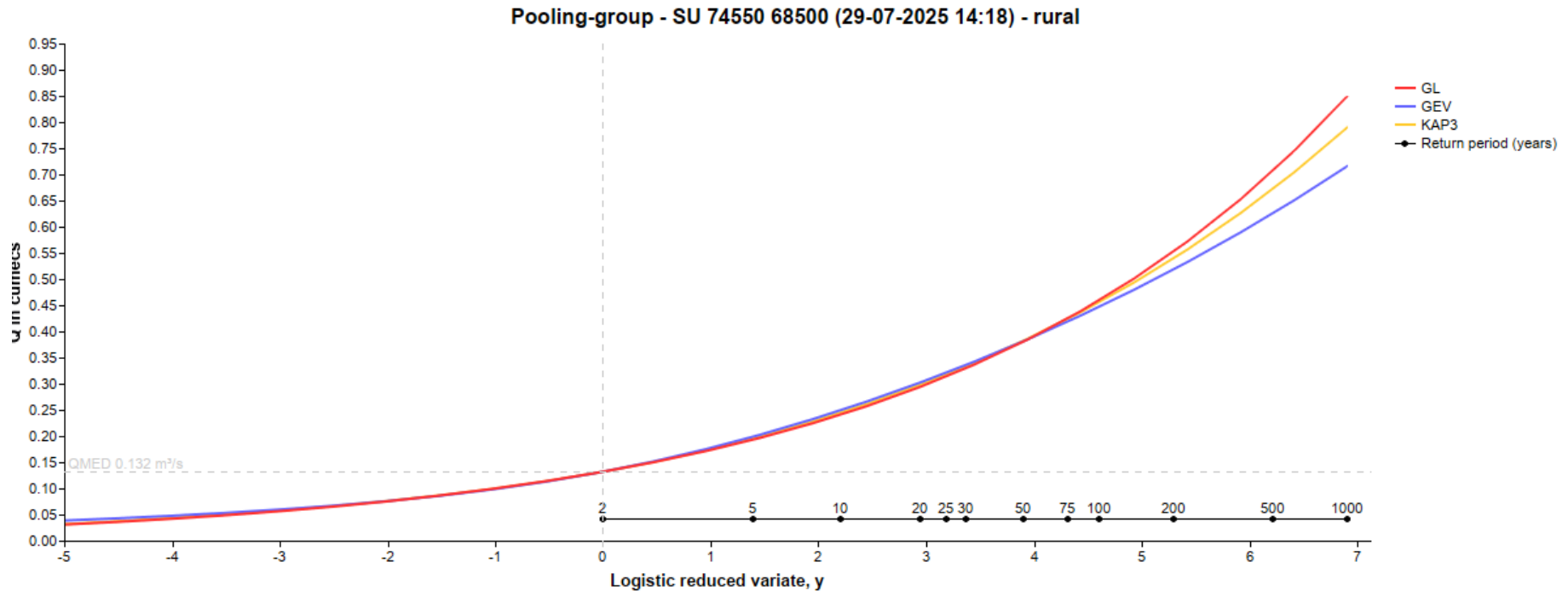
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.132     | 0.132      | 0.132       |
| 5             | 0.193     | 0.198      | 0.195       |
| 10            | 0.240     | 0.249      | 0.244       |
| 20            | 0.294     | 0.302      | 0.298       |
| 25            | 0.313     | 0.321      | 0.317       |
| 30            | 0.330     | 0.336      | 0.333       |
| 50            | 0.380     | 0.381      | 0.381       |
| 75            | 0.424     | 0.418      | 0.423       |
| 100           | 0.459     | 0.446      | 0.455       |
| 200           | 0.553     | 0.519      | 0.540       |
| 500           | 0.707     | 0.625      | 0.672       |
| 1000          | 0.850     | 0.716      | 0.790       |

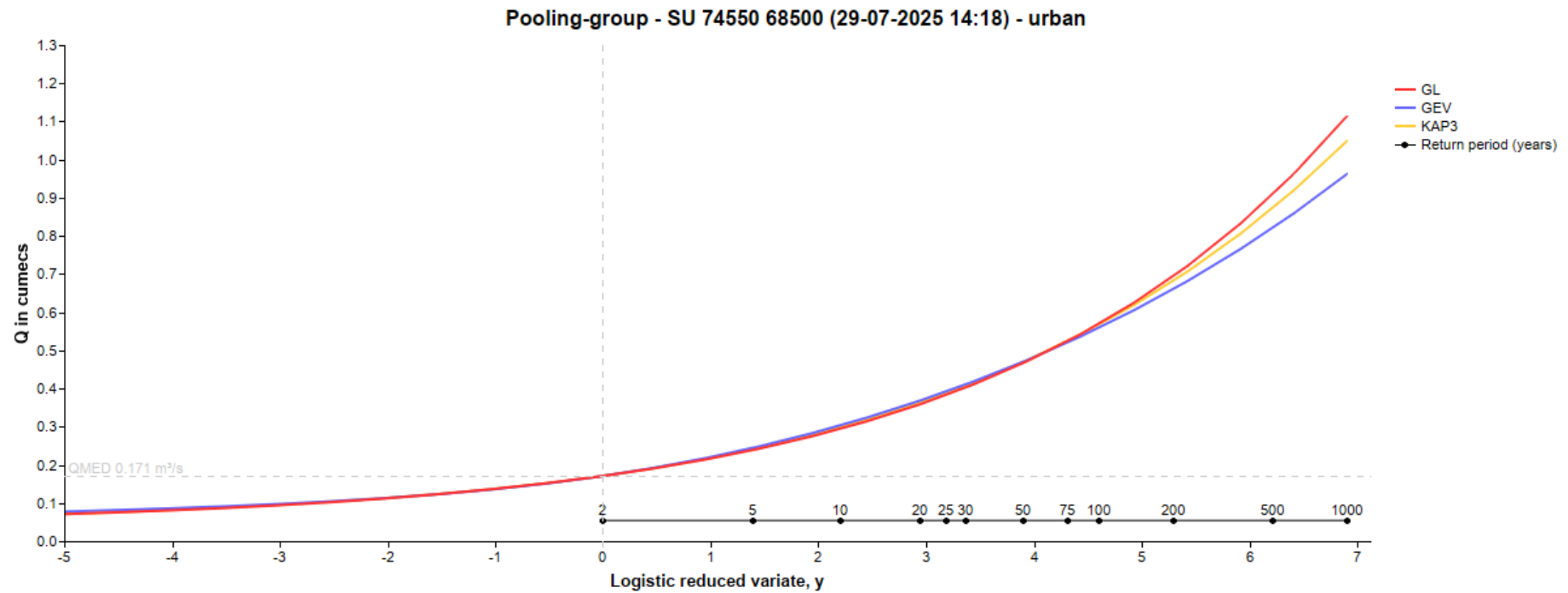
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.171     | 0.171      | 0.171       |
| 5             | 0.239     | 0.244      | 0.241       |
| 10            | 0.294     | 0.303      | 0.298       |
| 20            | 0.359     | 0.369      | 0.364       |
| 25            | 0.383     | 0.392      | 0.387       |
| 30            | 0.403     | 0.411      | 0.407       |
| 50            | 0.466     | 0.469      | 0.469       |
| 75            | 0.524     | 0.520      | 0.524       |
| 100           | 0.569     | 0.559      | 0.566       |
| 200           | 0.695     | 0.661      | 0.683       |
| 500           | 0.909     | 0.821      | 0.873       |
| 1000          | 1.116     | 0.963      | 1.050       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



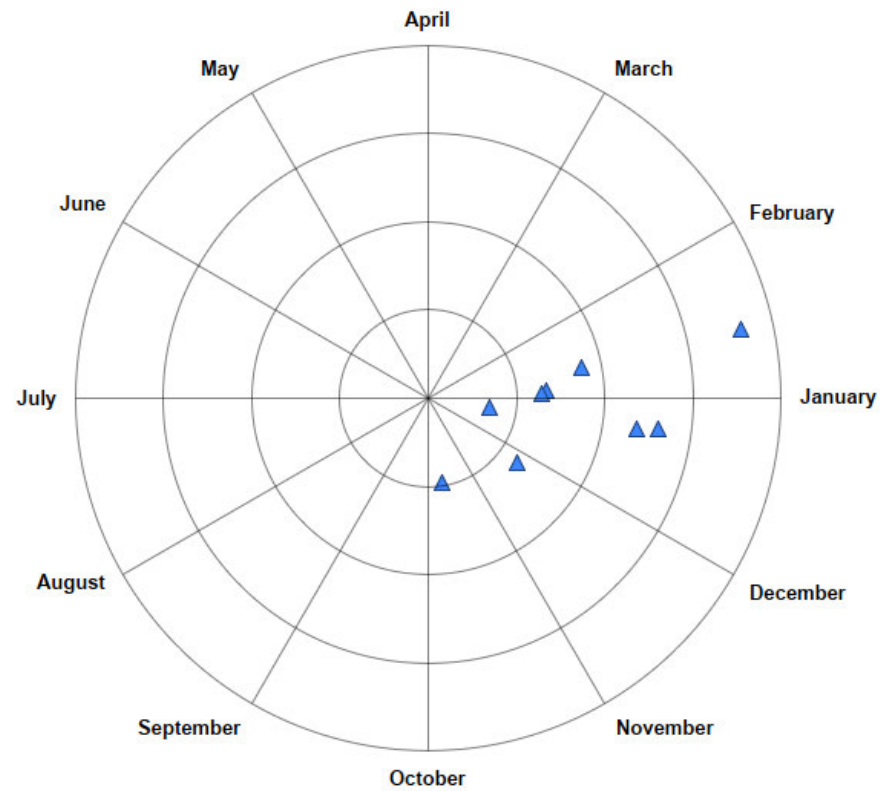
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

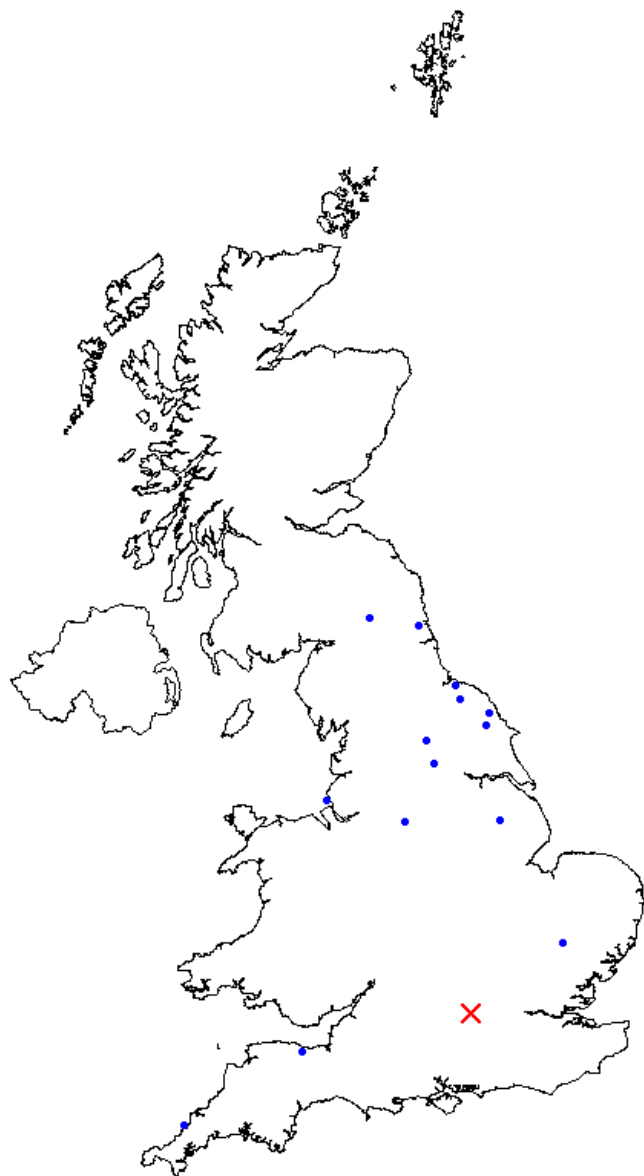
#### Station record parameters

Flood seasonality: SU 74550 68500 (29-07-2025 14:18) - rural



# UK Design Flood Estimation

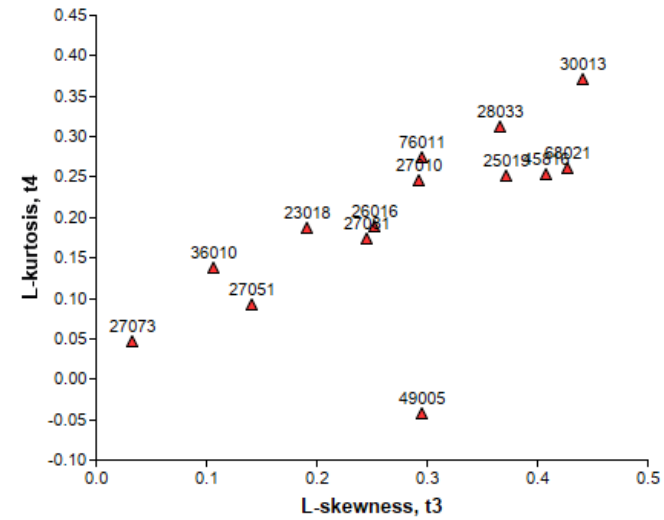
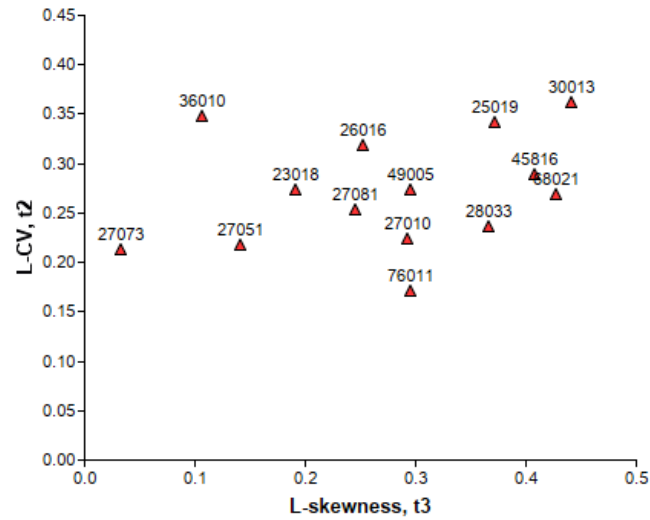
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

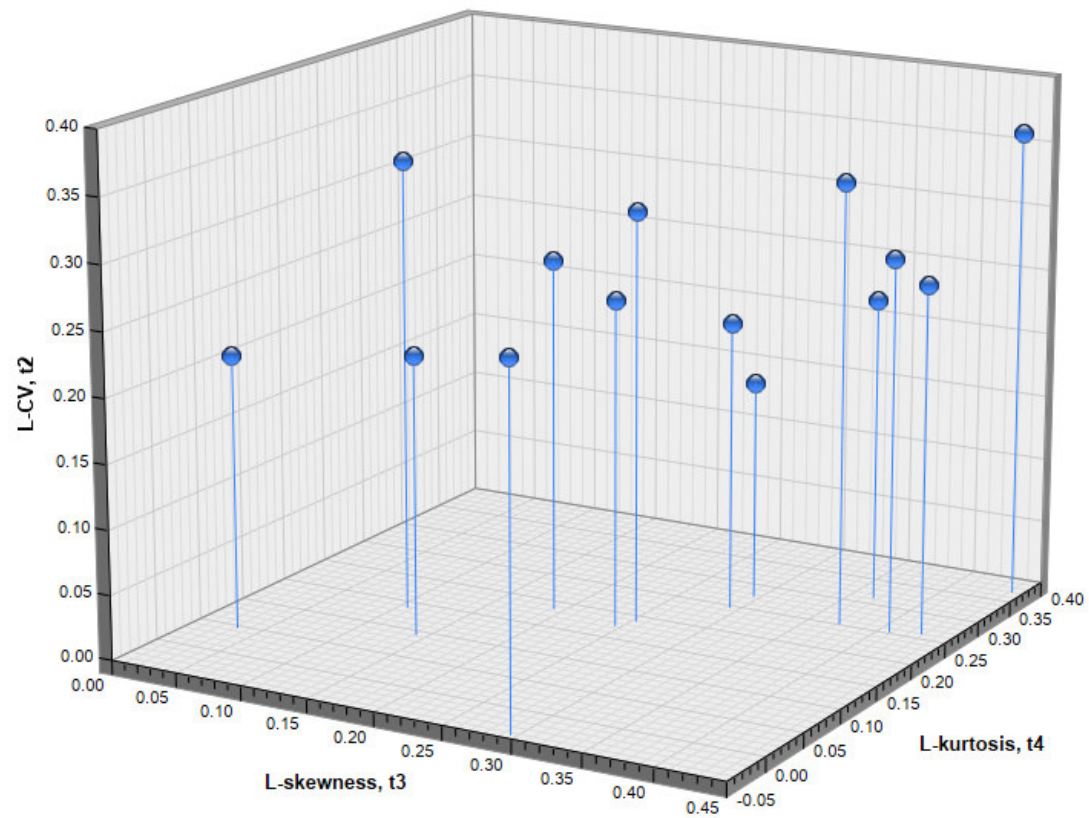
L-moment ratios - SU 74550 68500 (29-07-2025 14:18) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

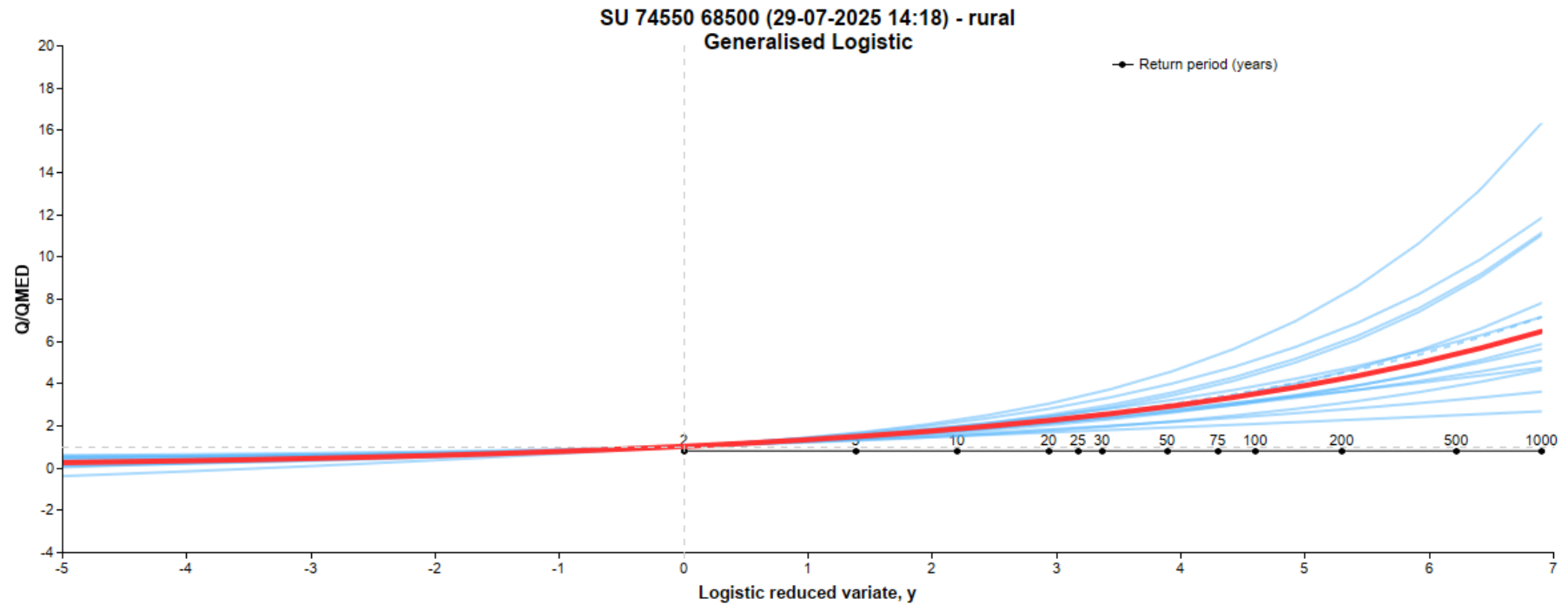
L-moment ratios - SU 74550 68500 (29-07-2025 14:18) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

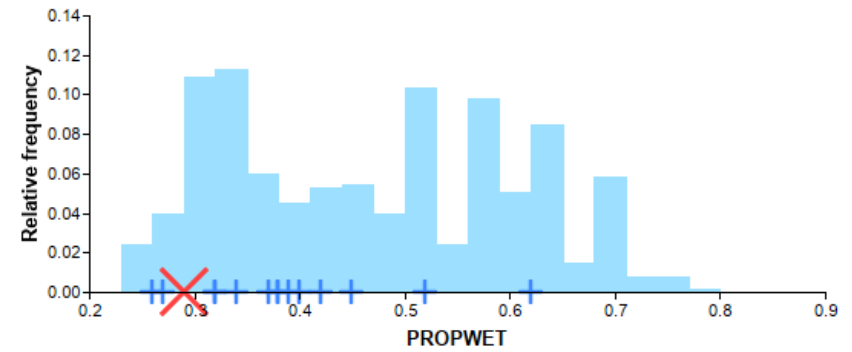
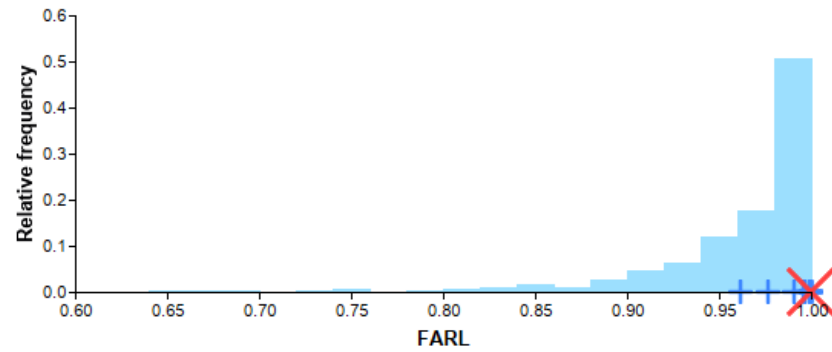
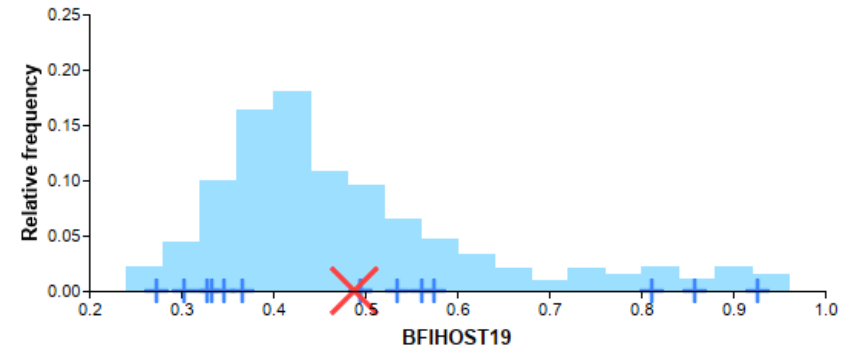
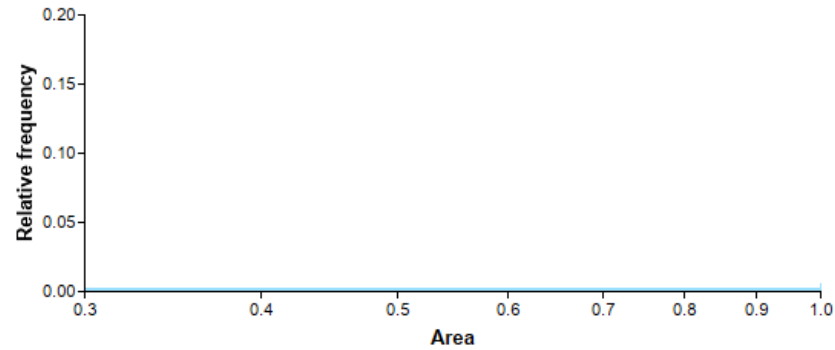
Pooling group growth curves



# UK Design Flood Estimation

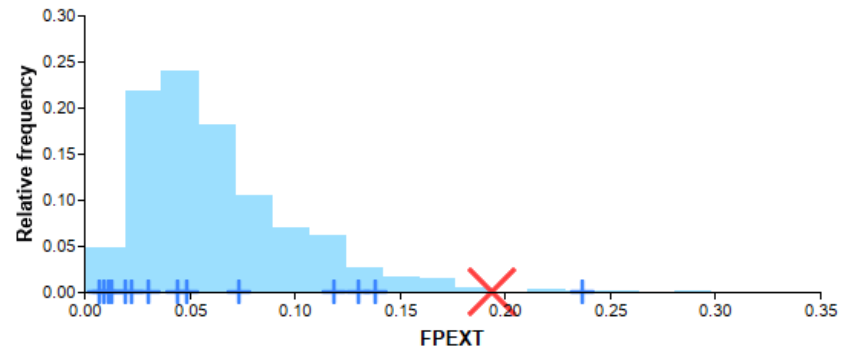
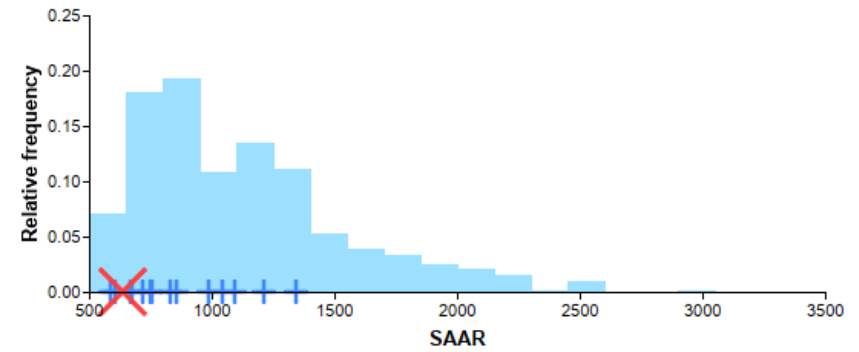
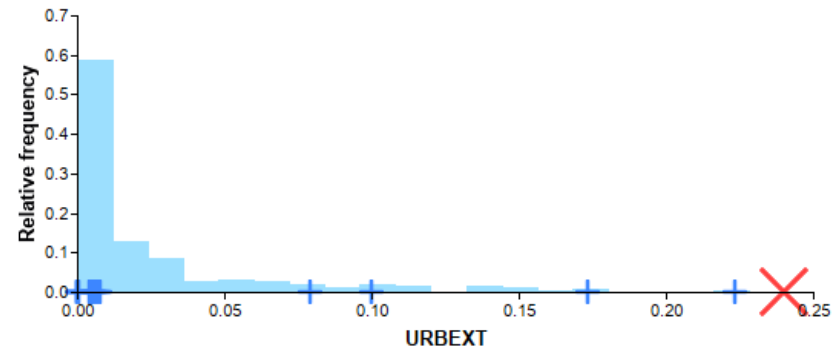
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

Date of creation: 31-07-2025 08:45:29  
Software: WINFAP Version: 5.2.9046 (26106)  
Peak Flow dataset: Peak Flow Dataset 13.0.2  
Supplementary data used: No

### Site details

Site number: 3150260764  
Site name: FBH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1  
Site location: SU 74550 68500  
Easting: 474550  
Northing: 168500  
Catchment area: 0.63 km<sup>2</sup>  
SAAR: 638 mm  
BFHOST19: 0.488  
FPEXT: 0.194  
FARL: 1.000  
URBEXT2000: 0.2400

### Site data

#### At-site data

At-site data present: No

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Analysis settings

#### Urbanisation settings

User defined: No  
Urban area: 0.24 km<sup>2</sup>  
PRimp: 70.00%  
Impervious Factor: 0.300  
UAF: 1.29562

#### Growth curve settings

Distance Measure Method: Small catchment  
Pooling group URBEXT2000 Threshold: 0.240  
Deurbanise Pooling Group L-moments: Yes

#### QMED settings

Use at-site data: No  
Method: Donor Station(s)

### Growth curve data and results

#### Pooling group AM data

| Station                                  | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised |
|------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|
| 27073 (Brompton Beck @ Snainton Ings)    | 2.047    | 43            | 0.812   | 0.212         | 0.213            | 0.033           | 0.032              |
| 27051 (Crimple @ Bum Bridge)             | 2.194    | 51            | 4.564   | 0.217         | 0.217            | 0.142           | 0.141              |
| 23018 (Ouse Burn @ Woolsington)          | 2.202    | 32            | 3.287   | 0.273         | 0.290            | 0.192           | 0.175              |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 2.598    | 26            | 0.100   | 0.318         | 0.318            | 0.253           | 0.253              |
| 25019 (Leven @ Easby)                    | 2.623    | 45            | 5.090   | 0.341         | 0.342            | 0.373           | 0.372              |
| 68021 (Arrowe Brook @ Acton Lane)        | 2.687    | 17            | 3.976   | 0.269         | 0.298            | 0.428           | 0.393              |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 2.920    | 37            | 2.470   | 0.253         | 0.289            | 0.246           | 0.207              |
| 27010 (Hodge Beck @ Bransdale Weir)      | 2.964    | 41            | 9.420   | 0.224         | 0.224            | 0.293           | 0.293              |
| 36010 (Bumpstead Brook @ Broad Green)    | 2.998    | 56            | 7.855   | 0.348         | 0.350            | 0.107           | 0.106              |
| 7009 (Mosset Burn @ Wardend Bridge)      | 3.081    | 25            | 7.053   | 0.365         | 0.365            | 0.329           | 0.329              |
| 26014 (Water Forlomes @ Driffeld)        | 3.137    | 25            | 0.424   | 0.318         | 0.319            | 0.205           | 0.204              |
| 36011 (Stour Brook @ Stumer)             | 3.168    | 53            | 6.780   | 0.282         | 0.300            | 0.179           | 0.162              |
| 38020 (Cobbins Brook @ Sewardstone Road) | 3.261    | 52            | 7.402   | 0.325         | 0.335            | 0.331           | 0.321              |
| <b>Total</b>                             |          | <b>503</b>    |         |               |                  |                 |                    |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling group suitability

| Station                                  | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MK) | MK significance (%) | Discordancy | Comments |
|------------------------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|-------------------|---------------------|-------------|----------|
| 27073 (Brompton Beck @ Snainton Ings)    | Yes                  | Yes                     | 43    | 2               | 4.65                       | 0.92              | None                | 1.575       |          |
| 27051 (Crimple @ Bum Bridge)             | Yes                  | Yes                     | 51    | 3               | 5.88                       | 1.34              | None                | 0.917       |          |
| 23018 (Ouse Burn @ Woolsington)          | Yes                  | Yes                     | 32    | 4               | 12.50                      | 0.70              | None                | 0.143       |          |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | Yes                  | Yes                     | 26    | 4               | 15.38                      |                   |                     | 0.123       |          |
| 25019 (Leven @ Easby)                    | Yes                  | Yes                     | 45    | 3               | 6.67                       |                   |                     | 0.670       |          |
| 68021 (Arrove Brook @ Acton Lane)        | Yes                  | Yes                     | 17    | 0               | 0.00                       |                   |                     | 1.535       |          |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | Yes                  | Yes                     | 37    | 1               | 2.70                       | 2.16              | 5                   | 0.236       |          |
| 27010 (Hodge Beck @ Bransdale Weir)      | Yes                  | Yes                     | 41    | 1               | 2.44                       | -2.10             | 5                   | 1.003       |          |
| 36010 (Bumpstead Brook @ Broad Green)    | Yes                  | Yes                     | 56    | 12              | 21.43                      | 0.10              | None                | 1.617       |          |
| 7009 (Mosset Burn @ Wardend Bridge)      | Yes                  | Yes                     | 25    | 3               | 12.00                      |                   |                     | 1.303       |          |
| 26014 (Water Forlomes @ Driffield)       | Yes                  | Yes                     | 25    | 3               | 12.00                      |                   |                     | 1.109       |          |
| 36011 (Stour Brook @ Sturmer)            | Yes                  | Yes                     | 53    | 8               | 15.09                      | 0.39              | None                | 1.227       |          |
| 38020 (Cobbins Brook @ Sewardstone Road) | Yes                  | Yes                     | 52    | 8               | 15.38                      | -1.25             | None                | 1.543       |          |

### Pooling group catchment descriptors

| Station                                  | Area   | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|------------------------------------------|--------|------|-------|-------|------------|-----------|
| 27073 (Brompton Beck @ Snainton Ings)    | 8.060  | 721  | 0.237 | 1.000 | 0.008      | 0.811     |
| 27051 (Crimple @ Bum Bridge)             | 8.172  | 855  | 0.013 | 1.000 | 0.006      | 0.329     |
| 23018 (Ouse Burn @ Woolsington)          | 10.137 | 670  | 0.131 | 0.977 | 0.100      | 0.333     |
| 26016 (Gypsy Race @ Kirby Grindalythe)   | 15.850 | 757  | 0.030 | 1.000 | 0.000      | 0.927     |
| 25019 (Leven @ Easby)                    | 15.088 | 830  | 0.019 | 1.000 | 0.004      | 0.495     |
| 68021 (Arrove Brook @ Acton Lane)        | 17.872 | 750  | 0.139 | 0.996 | 0.173      | 0.495     |
| 27081 (Oulton Beck @ Oulton Farrer Lane) | 25.102 | 677  | 0.049 | 0.997 | 0.224      | 0.575     |
| 27010 (Hodge Beck @ Bransdale Weir)      | 18.820 | 987  | 0.009 | 1.000 | 0.001      | 0.303     |
| 36010 (Bumpstead Brook @ Broad Green)    | 27.547 | 588  | 0.045 | 0.999 | 0.007      | 0.367     |
| 7009 (Mosset Burn @ Wardend Bridge)      | 28.295 | 803  | 0.060 | 0.998 | 0.000      | 0.606     |
| 26014 (Water Forlomes @ Driffield)       | 32.415 | 721  | 0.016 | 1.000 | 0.007      | 0.924     |
| 36011 (Stour Brook @ Sturmer)            | 34.242 | 592  | 0.060 | 0.999 | 0.100      | 0.363     |
| 38020 (Cobbins Brook @ Sewardstone Road) | 38.785 | 616  | 0.058 | 0.997 | 0.051      | 0.245     |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Pooling Group Rejected Stations

| Station                                              | Distance | Years of data | QMED AM | L-CV Observed | L-CV Deurbanised | L-SKEW Observed | L-SKEW Deurbanised | Comments   |
|------------------------------------------------------|----------|---------------|---------|---------------|------------------|-----------------|--------------------|------------|
| 76011 (Coal Bum @ Coalburn)                          | 1.723    | 46            | 1.826   | 0.170         | 0.170            | 0.296           | 0.296              | High SAAR  |
| 45816 (Haddeo @ Upton)                               | 2.628    | 30            | 3.352   | 0.288         | 0.289            | 0.408           | 0.407              | High SAAR  |
| 30013 (Heighington Beck @ Heighington)               | 2.880    | 47            | 0.643   | 0.361         | 0.378            | 0.442           | 0.426              | Low FARL   |
| 49005 (Bolingey Stream @ Bolingey Cocks Bridge)      | 2.926    | 13            | 4.072   | 0.274         | 0.275            | 0.295           | 0.294              | Discordant |
| 28033 (Dove @ Hollinslough)                          | 2.930    | 48            | 4.138   | 0.235         | 0.235            | 0.367           | 0.367              | High SAAR  |
| 44008 (South Winterbourne @ Winterbourne Steepleton) | 3.045    | 32            | 0.572   | 0.405         | 0.406            | 0.254           | 0.254              | High SAAR  |
| 39086 (Gatwick Stream @ Gatwick Link)                | 3.212    | 48            | 9.909   | 0.148         | 0.164            | -0.010          | -0.035             | Low FARL   |

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Growth curve L-moments

|                   |       |                   |       |
|-------------------|-------|-------------------|-------|
| Rural L-CV:       | 0.295 | Urban L-CV:       | 0.256 |
| Rural L-Skewness: | 0.224 | Urban L-Skewness: | 0.267 |

### Rural fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.303 | -0.224 |        | -0.350 |
| GEV          | 0.835    | 0.442 | -0.083 |        | -4.486 |
| KAP3         | 0.917    | 0.364 | -0.161 | -0.400 | -1.350 |

### Goodness of fit

|       |           |
|-------|-----------|
| GL:   | 0.6759 *  |
| GEV:  | -0.9827 * |
| P3:   | -2.5911   |
| GP:   | -4.9096   |
| KAP3: | 0.0973 *  |

\* Distribution gives an acceptable fit (absolute Z value < 1.645)

### Heterogeneity

Standardised test value H2: 1.5712

The pooling group is possibly heterogeneous and a review of the pooling group is optional.

### Standardised growth curves

#### Rural

| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.493 | 1.542 | 1.514 |
| 10            | 1.861 | 1.930 | 1.893 |
| 20            | 2.265 | 2.326 | 2.297 |
| 25            | 2.405 | 2.456 | 2.435 |
| 30            | 2.525 | 2.564 | 2.551 |
| 50            | 2.884 | 2.874 | 2.891 |
| 75            | 3.198 | 3.128 | 3.180 |
| 100           | 3.437 | 3.314 | 3.396 |
| 200           | 4.080 | 3.778 | 3.958 |
| 500           | 5.095 | 4.433 | 4.803 |
| 1000          | 6.013 | 4.962 | 5.529 |

#### Urban

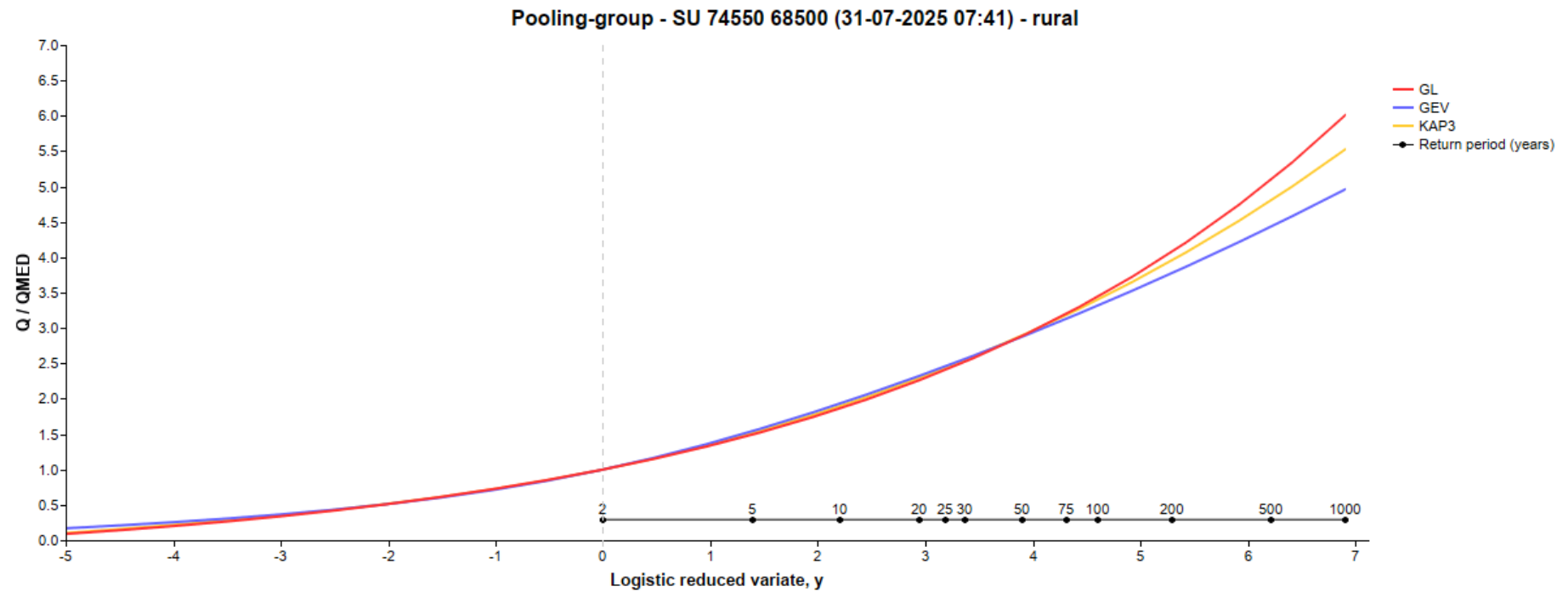
| Return period | GL    | GEV   | KAP3  |
|---------------|-------|-------|-------|
| 2             | 1.000 | 1.000 | 1.000 |
| 5             | 1.427 | 1.466 | 1.443 |
| 10            | 1.761 | 1.819 | 1.787 |
| 20            | 2.140 | 2.197 | 2.169 |
| 25            | 2.274 | 2.325 | 2.302 |
| 30            | 2.390 | 2.433 | 2.415 |
| 50            | 2.742 | 2.748 | 2.755 |
| 75            | 3.056 | 3.015 | 3.050 |
| 100           | 3.300 | 3.214 | 3.275 |
| 200           | 3.967 | 3.728 | 3.876 |
| 500           | 5.059 | 4.491 | 4.817 |
| 1000          | 6.082 | 5.139 | 5.661 |

### Urban fitted parameters

| Distribution | Location | Scale | Shape  | H      | Bound  |
|--------------|----------|-------|--------|--------|--------|
| GL           | 1.000    | 0.254 | -0.267 |        | 0.049  |
| GEV          | 0.865    | 0.358 | -0.146 |        | -1.583 |
| KAP3         | 0.931    | 0.300 | -0.213 | -0.400 | -0.476 |

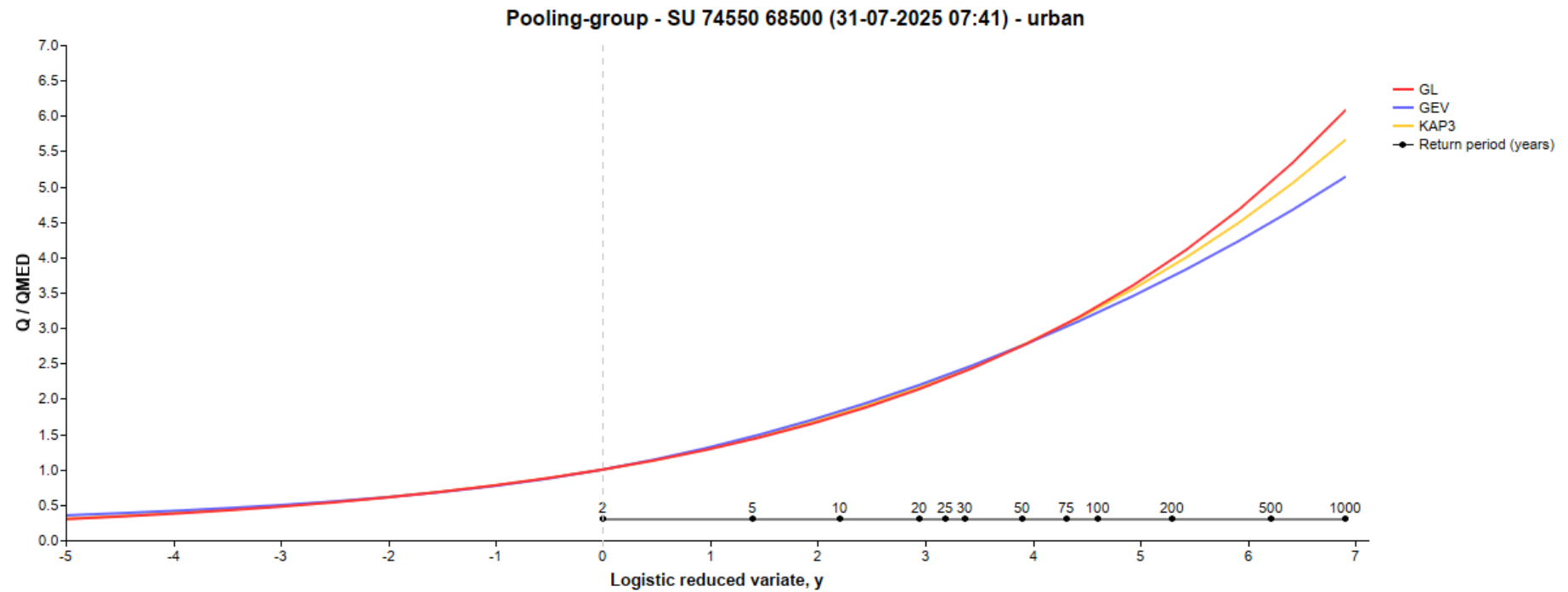
# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### QMED data and results

#### Donor selection criteria

Only sites suitable for QMED: Yes  
URBEXT2000: <0.240  
Donor adjusted FSE: 1.401  
No. of donors: 1

#### Donor stations

| Station                    | Distance | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural |
|----------------------------|----------|--------------------------|----------|------------------|----------------|----------------|
| 39052 (The Cut @ Binfield) | 14.98    | Yes                      | 7.543    | 6.110            | 9.547          | 7.733          |

#### Donor suitability

| Station                    | Suitability for QMED | Suitability for pooling | Years | Non-flood years | Percentage non-flood years | Mann Kendall (MKZ) | MKZ significance (%) | Comments |
|----------------------------|----------------------|-------------------------|-------|-----------------|----------------------------|--------------------|----------------------|----------|
| 39052 (The Cut @ Binfield) | Yes                  | No                      | 66    | 2               | 3.03                       | 1.22               | None                 |          |

#### Donor catchment descriptors

| Station                                                           | Area   | Centroid X | Centroid Y | SAAR | FPEXT | FARL  | URBEXT2000 | BFIHOST19 |
|-------------------------------------------------------------------|--------|------------|------------|------|-------|-------|------------|-----------|
| *FEH_Catchment_Descriptors_474550_168500_v5_0_1 @ SU 74550 68500) | 0.630  | 473809     | 168553     | 638  | 0.194 | 1.000 | 0.240      | 0.488     |
| 39052 (The Cut @ Binfield)                                        | 49.998 | 488740     | 169768     | 676  | 0.127 | 0.939 | 0.237      | 0.366     |

#### Unused Donor stations

| Station                                  | Distance | URBEXT | Use QMED obs deurbanised | QMED obs | QMED deurbanised | QMED CDs urban | QMED CDs rural | Centroid X | Centroid Y | Area     | SAAR | BFIHOST19 | FARL  | Years of data | QMED suitability | Pooling suitability |
|------------------------------------------|----------|--------|--------------------------|----------|------------------|----------------|----------------|------------|------------|----------|------|-----------|-------|---------------|------------------|---------------------|
| 39007 (Blackwater @ Swallowfield)        | 15.05    | 0.132  | Yes                      | 22.300   | 17.972           | 17.807         | 14.351         | 479802     | 154750     | 359.810  | 708  | 0.674     | 0.886 | 70            | Yes              | Yes                 |
| 39022 (Loddon @ Sheepbridge)             | 16.31    | 0.087  | Yes                      | 16.350   | 14.203           | 13.034         | 11.322         | 464845     | 154923     | 176.773  | 735  | 0.664     | 0.947 | 58            | Yes              | Yes                 |
| 39027 (Pang @ Pangbourne)                | 21.77    | 0.012  | Yes                      | 2.140    | 2.081            | 6.817          | 6.817          | 453633     | 176722     | 175.683  | 694  | 0.782     | 0.996 | 55            | Yes              | No                  |
| 39001 (Thames @ Kingston)                | 22.17    | 0.066  | Yes                      | 316.110  | 282.569          | 324.496        | 290.065        | 462899     | 187850     | 9930.798 | 706  | 0.679     | 0.942 | 140           | Yes              | Yes                 |
| 39025 (Enborne @ Brimpton)               | 26.23    | 0.020  | Yes                      | 16.700   | 16.271           | 18.310         | 18.310         | 448695     | 160991     | 142.010  | 789  | 0.563     | 0.978 | 56            | Yes              | Yes                 |
| 39023 (Wye @ Bourne End Hedsor)          | 28.75    | 0.113  | Yes                      | 2.730    | 1.992            | 6.665          | 4.864          | 483929     | 195468     | 134.183  | 755  | 0.839     | 0.984 | 59            | Yes              | Yes                 |
| 39033 (Winterbourne Stream @ Bagnor)     | 29.81    | 0.001  | Yes                      | 0.399    | 0.398            | 2.053          | 2.053          | 445079     | 176491     | 45.312   | 717  | 0.812     | 1.000 | 61            | Yes              | Yes                 |
| 42009 (Candover Stream @ Borough Bridge) | 30.14    | 0.011  | Yes                      | 1.065    | 1.011            | 1.806          | 1.806          | 460964     | 141288     | 72.062   | 819  | 0.924     | 0.930 | 52            | Yes              | Yes                 |
| 39011 (Wey @ Tilford)                    | 31.22    | 0.053  | Yes                      | 25.800   | 22.877           | 22.987         | 20.383         | 477280     | 137531     | 391.325  | 855  | 0.773     | 0.957 | 69            | Yes              | No                  |

#### QMED

Rural: 0.132 m³/s  
Urban: 0.171 m³/s

# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

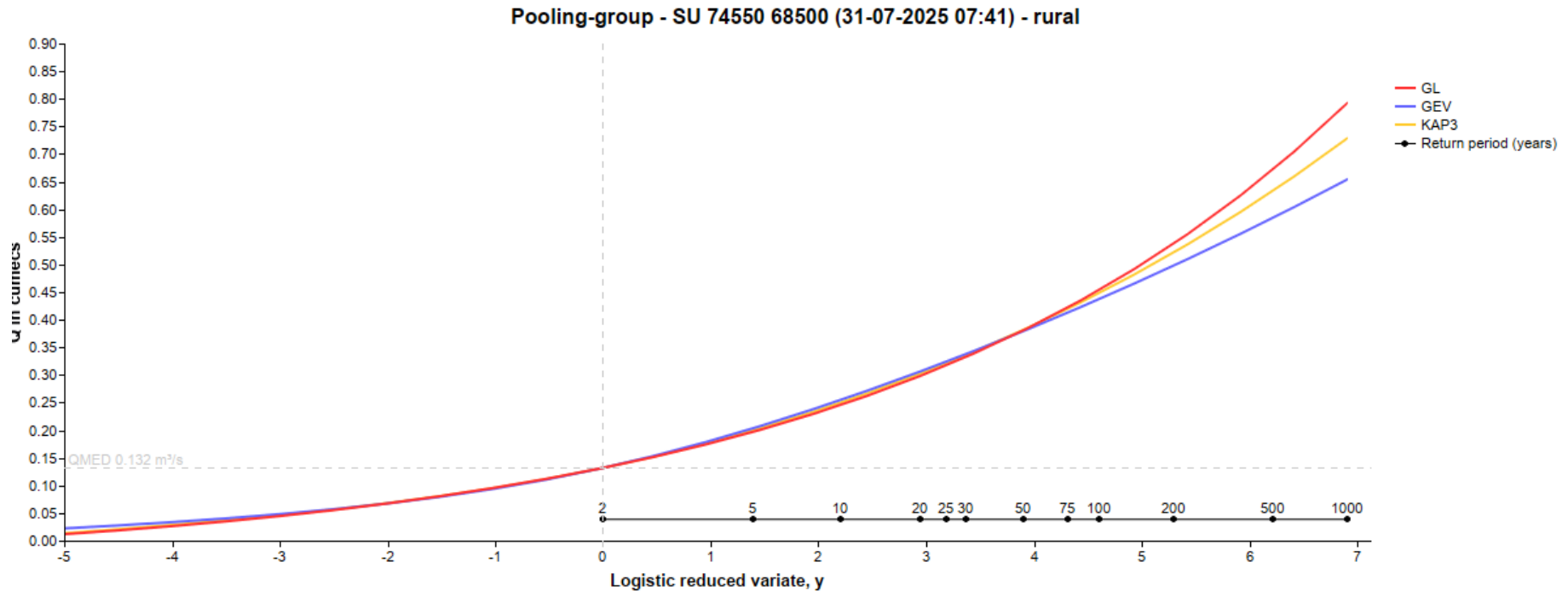
### Flood Frequency Curve

#### Rural Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.132     | 0.132      | 0.132       |
| 5             | 0.197     | 0.203      | 0.200       |
| 10            | 0.245     | 0.254      | 0.250       |
| 20            | 0.299     | 0.307      | 0.303       |
| 25            | 0.317     | 0.324      | 0.321       |
| 30            | 0.333     | 0.338      | 0.336       |
| 50            | 0.380     | 0.379      | 0.381       |
| 75            | 0.422     | 0.412      | 0.419       |
| 100           | 0.453     | 0.437      | 0.448       |
| 200           | 0.538     | 0.498      | 0.522       |
| 500           | 0.672     | 0.584      | 0.633       |
| 1000          | 0.793     | 0.654      | 0.729       |

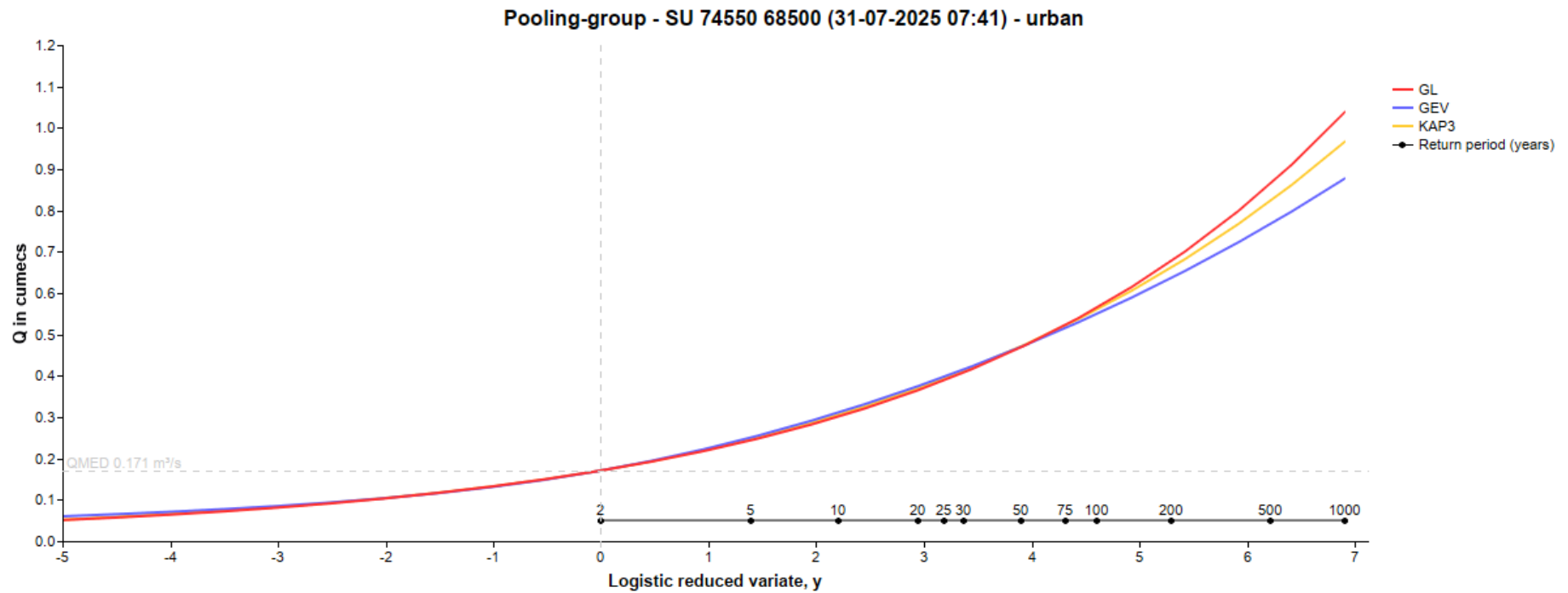
#### Urban Flood Frequency Curve

| Return period | GL (m³/s) | GEV (m³/s) | KAP3 (m³/s) |
|---------------|-----------|------------|-------------|
| 2             | 0.171     | 0.171      | 0.171       |
| 5             | 0.244     | 0.250      | 0.246       |
| 10            | 0.301     | 0.311      | 0.305       |
| 20            | 0.365     | 0.375      | 0.370       |
| 25            | 0.388     | 0.397      | 0.393       |
| 30            | 0.408     | 0.416      | 0.413       |
| 50            | 0.468     | 0.469      | 0.471       |
| 75            | 0.522     | 0.515      | 0.521       |
| 100           | 0.564     | 0.549      | 0.559       |
| 200           | 0.678     | 0.637      | 0.662       |
| 500           | 0.864     | 0.767      | 0.823       |
| 1000          | 1.039     | 0.878      | 0.967       |



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



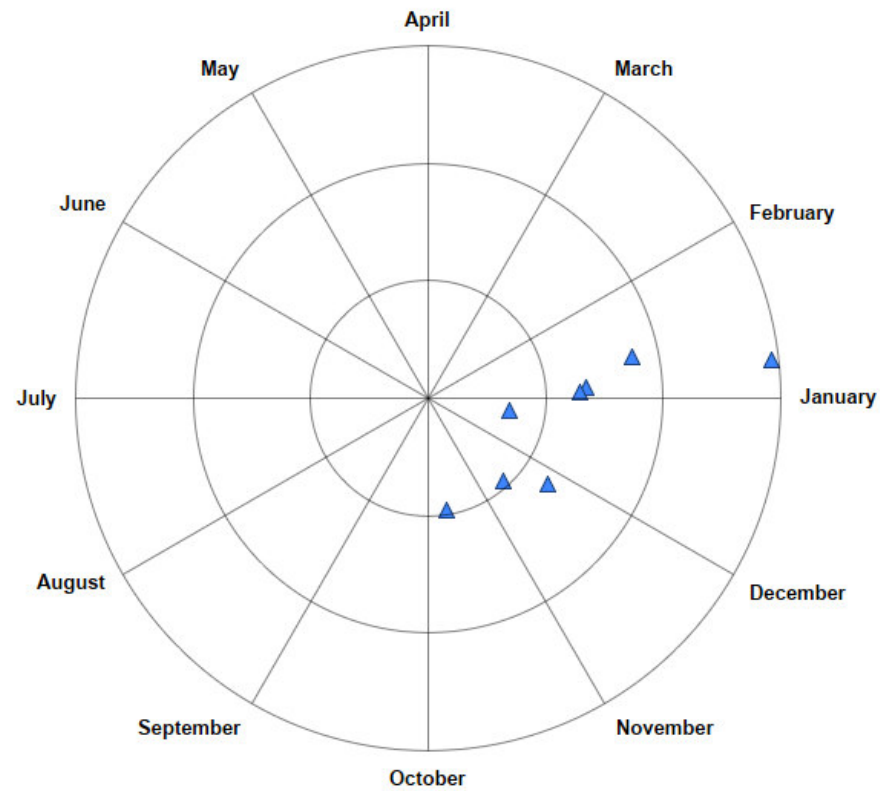
# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Appendix

#### Station record parameters

Flood seasonality: SU 74550 68500 (31-07-2025 07:41) - rural



# UK Design Flood Estimation

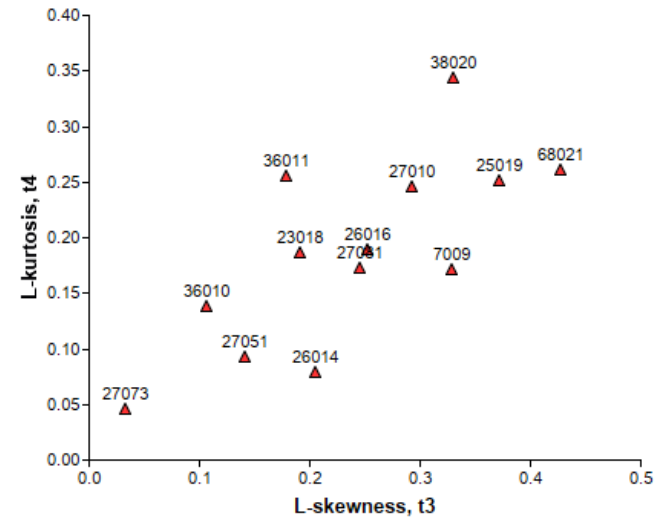
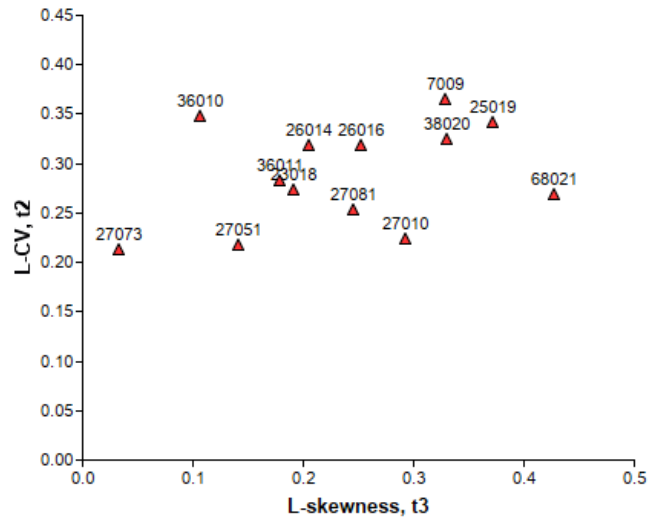
Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

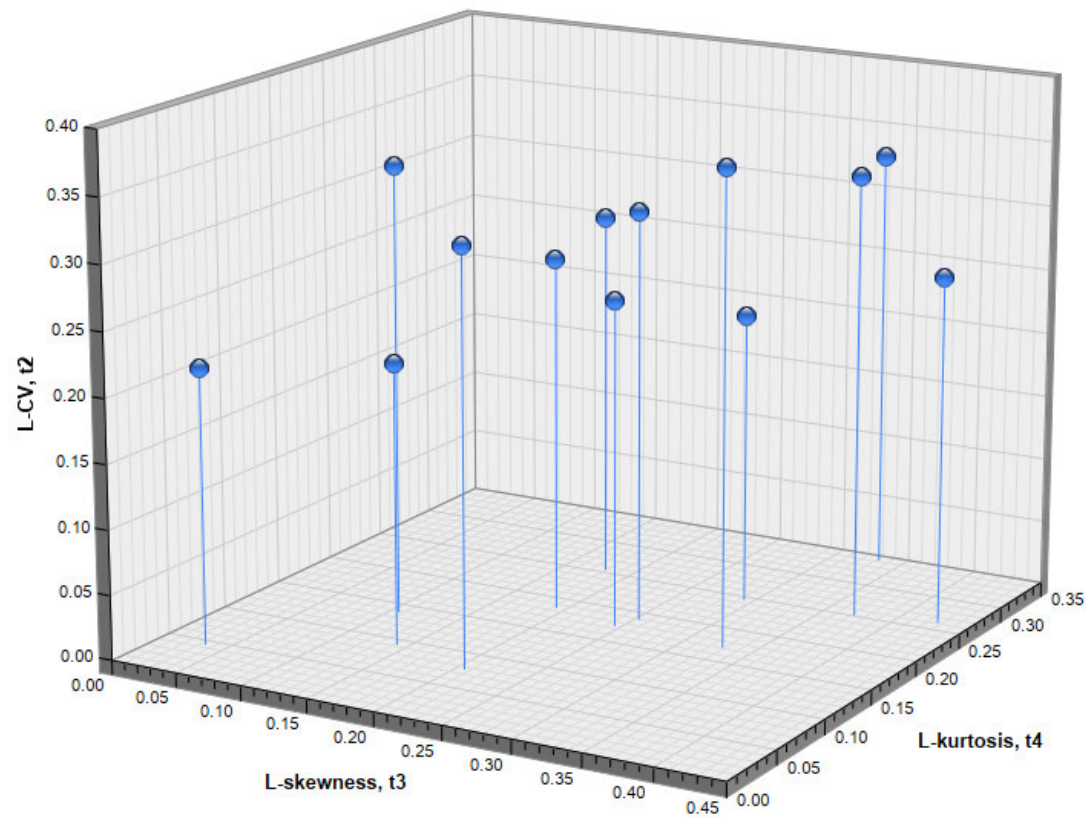
L-moment ratios - SU 74550 68500 (31-07-2025 07:41) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

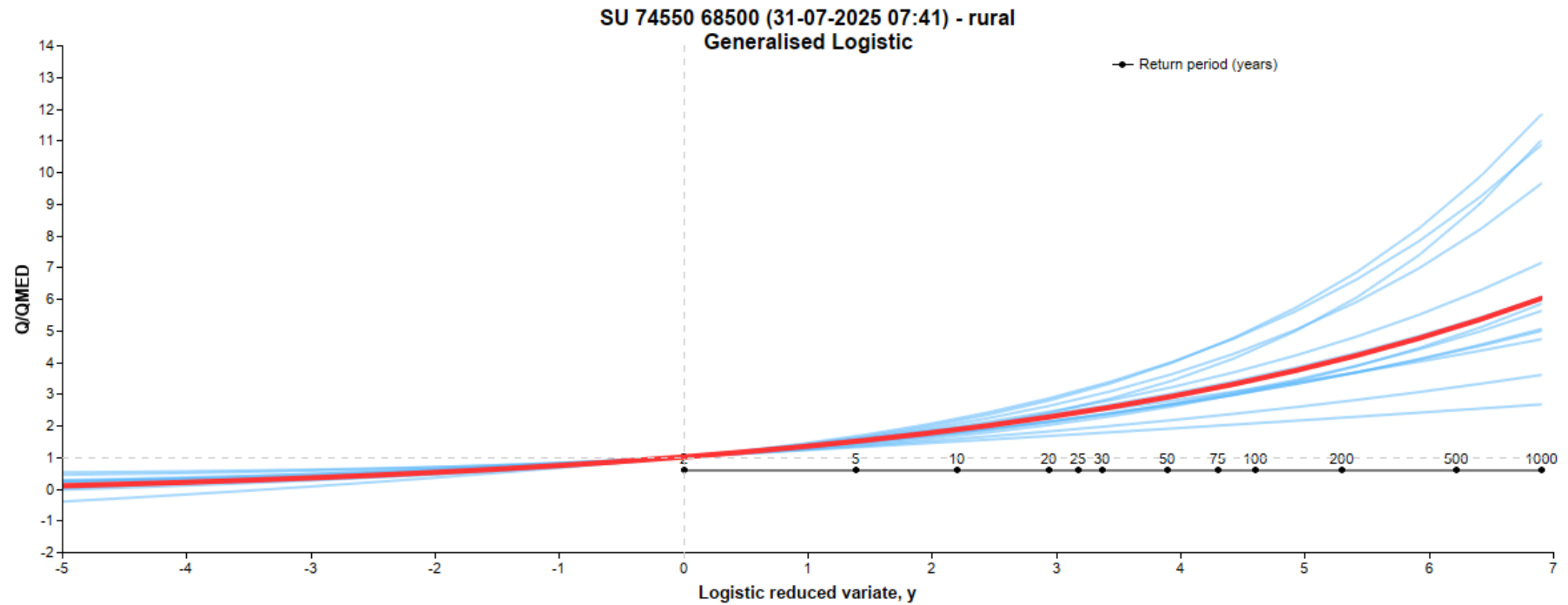
L-moment ratios - SU 74550 68500 (31-07-2025 07:41) - urban



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

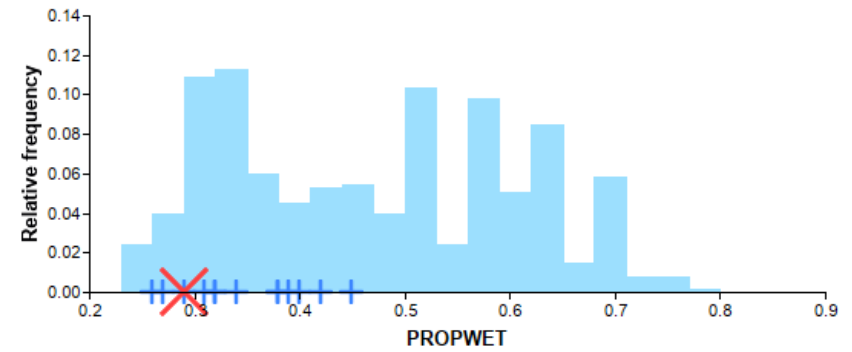
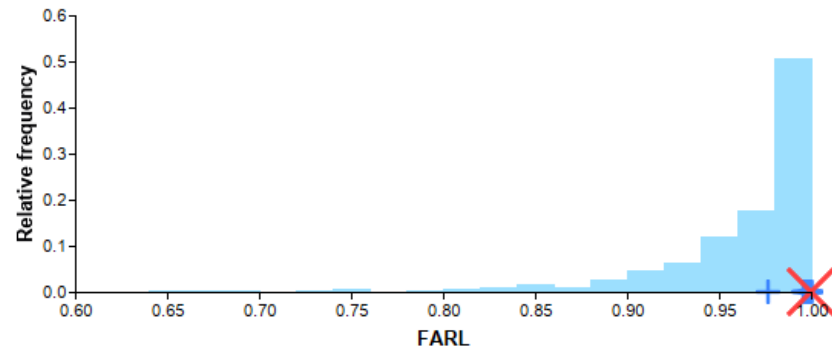
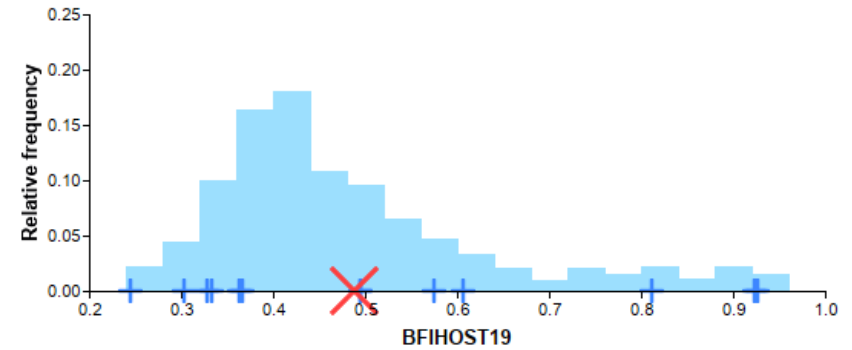
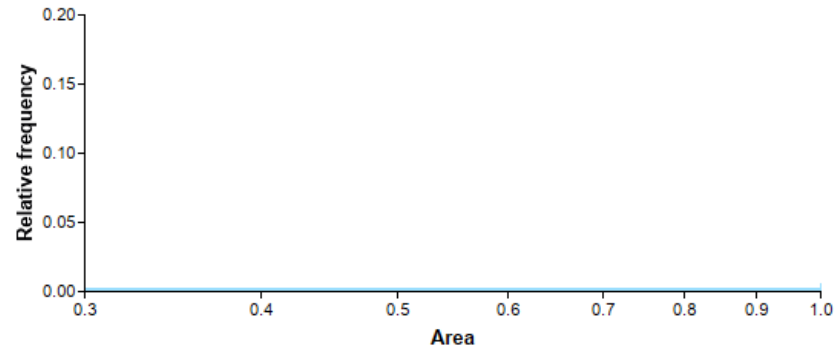
Pooling group growth curves



# UK Design Flood Estimation

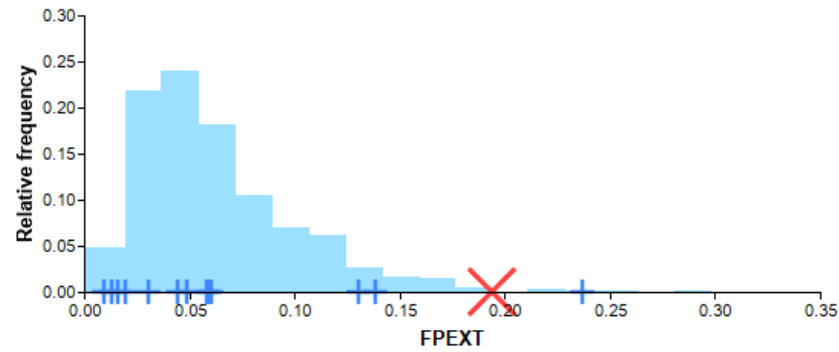
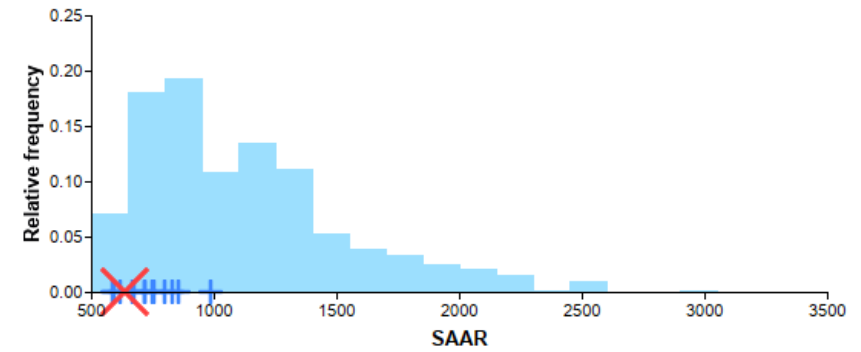
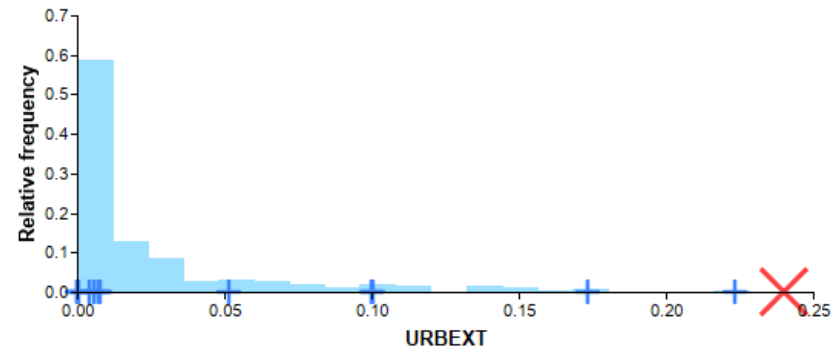
## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method

### Catchment descriptors



# UK Design Flood Estimation

## Summary of ESS/Pooled Estimation Analysis using the Flood Estimation Handbook Statistical Method



## Appendix 2 – ReFH2 Calculation Logs

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# UK Design Flood Estimation

Generated on 29 July 2025 13:43:08 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: 79A3-525D

Site name: FEH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1

Easting: 474800

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.74 [0.91]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 30 year

### Summary of results

|                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 56.38 | Total runoff (ML):             | 7.65  |
| Total Rainfall (mm):   | 37.73 | Total flow (ML):               | 17.54 |
| Peak Rainfall (mm):    | 6.44  | Peak flow (m <sup>3</sup> /s): | 0.29  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 07:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.68     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value | User-defined? |
|-----------------------------|-------|---------------|
| Cini (mm)                   | 83.16 | No            |
| Cmax (mm)                   | 573.9 | No            |
| Use alpha correction factor | No    | No            |
| Alpha correction factor     | n/a   | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 4.64  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.01  | No            |
| BL (hr)                 | 45.11 | No            |
| BR                      | 2.26  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.31 [0.16] | Yes           |
| Effective URBEXT2000                      | 0.27        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 0.564        | 0.000                | 0.135            | 0.000            | 0.007              | 0.007                |
| 00:30:00           | 0.824        | 0.000                | 0.203            | 0.000            | 0.007              | 0.007                |
| 01:00:00           | 1.202        | 0.000                | 0.298            | 0.001            | 0.007              | 0.008                |
| 01:30:00           | 1.746        | 0.000                | 0.437            | 0.004            | 0.007              | 0.011                |
| 02:00:00           | 2.527        | 0.000                | 0.641            | 0.008            | 0.007              | 0.014                |
| 02:30:00           | 3.633        | 0.000                | 0.939            | 0.014            | 0.007              | 0.021                |
| 03:00:00           | 5.151        | 0.000                | 1.367            | 0.024            | 0.007              | 0.031                |
| 03:30:00           | 6.438        | 0.000                | 1.765            | 0.040            | 0.007              | 0.047                |
| 04:00:00           | 5.151        | 0.000                | 1.458            | 0.062            | 0.007              | 0.070                |
| 04:30:00           | 3.633        | 0.000                | 1.053            | 0.091            | 0.008              | 0.099                |
| 05:00:00           | 2.527        | 0.000                | 0.745            | 0.124            | 0.009              | 0.133                |
| 05:30:00           | 1.746        | 0.000                | 0.520            | 0.159            | 0.010              | 0.169                |
| 06:00:00           | 1.202        | 0.000                | 0.361            | 0.193            | 0.012              | 0.205                |
| 06:30:00           | 0.824        | 0.000                | 0.249            | 0.224            | 0.014              | 0.238                |
| 07:00:00           | 0.564        | 0.000                | 0.171            | 0.249            | 0.016              | 0.266                |
| 07:30:00           | 0.000        | 0.000                | 0.000            | 0.266            | 0.019              | 0.284                |
| 08:00:00           | 0.000        | 0.000                | 0.000            | 0.272            | 0.022              | 0.294                |
| 08:30:00           | 0.000        | 0.000                | 0.000            | 0.269            | 0.025              | 0.294                |
| 09:00:00           | 0.000        | 0.000                | 0.000            | 0.259            | 0.028              | 0.287                |
| 09:30:00           | 0.000        | 0.000                | 0.000            | 0.244            | 0.031              | 0.275                |
| 10:00:00           | 0.000        | 0.000                | 0.000            | 0.226            | 0.034              | 0.260                |
| 10:30:00           | 0.000        | 0.000                | 0.000            | 0.206            | 0.037              | 0.243                |
| 11:00:00           | 0.000        | 0.000                | 0.000            | 0.185            | 0.040              | 0.225                |
| 11:30:00           | 0.000        | 0.000                | 0.000            | 0.166            | 0.042              | 0.208                |
| 12:00:00           | 0.000        | 0.000                | 0.000            | 0.148            | 0.044              | 0.192                |
| 12:30:00           | 0.000        | 0.000                | 0.000            | 0.131            | 0.046              | 0.177                |
| 13:00:00           | 0.000        | 0.000                | 0.000            | 0.115            | 0.047              | 0.163                |
| 13:30:00           | 0.000        | 0.000                | 0.000            | 0.100            | 0.049              | 0.149                |
| 14:00:00           | 0.000        | 0.000                | 0.000            | 0.087            | 0.050              | 0.137                |
| 14:30:00           | 0.000        | 0.000                | 0.000            | 0.074            | 0.051              | 0.125                |
| 15:00:00           | 0.000        | 0.000                | 0.000            | 0.063            | 0.052              | 0.115                |
| 15:30:00           | 0.000        | 0.000                | 0.000            | 0.052            | 0.053              | 0.105                |
| 16:00:00           | 0.000        | 0.000                | 0.000            | 0.043            | 0.053              | 0.096                |
| 16:30:00           | 0.000        | 0.000                | 0.000            | 0.034            | 0.054              | 0.088                |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.028                         | 0.054                           | 0.082                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.023                         | 0.054                           | 0.077                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.018                         | 0.054                           | 0.072                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.014                         | 0.054                           | 0.069                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.011                         | 0.054                           | 0.065                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.008                         | 0.054                           | 0.062                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.006                         | 0.054                           | 0.059                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.004                         | 0.053                           | 0.057                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.002                         | 0.053                           | 0.055                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.052                           | 0.054                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.052                           | 0.052                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.051                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 83:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 83:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 84:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 85:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 85:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 86:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 87:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 87:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 88:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 89:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 89:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 90:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 91:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 91:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 92:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 93:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 93:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 94:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 95:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 95:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 96:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 97:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 97:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 98:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 99:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 99:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 100:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 101:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 101:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 102:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 103:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 103:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 104:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 105:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 105:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 106:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 107:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 107:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 108:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 109:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 109:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 110:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 111:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 111:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.74 [0.91] | Yes                      |
| ALTBAR                            | 46          | No                       |
| ASPBAR                            | 117         | No                       |
| ASPVAR                            | 0.75        | No                       |
| BFIHOST                           | 0.56        | No                       |
| BFIHOST19                         | 0.62        | No                       |
| DPLBAR (km)                       | 1.59        | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 12.1        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 3.07        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 639         | No                       |
| SAAR4170 (mm)                     | 644         | No                       |
| SPRHOST                           | 31.2        | No                       |
| URBEXT2000                        | 0.27 [0.14] | Yes                      |
| URBEXT1990                        | 0.07        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.44        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# UK Design Flood Estimation

Generated on 29 July 2025 13:43:17 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: 79A3-525D

Site name: FEH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1

Easting: 474800

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.74 [0.91]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 100 year

### Summary of results

|                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 70.55 | Total runoff (ML):             | 9.83  |
| Total Rainfall (mm):   | 47.21 | Total flow (ML):               | 22.77 |
| Peak Rainfall (mm):    | 8.06  | Peak flow (m <sup>3</sup> /s): | 0.38  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 07:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.68     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value | User-defined? |
|-----------------------------|-------|---------------|
| Cini (mm)                   | 83.16 | No            |
| Cmax (mm)                   | 573.9 | No            |
| Use alpha correction factor | No    | No            |
| Alpha correction factor     | n/a   | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 4.64  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.01  | No            |
| BL (hr)                 | 45.11 | No            |
| BR                      | 2.26  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.31 [0.16] | Yes           |
| Effective URBEXT2000                      | 0.27        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 0.706        | 0.000                | 0.170            | 0.000            | 0.007              | 0.007                |
| 00:30:00           | 1.031        | 0.000                | 0.255            | 0.000            | 0.007              | 0.007                |
| 01:00:00           | 1.504        | 0.000                | 0.374            | 0.002            | 0.007              | 0.009                |
| 01:30:00           | 2.185        | 0.000                | 0.550            | 0.005            | 0.007              | 0.011                |
| 02:00:00           | 3.162        | 0.000                | 0.809            | 0.010            | 0.007              | 0.016                |
| 02:30:00           | 4.546        | 0.000                | 1.191            | 0.018            | 0.007              | 0.025                |
| 03:00:00           | 6.445        | 0.000                | 1.743            | 0.031            | 0.007              | 0.038                |
| 03:30:00           | 8.056        | 0.000                | 2.268            | 0.050            | 0.007              | 0.058                |
| 04:00:00           | 6.445        | 0.000                | 1.886            | 0.079            | 0.008              | 0.086                |
| 04:30:00           | 4.546        | 0.000                | 1.369            | 0.115            | 0.009              | 0.124                |
| 05:00:00           | 3.162        | 0.000                | 0.971            | 0.157            | 0.010              | 0.167                |
| 05:30:00           | 2.185        | 0.000                | 0.680            | 0.202            | 0.011              | 0.213                |
| 06:00:00           | 1.504        | 0.000                | 0.472            | 0.246            | 0.014              | 0.259                |
| 06:30:00           | 1.031        | 0.000                | 0.326            | 0.286            | 0.016              | 0.302                |
| 07:00:00           | 0.706        | 0.000                | 0.224            | 0.318            | 0.019              | 0.338                |
| 07:30:00           | 0.000        | 0.000                | 0.000            | 0.340            | 0.023              | 0.362                |
| 08:00:00           | 0.000        | 0.000                | 0.000            | 0.348            | 0.026              | 0.375                |
| 08:30:00           | 0.000        | 0.000                | 0.000            | 0.346            | 0.031              | 0.376                |
| 09:00:00           | 0.000        | 0.000                | 0.000            | 0.333            | 0.035              | 0.368                |
| 09:30:00           | 0.000        | 0.000                | 0.000            | 0.314            | 0.039              | 0.353                |
| 10:00:00           | 0.000        | 0.000                | 0.000            | 0.291            | 0.043              | 0.333                |
| 10:30:00           | 0.000        | 0.000                | 0.000            | 0.265            | 0.047              | 0.312                |
| 11:00:00           | 0.000        | 0.000                | 0.000            | 0.239            | 0.050              | 0.289                |
| 11:30:00           | 0.000        | 0.000                | 0.000            | 0.215            | 0.053              | 0.268                |
| 12:00:00           | 0.000        | 0.000                | 0.000            | 0.191            | 0.056              | 0.247                |
| 12:30:00           | 0.000        | 0.000                | 0.000            | 0.169            | 0.058              | 0.228                |
| 13:00:00           | 0.000        | 0.000                | 0.000            | 0.149            | 0.060              | 0.209                |
| 13:30:00           | 0.000        | 0.000                | 0.000            | 0.130            | 0.062              | 0.192                |
| 14:00:00           | 0.000        | 0.000                | 0.000            | 0.113            | 0.064              | 0.176                |
| 14:30:00           | 0.000        | 0.000                | 0.000            | 0.097            | 0.065              | 0.162                |
| 15:00:00           | 0.000        | 0.000                | 0.000            | 0.082            | 0.066              | 0.148                |
| 15:30:00           | 0.000        | 0.000                | 0.000            | 0.068            | 0.067              | 0.135                |
| 16:00:00           | 0.000        | 0.000                | 0.000            | 0.056            | 0.068              | 0.124                |
| 16:30:00           | 0.000        | 0.000                | 0.000            | 0.045            | 0.069              | 0.114                |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.037                         | 0.069                           | 0.106                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.030                         | 0.069                           | 0.099                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.024                         | 0.070                           | 0.093                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.019                         | 0.070                           | 0.088                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.015                         | 0.069                           | 0.084                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.011                         | 0.069                           | 0.080                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.008                         | 0.069                           | 0.076                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.005                         | 0.068                           | 0.073                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.003                         | 0.068                           | 0.071                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.002                         | 0.067                           | 0.069                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.066                           | 0.067                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.065                           | 0.066                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.064                           | 0.064                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.062                           | 0.062                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.060                           | 0.060                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.058                           | 0.058                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 83:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 83:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 84:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 85:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 85:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 86:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 87:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 87:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 88:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 89:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 89:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 90:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 91:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 91:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 92:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 93:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 93:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 94:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 95:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 95:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 96:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 97:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 97:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 98:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 99:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 99:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 100:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 101:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 101:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 102:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 103:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 103:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 104:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 105:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 105:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 106:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 107:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 107:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 108:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 109:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 109:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 110:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 111:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 111:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 112:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 112:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 113:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 113:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 114:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 114:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 115:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 115:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 116:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 116:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 117:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 117:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 118:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 118:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 119:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 119:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 120:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 120:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 121:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 121:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 122:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 122:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 123:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.74 [0.91] | Yes                      |
| ALTBAR                            | 46          | No                       |
| ASPBAR                            | 117         | No                       |
| ASPVAR                            | 0.75        | No                       |
| BFIHOST                           | 0.56        | No                       |
| BFIHOST19                         | 0.62        | No                       |
| DPLBAR (km)                       | 1.59        | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 12.1        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 3.07        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 639         | No                       |
| SAAR4170 (mm)                     | 644         | No                       |
| SPRHOST                           | 31.2        | No                       |
| URBEXT2000                        | 0.27 [0.14] | Yes                      |
| URBEXT1990                        | 0.07        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.44        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# UK Design Flood Estimation

Generated on 29 July 2025 13:43:27 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: 79A3-525D

Site name: FEH\_Catchment\_Descriptors\_474800\_168300\_v5\_0\_1

Easting: 474800

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.74 [0.91]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 1000 year

### Summary of results

|                        |        |                                |       |
|------------------------|--------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 107.92 | Total runoff (ML):             | 16.07 |
| Total Rainfall (mm):   | 72.23  | Total flow (ML):               | 38.12 |
| Peak Rainfall (mm):    | 12.32  | Peak flow (m <sup>3</sup> /s): | 0.61  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 07:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.68     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value | User-defined? |
|-----------------------------|-------|---------------|
| Cini (mm)                   | 83.16 | No            |
| Cmax (mm)                   | 573.9 | No            |
| Use alpha correction factor | No    | No            |
| Alpha correction factor     | n/a   | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 4.64  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.01  | No            |
| BL (hr)                 | 45.11 | No            |
| BR                      | 2.25  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.31 [0.16] | Yes           |
| Effective URBEXT2000                      | 0.27        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 00:00:00           | 1.080        | 0.000                             | 0.262            | 0.000                         | 0.007                           | 0.007                             |
| 00:30:00           | 1.578        | 0.000                             | 0.391            | 0.001                         | 0.007                           | 0.008                             |
| 01:00:00           | 2.300        | 0.000                             | 0.577            | 0.003                         | 0.007                           | 0.010                             |
| 01:30:00           | 3.343        | 0.000                             | 0.854            | 0.007                         | 0.007                           | 0.014                             |
| 02:00:00           | 4.837        | 0.000                             | 1.266            | 0.015                         | 0.007                           | 0.022                             |
| 02:30:00           | 6.954        | 0.000                             | 1.883            | 0.028                         | 0.007                           | 0.035                             |
| 03:00:00           | 9.860        | 0.000                             | 2.797            | 0.048                         | 0.007                           | 0.055                             |
| 03:30:00           | 12.324       | 0.000                             | 3.706            | 0.078                         | 0.008                           | 0.086                             |
| 04:00:00           | 9.860        | 0.000                             | 3.134            | 0.123                         | 0.009                           | 0.132                             |
| 04:30:00           | 6.954        | 0.000                             | 2.300            | 0.181                         | 0.010                           | 0.191                             |
| 05:00:00           | 4.837        | 0.000                             | 1.644            | 0.249                         | 0.012                           | 0.261                             |
| 05:30:00           | 3.343        | 0.000                             | 1.157            | 0.321                         | 0.015                           | 0.336                             |
| 06:00:00           | 2.300        | 0.000                             | 0.806            | 0.392                         | 0.018                           | 0.411                             |
| 06:30:00           | 1.578        | 0.000                             | 0.558            | 0.458                         | 0.023                           | 0.481                             |
| 07:00:00           | 1.080        | 0.000                             | 0.384            | 0.513                         | 0.028                           | 0.540                             |
| 07:30:00           | 0.000        | 0.000                             | 0.000            | 0.549                         | 0.034                           | 0.583                             |
| 08:00:00           | 0.000        | 0.000                             | 0.000            | 0.566                         | 0.040                           | 0.606                             |
| 08:30:00           | 0.000        | 0.000                             | 0.000            | 0.564                         | 0.047                           | 0.611                             |
| 09:00:00           | 0.000        | 0.000                             | 0.000            | 0.545                         | 0.054                           | 0.600                             |
| 09:30:00           | 0.000        | 0.000                             | 0.000            | 0.516                         | 0.061                           | 0.577                             |
| 10:00:00           | 0.000        | 0.000                             | 0.000            | 0.478                         | 0.068                           | 0.547                             |
| 10:30:00           | 0.000        | 0.000                             | 0.000            | 0.438                         | 0.075                           | 0.512                             |
| 11:00:00           | 0.000        | 0.000                             | 0.000            | 0.396                         | 0.081                           | 0.476                             |
| 11:30:00           | 0.000        | 0.000                             | 0.000            | 0.355                         | 0.086                           | 0.441                             |
| 12:00:00           | 0.000        | 0.000                             | 0.000            | 0.317                         | 0.091                           | 0.408                             |
| 12:30:00           | 0.000        | 0.000                             | 0.000            | 0.281                         | 0.095                           | 0.376                             |
| 13:00:00           | 0.000        | 0.000                             | 0.000            | 0.247                         | 0.099                           | 0.346                             |
| 13:30:00           | 0.000        | 0.000                             | 0.000            | 0.217                         | 0.102                           | 0.319                             |
| 14:00:00           | 0.000        | 0.000                             | 0.000            | 0.188                         | 0.105                           | 0.293                             |
| 14:30:00           | 0.000        | 0.000                             | 0.000            | 0.162                         | 0.107                           | 0.269                             |
| 15:00:00           | 0.000        | 0.000                             | 0.000            | 0.137                         | 0.109                           | 0.246                             |
| 15:30:00           | 0.000        | 0.000                             | 0.000            | 0.114                         | 0.111                           | 0.225                             |
| 16:00:00           | 0.000        | 0.000                             | 0.000            | 0.094                         | 0.112                           | 0.207                             |
| 16:30:00           | 0.000        | 0.000                             | 0.000            | 0.077                         | 0.114                           | 0.191                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.063                         | 0.114                           | 0.178                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.052                         | 0.115                           | 0.166                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.042                         | 0.115                           | 0.157                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.033                         | 0.115                           | 0.148                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.026                         | 0.115                           | 0.141                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.019                         | 0.115                           | 0.134                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.014                         | 0.114                           | 0.128                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.009                         | 0.113                           | 0.122                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.006                         | 0.112                           | 0.118                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.004                         | 0.111                           | 0.115                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.002                         | 0.110                           | 0.112                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.109                           | 0.110                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.108                           | 0.108                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.106                           | 0.107                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.105                           | 0.105                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.104                           | 0.104                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.103                           | 0.103                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.102                           | 0.102                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.101                           | 0.101                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.100                           | 0.100                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.099                           | 0.099                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.097                           | 0.097                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.096                           | 0.096                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.095                           | 0.095                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.094                           | 0.094                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.093                           | 0.093                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.092                           | 0.092                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.091                           | 0.091                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.090                           | 0.090                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.089                           | 0.089                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.088                           | 0.088                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.087                           | 0.087                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.086                           | 0.086                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.085                           | 0.085                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.084                           | 0.084                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.083                           | 0.083                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.083                           | 0.083                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.082                           | 0.082                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.081                           | 0.081                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.080                           | 0.080                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.079                           | 0.079                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.078                           | 0.078                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.077                           | 0.077                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.076                           | 0.076                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.076                           | 0.076                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.075                           | 0.075                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.074                           | 0.074                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.073                           | 0.073                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.072                           | 0.072                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.071                           | 0.071                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.071                           | 0.071                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.070                           | 0.070                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.069                           | 0.069                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.068                           | 0.068                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.068                           | 0.068                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.067                           | 0.067                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.066                           | 0.066                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.064                           | 0.064                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.062                           | 0.062                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.060                           | 0.060                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.058                           | 0.058                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 83:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 83:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 84:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 85:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 85:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 86:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 87:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 87:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 88:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 89:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 89:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 90:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 91:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 91:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 92:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 93:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 93:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 94:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 95:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 95:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 96:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 97:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 97:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 98:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 99:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 99:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 100:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 101:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 101:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 102:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 103:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 103:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 104:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 105:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 105:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 106:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 107:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 107:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 108:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 109:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 109:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 110:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 111:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 111:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 112:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 112:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 113:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 113:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 114:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 114:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 115:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 115:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 116:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 116:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 117:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 117:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 118:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 118:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 119:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 119:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 120:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |
| 120:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 121:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 121:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 122:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 122:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 123:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 123:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.012                           | 0.012                             |
| 124:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 124:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 125:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 125:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 126:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 126:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 127:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 127:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 128:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.011                           | 0.011                             |
| 128:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 129:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 129:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 130:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 130:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 131:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 131:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 132:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 132:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.010                           | 0.010                             |
| 133:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 133:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 134:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 134:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 135:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 135:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 136:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 136:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 137:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 137:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.009                           | 0.009                             |
| 138:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 138:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 139:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 139:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 140:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 140:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 141:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 141:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 142:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 142:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 143:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.008                           | 0.008                             |
| 143:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 144:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 144:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 145:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |
| 145:30:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.007                           | 0.007                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.74 [0.91] | Yes                      |
| ALTBAR                            | 46          | No                       |
| ASPBAR                            | 117         | No                       |
| ASPVAR                            | 0.75        | No                       |
| BFIHOST                           | 0.56        | No                       |
| BFIHOST19                         | 0.62        | No                       |
| DPLBAR (km)                       | 1.59        | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 12.1        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 3.07        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 639         | No                       |
| SAAR4170 (mm)                     | 644         | No                       |
| SPRHOST                           | 31.2        | No                       |
| URBEXT2000                        | 0.27 [0.14] | Yes                      |
| URBEXT1990                        | 0.07        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.44        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.

# UK Design Flood Estimation

Generated on 29 July 2025 13:08:45 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site detailsChecksum: 3924-2653

Site name: FEH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1

Easting: 474950

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km²): 550.1 [551.18]\*

Using plot scale calculations: No

Model: 2.3

Site description:None

## Model run: 30 year

### Summary of results

|                        |       |                    |          |
|------------------------|-------|--------------------|----------|
| Rainfall - FEH22 (mm): | 70.78 | Total runoff (ML): | 5089.04  |
| Total Rainfall (mm):   | 46.72 | Total flow (ML):   | 14679.31 |
| Peak Rainfall (mm):    | 9.11  | Peak flow (m³/s):  | 67.21    |

### Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.  
\* Indicates that the user locked the duration/timestep

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 26:00:00 | No            |
| Timestep (hh:mm:ss)              | 02:00:00 | No            |
| SCF (Seasonal correction factor) | 0.72     | No            |
| ARF (Areal reduction factor)     | 0.91     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 75.2   | No            |
| Cmax (mm)                   | 635.11 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 14.63 | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 5.82  | No            |
| BL (hr)                 | 82.04 | No            |
| BR                      | 2.53  | No            |

#### Urbanisation parameters

| Name                                      | Value | User-defined? |
|-------------------------------------------|-------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0     | No            |
| Exporting drained area (km <sup>2</sup> ) | 0     | No            |
| Urban area (km <sup>2</sup> )             | 99.65 | No            |
| Effective URBEXT2000                      | 0.12  | n/a           |
| Impervious runoff factor                  | 0.7   | No            |
| Imperviousness factor                     | 0.4   | No            |
| Tp scaling factor                         | 0.75  | No            |
| Depression storage depth (mm)             | 0.5   | No            |

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 0.831        | 0.000                | 0.135            | 0.000            | 5.402              | 5.402                |
| 02:00:00           | 1.287        | 0.000                | 0.213            | 0.082            | 5.273              | 5.355                |
| 04:00:00           | 1.987        | 0.000                | 0.333            | 0.375            | 5.153              | 5.529                |
| 06:00:00           | 3.052        | 0.000                | 0.523            | 1.001            | 5.051              | 6.052                |
| 08:00:00           | 4.654        | 0.000                | 0.825            | 2.146            | 4.980              | 7.126                |
| 10:00:00           | 6.994        | 0.000                | 1.301            | 4.104            | 4.962              | 9.066                |
| 12:00:00           | 9.109        | 0.000                | 1.804            | 7.320            | 5.030              | 12.349               |
| 14:00:00           | 6.994        | 0.000                | 1.469            | 12.249           | 5.236              | 17.484               |
| 16:00:00           | 4.654        | 0.000                | 1.018            | 18.854           | 5.642              | 24.496               |
| 18:00:00           | 3.052        | 0.000                | 0.685            | 26.434           | 6.301              | 32.735               |
| 20:00:00           | 1.987        | 0.000                | 0.454            | 34.248           | 7.239              | 41.488               |
| 22:00:00           | 1.287        | 0.000                | 0.297            | 41.546           | 8.462              | 50.008               |
| 24:00:00           | 0.831        | 0.000                | 0.193            | 47.501           | 9.953              | 57.454               |
| 26:00:00           | 0.000        | 0.000                | 0.000            | 51.348           | 11.671             | 63.019               |
| 28:00:00           | 0.000        | 0.000                | 0.000            | 52.759           | 13.543             | 66.302               |
| 30:00:00           | 0.000        | 0.000                | 0.000            | 51.744           | 15.465             | 67.209               |
| 32:00:00           | 0.000        | 0.000                | 0.000            | 48.957           | 17.333             | 66.289               |
| 34:00:00           | 0.000        | 0.000                | 0.000            | 45.088           | 19.070             | 64.158               |
| 36:00:00           | 0.000        | 0.000                | 0.000            | 40.689           | 20.627             | 61.317               |
| 38:00:00           | 0.000        | 0.000                | 0.000            | 36.114           | 21.978             | 58.092               |
| 40:00:00           | 0.000        | 0.000                | 0.000            | 31.616           | 23.109             | 54.725               |
| 42:00:00           | 0.000        | 0.000                | 0.000            | 27.370           | 24.026             | 51.396               |
| 44:00:00           | 0.000        | 0.000                | 0.000            | 23.572           | 24.747             | 48.319               |
| 46:00:00           | 0.000        | 0.000                | 0.000            | 20.189           | 25.298             | 45.487               |
| 48:00:00           | 0.000        | 0.000                | 0.000            | 17.146           | 25.702             | 42.848               |
| 50:00:00           | 0.000        | 0.000                | 0.000            | 14.393           | 25.975             | 40.368               |
| 52:00:00           | 0.000        | 0.000                | 0.000            | 11.929           | 26.129             | 38.058               |
| 54:00:00           | 0.000        | 0.000                | 0.000            | 9.791            | 26.173             | 35.964               |
| 56:00:00           | 0.000        | 0.000                | 0.000            | 7.947            | 26.114             | 34.061               |
| 58:00:00           | 0.000        | 0.000                | 0.000            | 6.309            | 25.958             | 32.268               |
| 60:00:00           | 0.000        | 0.000                | 0.000            | 4.836            | 25.711             | 30.547               |
| 62:00:00           | 0.000        | 0.000                | 0.000            | 3.521            | 25.381             | 28.901               |
| 64:00:00           | 0.000        | 0.000                | 0.000            | 2.390            | 24.976             | 27.366               |
| 66:00:00           | 0.000        | 0.000                | 0.000            | 1.502            | 24.511             | 26.013               |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.885                         | 24.005                          | 24.890                            |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.486                         | 23.475                          | 23.962                            |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.241                         | 22.936                          | 23.176                            |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.100                         | 22.395                          | 22.495                            |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.028                         | 21.860                          | 21.888                            |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.002                         | 21.335                          | 21.336                            |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.821                          | 20.821                            |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.320                          | 20.320                            |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.830                          | 19.830                            |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.353                          | 19.353                            |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.887                          | 18.887                            |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.432                          | 18.432                            |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.988                          | 17.988                            |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.555                          | 17.555                            |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.132                          | 17.132                            |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.719                          | 16.719                            |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.317                          | 16.317                            |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.924                          | 15.924                            |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.540                          | 15.540                            |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.166                          | 15.166                            |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.801                          | 14.801                            |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.444                          | 14.444                            |
| 112:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.096                          | 14.096                            |
| 114:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.757                          | 13.757                            |
| 116:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.426                          | 13.426                            |
| 118:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.102                          | 13.102                            |
| 120:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.787                          | 12.787                            |
| 122:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.479                          | 12.479                            |
| 124:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.178                          | 12.178                            |
| 126:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.885                          | 11.885                            |
| 128:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.599                          | 11.599                            |
| 130:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.319                          | 11.319                            |
| 132:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.047                          | 11.047                            |
| 134:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.781                          | 10.781                            |
| 136:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.521                          | 10.521                            |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 138:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.268                          | 10.268                            |
| 140:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.020                          | 10.020                            |
| 142:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.779                           | 9.779                             |
| 144:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.544                           | 9.544                             |
| 146:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.314                           | 9.314                             |
| 148:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.089                           | 9.089                             |
| 150:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.871                           | 8.871                             |
| 152:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.657                           | 8.657                             |
| 154:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.448                           | 8.448                             |
| 156:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.245                           | 8.245                             |
| 158:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.046                           | 8.046                             |
| 160:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.853                           | 7.853                             |
| 162:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.663                           | 7.663                             |
| 164:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.479                           | 7.479                             |
| 166:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.299                           | 7.299                             |
| 168:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.123                           | 7.123                             |
| 170:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.951                           | 6.951                             |
| 172:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.784                           | 6.784                             |
| 174:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.621                           | 6.621                             |
| 176:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.461                           | 6.461                             |
| 178:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.306                           | 6.306                             |
| 180:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.154                           | 6.154                             |
| 182:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.006                           | 6.006                             |
| 184:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.861                           | 5.861                             |
| 186:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.720                           | 5.720                             |
| 188:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.582                           | 5.582                             |
| 190:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.448                           | 5.448                             |

## Appendix

### Catchment descriptors \*

| Name                              | Value          | User-defined value used? |
|-----------------------------------|----------------|--------------------------|
| Area (km <sup>2</sup> )           | 550.1 [551.18] | Yes                      |
| ALTBAR                            | 89             | No                       |
| ASPBAR                            | 9              | No                       |
| ASPVAR                            | 0.21           | No                       |
| BFIHOST                           | 0.61           | No                       |
| BFIHOST19                         | 0.67           | No                       |
| DPLBAR (km)                       | 24.71          | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 32             | No                       |
| FARL                              | 0.91           | No                       |
| LDP                               | 41.58          | No                       |
| PROPWET                           | 0.32           | No                       |
| RMED1H                            | 11.6           | No                       |
| RMED1D                            | 32.1           | No                       |
| RMED2D                            | 41.2           | No                       |
| SAAR (mm)                         | 716            | No                       |
| SAAR4170 (mm)                     | 725            | No                       |
| SPRHOST                           | 26.95          | No                       |
| URBEXT2000                        | 0.12           | No                       |
| URBEXT1990                        | 0.06           | No                       |
| URBCONC                           | 0.86           | No                       |
| URBLOC                            | 1.12           | No                       |
| DDF parameter C                   | -0.03          | No                       |
| DDF parameter D1                  | 0.31           | No                       |
| DDF parameter D2                  | 0.27           | No                       |
| DDF parameter D3                  | 0.34           | No                       |
| DDF parameter E                   | 0.3            | No                       |
| DDF parameter F                   | 2.59           | No                       |
| DDF parameter C (1km grid value)  | -0.03          | No                       |
| DDF parameter D1 (1km grid value) | 0.26           | No                       |
| DDF parameter D2 (1km grid value) | 0.26           | No                       |
| DDF parameter D3 (1km grid value) | 0.33           | No                       |
| DDF parameter E (1km grid value)  | 0.3            | No                       |
| DDF parameter F (1km grid value)  | 2.62           | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

# UK Design Flood Estimation

Generated on 29 July 2025 13:09:42 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: 3924-2653

Site name: FEH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1

Easting: 474950

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 550.1 [551.18]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 100 year

### Summary of results

|                        |       |                                |          |
|------------------------|-------|--------------------------------|----------|
| Rainfall - FEH22 (mm): | 86.86 | Total runoff (ML):             | 6494.73  |
| Total Rainfall (mm):   | 57.33 | Total flow (ML):               | 18862.51 |
| Peak Rainfall (mm):    | 11.18 | Peak flow (m <sup>3</sup> /s): | 84.83    |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 26:00:00 | No            |
| Timestep (hh:mm:ss)              | 02:00:00 | No            |
| SCF (Seasonal correction factor) | 0.72     | No            |
| ARF (Areal reduction factor)     | 0.91     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 75.2   | No            |
| Cmax (mm)                   | 635.11 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 14.63 | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 5.82  | No            |
| BL (hr)                 | 82.04 | No            |
| BR                      | 2.53  | No            |

#### Urbanisation parameters

| Name                                      | Value | User-defined? |
|-------------------------------------------|-------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0     | No            |
| Exporting drained area (km <sup>2</sup> ) | 0     | No            |
| Urban area (km <sup>2</sup> )             | 99.65 | No            |
| Effective URBEXT2000                      | 0.12  | n/a           |
| Impervious runoff factor                  | 0.7   | No            |
| Imperviousness factor                     | 0.4   | No            |
| Tp scaling factor                         | 0.75  | No            |
| Depression storage depth (mm)             | 0.5   | No            |

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 1.020        | 0.000                | 0.166            | 0.000            | 5.402              | 5.402                |
| 02:00:00           | 1.580        | 0.000                | 0.262            | 0.101            | 5.273              | 5.374                |
| 04:00:00           | 2.438        | 0.000                | 0.412            | 0.462            | 5.155              | 5.617                |
| 06:00:00           | 3.745        | 0.000                | 0.650            | 1.232            | 5.058              | 6.291                |
| 08:00:00           | 5.711        | 0.000                | 1.031            | 2.645            | 4.999              | 7.644                |
| 10:00:00           | 8.582        | 0.000                | 1.641            | 5.069            | 5.004              | 10.074               |
| 12:00:00           | 11.178       | 0.000                | 2.302            | 9.068            | 5.117              | 14.185               |
| 14:00:00           | 8.582        | 0.000                | 1.894            | 15.236           | 5.403              | 20.639               |
| 16:00:00           | 5.711        | 0.000                | 1.322            | 23.554           | 5.944              | 29.499               |
| 18:00:00           | 3.745        | 0.000                | 0.893            | 33.151           | 6.808              | 39.958               |
| 20:00:00           | 2.438        | 0.000                | 0.593            | 43.094           | 8.030              | 51.124               |
| 22:00:00           | 1.580        | 0.000                | 0.389            | 52.437           | 9.621              | 62.058               |
| 24:00:00           | 1.020        | 0.000                | 0.253            | 60.134           | 11.561             | 71.696               |
| 26:00:00           | 0.000        | 0.000                | 0.000            | 65.206           | 13.800             | 79.006               |
| 28:00:00           | 0.000        | 0.000                | 0.000            | 67.196           | 16.244             | 83.440               |
| 30:00:00           | 0.000        | 0.000                | 0.000            | 66.074           | 18.759             | 84.833               |
| 32:00:00           | 0.000        | 0.000                | 0.000            | 62.650           | 21.210             | 83.859               |
| 34:00:00           | 0.000        | 0.000                | 0.000            | 57.801           | 23.495             | 81.296               |
| 36:00:00           | 0.000        | 0.000                | 0.000            | 52.235           | 25.550             | 77.785               |
| 38:00:00           | 0.000        | 0.000                | 0.000            | 46.413           | 27.336             | 73.749               |
| 40:00:00           | 0.000        | 0.000                | 0.000            | 40.667           | 28.839             | 69.506               |
| 42:00:00           | 0.000        | 0.000                | 0.000            | 35.229           | 30.062             | 65.291               |
| 44:00:00           | 0.000        | 0.000                | 0.000            | 30.365           | 31.029             | 61.394               |
| 46:00:00           | 0.000        | 0.000                | 0.000            | 26.034           | 31.775             | 57.809               |
| 48:00:00           | 0.000        | 0.000                | 0.000            | 22.142           | 32.329             | 54.471               |
| 50:00:00           | 0.000        | 0.000                | 0.000            | 18.622           | 32.712             | 51.334               |
| 52:00:00           | 0.000        | 0.000                | 0.000            | 15.470           | 32.940             | 48.409               |
| 54:00:00           | 0.000        | 0.000                | 0.000            | 12.728           | 33.024             | 45.753               |
| 56:00:00           | 0.000        | 0.000                | 0.000            | 10.357           | 32.975             | 43.332               |
| 58:00:00           | 0.000        | 0.000                | 0.000            | 8.245            | 32.799             | 41.044               |
| 60:00:00           | 0.000        | 0.000                | 0.000            | 6.338            | 32.505             | 38.843               |
| 62:00:00           | 0.000        | 0.000                | 0.000            | 4.630            | 32.101             | 36.731               |
| 64:00:00           | 0.000        | 0.000                | 0.000            | 3.155            | 31.600             | 34.755               |
| 66:00:00           | 0.000        | 0.000                | 0.000            | 1.990            | 31.020             | 33.009               |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 1.176                         | 30.384                          | 31.560                            |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.647                         | 29.717                          | 30.363                            |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.321                         | 29.035                          | 29.356                            |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.133                         | 28.352                          | 28.485                            |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.037                         | 27.675                          | 27.712                            |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.002                         | 27.010                          | 27.012                            |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 26.359                          | 26.359                            |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 25.725                          | 25.725                            |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 25.105                          | 25.105                            |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 24.500                          | 24.500                            |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 23.910                          | 23.910                            |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 23.335                          | 23.335                            |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 22.773                          | 22.773                            |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 22.224                          | 22.224                            |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 21.689                          | 21.689                            |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 21.167                          | 21.167                            |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.657                          | 20.657                            |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.159                          | 20.159                            |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.674                          | 19.674                            |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.200                          | 19.200                            |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.738                          | 18.738                            |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.286                          | 18.286                            |
| 112:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.846                          | 17.846                            |
| 114:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.416                          | 17.416                            |
| 116:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.997                          | 16.997                            |
| 118:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.587                          | 16.587                            |
| 120:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.188                          | 16.188                            |
| 122:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.798                          | 15.798                            |
| 124:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.418                          | 15.418                            |
| 126:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.046                          | 15.046                            |
| 128:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.684                          | 14.684                            |
| 130:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.330                          | 14.330                            |
| 132:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.985                          | 13.985                            |
| 134:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.648                          | 13.648                            |
| 136:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.320                          | 13.320                            |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 138:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.999                          | 12.999                            |
| 140:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.686                          | 12.686                            |
| 142:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.380                          | 12.380                            |
| 144:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.082                          | 12.082                            |
| 146:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.791                          | 11.791                            |
| 148:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.507                          | 11.507                            |
| 150:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.230                          | 11.230                            |
| 152:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.960                          | 10.960                            |
| 154:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.696                          | 10.696                            |
| 156:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.438                          | 10.438                            |
| 158:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.187                          | 10.187                            |
| 160:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.941                           | 9.941                             |
| 162:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.702                           | 9.702                             |
| 164:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.468                           | 9.468                             |
| 166:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.240                           | 9.240                             |
| 168:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.018                           | 9.018                             |
| 170:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.801                           | 8.801                             |
| 172:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.589                           | 8.589                             |
| 174:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.382                           | 8.382                             |
| 176:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.180                           | 8.180                             |
| 178:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.983                           | 7.983                             |
| 180:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.791                           | 7.791                             |
| 182:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.603                           | 7.603                             |
| 184:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.420                           | 7.420                             |
| 186:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.241                           | 7.241                             |
| 188:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.067                           | 7.067                             |
| 190:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.897                           | 6.897                             |
| 192:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.730                           | 6.730                             |
| 194:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.568                           | 6.568                             |
| 196:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.410                           | 6.410                             |
| 198:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.256                           | 6.256                             |
| 200:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.105                           | 6.105                             |
| 202:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.958                           | 5.958                             |
| 204:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.815                           | 5.815                             |
| 206:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.675                           | 5.675                             |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 208:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.538                           | 5.538                             |

## Appendix

### Catchment descriptors \*

| Name                              | Value          | User-defined value used? |
|-----------------------------------|----------------|--------------------------|
| Area (km <sup>2</sup> )           | 550.1 [551.18] | Yes                      |
| ALTBAR                            | 89             | No                       |
| ASPBAR                            | 9              | No                       |
| ASPVAR                            | 0.21           | No                       |
| BFIHOST                           | 0.61           | No                       |
| BFIHOST19                         | 0.67           | No                       |
| DPLBAR (km)                       | 24.71          | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 32             | No                       |
| FARL                              | 0.91           | No                       |
| LDP                               | 41.58          | No                       |
| PROPWET                           | 0.32           | No                       |
| RMED1H                            | 11.6           | No                       |
| RMED1D                            | 32.1           | No                       |
| RMED2D                            | 41.2           | No                       |
| SAAR (mm)                         | 716            | No                       |
| SAAR4170 (mm)                     | 725            | No                       |
| SPRHOST                           | 26.95          | No                       |
| URBEXT2000                        | 0.12           | No                       |
| URBEXT1990                        | 0.06           | No                       |
| URBCONC                           | 0.86           | No                       |
| URBLOC                            | 1.12           | No                       |
| DDF parameter C                   | -0.03          | No                       |
| DDF parameter D1                  | 0.31           | No                       |
| DDF parameter D2                  | 0.27           | No                       |
| DDF parameter D3                  | 0.34           | No                       |
| DDF parameter E                   | 0.3            | No                       |
| DDF parameter F                   | 2.59           | No                       |
| DDF parameter C (1km grid value)  | -0.03          | No                       |
| DDF parameter D1 (1km grid value) | 0.26           | No                       |
| DDF parameter D2 (1km grid value) | 0.26           | No                       |
| DDF parameter D3 (1km grid value) | 0.33           | No                       |
| DDF parameter E (1km grid value)  | 0.3            | No                       |
| DDF parameter F (1km grid value)  | 2.62           | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

# UK Design Flood Estimation

Generated on 29 July 2025 13:09:50 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

Site detailsChecksum: 3924-2653

Site name: FEH\_Catchment\_Descriptors\_474950\_168300\_v5\_0\_1

Easting: 474950

Northing: 168300

Country: England, Wales or Northern Ireland

Catchment Area (km²): 550.1 [551.18]\*

Using plot scale calculations: No

Model: 2.3

Site description:None

## Model run: 1000 year

### Summary of results

|                        |        |                    |          |
|------------------------|--------|--------------------|----------|
| Rainfall - FEH22 (mm): | 132.18 | Total runoff (ML): | 10957.83 |
| Total Rainfall (mm):   | 87.25  | Total flow (ML):   | 32512.96 |
| Peak Rainfall (mm):    | 17.01  | Peak flow (m³/s):  | 140.95   |

### Parameters

Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.  
\* Indicates that the user locked the duration/timestep

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 26:00:00 | No            |
| Timestep (hh:mm:ss)              | 02:00:00 | No            |
| SCF (Seasonal correction factor) | 0.72     | No            |
| ARF (Areal reduction factor)     | 0.91     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 75.2   | No            |
| Cmax (mm)                   | 635.11 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 14.63 | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 5.82  | No            |
| BL (hr)                 | 82.04 | No            |
| BR                      | 2.53  | No            |

#### Urbanisation parameters

| Name                                      | Value | User-defined? |
|-------------------------------------------|-------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0     | No            |
| Exporting drained area (km <sup>2</sup> ) | 0     | No            |
| Urban area (km <sup>2</sup> )             | 99.65 | No            |
| Effective URBEXT2000                      | 0.12  | n/a           |
| Impervious runoff factor                  | 0.7   | No            |
| Imperviousness factor                     | 0.4   | No            |
| Tp scaling factor                         | 0.75  | No            |
| Depression storage depth (mm)             | 0.5   | No            |

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 1.553        | 0.000                | 0.254            | 0.000            | 5.402              | 5.402                |
| 02:00:00           | 2.404        | 0.000                | 0.402            | 0.154            | 5.274              | 5.428                |
| 04:00:00           | 3.710        | 0.000                | 0.637            | 0.707            | 5.161              | 5.868                |
| 06:00:00           | 5.699        | 0.000                | 1.019            | 1.891            | 5.079              | 6.969                |
| 08:00:00           | 8.691        | 0.000                | 1.648            | 4.073            | 5.053              | 9.126                |
| 10:00:00           | 13.061       | 0.000                | 2.689            | 7.851            | 5.128              | 12.979               |
| 12:00:00           | 17.011       | 0.000                | 3.884            | 14.164           | 5.373              | 19.536               |
| 14:00:00           | 13.061       | 0.000                | 3.276            | 24.070           | 5.901              | 29.971               |
| 16:00:00           | 8.691        | 0.000                | 2.321            | 37.643           | 6.854              | 44.497               |
| 18:00:00           | 5.699        | 0.000                | 1.583            | 53.516           | 8.355              | 61.871               |
| 20:00:00           | 3.710        | 0.000                | 1.057            | 70.173           | 10.475             | 80.648               |
| 22:00:00           | 2.404        | 0.000                | 0.696            | 86.059           | 13.239             | 99.298               |
| 24:00:00           | 1.553        | 0.000                | 0.454            | 99.449           | 16.622             | 116.072              |
| 26:00:00           | 0.000        | 0.000                | 0.000            | 108.674          | 20.545             | 129.218              |
| 28:00:00           | 0.000        | 0.000                | 0.000            | 112.815          | 24.851             | 137.667              |
| 30:00:00           | 0.000        | 0.000                | 0.000            | 111.638          | 29.310             | 140.948              |
| 32:00:00           | 0.000        | 0.000                | 0.000            | 106.407          | 33.680             | 140.087              |
| 34:00:00           | 0.000        | 0.000                | 0.000            | 98.590           | 37.778             | 136.368              |
| 36:00:00           | 0.000        | 0.000                | 0.000            | 89.399           | 41.482             | 130.882              |
| 38:00:00           | 0.000        | 0.000                | 0.000            | 79.646           | 44.721             | 124.367              |
| 40:00:00           | 0.000        | 0.000                | 0.000            | 69.926           | 47.462             | 117.388              |
| 42:00:00           | 0.000        | 0.000                | 0.000            | 60.673           | 49.709             | 110.382              |
| 44:00:00           | 0.000        | 0.000                | 0.000            | 52.392           | 51.501             | 103.893              |
| 46:00:00           | 0.000        | 0.000                | 0.000            | 45.033           | 52.900             | 97.934               |
| 48:00:00           | 0.000        | 0.000                | 0.000            | 38.434           | 53.958             | 92.392               |
| 50:00:00           | 0.000        | 0.000                | 0.000            | 32.468           | 54.713             | 87.181               |
| 52:00:00           | 0.000        | 0.000                | 0.000            | 27.115           | 55.194             | 82.309               |
| 54:00:00           | 0.000        | 0.000                | 0.000            | 22.436           | 55.422             | 77.858               |
| 56:00:00           | 0.000        | 0.000                | 0.000            | 18.362           | 55.414             | 73.776               |
| 58:00:00           | 0.000        | 0.000                | 0.000            | 14.706           | 55.185             | 69.891               |
| 60:00:00           | 0.000        | 0.000                | 0.000            | 11.380           | 54.745             | 66.126               |
| 62:00:00           | 0.000        | 0.000                | 0.000            | 8.376            | 54.110             | 62.486               |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 5.754                         | 53.302                          | 59.056                            |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 3.657                         | 52.349                          | 56.006                            |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 2.172                         | 51.294                          | 53.466                            |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 1.199                         | 50.177                          | 51.376                            |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.596                         | 49.032                          | 49.628                            |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.248                         | 47.881                          | 48.128                            |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.069                         | 46.739                          | 46.808                            |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.004                         | 45.616                          | 45.620                            |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 44.517                          | 44.517                            |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 43.445                          | 43.445                            |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 42.399                          | 42.399                            |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 41.378                          | 41.378                            |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 40.381                          | 40.381                            |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 39.409                          | 39.409                            |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 38.460                          | 38.460                            |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 37.533                          | 37.533                            |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 36.629                          | 36.629                            |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 35.747                          | 35.747                            |
| 100:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 34.886                          | 34.886                            |
| 102:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 34.046                          | 34.046                            |
| 104:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 33.226                          | 33.226                            |
| 106:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 32.426                          | 32.426                            |
| 108:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 31.645                          | 31.645                            |
| 110:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 30.883                          | 30.883                            |
| 112:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 30.139                          | 30.139                            |
| 114:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 29.413                          | 29.413                            |
| 116:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 28.705                          | 28.705                            |
| 118:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 28.014                          | 28.014                            |
| 120:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 27.339                          | 27.339                            |
| 122:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 26.681                          | 26.681                            |
| 124:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 26.038                          | 26.038                            |
| 126:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 25.411                          | 25.411                            |
| 128:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 24.799                          | 24.799                            |
| 130:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 24.202                          | 24.202                            |
| 132:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 23.619                          | 23.619                            |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 134:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 23.050                          | 23.050                            |
| 136:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 22.495                          | 22.495                            |
| 138:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 21.953                          | 21.953                            |
| 140:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 21.424                          | 21.424                            |
| 142:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.908                          | 20.908                            |
| 144:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 20.405                          | 20.405                            |
| 146:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.913                          | 19.913                            |
| 148:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 19.434                          | 19.434                            |
| 150:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.966                          | 18.966                            |
| 152:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.509                          | 18.509                            |
| 154:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 18.063                          | 18.063                            |
| 156:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.628                          | 17.628                            |
| 158:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 17.204                          | 17.204                            |
| 160:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.789                          | 16.789                            |
| 162:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 16.385                          | 16.385                            |
| 164:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.990                          | 15.990                            |
| 166:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.605                          | 15.605                            |
| 168:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 15.230                          | 15.230                            |
| 170:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.863                          | 14.863                            |
| 172:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.505                          | 14.505                            |
| 174:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 14.155                          | 14.155                            |
| 176:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.815                          | 13.815                            |
| 178:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.482                          | 13.482                            |
| 180:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 13.157                          | 13.157                            |
| 182:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.840                          | 12.840                            |
| 184:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.531                          | 12.531                            |
| 186:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 12.229                          | 12.229                            |
| 188:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.935                          | 11.935                            |
| 190:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.647                          | 11.647                            |
| 192:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.367                          | 11.367                            |
| 194:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 11.093                          | 11.093                            |
| 196:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.826                          | 10.826                            |
| 198:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.565                          | 10.565                            |
| 200:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.311                          | 10.311                            |
| 202:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 10.062                          | 10.062                            |

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 204:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.820                           | 9.820                             |
| 206:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.584                           | 9.584                             |
| 208:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.353                           | 9.353                             |
| 210:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 9.128                           | 9.128                             |
| 212:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.908                           | 8.908                             |
| 214:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.693                           | 8.693                             |
| 216:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.484                           | 8.484                             |
| 218:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.279                           | 8.279                             |
| 220:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 8.080                           | 8.080                             |
| 222:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.885                           | 7.885                             |
| 224:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.696                           | 7.696                             |
| 226:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.510                           | 7.510                             |
| 228:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.329                           | 7.329                             |
| 230:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 7.153                           | 7.153                             |
| 232:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.981                           | 6.981                             |
| 234:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.812                           | 6.812                             |
| 236:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.648                           | 6.648                             |
| 238:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.488                           | 6.488                             |
| 240:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.332                           | 6.332                             |
| 242:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.180                           | 6.180                             |
| 244:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 6.031                           | 6.031                             |
| 246:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.885                           | 5.885                             |
| 248:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.744                           | 5.744                             |
| 250:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.605                           | 5.605                             |
| 252:00:00          | 0.000        | 0.000                             | 0.000            | 0.000                         | 5.470                           | 5.470                             |

## Appendix

### Catchment descriptors \*

| Name                              | Value          | User-defined value used? |
|-----------------------------------|----------------|--------------------------|
| Area (km <sup>2</sup> )           | 550.1 [551.18] | Yes                      |
| ALTBAR                            | 89             | No                       |
| ASPBAR                            | 9              | No                       |
| ASPVAR                            | 0.21           | No                       |
| BFIHOST                           | 0.61           | No                       |
| BFIHOST19                         | 0.67           | No                       |
| DPLBAR (km)                       | 24.71          | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 32             | No                       |
| FARL                              | 0.91           | No                       |
| LDP                               | 41.58          | No                       |
| PROPWET                           | 0.32           | No                       |
| RMED1H                            | 11.6           | No                       |
| RMED1D                            | 32.1           | No                       |
| RMED2D                            | 41.2           | No                       |
| SAAR (mm)                         | 716            | No                       |
| SAAR4170 (mm)                     | 725            | No                       |
| SPRHOST                           | 26.95          | No                       |
| URBEXT2000                        | 0.12           | No                       |
| URBEXT1990                        | 0.06           | No                       |
| URBCONC                           | 0.86           | No                       |
| URBLOC                            | 1.12           | No                       |
| DDF parameter C                   | -0.03          | No                       |
| DDF parameter D1                  | 0.31           | No                       |
| DDF parameter D2                  | 0.27           | No                       |
| DDF parameter D3                  | 0.34           | No                       |
| DDF parameter E                   | 0.3            | No                       |
| DDF parameter F                   | 2.59           | No                       |
| DDF parameter C (1km grid value)  | -0.03          | No                       |
| DDF parameter D1 (1km grid value) | 0.26           | No                       |
| DDF parameter D2 (1km grid value) | 0.26           | No                       |
| DDF parameter D3 (1km grid value) | 0.33           | No                       |
| DDF parameter E (1km grid value)  | 0.3            | No                       |
| DDF parameter F (1km grid value)  | 2.62           | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

# UK Design Flood Estimation

Generated on 29 July 2025 13:29:46 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: B6C0-F2DC

Site name: FEH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1

Easting: 474550

Northing: 168500

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.63 [1.19]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 30 year

### Summary of results

|                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 51.55 | Total runoff (ML):             | 7.64  |
| Total Rainfall (mm):   | 33.00 | Total flow (ML):               | 20.77 |
| Peak Rainfall (mm):    | 8.98  | Peak flow (m <sup>3</sup> /s): | 0.46  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 04:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.65     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 103.71 | No            |
| Cmax (mm)                   | 409.43 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 2.96  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.02  | No            |
| BL (hr)                 | 35.33 | No            |
| BR                      | 2.41  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.24 [0.09] | Yes           |
| Effective URBEXT2000                      | 0.24        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 00:00:00           | 0.943        | 0.000                             | 0.308            | 0.000                         | 0.013                           | 0.013                             |
| 00:30:00           | 1.770        | 0.000                             | 0.594            | 0.001                         | 0.013                           | 0.014                             |
| 01:00:00           | 3.290        | 0.000                             | 1.122            | 0.007                         | 0.013                           | 0.020                             |
| 01:30:00           | 6.011        | 0.000                             | 2.112            | 0.020                         | 0.013                           | 0.033                             |
| 02:00:00           | 8.976        | 0.000                             | 3.300            | 0.048                         | 0.013                           | 0.061                             |
| 02:30:00           | 6.011        | 0.000                             | 2.309            | 0.100                         | 0.014                           | 0.114                             |
| 03:00:00           | 3.290        | 0.000                             | 1.297            | 0.174                         | 0.016                           | 0.190                             |
| 03:30:00           | 1.770        | 0.000                             | 0.707            | 0.257                         | 0.020                           | 0.277                             |
| 04:00:00           | 0.943        | 0.000                             | 0.380            | 0.335                         | 0.025                           | 0.360                             |
| 04:30:00           | 0.000        | 0.000                             | 0.000            | 0.394                         | 0.032                           | 0.425                             |
| 05:00:00           | 0.000        | 0.000                             | 0.000            | 0.418                         | 0.040                           | 0.458                             |
| 05:30:00           | 0.000        | 0.000                             | 0.000            | 0.409                         | 0.048                           | 0.457                             |
| 06:00:00           | 0.000        | 0.000                             | 0.000            | 0.376                         | 0.057                           | 0.432                             |
| 06:30:00           | 0.000        | 0.000                             | 0.000            | 0.330                         | 0.064                           | 0.395                             |
| 07:00:00           | 0.000        | 0.000                             | 0.000            | 0.283                         | 0.071                           | 0.354                             |
| 07:30:00           | 0.000        | 0.000                             | 0.000            | 0.238                         | 0.077                           | 0.316                             |
| 08:00:00           | 0.000        | 0.000                             | 0.000            | 0.198                         | 0.082                           | 0.280                             |
| 08:30:00           | 0.000        | 0.000                             | 0.000            | 0.162                         | 0.086                           | 0.248                             |
| 09:00:00           | 0.000        | 0.000                             | 0.000            | 0.131                         | 0.089                           | 0.220                             |
| 09:30:00           | 0.000        | 0.000                             | 0.000            | 0.103                         | 0.092                           | 0.195                             |
| 10:00:00           | 0.000        | 0.000                             | 0.000            | 0.079                         | 0.094                           | 0.173                             |
| 10:30:00           | 0.000        | 0.000                             | 0.000            | 0.059                         | 0.095                           | 0.155                             |
| 11:00:00           | 0.000        | 0.000                             | 0.000            | 0.044                         | 0.096                           | 0.140                             |
| 11:30:00           | 0.000        | 0.000                             | 0.000            | 0.032                         | 0.096                           | 0.128                             |
| 12:00:00           | 0.000        | 0.000                             | 0.000            | 0.022                         | 0.096                           | 0.118                             |
| 12:30:00           | 0.000        | 0.000                             | 0.000            | 0.013                         | 0.096                           | 0.109                             |
| 13:00:00           | 0.000        | 0.000                             | 0.000            | 0.007                         | 0.095                           | 0.102                             |
| 13:30:00           | 0.000        | 0.000                             | 0.000            | 0.003                         | 0.094                           | 0.097                             |
| 14:00:00           | 0.000        | 0.000                             | 0.000            | 0.001                         | 0.093                           | 0.094                             |
| 14:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.091                           | 0.092                             |
| 15:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.090                           | 0.090                             |
| 15:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.089                           | 0.089                             |
| 16:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.087                           | 0.087                             |
| 16:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.086                           | 0.086                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.085                           | 0.085                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.084                           | 0.084                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.083                           | 0.083                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.082                           | 0.082                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.080                           | 0.080                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.079                           | 0.079                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.078                           | 0.078                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.077                           | 0.077                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.076                           | 0.076                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.075                           | 0.075                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.074                           | 0.074                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.073                           | 0.073                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.072                           | 0.072                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.071                           | 0.071                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.070                           | 0.070                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.069                           | 0.069                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.068                           | 0.068                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.067                           | 0.067                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.066                           | 0.066                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.064                           | 0.064                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.062                           | 0.062                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.060                           | 0.060                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.058                           | 0.058                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.63 [1.19] | Yes                      |
| ALTBAR                            | 51          | No                       |
| ASPBAR                            | 116         | No                       |
| ASPVAR                            | 0.73        | No                       |
| BFIHOST                           | 0.46        | No                       |
| BFIHOST19                         | 0.49        | No                       |
| DPLBAR (km)                       | 1           | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 21.5        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 2.06        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 638         | No                       |
| SAAR4170 (mm)                     | 647         | No                       |
| SPRHOST                           | 36.1        | No                       |
| URBEXT2000                        | 0.24 [0.09] | Yes                      |
| URBEXT1990                        | 0.05        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.53        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# UK Design Flood Estimation

Generated on 29 July 2025 13:30:21 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: B6C0-F2DC

Site name: FEH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1

Easting: 474550

Northing: 168500

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.63 [1.19]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 100 year

### Summary of results

|                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 64.97 | Total runoff (ML):             | 9.88  |
| Total Rainfall (mm):   | 41.60 | Total flow (ML):               | 26.19 |
| Peak Rainfall (mm):    | 11.31 | Peak flow (m <sup>3</sup> /s): | 0.59  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 04:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.65     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 103.71 | No            |
| Cmax (mm)                   | 409.43 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 2.96  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.02  | No            |
| BL (hr)                 | 35.33 | No            |
| BR                      | 2.29  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.24 [0.09] | Yes           |
| Effective URBEXT2000                      | 0.24        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 1.189        | 0.000                | 0.390            | 0.000            | 0.013              | 0.013                |
| 00:30:00           | 2.230        | 0.000                | 0.751            | 0.002            | 0.013              | 0.015                |
| 01:00:00           | 4.147        | 0.000                | 1.425            | 0.009            | 0.013              | 0.022                |
| 01:30:00           | 7.576        | 0.000                | 2.700            | 0.026            | 0.013              | 0.038                |
| 02:00:00           | 11.314       | 0.000                | 4.266            | 0.061            | 0.013              | 0.074                |
| 02:30:00           | 7.576        | 0.000                | 3.013            | 0.127            | 0.015              | 0.142                |
| 03:00:00           | 4.147        | 0.000                | 1.703            | 0.222            | 0.017              | 0.240                |
| 03:30:00           | 2.230        | 0.000                | 0.931            | 0.329            | 0.022              | 0.351                |
| 04:00:00           | 1.189        | 0.000                | 0.501            | 0.431            | 0.028              | 0.459                |
| 04:30:00           | 0.000        | 0.000                | 0.000            | 0.507            | 0.036              | 0.543                |
| 05:00:00           | 0.000        | 0.000                | 0.000            | 0.539            | 0.046              | 0.585                |
| 05:30:00           | 0.000        | 0.000                | 0.000            | 0.529            | 0.057              | 0.585                |
| 06:00:00           | 0.000        | 0.000                | 0.000            | 0.486            | 0.067              | 0.554                |
| 06:30:00           | 0.000        | 0.000                | 0.000            | 0.429            | 0.077              | 0.506                |
| 07:00:00           | 0.000        | 0.000                | 0.000            | 0.367            | 0.086              | 0.453                |
| 07:30:00           | 0.000        | 0.000                | 0.000            | 0.310            | 0.093              | 0.403                |
| 08:00:00           | 0.000        | 0.000                | 0.000            | 0.257            | 0.099              | 0.357                |
| 08:30:00           | 0.000        | 0.000                | 0.000            | 0.211            | 0.104              | 0.315                |
| 09:00:00           | 0.000        | 0.000                | 0.000            | 0.171            | 0.108              | 0.279                |
| 09:30:00           | 0.000        | 0.000                | 0.000            | 0.135            | 0.112              | 0.246                |
| 10:00:00           | 0.000        | 0.000                | 0.000            | 0.103            | 0.114              | 0.217                |
| 10:30:00           | 0.000        | 0.000                | 0.000            | 0.078            | 0.116              | 0.194                |
| 11:00:00           | 0.000        | 0.000                | 0.000            | 0.058            | 0.117              | 0.175                |
| 11:30:00           | 0.000        | 0.000                | 0.000            | 0.042            | 0.117              | 0.159                |
| 12:00:00           | 0.000        | 0.000                | 0.000            | 0.028            | 0.117              | 0.146                |
| 12:30:00           | 0.000        | 0.000                | 0.000            | 0.017            | 0.117              | 0.134                |
| 13:00:00           | 0.000        | 0.000                | 0.000            | 0.009            | 0.116              | 0.125                |
| 13:30:00           | 0.000        | 0.000                | 0.000            | 0.004            | 0.114              | 0.118                |
| 14:00:00           | 0.000        | 0.000                | 0.000            | 0.002            | 0.113              | 0.114                |
| 14:30:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.111              | 0.112                |
| 15:00:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.110              | 0.110                |
| 15:30:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.108              | 0.108                |
| 16:00:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.107              | 0.107                |
| 16:30:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.105              | 0.105                |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.104                           | 0.104                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.102                           | 0.102                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.101                           | 0.101                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.099                           | 0.099                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.098                           | 0.098                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.097                           | 0.097                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.095                           | 0.095                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.094                           | 0.094                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.093                           | 0.093                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.091                           | 0.091                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.090                           | 0.090                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.089                           | 0.089                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.088                           | 0.088                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.086                           | 0.086                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.085                           | 0.085                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.084                           | 0.084                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.083                           | 0.083                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.082                           | 0.082                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.080                           | 0.080                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.079                           | 0.079                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.078                           | 0.078                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.077                           | 0.077                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.076                           | 0.076                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.075                           | 0.075                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.074                           | 0.074                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.073                           | 0.073                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.072                           | 0.072                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.071                           | 0.071                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.070                           | 0.070                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.069                           | 0.069                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.068                           | 0.068                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.067                           | 0.067                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.066                           | 0.066                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.064                           | 0.064                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.062                           | 0.062                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.060                           | 0.060                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.058                           | 0.058                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |

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| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 83:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 83:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 84:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 85:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 85:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 86:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 87:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 87:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 88:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 89:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.014                           | 0.014                             |
| 89:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.013                           | 0.013                             |

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## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.63 [1.19] | Yes                      |
| ALTBAR                            | 51          | No                       |
| ASPBAR                            | 116         | No                       |
| ASPVAR                            | 0.73        | No                       |
| BFIHOST                           | 0.46        | No                       |
| BFIHOST19                         | 0.49        | No                       |
| DPLBAR (km)                       | 1           | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 21.5        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 2.06        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 638         | No                       |
| SAAR4170 (mm)                     | 647         | No                       |
| SPRHOST                           | 36.1        | No                       |
| URBEXT2000                        | 0.24 [0.09] | Yes                      |
| URBEXT1990                        | 0.05        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.53        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# UK Design Flood Estimation

Generated on 29 July 2025 13:30:29 by Helena.duroe  
Printed from the ReFH2 Flood Modelling software package, version 4.1.8985.14298

## Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH2)

### Site details

Checksum: B6C0-F2DC

Site name: FEH\_Catchment\_Descriptors\_474550\_168500\_v5\_0\_1

Easting: 474550

Northing: 168500

Country: England, Wales or Northern Ireland

Catchment Area (km<sup>2</sup>): 0.63 [1.19]\*

Using plot scale calculations: No

Model: 2.3

Site description: None

## Model run: 1000 year

### Summary of results

|                        |       |                                |       |
|------------------------|-------|--------------------------------|-------|
| Rainfall - FEH22 (mm): | 98.93 | Total runoff (ML):             | 15.99 |
| Total Rainfall (mm):   | 63.34 | Total flow (ML):               | 39.73 |
| Peak Rainfall (mm):    | 17.23 | Peak flow (m <sup>3</sup> /s): | 0.93  |

### Parameters

*Where the user has overridden a system-generated value, this original value is shown in square brackets after the value used.*

*\* Indicates that the user locked the duration/timestep*

#### Rainfall parameters (Rainfall - FEH22)

| Name                             | Value    | User-defined? |
|----------------------------------|----------|---------------|
| Duration (hh:mm:ss)              | 04:30:00 | No            |
| Timestep (hh:mm:ss)              | 00:30:00 | No            |
| SCF (Seasonal correction factor) | 0.65     | No            |
| ARF (Areal reduction factor)     | 0.98     | No            |
| Seasonality                      | Winter   | No            |

#### Loss model parameters

| Name                        | Value  | User-defined? |
|-----------------------------|--------|---------------|
| Cini (mm)                   | 103.71 | No            |
| Cmax (mm)                   | 409.43 | No            |
| Use alpha correction factor | No     | No            |
| Alpha correction factor     | n/a    | No            |

#### Routing model parameters

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Name    | Value | User-defined? |
|---------|-------|---------------|
| Tp (hr) | 2.96  | No            |
| Up      | 0.65  | No            |
| Uk      | 0.8   | No            |

#### Baseflow model parameters

| Name                    | Value | User-defined? |
|-------------------------|-------|---------------|
| BF0 (m <sup>3</sup> /s) | 0.02  | No            |
| BL (hr)                 | 35.33 | No            |
| BR                      | 2.02  | No            |

#### Urbanisation parameters

| Name                                      | Value       | User-defined? |
|-------------------------------------------|-------------|---------------|
| Sewer capacity (m <sup>3</sup> /s)        | 0           | No            |
| Exporting drained area (km <sup>2</sup> ) | 0           | No            |
| Urban area (km <sup>2</sup> )             | 0.24 [0.09] | Yes           |
| Effective URBEXT2000                      | 0.24        | n/a           |
| Impervious runoff factor                  | 0.7         | No            |
| Imperviousness factor                     | 0.4         | No            |
| Tp scaling factor                         | 0.75        | No            |
| Depression storage depth (mm)             | 0.5         | No            |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

# Time series data

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m³/s) | Net Rain<br>(mm) | Runoff<br>(m³/s) | Baseflow<br>(m³/s) | Total Flow<br>(m³/s) |
|--------------------|--------------|----------------------|------------------|------------------|--------------------|----------------------|
| 00:00:00           | 1.810        | 0.000                | 0.598            | 0.000            | 0.013              | 0.013                |
| 00:30:00           | 3.396        | 0.000                | 1.152            | 0.003            | 0.013              | 0.016                |
| 01:00:00           | 6.315        | 0.000                | 2.210            | 0.013            | 0.013              | 0.026                |
| 01:30:00           | 11.535       | 0.000                | 4.261            | 0.039            | 0.013              | 0.052                |
| 02:00:00           | 17.226       | 0.000                | 6.905            | 0.094            | 0.014              | 0.108                |
| 02:30:00           | 11.535       | 0.000                | 4.987            | 0.198            | 0.016              | 0.214                |
| 03:00:00           | 6.315        | 0.000                | 2.853            | 0.349            | 0.020              | 0.369                |
| 03:30:00           | 3.396        | 0.000                | 1.570            | 0.521            | 0.026              | 0.547                |
| 04:00:00           | 1.810        | 0.000                | 0.847            | 0.686            | 0.035              | 0.721                |
| 04:30:00           | 0.000        | 0.000                | 0.000            | 0.812            | 0.047              | 0.859                |
| 05:00:00           | 0.000        | 0.000                | 0.000            | 0.869            | 0.061              | 0.930                |
| 05:30:00           | 0.000        | 0.000                | 0.000            | 0.856            | 0.077              | 0.933                |
| 06:00:00           | 0.000        | 0.000                | 0.000            | 0.791            | 0.092              | 0.884                |
| 06:30:00           | 0.000        | 0.000                | 0.000            | 0.699            | 0.107              | 0.806                |
| 07:00:00           | 0.000        | 0.000                | 0.000            | 0.601            | 0.120              | 0.721                |
| 07:30:00           | 0.000        | 0.000                | 0.000            | 0.507            | 0.131              | 0.638                |
| 08:00:00           | 0.000        | 0.000                | 0.000            | 0.421            | 0.140              | 0.562                |
| 08:30:00           | 0.000        | 0.000                | 0.000            | 0.346            | 0.148              | 0.494                |
| 09:00:00           | 0.000        | 0.000                | 0.000            | 0.281            | 0.154              | 0.435                |
| 09:30:00           | 0.000        | 0.000                | 0.000            | 0.223            | 0.158              | 0.381                |
| 10:00:00           | 0.000        | 0.000                | 0.000            | 0.172            | 0.162              | 0.334                |
| 10:30:00           | 0.000        | 0.000                | 0.000            | 0.130            | 0.165              | 0.295                |
| 11:00:00           | 0.000        | 0.000                | 0.000            | 0.097            | 0.167              | 0.264                |
| 11:30:00           | 0.000        | 0.000                | 0.000            | 0.071            | 0.167              | 0.238                |
| 12:00:00           | 0.000        | 0.000                | 0.000            | 0.048            | 0.167              | 0.216                |
| 12:30:00           | 0.000        | 0.000                | 0.000            | 0.030            | 0.167              | 0.196                |
| 13:00:00           | 0.000        | 0.000                | 0.000            | 0.016            | 0.165              | 0.181                |
| 13:30:00           | 0.000        | 0.000                | 0.000            | 0.007            | 0.163              | 0.171                |
| 14:00:00           | 0.000        | 0.000                | 0.000            | 0.003            | 0.161              | 0.164                |
| 14:30:00           | 0.000        | 0.000                | 0.000            | 0.001            | 0.159              | 0.160                |
| 15:00:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.157              | 0.157                |
| 15:30:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.155              | 0.155                |
| 16:00:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.153              | 0.153                |
| 16:30:00           | 0.000        | 0.000                | 0.000            | 0.000            | 0.150              | 0.150                |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 17:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.148                           | 0.148                             |
| 17:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.146                           | 0.146                             |
| 18:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.144                           | 0.144                             |
| 18:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.142                           | 0.142                             |
| 19:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.140                           | 0.140                             |
| 19:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.138                           | 0.138                             |
| 20:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.136                           | 0.136                             |
| 20:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.134                           | 0.134                             |
| 21:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.132                           | 0.132                             |
| 21:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.131                           | 0.131                             |
| 22:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.129                           | 0.129                             |
| 22:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.127                           | 0.127                             |
| 23:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.125                           | 0.125                             |
| 23:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.123                           | 0.123                             |
| 24:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.122                           | 0.122                             |
| 24:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.120                           | 0.120                             |
| 25:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.118                           | 0.118                             |
| 25:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.117                           | 0.117                             |
| 26:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.115                           | 0.115                             |
| 26:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.113                           | 0.113                             |
| 27:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.112                           | 0.112                             |
| 27:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.110                           | 0.110                             |
| 28:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.109                           | 0.109                             |
| 28:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.107                           | 0.107                             |
| 29:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.106                           | 0.106                             |
| 29:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.104                           | 0.104                             |
| 30:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.103                           | 0.103                             |
| 30:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.101                           | 0.101                             |
| 31:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.100                           | 0.100                             |
| 31:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.098                           | 0.098                             |
| 32:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.097                           | 0.097                             |
| 32:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.096                           | 0.096                             |
| 33:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.094                           | 0.094                             |
| 33:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.093                           | 0.093                             |
| 34:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.092                           | 0.092                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 34:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.090                           | 0.090                             |
| 35:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.089                           | 0.089                             |
| 35:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.088                           | 0.088                             |
| 36:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.087                           | 0.087                             |
| 36:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.085                           | 0.085                             |
| 37:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.084                           | 0.084                             |
| 37:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.083                           | 0.083                             |
| 38:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.082                           | 0.082                             |
| 38:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.081                           | 0.081                             |
| 39:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.080                           | 0.080                             |
| 39:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.078                           | 0.078                             |
| 40:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.077                           | 0.077                             |
| 40:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.076                           | 0.076                             |
| 41:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.075                           | 0.075                             |
| 41:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.074                           | 0.074                             |
| 42:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.073                           | 0.073                             |
| 42:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.072                           | 0.072                             |
| 43:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.071                           | 0.071                             |
| 43:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.070                           | 0.070                             |
| 44:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.069                           | 0.069                             |
| 44:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.068                           | 0.068                             |
| 45:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.067                           | 0.067                             |
| 45:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.066                           | 0.066                             |
| 46:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.065                           | 0.065                             |
| 46:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.064                           | 0.064                             |
| 47:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 47:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.063                           | 0.063                             |
| 48:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.062                           | 0.062                             |
| 48:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.061                           | 0.061                             |
| 49:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.060                           | 0.060                             |
| 49:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.059                           | 0.059                             |
| 50:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.058                           | 0.058                             |
| 50:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 51:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.057                           | 0.057                             |
| 51:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.056                           | 0.056                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 52:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.055                           | 0.055                             |
| 52:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 53:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.054                           | 0.054                             |
| 53:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.053                           | 0.053                             |
| 54:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.052                           | 0.052                             |
| 54:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 55:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.051                           | 0.051                             |
| 55:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.050                           | 0.050                             |
| 56:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.049                           | 0.049                             |
| 56:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 57:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.048                           | 0.048                             |
| 57:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.047                           | 0.047                             |
| 58:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 58:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.046                           | 0.046                             |
| 59:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 59:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.045                           | 0.045                             |
| 60:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.044                           | 0.044                             |
| 60:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 61:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.043                           | 0.043                             |
| 61:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.042                           | 0.042                             |
| 62:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 62:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.041                           | 0.041                             |
| 63:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 63:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.040                           | 0.040                             |
| 64:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 64:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.039                           | 0.039                             |
| 65:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 65:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.038                           | 0.038                             |
| 66:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 66:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.037                           | 0.037                             |
| 67:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 67:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.036                           | 0.036                             |
| 68:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 68:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.035                           | 0.035                             |
| 69:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 69:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.034                           | 0.034                             |
| 70:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 70:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.033                           | 0.033                             |
| 71:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 71:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.032                           | 0.032                             |
| 72:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 72:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.031                           | 0.031                             |
| 73:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 73:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 74:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.030                           | 0.030                             |
| 74:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 75:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.029                           | 0.029                             |
| 75:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 76:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 76:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.028                           | 0.028                             |
| 77:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 77:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.027                           | 0.027                             |
| 78:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 78:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 79:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.026                           | 0.026                             |
| 79:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 80:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 80:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.025                           | 0.025                             |
| 81:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 81:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 82:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.024                           | 0.024                             |
| 82:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 83:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 83:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.023                           | 0.023                             |
| 84:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 84:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 85:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.022                           | 0.022                             |
| 85:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 86:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |
| 86:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.021                           | 0.021                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

| Time<br>(hh:mm:ss) | Rain<br>(mm) | Sewer Loss<br>(m <sup>3</sup> /s) | Net Rain<br>(mm) | Runoff<br>(m <sup>3</sup> /s) | Baseflow<br>(m <sup>3</sup> /s) | Total Flow<br>(m <sup>3</sup> /s) |
|--------------------|--------------|-----------------------------------|------------------|-------------------------------|---------------------------------|-----------------------------------|
| 87:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 87:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 88:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 88:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.020                           | 0.020                             |
| 89:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 89:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 90:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 90:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.019                           | 0.019                             |
| 91:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 91:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 92:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 92:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.018                           | 0.018                             |
| 93:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 93:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 94:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 94:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.017                           | 0.017                             |
| 95:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 95:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 96:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 96:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.016                           | 0.016                             |
| 97:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 97:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 98:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 98:30:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |
| 99:00:00           | 0.000        | 0.000                             | 0.000            | 0.000                         | 0.015                           | 0.015                             |

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix

### Catchment descriptors \*

| Name                              | Value       | User-defined value used? |
|-----------------------------------|-------------|--------------------------|
| Area (km <sup>2</sup> )           | 0.63 [1.19] | Yes                      |
| ALTBAR                            | 51          | No                       |
| ASPBAR                            | 116         | No                       |
| ASPVAR                            | 0.73        | No                       |
| BFIHOST                           | 0.46        | No                       |
| BFIHOST19                         | 0.49        | No                       |
| DPLBAR (km)                       | 1           | No                       |
| DPSBAR (mkm <sup>-1</sup> )       | 21.5        | No                       |
| FARL                              | 1           | No                       |
| LDP                               | 2.06        | No                       |
| PROPWET                           | 0.29        | No                       |
| RMED1H                            | 11.4        | No                       |
| RMED1D                            | 29.1        | No                       |
| RMED2D                            | 36.2        | No                       |
| SAAR (mm)                         | 638         | No                       |
| SAAR4170 (mm)                     | 647         | No                       |
| SPRHOST                           | 36.1        | No                       |
| URBEXT2000                        | 0.24 [0.09] | Yes                      |
| URBEXT1990                        | 0.05        | No                       |
| URBCONC                           | 0.8         | No                       |
| URBLOC                            | 1.53        | No                       |
| DDF parameter C                   | -0.03       | No                       |
| DDF parameter D1                  | 0.27        | No                       |
| DDF parameter D2                  | 0.27        | No                       |
| DDF parameter D3                  | 0.33        | No                       |
| DDF parameter E                   | 0.31        | No                       |
| DDF parameter F                   | 2.6         | No                       |
| DDF parameter C (1km grid value)  | -0.03       | No                       |
| DDF parameter D1 (1km grid value) | 0.26        | No                       |
| DDF parameter D2 (1km grid value) | 0.26        | No                       |
| DDF parameter D3 (1km grid value) | 0.33        | No                       |
| DDF parameter E (1km grid value)  | 0.3         | No                       |
| DDF parameter F (1km grid value)  | 2.62        | No                       |

*Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM*

*\*The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

## Appendix 3 - Full ReFH2 Hydrographs

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| Time     | 1-Year      | 2-Year      | 5-Year      | 10-Year     | 30-Year     | 50-Year     | 75-Year     | 100-Year    | 200-Year    | 1000-Year   | 100-Year+14%CC | 100-Year+23%CC | 100-Year+46%CC |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|
| 00:00:00 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 5.401618739 | 6.157845363    | 6.643991049    | 7.886363359    |
| 02:00:00 | 5.3097876   | 5.314472769 | 5.329074453 | 5.339061632 | 5.354780998 | 5.362496358 | 5.369045674 | 5.374005003 | 5.387339377 | 5.428375978 | 6.126365703    | 6.610026153    | 7.846047304    |
| 04:00:00 | 5.32105256  | 5.342829672 | 5.410298015 | 5.456228091 | 5.528580794 | 5.564120014 | 5.594302088 | 5.617165356 | 5.6786753   | 5.868304169 | 6.403568506    | 6.909113388    | 8.201061419    |
| 06:00:00 | 5.494447287 | 5.553093311 | 5.734398574 | 5.857655246 | 6.052079903 | 6.147696517 | 6.228959926 | 6.290554444 | 6.456420458 | 6.969186884 | 7.171232066    | 7.737381966    | 9.184209488    |
| 08:00:00 | 5.920302716 | 6.046885067 | 6.438414988 | 6.704870773 | 7.126012884 | 7.333499613 | 7.510031556 | 7.643952596 | 8.005081703 | 9.126014447 | 8.71410596     | 9.402061693    | 11.16017079    |
| 10:00:00 | 6.737549361 | 6.981043219 | 7.735554794 | 8.250293517 | 9.066201464 | 9.469222855 | 9.812653404 | 10.07351342 | 10.77833202 | 12.97866847 | 11.4838053     | 12.39042151    | 14.70732959    |
| 12:00:00 | 8.149448327 | 8.585858044 | 9.942201869 | 10.87106248 | 12.34946497 | 13.08242007 | 13.70837902 | 14.18467738 | 15.47515282 | 19.53610825 | 16.17053222    | 17.44715318    | 20.70962898    |
| 14:00:00 | 10.35820904 | 11.0923251  | 13.38331705 | 14.96038262 | 17.48417164 | 18.74144276 | 19.81826088 | 20.63949145 | 22.87245519 | 29.97099392 | 23.52902025    | 25.38657448    | 30.13365751    |
| 16:00:00 | 13.35068213 | 14.48841969 | 18.05507457 | 20.52384743 | 24.49642435 | 26.48499686 | 28.19301098 | 29.49855669 | 33.06083263 | 44.49720894 | 33.62835463    | 36.28322473    | 43.06789277    |
| 18:00:00 | 16.82826312 | 18.43878078 | 23.50799165 | 27.03398892 | 32.73514153 | 35.60094144 | 38.06845733 | 39.95817987 | 45.12980935 | 61.87091988 | 45.55232505    | 49.14856123    | 58.3389426     |
| 20:00:00 | 20.47730393 | 22.58939874 | 29.26094068 | 33.92121297 | 41.48767502 | 45.30471348 | 48.59811374 | 51.12444977 | 58.05567803 | 80.64818916 | 58.28187273    | 62.88307321    | 74.64169666    |
| 22:00:00 | 23.97230016 | 26.57246746 | 34.81248849 | 40.5907367  | 50.00766352 | 54.77347874 | 58.89316067 | 62.05792819 | 70.7601155  | 99.29792126 | 70.74603814    | 76.33125168    | 90.60457516    |
| 24:00:00 | 26.94960372 | 29.97664663 | 39.60012548 | 46.37400315 | 57.45360648 | 63.07816161 | 67.94879556 | 71.69562368 | 82.02006473 | 116.0715822 | 81.733011      | 88.18561713    | 104.6756106    |
| 26:00:00 | 29.07237486 | 32.4194869  | 43.09482865 | 50.63753104 | 63.01920838 | 69.32389636 | 74.79303529 | 79.00597836 | 90.63875603 | 129.2181557 | 90.06681533    | 97.17735338    | 115.3487284    |
| 28:00:00 | 30.20260164 | 33.74028592 | 45.05804937 | 53.08325635 | 66.30169753 | 73.05159467 | 78.91644768 | 83.43988966 | 95.95381721 | 137.666529  | 95.12147422    | 102.6310643    | 121.8222389    |
| 30:00:00 | 30.34290848 | 33.93654191 | 45.46415705 | 53.66359024 | 67.20861061 | 74.14216521 | 80.1749649  | 84.83292932 | 97.73990095 | 140.9476485 | 96.70953943    | 104.3445031    | 123.8560768    |
| 32:00:00 | 29.74854019 | 33.29469629 | 44.69559491 | 52.82591591 | 66.28941246 | 73.19511794 | 79.21054844 | 83.85918594 | 96.7573991  | 140.0867908 | 95.59947198    | 103.1467987    | 122.4344115    |
| 34:00:00 | 28.68360448 | 32.11366021 | 43.16182561 | 51.05743357 | 64.15832897 | 70.88910972 | 76.75762302 | 81.2959688  | 93.9017229  | 136.368289  | 92.67740443    | 99.99404162    | 118.6921144    |
| 36:00:00 | 27.3573496  | 30.63106823 | 41.19167833 | 48.75195087 | 61.31668511 | 67.78057749 | 73.42061491 | 77.78477906 | 89.91719848 | 130.8815044 | 88.67464813    | 95.67527825    | 113.5657774    |
| 38:00:00 | 25.90169494 | 28.99734355 | 38.99576942 | 46.16358645 | 58.09153075 | 64.23435798 | 69.59746317 | 73.74924794 | 85.29920742 | 124.3669507 | 84.07414265    | 90.71157496    | 107.673902     |
| 40:00:00 | 24.41222358 | 27.32178464 | 36.72838307 | 43.47943429 | 54.7254179  | 60.52192648 | 65.58507332 | 69.50607314 | 80.41994902 | 117.3884429 | 79.23692338    | 85.49246996    | 101.4788668    |
| 42:00:00 | 22.95519713 | 25.68066129 | 34.49924454 | 40.83411124 | 51.39573247 | 56.8432634  | 61.60343165 | 65.29089401 | 75.55929965 | 110.3815745 | 74.43161917    | 80.30779963    | 95.32470525    |
| 44:00:00 | 21.60924503 | 24.1648699  | 32.44047314 | 38.390623   | 48.31902175 | 53.44339454 | 57.92287223 | 61.39390039 | 71.06378684 | 103.8931189 | 69.98904645    | 75.51449748    | 89.63509457    |
| 46:00:00 | 20.36657112 | 22.76611505 | 30.5429022  | 36.13977964 | 45.48697072 | 50.3148411  | 54.53683585 | 57.80935738 | 66.93043774 | 97.9335733  | 65.90266741    | 71.10550957    | 84.40166177    |
| 48:00:00 | 19.20550069 | 21.45978855 | 28.77254775 | 34.04094979 | 42.84797808 | 47.40039119 | 51.38323123 | 54.47140769 | 63.08296558 | 92.39178872 | 62.09740477    | 66.99983146    | 79.52825523    |
| 50:00:00 | 18.11360582 | 20.2315287  | 27.10852186 | 32.06833809 | 40.36772957 | 44.66119454 | 48.4191748  | 51.33400203 | 59.46633334 | 87.18073483 | 58.52076231    | 63.14082249    | 74.94764296    |
| 52:00:00 | 17.09860169 | 19.08973877 | 25.56098957 | 30.23299669 | 38.05817437 | 42.10941784 | 45.656903   | 48.4093596  | 56.09241498 | 82.30850145 | 55.18666994    | 59.5435123     | 70.67766501    |
| 54:00:00 | 16.18160752 | 18.05810297 | 24.16150001 | 28.57177056 | 35.96444226 | 39.7942346  | 43.14901028 | 45.7526582  | 53.02330392 | 77.85818877 | 52.15803035    | 56.27576958    | 66.79888097    |
| 56:00:00 | 15.35173659 | 17.12429735 | 22.89315402 | 27.06453479 | 34.06112293 | 37.68754739 | 40.8650703  | 43.33167872 | 50.22183608 | 73.77627931 | 49.39811374    | 53.29796483    | 63.26425093    |
| 58:00:00 | 14.57491729 | 16.24969596 | 21.70276718 | 25.64779168 | 32.26774718 | 35.70022736 | 38.70843332 | 41.04397271 | 47.56952938 | 69.89091928 | 46.79012888    | 50.48408643    | 59.92420015    |
| 60:00:00 | 13.83506507 | 15.41611849 | 20.56552294 | 24.29207575 | 30.54728159 | 33.79141468 | 36.63493373 | 38.8428361  | 45.0127044  | 66.12559559 | 44.28083316    | 47.77668841    | 56.71054071    |
| 62:00:00 | 13.13240638 | 14.62387728 | 19.48207091 | 22.99832734 | 28.90122586 | 31.96292901 | 34.64668617 | 36.7306212  | 42.55441333 | 62.48606891 | 41.87290817    | 45.17866408    | 53.62670696    |
| 64:00:00 | 12.48149393 | 13.88958925 | 18.47576522 | 21.79478767 | 27.3660418  | 30.25550287 | 32.78817005 | 34.75471888 | 40.25019168 | 59.05582174 | 39.62037952    | 42.74830422    | 50.74188956    |
| 66:00:00 | 11.90996377 | 13.24494511 | 17.59169499 | 20.7363979  | 26.0134455  | 28.74965184 | 31.14766235 | 33.00946125 | 38.2114117  | 56.00558197 | 37.63078583    | 40.60163734    | 48.19381343    |
| 68:00:00 | 11.43305761 | 12.7078329  | 16.85695812 | 19.85739922 | 24.89039842 | 27.49923993 | 29.78522626 | 31.55981304 | 36.51710141 | 53.46571032 | 35.97818687    | 38.81857004    | 46.07732704    |
| 70:00:00 | 11.03340527 | 12.25887478 | 16.24615019 | 19.1284403  | 23.96155674 | 26.46608015 | 28.66031192 | 30.36346595 | 35.12035618 | 51.37635502 | 34.61435118    | 37.34706312    | 44.33066029    |
| 72:00:00 | 10.68990928 | 11.87412016 | 15.72615863 | 18.50988389 | 23.17649247 | 25.59421567 | 27.71214928 | 29.35593214 | 33.94637986 | 49.62815481 | 33.46576264    | 36.10779653    | 42.85966092    |
| 74:00:00 | 10.38660768 | 11.53533525 | 15.27131355 | 17.97064877 | 22.49499563 | 24.83868296 | 26.89159899 | 28.48482432 | 32.93368617 | 48.12828677 | 32.47269973    | 35.03633392    | 41.58784351    |
| 76:00:00 | 10.11239391 | 11.22978809 | 14.8635089  | 17.48867478 | 21.88826976 | 24.16715043 | 26.16321065 | 27.7122585  | 32.03754075 | 46.8081392  | 31.59197469    | 34.08607796    | 40.45989741    |
| 78:00:00 | 9.859730112 | 10.94882045 | 14.49036075 | 17.04881974 | 21.33644824 | 23.55726163 | 25.50242613 | 27.01195559 | 31.22680795 | 45.61954159 | 30.79362938    | 33.22470538    | 39.43745517    |
| 80:00:00 | 9.621735752 | 10.68451483 | 14.14048717 | 16.63712404 | 20.82113699 | 22.98827759 | 24.88642914 | 26.35947334 | 30.47244783 | 44.51724777 | 30.04979961    | 32.42215221    | 38.48483108    |
| 82:00:00 | 9.39001129  | 10.427195   | 13.79993565 | 16.23644492 | 20.31969246 | 22.43464087 | 24.2870784  | 25.72464664 | 29.73856657 | 43.44511946 | 29.32609717    | 31.64131537    | 37.5579841     |
| 84:00:00 | 9.163867549 | 10.17607231 | 13.46758577 | 15.84541553 | 19.83032443 | 21.89433762 | 23.70216209 | 25.10510875 | 29.02235969 | 42.39881168 | 28.61982397    | 30.87928376    | 36.65345877    |
| 86:00:00 | 8.943170127 | 9.930997519 | 13.14324003 | 15.46380347 | 19.35274207 | 21.36704673 | 23.13133258 | 24.50049146 | 28.32340154 | 41.37770259 | 27.93056026    | 30.13560449    | 35.77071753    |
| 88:00:00 | 8.727787857 | 9.691824971 | 12.82670564 | 15.09138194 | 18.88666154 | 20.85245482 | 22.5742506  | 23.91043543 | 27.64127669 | 40.38118532 | 27.25789639    | 29.40983557    | 34.90923572    |
| 90:00:00 | 8.517592733 | 9.45841252  | 12.51779449 | 14.72792961 | 18.43180583 | 20.35025605 | 22.03058507 | 23.33458997 | 26.97557976 | 39.40866761 | 26.60143257    | 28.70154567    | 34.06850136    |
| 92:00:00 | 8.312459829 | 9.230621443 | 12.21632298 | 14.37323045 | 17.9879046  | 19.86015195 | 21.50001287 | 22.77261286 | 26.3259151  | 38.45957147 | 25.96077866    | 28.01031381    | 33.24801477    |

|           |             |             |             |             |             |             |             |             |             |             |             |             |             |
|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 94:00:00  | 8.112267231 | 9.008316357 | 11.92211194 | 14.02707367 | 17.55469404 | 19.38185124 | 20.98221868 | 22.22417008 | 25.69189659 | 37.53333282 | 25.33555389 | 27.3357292  | 32.44728832 |
| 96:00:00  | 7.916895958 | 8.791365143 | 11.63498652 | 13.68925353 | 17.13191668 | 18.91506966 | 20.47689474 | 21.68893569 | 25.07314743 | 36.62940118 | 24.72538669 | 26.6773909  | 31.66584611 |
| 98:00:00  | 7.726229897 | 8.579638858 | 11.35477606 | 13.35956926 | 16.71932126 | 18.45952978 | 19.98374075 | 21.16659159 | 24.46929988 | 35.74723932 | 24.12991441 | 26.03490765 | 30.90322372 |
| 100:00:00 | 7.54015573  | 8.373011671 | 11.08131403 | 13.03782492 | 16.31666254 | 18.01496086 | 19.5024636  | 20.65682732 | 23.87999505 | 34.88632296 | 23.54878315 | 25.40789761 | 30.15896789 |
| 102:00:00 | 7.358562868 | 8.171360776 | 10.81443791 | 12.72382929 | 15.92370124 | 17.5810987  | 19.03277726 | 20.15933993 | 23.30488271 | 34.04614041 | 22.98164753 | 24.79598812 | 29.4326363  |
| 104:00:00 | 7.181343387 | 7.974566328 | 10.55398908 | 12.41739576 | 15.54020379 | 17.15768542 | 18.57440257 | 19.67383375 | 22.74362104 | 33.22619235 | 22.42817048 | 24.19881551 | 28.72379728 |
| 106:00:00 | 7.008391959 | 7.782511366 | 10.29981275 | 12.1183422  | 15.16594228 | 16.7444694  | 18.12706713 | 19.20002023 | 22.19587649 | 32.42599146 | 21.88802306 | 23.61602488 | 28.03202953 |
| 108:00:00 | 6.839605797 | 7.595081748 | 10.05175787 | 11.82649087 | 14.80069427 | 16.34120503 | 17.69050506 | 18.73761776 | 21.66132351 | 31.64506215 | 21.36088424 | 23.04726984 | 27.35692193 |
| 110:00:00 | 6.674884585 | 7.412166079 | 9.809676994 | 11.54166833 | 14.44424269 | 15.94765266 | 17.2644569  | 18.28635153 | 21.1396444  | 30.88294031 | 20.84644074 | 22.49221238 | 26.69807323 |
| 112:00:00 | 6.514130426 | 7.233655648 | 9.573426261 | 11.26370529 | 14.09637569 | 15.56357838 | 16.84866945 | 17.84595334 | 20.63052912 | 30.13917298 | 20.34438681 | 21.95052261 | 26.05509188 |
| 114:00:00 | 6.35724778  | 7.059444361 | 9.342865258 | 10.99243656 | 13.75688652 | 15.18875393 | 16.44289559 | 17.41616146 | 20.13367508 | 29.41331812 | 19.85442407 | 21.4218786  | 25.42759573 |
| 116:00:00 | 6.204143406 | 6.889428682 | 9.117856956 | 10.72770091 | 13.42557342 | 14.82295654 | 16.04689416 | 16.99672044 | 19.64878699 | 28.70494434 | 19.3762613  | 20.90596614 | 24.81521185 |
| 118:00:00 | 6.054726313 | 6.723507563 | 8.898267627 | 10.46934101 | 13.10223947 | 14.4659688  | 15.6604298  | 16.58738101 | 19.17557668 | 28.01363064 | 18.90961435 | 20.40247864 | 24.21757627 |
| 120:00:00 | 5.908907696 | 6.561582396 | 8.683966764 | 10.2172033  | 12.78669252 | 14.11757856 | 15.28327284 | 16.18789987 | 18.7137629  | 27.33896614 | 18.45420585 | 19.91111684 | 23.63433381 |
| 122:00:00 | 5.766600893 | 6.403556943 | 8.474827002 | 9.971137935 | 12.47874502 | 13.77757876 | 14.91519911 | 15.79803961 | 18.26307118 | 26.68054989 | 18.00976516 | 19.43158872 | 23.06513783 |
| 124:00:00 | 5.627721326 | 6.249337286 | 8.270724044 | 9.730998668 | 12.17821396 | 13.44576731 | 14.55598986 | 15.41756853 | 17.82323366 | 26.03799056 | 17.57602812 | 18.96360929 | 22.50965005 |
| 126:00:00 | 5.492186457 | 6.098831769 | 8.071536586 | 9.496642779 | 11.88492072 | 13.12194703 | 14.2054316  | 15.04626049 | 17.39398895 | 25.41090627 | 17.15273696 | 18.50690041 | 21.96754032 |
| 128:00:00 | 0           | 5.951950941 | 7.877146248 | 9.267930986 | 11.59869098 | 12.80592545 | 13.86331599 | 14.68389483 | 16.97508192 | 24.79892432 | 16.73964011 | 18.06119065 | 21.43848646 |
| 130:00:00 | 0           | 5.808607508 | 7.687437496 | 9.044727359 | 11.31935465 | 12.49751476 | 13.5294397  | 14.33025619 | 16.56626361 | 24.201681   | 16.33649205 | 17.62621511 | 20.92217403 |
| 132:00:00 | 0           | 5.668716278 | 7.502297584 | 8.826899242 | 11.04674569 | 12.19653166 | 13.2036043  | 13.98513437 | 16.16729105 | 23.61882135 | 15.94305318 | 17.20171528 | 20.41829618 |
| 134:00:00 | 0           | 5.53219411  | 7.321616476 | 8.614317175 | 10.78070209 | 11.90279726 | 12.88561613 | 13.64832428 | 15.77792713 | 23.04999897 | 15.55908967 | 16.78743886 | 19.92655344 |
| 136:00:00 | 0           | 0           | 7.145286791 | 8.406854814 | 10.52106574 | 11.616137   | 12.57528621 | 13.31962572 | 15.39794042 | 22.49487578 | 15.18437333 | 16.38313964 | 19.44665356 |
| 138:00:00 | 0           | 0           | 6.97320373  | 8.20438886  | 10.26768232 | 11.3363805  | 12.27243011 | 12.99884336 | 15.0271051  | 21.95312187 | 14.81868144 | 15.98857734 | 18.97831131 |
| 140:00:00 | 0           | 0           | 6.805265021 | 8.006798982 | 10.02040124 | 11.0633615  | 11.97686782 | 12.68578655 | 14.66520077 | 21.42441525 | 14.46179666 | 15.60351745 | 18.52124836 |
| 142:00:00 | 0           | 0           | 6.641370853 | 7.813967747 | 9.779075546 | 10.79691774 | 11.68842368 | 12.38026921 | 14.31201234 | 20.90844171 | 14.1135069  | 15.22773113 | 18.07519305 |
| 144:00:00 | 0           | 0           | 6.48142382  | 7.625780551 | 9.543561801 | 10.53689085 | 11.40692627 | 12.08210978 | 13.9673299  | 20.40489458 | 13.77360515 | 14.86099503 | 17.63988028 |
| 146:00:00 | 0           | 0           | 6.325328861 | 7.442125549 | 9.313720036 | 10.28312631 | 11.13220829 | 11.79113106 | 13.63094859 | 19.9134746  | 13.44188941 | 14.5030912  | 17.21505135 |
| 148:00:00 | 0           | 0           | 6.172993205 | 7.262893591 | 9.089413651 | 10.03547329 | 10.86410646 | 11.5071601  | 13.30266851 | 19.4338897  | 13.11816252 | 14.15380693 | 16.80045375 |
| 150:00:00 | 0           | 0           | 6.024326315 | 7.087978155 | 8.870509335 | 9.79378461  | 10.60246144 | 11.23002814 | 12.98229454 | 18.96585485 | 12.80223208 | 13.81293462 | 16.39584109 |
| 152:00:00 | 0           | 0           | 5.879239835 | 6.917275283 | 8.656876987 | 9.55791662  | 10.34711773 | 10.95957048 | 12.66963627 | 18.50909189 | 12.49391034 | 13.48027168 | 16.00097289 |
| 154:00:00 | 0           | 0           | 5.737647536 | 6.750683523 | 8.448389639 | 9.327729142 | 10.09792358 | 10.69562636 | 12.36450789 | 18.06332935 | 12.19301405 | 13.15562042 | 15.61561448 |
| 156:00:00 | 0           | 0           | 5.599465266 | 6.588103865 | 8.244923384 | 9.10308537  | 9.854730877 | 10.43803892 | 12.06672805 | 17.6283023  | 11.89936437 | 12.83878787 | 15.23953682 |
| 158:00:00 | 0           | 0           | 5.4646109   | 6.429439684 | 8.046357295 | 8.883851791 | 9.617395092 | 10.18665507 | 11.77611977 | 17.20375221 | 11.61278678 | 12.52958574 | 14.8725164  |
| 160:00:00 | 0           | 0           | 0           | 6.274596682 | 7.852573361 | 8.669898111 | 9.385775168 | 9.94132541  | 11.49251034 | 16.78942673 | 11.33311097 | 12.22783025 | 14.5143351  |
| 162:00:00 | 0           | 0           | 0           | 6.123482831 | 7.663456409 | 8.46109717  | 9.159733448 | 9.701904131 | 11.2157312  | 16.38507964 | 11.06017071 | 11.93334208 | 14.16478003 |
| 164:00:00 | 0           | 0           | 0           | 5.976008321 | 7.478894043 | 8.257324874 | 8.939135589 | 9.468248939 | 10.94561785 | 15.99047061 | 10.79380379 | 11.64594619 | 13.82364345 |
| 166:00:00 | 0           | 0           | 0           | 5.832085504 | 7.298776573 | 8.058460115 | 8.723850484 | 9.240220967 | 10.68200975 | 15.60536513 | 10.5338519  | 11.36547179 | 13.49072261 |
| 168:00:00 | 0           | 0           | 0           | 5.691628844 | 7.122996951 | 7.864384702 | 8.513750185 | 9.017684692 | 10.42475025 | 15.22953431 | 10.28016055 | 11.09175217 | 13.16581965 |
| 170:00:00 | 0           | 0           | 0           | 5.554554862 | 6.951450706 | 7.674983293 | 8.308709824 | 8.800507855 | 10.17368644 | 14.86275479 | 10.03257895 | 10.82462466 | 12.84874147 |
| 172:00:00 | 0           | 0           | 0           | 0           | 6.784035885 | 7.49014332  | 8.108607538 | 8.588561383 | 9.928669109 | 14.50480858 | 9.790959977 | 10.5639305  | 12.53929962 |
| 174:00:00 | 0           | 0           | 0           | 0           | 6.620652987 | 7.309754929 | 7.913324403 | 8.381719311 | 9.689552637 | 14.15548294 | 9.555160014 | 10.30951475 | 12.23731019 |
| 176:00:00 | 0           | 0           | 0           | 0           | 6.461204912 | 7.133710911 | 7.722744358 | 8.179858706 | 9.456194911 | 13.81457027 | 9.325038925 | 10.06122621 | 11.94259371 |
| 178:00:00 | 0           | 0           | 0           | 0           | 6.305596894 | 6.961906637 | 7.536754134 | 7.982859598 | 9.228457242 | 13.48186794 | 9.100459942 | 9.818917306 | 11.65497501 |
| 180:00:00 | 0           | 0           | 0           | 0           | 6.153736451 | 6.794240001 | 7.355243195 | 7.790604906 | 9.006204278 | 13.15717823 | 8.881289593 | 9.582444034 | 11.37428316 |
| 182:00:00 | 0           | 0           | 0           | 0           | 6.00553333  | 6.630611353 | 7.178103663 | 7.602980368 | 8.789303929 | 12.84030816 | 8.667397619 | 9.351665852 | 11.10035134 |
| 184:00:00 | 0           | 0           | 0           | 0           | 5.86089945  | 6.470923446 | 7.005230259 | 7.419874473 | 8.577627286 | 12.53106942 | 8.458656899 | 9.126445601 | 10.83301673 |
| 186:00:00 | 0           | 0           | 0           | 0           | 5.71974885  | 6.315081372 | 6.836520241 | 7.241178397 | 8.371048544 | 12.2292782  | 8.254943373 | 8.906649428 | 10.57212046 |
| 188:00:00 | 0           | 0           | 0           | 0           | 5.581997642 | 6.162992511 | 6.67187334  | 7.066785937 | 8.169444928 | 11.93475516 | 8.056135968 | 8.692146703 | 10.31750747 |

|           |   |   |   |   |             |             |             |             |             |             |             |             |             |
|-----------|---|---|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 190:00:00 | 0 | 0 | 0 | 0 | 5.447563956 | 6.014566472 | 6.511191702 | 6.896593447 | 7.97269662  | 11.64732524 | 7.862116529 | 8.482809939 | 10.06902643 |
| 192:00:00 | 0 | 0 | 0 | 0 | 0           | 5.869715042 | 6.35437983  | 6.730499776 | 7.780686687 | 11.36681762 | 7.672769745 | 8.278514725 | 9.826529674 |
| 194:00:00 | 0 | 0 | 0 | 0 | 0           | 5.728352133 | 6.201344527 | 6.568406213 | 7.593301014 | 11.09306559 | 7.487983082 | 8.079139641 | 9.58987307  |
| 196:00:00 | 0 | 0 | 0 | 0 | 0           | 5.590393728 | 6.05199484  | 6.410216419 | 7.410428231 | 10.82590645 | 7.307646717 | 7.884566195 | 9.358915971 |
| 198:00:00 | 0 | 0 | 0 | 0 | 0           | 5.455757836 | 5.906242007 | 6.255836379 | 7.231959653 | 10.56518142 | 7.131653472 | 7.694678746 | 9.133521113 |
| 200:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 5.763999402 | 6.105174341 | 7.057789212 | 10.31073555 | 6.959898748 | 7.509364439 | 8.913554537 |
| 202:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 5.625182489 | 5.958140762 | 6.887813394 | 10.0624176  | 6.792280469 | 7.328513137 | 8.698885513 |
| 204:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 5.489708764 | 5.814648257 | 6.721931177 | 9.820080006 | 6.628699013 | 7.152017357 | 8.489386456 |
| 206:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 5.674611545 | 6.560043975 | 9.583578733 | 6.469057162 | 6.979772201 | 8.284932856 |
| 208:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 5.537947399 | 6.402055572 | 9.352773223 | 6.313260034 | 6.8116753   | 8.085403202 |
| 210:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 6.247872074 | 9.127526303 | 0           | 0           | 0           |
| 212:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 6.097401843 | 8.907704103 | 0           | 0           | 0           |
| 214:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 5.950555453 | 8.693175977 | 0           | 0           | 0           |
| 216:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 5.807245629 | 8.483814425 | 0           | 0           | 0           |
| 218:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 5.667387198 | 8.279495019 | 0           | 0           | 0           |
| 220:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 5.530897038 | 8.080096327 | 0           | 0           | 0           |
| 222:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 7.88549984  | 0           | 0           | 0           |
| 224:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 7.695589906 | 0           | 0           | 0           |
| 226:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 7.510253655 | 0           | 0           | 0           |
| 228:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 7.329380938 | 0           | 0           | 0           |
| 230:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 7.152864258 | 0           | 0           | 0           |
| 232:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.980598705 | 0           | 0           | 0           |
| 234:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.8124819   | 0           | 0           | 0           |
| 236:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.648413925 | 0           | 0           | 0           |
| 238:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.48829727  | 0           | 0           | 0           |
| 240:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.332036775 | 0           | 0           | 0           |
| 242:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.179539569 | 0           | 0           | 0           |
| 244:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 6.030715021 | 0           | 0           | 0           |
| 246:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 5.885474678 | 0           | 0           | 0           |
| 248:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 5.743732223 | 0           | 0           | 0           |
| 250:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 5.605403413 | 0           | 0           | 0           |
| 252:00:00 | 0 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 5.470406035 | 0           | 0           | 0           |

| Time     | 1-Year      | 2-Year      | 5-Year      | 10-Year     | 30-Year     | 50-Year     | 75-Year     | 100-Year    | 200-Year    | 1000-Year   | 100-Year+14%CC | 100-Year+23%CC | 100-Year+46%CC |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|----------------|----------------|----------------|
| 00:00:00 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.007020342 | 0.00800319     | 0.008635021    | 0.010249699    |
| 00:30:00 | 0.007066661 | 0.007086063 | 0.007148538 | 0.007190753 | 0.007259016 | 0.00729245  | 0.007320351 | 0.007341141 | 0.007395386 | 0.007558071 | 0.008368901    | 0.009029603    | 0.010718066    |
| 01:00:00 | 0.007420513 | 0.007509058 | 0.007794283 | 0.00798709  | 0.008295677 | 0.008445502 | 0.008570562 | 0.008663763 | 0.008907011 | 0.009637098 | 0.00987669     | 0.010656428    | 0.012649094    |
| 01:30:00 | 0.0082348   | 0.008466415 | 0.009212859 | 0.009717758 | 0.010522153 | 0.010911174 | 0.011236004 | 0.011478149 | 0.012110398 | 0.014010326 | 0.01308509     | 0.014118123    | 0.016758098    |
| 02:00:00 | 0.009730906 | 0.010213102 | 0.011768176 | 0.012820953 | 0.014496894 | 0.015306887 | 0.015983557 | 0.016488176 | 0.017806539 | 0.021775041 | 0.018796521    | 0.020280457    | 0.024072737    |
| 02:30:00 | 0.012221147 | 0.013111409 | 0.015985257 | 0.017933222 | 0.021035941 | 0.02253629  | 0.023790542 | 0.024726392 | 0.027173415 | 0.03455693  | 0.028188087    | 0.030413463    | 0.036100533    |
| 03:00:00 | 0.016154377 | 0.017682759 | 0.02262319  | 0.025977681 | 0.031328273 | 0.033918932 | 0.036086707 | 0.037705384 | 0.041942691 | 0.054777003 | 0.042984138    | 0.046377623    | 0.055049861    |
| 03:30:00 | 0.022163564 | 0.024663959 | 0.032761539 | 0.038272728 | 0.047083083 | 0.051357511 | 0.054938827 | 0.057615721 | 0.064634105 | 0.085974624 | 0.065681922    | 0.070867337    | 0.084118953    |
| 04:00:00 | 0.030784564 | 0.034682698 | 0.047338037 | 0.055977952 | 0.069830101 | 0.076568083 | 0.082222892 | 0.086455183 | 0.097573756 | 0.131572627 | 0.098558908    | 0.106339875    | 0.126224567    |
| 04:30:00 | 0.041855815 | 0.04755475  | 0.066105342 | 0.078811885 | 0.099250351 | 0.109220836 | 0.117603108 | 0.12388533  | 0.140423573 | 0.191289993 | 0.141229276    | 0.152378956    | 0.180872581    |
| 05:00:00 | 0.054544032 | 0.062315499 | 0.087674031 | 0.10509642  | 0.133206625 | 0.146956831 | 0.158534911 | 0.167222937 | 0.190137133 | 0.260978952 | 0.190634148    | 0.205684212    | 0.244145488    |
| 05:30:00 | 0.067902321 | 0.077867973 | 0.110456803 | 0.132906843 | 0.169226995 | 0.187035292 | 0.202050971 | 0.213330569 | 0.243127958 | 0.335661297 | 0.243196849    | 0.2623966      | 0.311462631    |
| 06:00:00 | 0.081061483 | 0.093202171 | 0.132982077 | 0.160452637 | 0.205003399 | 0.226893724 | 0.245373936 | 0.259269287 | 0.296029478 | 0.410636004 | 0.295566988    | 0.318901224    | 0.37853316     |
| 06:30:00 | 0.09309473  | 0.107240949 | 0.153679425 | 0.185822184 | 0.238070016 | 0.263793622 | 0.285534908 | 0.301896854 | 0.345240462 | 0.4808672   | 0.344162414    | 0.37133313     | 0.440769407    |
| 07:00:00 | 0.102916982 | 0.118722549 | 0.170706221 | 0.206770073 | 0.265525507 | 0.294510195 | 0.319035477 | 0.337508794 | 0.386509986 | 0.540389205 | 0.384760025    | 0.415135817    | 0.492762839    |
| 07:30:00 | 0.109446239 | 0.126386204 | 0.182209392 | 0.221028631 | 0.28442127  | 0.315756598 | 0.342301363 | 0.362313606 | 0.415467511 | 0.582988867 | 0.41303751     | 0.445645735    | 0.528977864    |
| 08:00:00 | 0.112329727 | 0.129815128 | 0.187548967 | 0.227792369 | 0.29366434  | 0.326290476 | 0.353960258 | 0.374839027 | 0.430367422 | 0.60599221  | 0.427316491    | 0.461052003    | 0.547264979    |
| 08:30:00 | 0.111960942 | 0.129457864 | 0.187338775 | 0.227776458 | 0.294113348 | 0.327032018 | 0.354980007 | 0.376086218 | 0.432288992 | 0.610636477 | 0.428738289    | 0.462586049    | 0.549085879    |
| 09:00:00 | 0.108957406 | 0.126025113 | 0.182583584 | 0.222179211 | 0.28726545  | 0.319618779 | 0.347113481 | 0.367892879 | 0.423286853 | 0.599588823 | 0.419397882    | 0.452508241    | 0.537123603    |
| 09:30:00 | 0.104096685 | 0.120418728 | 0.17458975  | 0.212583997 | 0.275149529 | 0.30629695  | 0.332789544 | 0.352824766 | 0.4062871   | 0.576883228 | 0.402220233    | 0.433974462    | 0.515124158    |
| 10:00:00 | 0.09809807  | 0.11347594  | 0.16458369  | 0.200488323 | 0.259706527 | 0.28922698  | 0.314354742 | 0.333368814 | 0.384149891 | 0.546559063 | 0.380040448    | 0.410043641    | 0.486718468    |
| 10:30:00 | 0.091559212 | 0.105893552 | 0.153591439 | 0.187149269 | 0.242574191 | 0.270236211 | 0.29379772  | 0.311635679 | 0.359311552 | 0.512092642 | 0.355264674    | 0.383311885    | 0.454988091    |
| 11:00:00 | 0.084960424 | 0.098232338 | 0.142442265 | 0.173585637 | 0.225085378 | 0.250814671 | 0.272742581 | 0.289351086 | 0.333769886 | 0.476357628 | 0.329860238    | 0.355901836    | 0.422452585    |
| 11:30:00 | 0.078635054 | 0.090882698 | 0.131719058 | 0.160517951 | 0.208191432 | 0.23203037  | 0.252357413 | 0.267759302 | 0.308974376 | 0.441474767 | 0.305245604    | 0.329343941    | 0.39092858     |
| 12:00:00 | 0.072661509 | 0.083938061 | 0.121568628 | 0.148133412 | 0.192150761 | 0.214179147 | 0.232970844 | 0.2472143   | 0.285348819 | 0.408109154 | 0.281824302    | 0.304073589    | 0.360932879    |
| 12:30:00 | 0.066996905 | 0.077350381 | 0.111929173 | 0.136363402 | 0.17688803  | 0.197184219 | 0.214505776 | 0.227639276 | 0.262819283 | 0.37621377  | 0.259508774    | 0.279996309    | 0.332353343    |
| 13:00:00 | 0.061693334 | 0.071182459 | 0.102902644 | 0.125340351 | 0.162590991 | 0.181263036 | 0.197205885 | 0.209298301 | 0.241706497 | 0.346308964 | 0.238600064    | 0.257436911    | 0.30557552     |
| 13:30:00 | 0.056767233 | 0.065454769 | 0.094524476 | 0.1151115   | 0.149328112 | 0.166495392 | 0.181161025 | 0.192289087 | 0.222130108 | 0.318592666 | 0.219209559    | 0.236515577    | 0.280742067    |
| 14:00:00 | 0.052175401 | 0.060117455 | 0.086723547 | 0.105591486 | 0.136991283 | 0.152762155 | 0.166242915 | 0.17647656  | 0.203937442 | 0.292860389 | 0.201183278    | 0.217066168    | 0.257655777    |
| 14:30:00 | 0.047880421 | 0.055126211 | 0.079432268 | 0.096696047 | 0.125468589 | 0.139937553 | 0.15231388  | 0.161713978 | 0.186957293 | 0.268860603 | 0.184353935    | 0.198908193    | 0.236102408    |
| 15:00:00 | 0.043854421 | 0.05044793  | 0.072599085 | 0.088359793 | 0.114670423 | 0.127919322 | 0.139260602 | 0.147879494 | 0.171044387 | 0.246367665 | 0.168582623    | 0.181891778    | 0.215904061    |
| 15:30:00 | 0.040129067 | 0.046118748 | 0.066273605 | 0.08064064  | 0.104666575 | 0.116782398 | 0.127162026 | 0.135054873 | 0.156287173 | 0.225484204 | 0.153962555    | 0.166117494    | 0.197180115    |
| 16:00:00 | 0.036806926 | 0.042257435 | 0.060626994 | 0.073745341 | 0.095720549 | 0.106817763 | 0.116332127 | 0.123571263 | 0.14306176  | 0.206722527 | 0.14087124     | 0.151992653    | 0.180414044    |
| 16:30:00 | 0.034007986 | 0.039003407 | 0.055862342 | 0.067920973 | 0.088150787 | 0.098378932 | 0.107154041 | 0.113834071 | 0.13183249  | 0.190730813 | 0.129770841    | 0.140015907    | 0.166197744    |
| 17:00:00 | 0.031733813 | 0.036358855 | 0.051984547 | 0.063174862 | 0.081969458 | 0.091480845 | 0.09964523  | 0.105862768 | 0.122624585 | 0.177555959 | 0.120683556    | 0.130211205    | 0.154559642    |
| 17:30:00 | 0.029852294 | 0.034170338 | 0.048770366 | 0.059235635 | 0.07682725  | 0.08573594  | 0.093385867 | 0.099213283 | 0.114929887 | 0.166490477 | 0.113103142    | 0.122032338    | 0.144851393    |
| 18:00:00 | 0.028246786 | 0.032302386 | 0.046022719 | 0.05586373  | 0.072415804 | 0.080802098 | 0.088005356 | 0.093493615 | 0.108299827 | 0.156909869 | 0.106582721    | 0.114997146    | 0.136500677    |
| 18:30:00 | 0.026840819 | 0.030666115 | 0.043611974 | 0.052901306 | 0.068531419 | 0.076453036 | 0.083258325 | 0.088444029 | 0.102436618 | 0.148397262 | 0.100826193    | 0.108786156    | 0.129128283    |
| 19:00:00 | 0.0255896   | 0.029209422 | 0.041461939 | 0.050255436 | 0.065053862 | 0.072555034 | 0.078999633 | 0.083910778 | 0.09716366  | 0.140704133 | 0.095658287    | 0.103210257    | 0.122509736    |
| 19:30:00 | 0.024475377 | 0.027911693 | 0.039542661 | 0.04788974  | 0.06193636  | 0.069056227 | 0.075173125 | 0.079834482 | 0.092413065 | 0.13373621  | 0.091011309    | 0.098196413    | 0.116558343    |
| 20:00:00 | 0.02350529  | 0.026781456 | 0.03786762  | 0.045821463 | 0.05920283  | 0.06598405  | 0.071809322 | 0.076248053 | 0.088224341 | 0.127555892 | 0.086922781    | 0.093785105    | 0.111322158    |
| 20:30:00 | 0.022689478 | 0.025831056 | 0.036457399 | 0.044077732 | 0.05689239  | 0.063384104 | 0.068959585 | 0.073207353 | 0.084665922 | 0.122276525 | 0.083456382    | 0.090045044    | 0.106882735    |
| 21:00:00 | 0.022032736 | 0.025066882 | 0.035325065 | 0.042677462 | 0.05503544  | 0.061293285 | 0.066666714 | 0.07075986  | 0.081798639 | 0.118008833 | 0.08066624     | 0.087034627    | 0.103309395    |
| 21:30:00 | 0.02151076  | 0.024461005 | 0.034431357 | 0.041574028 | 0.053574157 | 0.05964859  | 0.064863485 | 0.06883527  | 0.079544399 | 0.114653535 | 0.078472208    | 0.084667383    | 0.100499495    |
| 22:00:00 | 0.021088007 | 0.023971946 | 0.033715016 | 0.040692232 | 0.052410282 | 0.058340233 | 0.063430288 | 0.067306532 | 0.077756242 | 0.111999723 | 0.076729447    | 0.082787035    | 0.098267537    |
| 22:30:00 | 0.020736508 | 0.023566892 | 0.033126791 | 0.039970988 | 0.051462761 | 0.057277014 | 0.062267197 | 0.066067062 | 0.076309593 | 0.109863509 | 0.07531645     | 0.081262486    | 0.09645791     |
| 23:00:00 | 0.020435952 | 0.023221937 | 0.032630437 | 0.039365063 | 0.050671018 | 0.056390497 | 0.061298977 | 0.065036421 | 0.075109884 | 0.108103126 | 0.07414152     | 0.079994798    | 0.094953175    |

|          |             |             |             |             |             |             |             |             |             |             |             |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 23:30:00 | 0.020171904 | 0.022920051 | 0.032199969 | 0.038841897 | 0.049991204 | 0.055631012 | 0.060470918 | 0.064156031 | 0.074087995 | 0.106613977 | 0.073137876 | 0.078911919 | 0.093667806 |
| 24:00:00 | 0.019934229 | 0.022649264 | 0.031817045 | 0.038378447 | 0.049392165 | 0.054963215 | 0.059744033 | 0.06338411  | 0.07319451  | 0.105320849 | 0.072257886 | 0.077962455 | 0.092540801 |
| 24:30:00 | 0.01971337  | 0.022398269 | 0.031464268 | 0.037952804 | 0.048844181 | 0.054353335 | 0.059081031 | 0.062680657 | 0.072382025 | 0.104151198 | 0.071455595 | 0.077097209 | 0.09151376  |
| 25:00:00 | 0.019496085 | 0.022151391 | 0.031117463 | 0.037534481 | 0.048305812 | 0.053754243 | 0.058429829 | 0.06198978  | 0.071584218 | 0.103003226 | 0.070668349 | 0.07624743  | 0.090505079 |
| 25:30:00 | 0.019281196 | 0.021907235 | 0.030774481 | 0.03712077  | 0.047773377 | 0.053161754 | 0.057785805 | 0.061306518 | 0.070795204 | 0.101867906 | 0.06988943  | 0.075407017 | 0.089507516 |
| 26:00:00 | 0.019068675 | 0.021665769 | 0.030435279 | 0.036711618 | 0.04724681  | 0.052575796 | 0.05714888  | 0.060630787 | 0.070014886 | 0.1007451   | 0.069119097 | 0.074575868 | 0.088520948 |
| 26:30:00 | 0.018858497 | 0.021426965 | 0.030099816 | 0.036306976 | 0.046726048 | 0.051996296 | 0.056518975 | 0.059962503 | 0.06924317  | 0.099634669 | 0.068357254 | 0.073753879 | 0.087545255 |
| 27:00:00 | 0.018650635 | 0.021190793 | 0.029768051 | 0.035906794 | 0.046211025 | 0.051423184 | 0.055896012 | 0.059301586 | 0.06847996  | 0.098536478 | 0.067603808 | 0.072940951 | 0.086580316 |
| 27:30:00 | 0.018445065 | 0.020957225 | 0.029439942 | 0.035511023 | 0.045701679 | 0.050856389 | 0.055279917 | 0.058647953 | 0.067725161 | 0.097450392 | 0.066858667 | 0.072136983 | 0.085626012 |
| 28:00:00 | 0.01824176  | 0.020726231 | 0.02911545  | 0.035119614 | 0.045197947 | 0.05029584  | 0.054670612 | 0.058001525 | 0.066978683 | 0.096376277 | 0.066121739 | 0.071341876 | 0.084682227 |
| 28:30:00 | 0.018040696 | 0.020497782 | 0.028794534 | 0.03473252  | 0.044699767 | 0.049741471 | 0.054068023 | 0.057362222 | 0.066240432 | 0.095314    | 0.065392933 | 0.070555533 | 0.083748845 |
| 29:00:00 | 0.017841848 | 0.020271852 | 0.028477156 | 0.034349692 | 0.044207078 | 0.049193212 | 0.053472075 | 0.056729966 | 0.065510318 | 0.094263432 | 0.064672161 | 0.069777858 | 0.08282575  |
| 29:30:00 | 0.017645192 | 0.020048412 | 0.028163275 | 0.033971083 | 0.04371982  | 0.048650995 | 0.052882697 | 0.056104678 | 0.064788252 | 0.093224444 | 0.063959333 | 0.069008754 | 0.08191283  |
| 30:00:00 | 0.017450704 | 0.019827435 | 0.027852855 | 0.033596648 | 0.043237932 | 0.048114755 | 0.052299814 | 0.055486282 | 0.064074144 | 0.092196908 | 0.063254362 | 0.068248127 | 0.081009972 |
| 30:30:00 | 0.017258359 | 0.019608894 | 0.027545856 | 0.03322634  | 0.042761356 | 0.047584426 | 0.051723356 | 0.054874703 | 0.063367908 | 0.091180697 | 0.062557161 | 0.067495884 | 0.080117066 |
| 31:00:00 | 0.017068134 | 0.019392761 | 0.02724224  | 0.032860113 | 0.042290033 | 0.047059942 | 0.051153252 | 0.054269864 | 0.062669455 | 0.090175687 | 0.061867645 | 0.066751933 | 0.079234001 |
| 31:30:00 | 0.016880006 | 0.01917901  | 0.026941972 | 0.032497923 | 0.041823905 | 0.046541239 | 0.050589432 | 0.053671692 | 0.061978701 | 0.089181755 | 0.061185729 | 0.066016181 | 0.07836067  |
| 32:00:00 | 0.016693952 | 0.018967616 | 0.026645012 | 0.032139725 | 0.041362914 | 0.046028253 | 0.050031827 | 0.053080113 | 0.061295561 | 0.088198778 | 0.060511329 | 0.065288539 | 0.077496965 |
| 32:30:00 | 0.016509948 | 0.018758552 | 0.026351326 | 0.031785476 | 0.040907005 | 0.045520922 | 0.049480367 | 0.052495055 | 0.060619951 | 0.087226635 | 0.059844362 | 0.064568917 | 0.07664278  |
| 33:00:00 | 0.016327973 | 0.018551792 | 0.026060877 | 0.031435131 | 0.040456121 | 0.045019182 | 0.048934986 | 0.051916445 | 0.059951787 | 0.086265208 | 0.059184747 | 0.063857227 | 0.07579801  |
| 33:30:00 | 0.016148003 | 0.01834731  | 0.02577363  | 0.031088647 | 0.040010206 | 0.044522973 | 0.048395615 | 0.051344213 | 0.059290988 | 0.085314378 | 0.058532402 | 0.063153382 | 0.074962551 |
| 34:00:00 | 0.015970017 | 0.018145083 | 0.025489548 | 0.030745982 | 0.039569207 | 0.044032233 | 0.04786219  | 0.050778288 | 0.058637472 | 0.084374028 | 0.057887248 | 0.062457294 | 0.0741363   |
| 34:30:00 | 0.015793992 | 0.017945085 | 0.025208598 | 0.030407095 | 0.039133068 | 0.043546902 | 0.047334645 | 0.0502186   | 0.057991159 | 0.083444042 | 0.057249204 | 0.061768879 | 0.073319157 |
| 35:00:00 | 0.015619908 | 0.017747291 | 0.024930744 | 0.030071942 | 0.038701736 | 0.04306692  | 0.046812914 | 0.049665082 | 0.057351971 | 0.082524307 | 0.056618194 | 0.061088051 | 0.07251102  |
| 35:30:00 | 0.015447743 | 0.017551677 | 0.024655953 | 0.029740484 | 0.038275159 | 0.042592229 | 0.046296934 | 0.049117665 | 0.056719827 | 0.08161471  | 0.055994138 | 0.060414728 | 0.071711791 |
| 36:00:00 | 0.015277475 | 0.017358219 | 0.024384191 | 0.029412679 | 0.037853283 | 0.04212277  | 0.045786641 | 0.048576281 | 0.056094651 | 0.080715138 | 0.055376961 | 0.059748826 | 0.070921371 |
| 36:30:00 | 0.015109084 | 0.017166894 | 0.024115424 | 0.029088488 | 0.037436058 | 0.041658485 | 0.045281972 | 0.048040865 | 0.055476366 | 0.079825481 | 0.054766586 | 0.059090264 | 0.070139663 |
| 37:00:00 | 0.014942549 | 0.016977678 | 0.02384962  | 0.028767869 | 0.037023431 | 0.041199318 | 0.044782867 | 0.04751135  | 0.054864896 | 0.078945631 | 0.054162939 | 0.05843896  | 0.069366571 |
| 37:30:00 | 0.01477785  | 0.016790547 | 0.023586745 | 0.028450785 | 0.036615352 | 0.040745212 | 0.044289262 | 0.046987671 | 0.054260165 | 0.078075478 | 0.053565945 | 0.057794836 | 0.068602    |
| 38:00:00 | 0.014614966 | 0.016605478 | 0.023326768 | 0.028137195 | 0.036211771 | 0.040296111 | 0.043801098 | 0.046469765 | 0.0536621   | 0.077214916 | 0.052975532 | 0.057157811 | 0.067845857 |
| 38:30:00 | 0.014453877 | 0.01642245  | 0.023069656 | 0.027827062 | 0.035812639 | 0.03985196  | 0.043318314 | 0.045957567 | 0.053070627 | 0.07636384  | 0.052391626 | 0.056527807 | 0.067098048 |
| 39:00:00 | 0.014294564 | 0.016241439 | 0.022815378 | 0.027520347 | 0.035417905 | 0.039412705 | 0.042840852 | 0.045451015 | 0.052485673 | 0.075522144 | 0.051814157 | 0.055904748 | 0.066358481 |
| 39:30:00 | 0.014137006 | 0.016062423 | 0.022563903 | 0.027217013 | 0.035027523 | 0.038978291 | 0.042368653 | 0.044950045 | 0.051907166 | 0.074689726 | 0.051243052 | 0.055288556 | 0.065627066 |
| 40:00:00 | 0.013981186 | 0.01588538  | 0.0223152   | 0.026917022 | 0.034641443 | 0.038548665 | 0.041901658 | 0.044454598 | 0.051335037 | 0.073866482 | 0.050678242 | 0.054679156 | 0.064903713 |
| 40:30:00 | 0.013827083 | 0.015710288 | 0.022069238 | 0.026620338 | 0.034259619 | 0.038123775 | 0.04143981  | 0.043964612 | 0.050769213 | 0.073052313 | 0.050119657 | 0.054076472 | 0.064188333 |
| 41:00:00 | 0.013674678 | 0.015537127 | 0.021825987 | 0.026326924 | 0.033882004 | 0.037703568 | 0.040983054 | 0.043480026 | 0.050209625 | 0.072247117 | 0.04956723  | 0.053480432 | 0.063480838 |
| 41:30:00 | 0.013523953 | 0.015365874 | 0.021585417 | 0.026036744 | 0.03350855  | 0.037287993 | 0.040531331 | 0.043000781 | 0.049656206 | 0.071450797 | 0.049020891 | 0.052890961 | 0.062781141 |
| 42:00:00 | 0.01337489  | 0.015196508 | 0.021347498 | 0.025749762 | 0.033139213 | 0.036876998 | 0.040084588 | 0.042526819 | 0.049108887 | 0.070663254 | 0.048480574 | 0.052307988 | 0.062089156 |
| 42:30:00 | 0.01322747  | 0.01502901  | 0.021112203 | 0.025465944 | 0.032773947 | 0.036470533 | 0.039642768 | 0.042058081 | 0.0485676   | 0.069884391 | 0.047946212 | 0.05173144  | 0.061404798 |
| 43:00:00 | 0.013081674 | 0.014863357 | 0.0208795   | 0.025185254 | 0.032412707 | 0.036068548 | 0.039205819 | 0.041594509 | 0.048032279 | 0.069114113 | 0.047417741 | 0.051161247 | 0.060727984 |
| 43:30:00 | 0.012937486 | 0.014699531 | 0.020649363 | 0.024907657 | 0.032055448 | 0.035670994 | 0.038773685 | 0.041136047 | 0.047502859 | 0.068352325 | 0.046895094 | 0.050597338 | 0.060058629 |
| 44:00:00 | 0.012794886 | 0.01453751  | 0.020421762 | 0.024633121 | 0.031702127 | 0.035277822 | 0.038346315 | 0.040682639 | 0.046979274 | 0.067598933 | 0.046378208 | 0.050039646 | 0.059396652 |
| 44:30:00 | 0.012653859 | 0.014377275 | 0.020196669 | 0.02436161  | 0.031352701 | 0.034888984 | 0.037923655 | 0.040234227 | 0.04646146  | 0.066853846 | 0.045867019 | 0.0494881   | 0.058741972 |
| 45:00:00 | 0.012514386 | 0.014218806 | 0.019974058 | 0.024093092 | 0.031007126 | 0.034504431 | 0.037505654 | 0.039790759 | 0.045949354 | 0.066116971 | 0.045361465 | 0.048942633 | 0.058094508 |
| 45:30:00 | 0.01237645  | 0.014062084 | 0.0197539   | 0.023827534 | 0.03066536  | 0.034124117 | 0.03709226  | 0.039352178 | 0.045442892 | 0.065388218 | 0.044861483 | 0.048403179 | 0.05745418  |
| 46:00:00 | 0.012240035 | 0.013907089 | 0.019536169 | 0.023564903 | 0.030327361 | 0.033747995 | 0.036683422 | 0.038918431 | 0.044942012 | 0.064667497 | 0.044367012 | 0.04786967  | 0.05682091  |
| 46:30:00 | 0.012105123 | 0.013753803 | 0.019320838 | 0.023305166 | 0.029993087 | 0.033376019 | 0.036279091 | 0.038489465 | 0.044446653 | 0.063954721 | 0.043877991 | 0.047342042 | 0.056194619 |
| 47:00:00 | 0.011971698 | 0.013602206 | 0.019107881 | 0.023048292 | 0.029662498 | 0.033008143 | 0.035879216 | 0.038065228 | 0.043956754 | 0.063249801 | 0.04339436  | 0.04682023  | 0.055575232 |

|          |             |             |             |             |             |             |             |             |             |             |             |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 47:30:00 | 0.011839744 | 0.01345228  | 0.01889727  | 0.02279425  | 0.029335553 | 0.032644321 | 0.035483749 | 0.037645666 | 0.043472255 | 0.06255265  | 0.042916059 | 0.046304169 | 0.054962672 |
| 48:00:00 | 0.011709244 | 0.013304006 | 0.018688981 | 0.022543008 | 0.029012211 | 0.03228451  | 0.035092641 | 0.037230729 | 0.042993096 | 0.061863184 | 0.042443031 | 0.045793796 | 0.054356864 |
| 48:30:00 | 0.011580183 | 0.013157367 | 0.018482988 | 0.022294535 | 0.028692433 | 0.031928664 | 0.034705844 | 0.036820365 | 0.042519219 | 0.061181317 | 0.041975216 | 0.045289049 | 0.053757733 |
| 49:00:00 | 0.011452544 | 0.013012345 | 0.018279265 | 0.0220488   | 0.02837618  | 0.031576741 | 0.03432331  | 0.036414525 | 0.042050565 | 0.060506965 | 0.041512558 | 0.044789865 | 0.053165206 |
| 49:30:00 | 0.011326312 | 0.01286892  | 0.018077788 | 0.021805775 | 0.028063413 | 0.031228696 | 0.033944992 | 0.036013157 | 0.041587076 | 0.059840047 | 0.041054999 | 0.044296183 | 0.05257921  |
| 50:00:00 | 0.011201471 | 0.012727077 | 0.017878531 | 0.021565428 | 0.027754093 | 0.030884488 | 0.033570845 | 0.035616214 | 0.041128696 | 0.059180479 | 0.040602484 | 0.043807943 | 0.051999672 |
| 50:30:00 | 0.011078007 | 0.012586797 | 0.017681471 | 0.02132773  | 0.027448183 | 0.030544074 | 0.033200821 | 0.035223646 | 0.040675368 | 0.058528182 | 0.040154956 | 0.043325084 | 0.051426523 |
| 51:00:00 | 0.010955903 | 0.012448063 | 0.017486583 | 0.021092652 | 0.027145644 | 0.030207411 | 0.032834876 | 0.034835404 | 0.040227037 | 0.057883074 | 0.039712361 | 0.042847547 | 0.05085969  |
| 51:30:00 | 0.010835145 | 0.012310858 | 0.017293842 | 0.020860165 | 0.02684644  | 0.02987446  | 0.032472964 | 0.034451442 | 0.039783647 | 0.057245076 | 0.039274644 | 0.042375274 | 0.050299106 |
| 52:00:00 | 0.010715718 | 0.012175165 | 0.017103227 | 0.02063024  | 0.026550534 | 0.029545178 | 0.032115041 | 0.034071713 | 0.039345145 | 0.056614111 | 0.038841752 | 0.041908206 | 0.0497447   |
| 52:30:00 | 0.010597608 | 0.012040969 | 0.016914712 | 0.02040285  | 0.026257889 | 0.029219526 | 0.031761063 | 0.033696168 | 0.038911476 | 0.0559901   | 0.038413632 | 0.041446287 | 0.049196405 |
| 53:00:00 | 0.010480799 | 0.011908251 | 0.016728275 | 0.020177966 | 0.02596847  | 0.028897463 | 0.031410987 | 0.033324763 | 0.038482587 | 0.055372967 | 0.03799023  | 0.040989458 | 0.048654154 |
| 53:30:00 | 0.010365278 | 0.011776996 | 0.016543893 | 0.019955561 | 0.025682241 | 0.028578951 | 0.03106477  | 0.032957452 | 0.038058425 | 0.054762637 | 0.037571495 | 0.040537665 | 0.048117879 |
| 54:00:00 | 0.01025103  | 0.011647188 | 0.016361543 | 0.019735607 | 0.025399167 | 0.028263948 | 0.030722368 | 0.032594189 | 0.037638938 | 0.054159033 | 0.037157375 | 0.040090852 | 0.047587515 |
| 54:30:00 | 0.010138041 | 0.011518811 | 0.016181203 | 0.019518078 | 0.025119212 | 0.027952418 | 0.030383741 | 0.03223493  | 0.037224075 | 0.053562083 | 0.03674782  | 0.039648964 | 0.047062997 |
| 55:00:00 | 0.010026298 | 0.011391848 | 0.016002851 | 0.019302946 | 0.024842344 | 0.027644322 | 0.030048846 | 0.031879631 | 0.036813785 | 0.052971712 | 0.036342779 | 0.039211946 | 0.046544261 |
| 55:30:00 | 0.009915786 | 0.011266285 | 0.015826465 | 0.019090186 | 0.024568527 | 0.027339621 | 0.029717642 | 0.031528248 | 0.036408017 | 0.052387848 | 0.035942202 | 0.038779745 | 0.046031242 |
| 56:00:00 | 0.009806493 | 0.011142106 | 0.015652023 | 0.01887977  | 0.024297729 | 0.027038279 | 0.029390089 | 0.031180738 | 0.036006721 | 0.05181042  | 0.035546041 | 0.038352307 | 0.045523877 |
| 56:30:00 | 0.009698404 | 0.011019296 | 0.015479504 | 0.018671674 | 0.024029915 | 0.026740258 | 0.029066147 | 0.030837058 | 0.035609849 | 0.051239357 | 0.035154246 | 0.037929582 | 0.045022105 |
| 57:00:00 | 0.009591506 | 0.010897839 | 0.015308886 | 0.018465872 | 0.023765053 | 0.026445522 | 0.028745774 | 0.030497167 | 0.035217351 | 0.050674587 | 0.03476677  | 0.037511515 | 0.044525863 |
| 57:30:00 | 0.009485787 | 0.010777721 | 0.015140149 | 0.018262338 | 0.02350311  | 0.026154035 | 0.028428933 | 0.030161022 | 0.034829179 | 0.050116043 | 0.034383565 | 0.037098056 | 0.044035091 |
| 58:00:00 | 0.009381233 | 0.010658928 | 0.014973271 | 0.018061047 | 0.023244055 | 0.025865761 | 0.028115585 | 0.029828581 | 0.034445285 | 0.049563655 | 0.034004583 | 0.036689155 | 0.043549729 |
| 58:30:00 | 0.009277831 | 0.010541443 | 0.014808233 | 0.017861975 | 0.022987855 | 0.025580664 | 0.02780569  | 0.029499806 | 0.034065623 | 0.049017356 | 0.033629778 | 0.036284761 | 0.043069716 |
| 59:00:00 | 0.009175569 | 0.010425253 | 0.014645014 | 0.017665097 | 0.022734479 | 0.025298709 | 0.02749921  | 0.029174653 | 0.033690146 | 0.048477078 | 0.033259105 | 0.035884824 | 0.042594994 |
| 59:30:00 | 0.009074435 | 0.010310344 | 0.014483594 | 0.017470389 | 0.022483895 | 0.025019862 | 0.027196109 | 0.028853085 | 0.033318807 | 0.047942755 | 0.032892517 | 0.035489295 | 0.042125504 |
| 60:00:00 | 0.008974415 | 0.010196702 | 0.014323953 | 0.017277828 | 0.022236074 | 0.024744089 | 0.026896349 | 0.028535061 | 0.032951561 | 0.047414322 | 0.03252997  | 0.035098126 | 0.04166119  |
| 60:30:00 | 0.008875497 | 0.010084312 | 0.014166072 | 0.017087388 | 0.021990984 | 0.024471355 | 0.026599893 | 0.028220543 | 0.032588363 | 0.046891712 | 0.032171419 | 0.034711268 | 0.041201993 |
| 61:00:00 | 0.00877767  | 0.009973161 | 0.014009931 | 0.016899048 | 0.021748595 | 0.024201628 | 0.026306704 | 0.027909491 | 0.032229169 | 0.046374864 | 0.03181682  | 0.034328674 | 0.040747857 |
| 61:30:00 | 0.008680921 | 0.009863235 | 0.013855511 | 0.016712784 | 0.021508878 | 0.023934873 | 0.026016747 | 0.027601868 | 0.031873933 | 0.045863712 | 0.031466129 | 0.033950297 | 0.040298727 |
| 62:00:00 | 0.008585238 | 0.009754521 | 0.013702793 | 0.016528573 | 0.021271804 | 0.023671059 | 0.025729986 | 0.027297635 | 0.031522613 | 0.045358194 | 0.031119304 | 0.033576091 | 0.039854547 |
| 62:30:00 | 0.00849061  | 0.009647005 | 0.013551759 | 0.016346392 | 0.021037342 | 0.023410152 | 0.025446385 | 0.026996756 | 0.031175165 | 0.044858248 | 0.030776302 | 0.03320601  | 0.039415263 |
| 63:00:00 | 0.008397025 | 0.009540674 | 0.013402389 | 0.016166219 | 0.020805465 | 0.023152121 | 0.025165911 | 0.026699193 | 0.030831547 | 0.044363812 | 0.03043708  | 0.032840007 | 0.038980821 |
| 63:30:00 | 0.008304472 | 0.009435515 | 0.013254665 | 0.015988032 | 0.020576143 | 0.022896934 | 0.024888527 | 0.02640491  | 0.030491716 | 0.043874826 | 0.030101597 | 0.032478039 | 0.038551168 |
| 64:00:00 | 0.008212938 | 0.009331515 | 0.01310857  | 0.015811809 | 0.020349349 | 0.02264456  | 0.024614202 | 0.02611387  | 0.030155631 | 0.04339123  | 0.029769812 | 0.03212006  | 0.03812625  |
| 64:30:00 | 0.008122414 | 0.009228661 | 0.012964085 | 0.015637528 | 0.020125055 | 0.022394968 | 0.0243429   | 0.025826038 | 0.02982325  | 0.042912965 | 0.029441684 | 0.031766027 | 0.037706016 |
| 65:00:00 | 0.008032887 | 0.009126941 | 0.012821193 | 0.015465169 | 0.019903233 | 0.022148127 | 0.024074588 | 0.025541379 | 0.029494533 | 0.04243997  | 0.029117172 | 0.031415896 | 0.037290413 |
| 65:30:00 | 0.007944347 | 0.009026342 | 0.012679875 | 0.015294709 | 0.019683856 | 0.021904006 | 0.023809234 | 0.025259857 | 0.029169439 | 0.041972189 | 0.028796238 | 0.031069625 | 0.036879392 |
| 66:00:00 | 0.007856783 | 0.008926853 | 0.012540116 | 0.015126128 | 0.019466897 | 0.021662576 | 0.023546804 | 0.024981439 | 0.028847929 | 0.041509565 | 0.02847884  | 0.03072717  | 0.036472901 |
| 66:30:00 | 0.007770184 | 0.008828459 | 0.012401896 | 0.014959405 | 0.01925233  | 0.021423807 | 0.023287267 | 0.024706089 | 0.028529962 | 0.041052039 | 0.028164941 | 0.030388489 | 0.03607089  |
| 67:00:00 | 0.00768454  | 0.00873115  | 0.0122652   | 0.01479452  | 0.019040127 | 0.02118767  | 0.023030591 | 0.024433774 | 0.028215499 | 0.040599556 | 0.027854503 | 0.030053542 | 0.03567331  |
| 67:30:00 | 0.00759984  | 0.008634914 | 0.012130011 | 0.014631452 | 0.018830264 | 0.020954136 | 0.022776743 | 0.024164461 | 0.027904503 | 0.04015206  | 0.027547485 | 0.029722287 | 0.035280113 |
| 68:00:00 | 0.007516073 | 0.008539738 | 0.011996312 | 0.014470182 | 0.018622713 | 0.020723176 | 0.022525694 | 0.023898116 | 0.027596935 | 0.039709497 | 0.027243852 | 0.029394682 | 0.034891249 |
| 68:30:00 | 0.007433229 | 0.008445612 | 0.011864086 | 0.014310689 | 0.01841745  | 0.020494762 | 0.022277412 | 0.023634707 | 0.027292757 | 0.039271812 | 0.026943565 | 0.029070689 | 0.034506672 |
| 69:00:00 | 0.007351299 | 0.008352523 | 0.011733318 | 0.014152954 | 0.01821445  | 0.020268865 | 0.022031866 | 0.023374201 | 0.026991931 | 0.038838951 | 0.026646589 | 0.028750267 | 0.034126333 |
| 69:30:00 | 0.007270272 | 0.00826046  | 0.011603992 | 0.013996957 | 0.018013687 | 0.020045458 | 0.021789027 | 0.023116566 | 0.026694421 | 0.038410862 | 0.026352885 | 0.028433376 | 0.033750186 |
| 70:00:00 | 0.007190137 | 0.008169412 | 0.01147609  | 0.013842681 | 0.017815137 | 0.019824513 | 0.021548865 | 0.022861771 | 0.02640019  | 0.03798749  | 0.026062419 | 0.028119979 | 0.033378186 |
| 70:30:00 | 0.007110886 | 0.008079367 | 0.011349599 | 0.013690104 | 0.017618775 | 0.019606004 | 0.021311349 | 0.022609785 | 0.026109203 | 0.037568785 | 0.025775155 | 0.027810035 | 0.033010286 |
| 71:00:00 | 0           | 0.007990315 | 0.011224502 | 0.013539209 | 0.017424578 | 0.019389903 | 0.021076452 | 0.022360576 | 0.025821423 | 0.037154696 | 0.025491056 | 0.027503508 | 0.03264644  |

|          |   |             |             |             |              |             |             |              |             |             |             |             |             |
|----------|---|-------------|-------------|-------------|--------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|-------------|
| 71:30:00 | 0 | 0.007902244 | 0.011100783 | 0.013389978 | 0.017232521  | 0.019176184 | 0.020844143 | 0.022114113  | 0.025536814 | 0.03674517  | 0.025210089 | 0.02720036  | 0.032286606 |
| 72:00:00 | 0 | 0.007815144 | 0.010978428 | 0.013242391 | 0.017042581  | 0.018964821 | 0.020614396 | 0.021870368  | 0.025255343 | 0.036340158 | 0.024932219 | 0.026900552 | 0.031930737 |
| 72:30:00 | 0 | 0.007729004 | 0.010857422 | 0.013096431 | 0.016854735  | 0.018755787 | 0.02038718  | 0.021629309  | 0.024976974 | 0.035939611 | 0.024657412 | 0.02660405  | 0.031578791 |
| 73:00:00 | 0 | 0.007643814 | 0.01073775  | 0.01295208  | 0.016668959  | 0.018549057 | 0.020162469 | 0.021390907  | 0.024701674 | 0.035543478 | 0.024385634 | 0.026310815 | 0.031230724 |
| 73:30:00 | 0 | 0.007559562 | 0.010619396 | 0.01280932  | 0.016485231  | 0.018344606 | 0.019940235 | 0.021155132  | 0.024429407 | 0.035151711 | 0.024116851 | 0.026020813 | 0.030886493 |
| 74:00:00 | 0 | 0.00747624  | 0.010502348 | 0.012668133 | 0.016303528  | 0.018142409 | 0.01972045  | 0.020921957  | 0.024160142 | 0.034764263 | 0.023851031 | 0.025734007 | 0.030546057 |
| 74:30:00 | 0 | 0.007393835 | 0.010386589 | 0.012528503 | 0.016123827  | 0.01794244  | 0.019503088 | 0.020691351  | 0.023893845 | 0.034381085 | 0.02358814  | 0.025450362 | 0.030209373 |
| 75:00:00 | 0 | 0.007312339 | 0.010272106 | 0.012390411 | 0.015946108  | 0.017744675 | 0.019288121 | 0.020463287  | 0.023630483 | 0.034002131 | 0.023328148 | 0.025169844 | 0.0298764   |
| 75:30:00 | 0 | 0.007231741 | 0.010158885 | 0.012253842 | 0.015770347  | 0.01754909  | 0.019075524 | 0.020237737  | 0.023370023 | 0.033627353 | 0.023071021 | 0.024892417 | 0.029547097 |
| 76:00:00 | 0 | 0.007152032 | 0.010046912 | 0.012118778 | 0.015596523  | 0.017355661 | 0.01886527  | 0.020014674  | 0.023112435 | 0.033256707 | 0.022816728 | 0.024618048 | 0.029221423 |
| 76:30:00 | 0 | 0.007073201 | 0.009936173 | 0.011985203 | 0.015424616  | 0.017164364 | 0.018657334 | 0.019794068  | 0.022857685 | 0.032890145 | 0.022565238 | 0.024346704 | 0.02889934  |
| 77:00:00 | 0 | 0           | 0.009826655 | 0.0118531   | 0.015254603  | 0.016975175 | 0.018451689 | 0.019575895  | 0.022605744 | 0.032527624 | 0.02231652  | 0.02407835  | 0.028580806 |
| 77:30:00 | 0 | 0           | 0.009718344 | 0.011722453 | 0.015086464  | 0.016788072 | 0.018248312 | 0.019360126  | 0.022356579 | 0.032169099 | 0.022070543 | 0.023812954 | 0.028265783 |
| 78:00:00 | 0 | 0           | 0.009611226 | 0.011593246 | 0.014920178  | 0.016603031 | 0.018047175 | 0.019146735  | 0.022110161 | 0.031814526 | 0.021827278 | 0.023550484 | 0.027954233 |
| 78:30:00 | 0 | 0           | 0.00950529  | 0.011465463 | 0.014755725  | 0.016420029 | 0.017848256 | 0.018935696  | 0.021866459 | 0.03146386  | 0.021586694 | 0.023290906 | 0.027646116 |
| 79:00:00 | 0 | 0           | 0.009400521 | 0.011339089 | 0.014593085  | 0.016239045 | 0.01765153  | 0.018726984  | 0.021625443 | 0.03111706  | 0.021348761 | 0.02303419  | 0.027341396 |
| 79:30:00 | 0 | 0           | 0.009296907 | 0.011214107 | 0.014432238  | 0.016060055 | 0.017456971 | 0.018520571  | 0.021387084 | 0.030774082 | 0.021113451 | 0.022780303 | 0.027040034 |
| 80:00:00 | 0 | 0           | 0.009194435 | 0.011090503 | 0.014273163  | 0.015883039 | 0.017264558 | 0.018316434  | 0.021151351 | 0.030434885 | 0.020880735 | 0.022529214 | 0.026741994 |
| 80:30:00 | 0 | 0           | 0.009093092 | 0.010968262 | 0.0141115842 | 0.015707973 | 0.017074265 | 0.0181114547 | 0.020918218 | 0.030099426 | 0.020650584 | 0.022280893 | 0.026447239 |
| 81:00:00 | 0 | 0           | 0.008992866 | 0.010847368 | 0.013960254  | 0.015534837 | 0.016886069 | 0.017914886  | 0.020687653 | 0.029767665 | 0.02042297  | 0.022035309 | 0.026155733 |
| 81:30:00 | 0 | 0           | 0.008893745 | 0.010727806 | 0.013806382  | 0.015363609 | 0.016699948 | 0.017717425  | 0.02045963  | 0.029439561 | 0.020197864 | 0.021792432 | 0.02586744  |
| 82:00:00 | 0 | 0           | 0.008795717 | 0.010609562 | 0.013654206  | 0.015194269 | 0.016515878 | 0.01752214   | 0.020234121 | 0.029115072 | 0.01997524  | 0.021552232 | 0.025582324 |
| 82:30:00 | 0 | 0           | 0.008698769 | 0.010492622 | 0.013503707  | 0.015026795 | 0.016333837 | 0.017329008  | 0.020011097 | 0.028794161 | 0.019755069 | 0.02131468  | 0.025300352 |
| 83:00:00 | 0 | 0           | 0.008602889 | 0.01037697  | 0.013354866  | 0.014861167 | 0.016153803 | 0.017138005  | 0.019790531 | 0.028476787 | 0.019537325 | 0.021079746 | 0.025021487 |
| 83:30:00 | 0 | 0           | 0.008508067 | 0.010262594 | 0.013207667  | 0.014697364 | 0.015975753 | 0.016949106  | 0.019572396 | 0.02816291  | 0.019321981 | 0.020847401 | 0.024745695 |
| 84:00:00 | 0 | 0           | 0.008414289 | 0.010149477 | 0.013062089  | 0.014535367 | 0.015799665 | 0.01676229   | 0.019356666 | 0.027852494 | 0.019109011 | 0.020617617 | 0.024472944 |
| 84:30:00 | 0 | 0           | 0.008321546 | 0.010037608 | 0.012918117  | 0.014375156 | 0.015625518 | 0.016577533  | 0.019143313 | 0.027545499 | 0.018898388 | 0.020390366 | 0.024203199 |
| 85:00:00 | 0 | 0           | 0.008229824 | 0.009926972 | 0.012775731  | 0.014216711 | 0.015453291 | 0.016394813  | 0.018932312 | 0.027241887 | 0.018690087 | 0.02016562  | 0.023936427 |
| 85:30:00 | 0 | 0           | 0.008139114 | 0.009817555 | 0.012634915  | 0.014060011 | 0.015282962 | 0.016214106  | 0.018723637 | 0.026941623 | 0.018484081 | 0.019943351 | 0.023672595 |
| 86:00:00 | 0 | 0           | 0.008049403 | 0.009709344 | 0.01249565   | 0.013905039 | 0.015114511 | 0.016035392  | 0.018517261 | 0.026644667 | 0.018280346 | 0.019723532 | 0.023411672 |
| 86:30:00 | 0 | 0           | 0.007960681 | 0.009602326 | 0.012357921  | 0.013751776 | 0.014947916 | 0.015858647  | 0.018313161 | 0.026350985 | 0.018078857 | 0.019506135 | 0.023153624 |
| 87:00:00 | 0 | 0           | 0.007872937 | 0.009496488 | 0.01222171   | 0.013600201 | 0.014783157 | 0.01568385   | 0.01811131  | 0.02606054  | 0.017879589 | 0.019291135 | 0.022898421 |
| 87:30:00 | 0 | 0           | 0.00778616  | 0.009391816 | 0.012087     | 0.013450297 | 0.014620215 | 0.01551098   | 0.017911684 | 0.025773296 | 0.017682517 | 0.019078505 | 0.02264603  |
| 88:00:00 | 0 | 0           | 0.007700339 | 0.009288297 | 0.011953775  | 0.013302046 | 0.014459068 | 0.015340015  | 0.017714258 | 0.025489218 | 0.017487617 | 0.018868218 | 0.022396422 |
| 88:30:00 | 0 | 0           | 0.007615465 | 0.00918592  | 0.011822018  | 0.013155428 | 0.014299698 | 0.015170935  | 0.017519009 | 0.025208271 | 0.017294865 | 0.01866025  | 0.022149565 |
| 89:00:00 | 0 | 0           | 0.007531526 | 0.009084671 | 0.011691714  | 0.013010427 | 0.014142084 | 0.015003718  | 0.017325911 | 0.024930421 | 0.017104238 | 0.018454573 | 0.021905428 |
| 89:30:00 | 0 | 0           | 0.007448512 | 0.008984538 | 0.011562846  | 0.012867024 | 0.013986207 | 0.014838344  | 0.017134942 | 0.024655634 | 0.016915712 | 0.018251163 | 0.021663983 |
| 90:00:00 | 0 | 0           | 0.007366413 | 0.008885509 | 0.011435398  | 0.012725201 | 0.013832049 | 0.014674793  | 0.016946077 | 0.024383875 | 0.016729265 | 0.018049996 | 0.021425198 |
| 90:30:00 | 0 | 0           | 0.007285219 | 0.008787572 | 0.011309355  | 0.012584942 | 0.01367959  | 0.014513045  | 0.016759295 | 0.024115112 | 0.016544872 | 0.017851046 | 0.021189046 |
| 91:00:00 | 0 | 0           | 0.00720492  | 0.008690713 | 0.011184701  | 0.012446228 | 0.013528811 | 0.01435308   | 0.016574571 | 0.023849311 | 0.016362511 | 0.017654288 | 0.020955497 |
| 91:30:00 | 0 | 0           | 0.007125507 | 0.008594923 | 0.011061422  | 0.012309044 | 0.013379694 | 0.014194878  | 0.016391883 | 0.023586439 | 0.016182161 | 0.0174597   | 0.020724521 |
| 92:00:00 | 0 | 0           | 0           | 0.008500188 | 0.010939501  | 0.012173371 | 0.01323222  | 0.014038419  | 0.016211209 | 0.023326465 | 0.016003798 | 0.017267256 | 0.020496092 |
| 92:30:00 | 0 | 0           | 0           | 0.008406497 | 0.010818924  | 0.012039194 | 0.013086373 | 0.013883685  | 0.016032526 | 0.023069357 | 0.015827401 | 0.017076933 | 0.020270181 |
| 93:00:00 | 0 | 0           | 0           | 0.00831384  | 0.010699675  | 0.011906496 | 0.012942132 | 0.013730657  | 0.015855812 | 0.022815082 | 0.015652949 | 0.016888708 | 0.020046759 |
| 93:30:00 | 0 | 0           | 0           | 0.008222203 | 0.010581742  | 0.01177526  | 0.012799482 | 0.013579315  | 0.015681047 | 0.022563611 | 0.015480419 | 0.016702558 | 0.0198258   |
| 94:00:00 | 0 | 0           | 0           | 0.008131576 | 0.010465108  | 0.011645471 | 0.012658404 | 0.013429642  | 0.015508208 | 0.022314911 | 0.015309791 | 0.016518459 | 0.019607277 |
| 94:30:00 | 0 | 0           | 0           | 0.008041949 | 0.01034976   | 0.011517113 | 0.01251888  | 0.013281618  | 0.015337273 | 0.022068952 | 0.015141044 | 0.01633639  | 0.019391162 |
| 95:00:00 | 0 | 0           | 0           | 0.007953309 | 0.010235683  | 0.011390169 | 0.012380895 | 0.013135225  | 0.015168223 | 0.021825704 | 0.014974157 | 0.016156327 | 0.019177429 |

|           |   |   |   |             |             |             |             |             |             |             |             |             |             |
|-----------|---|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 95:30:00  | 0 | 0 | 0 | 0.007865646 | 0.010122863 | 0.011264625 | 0.012244431 | 0.012990447 | 0.015001036 | 0.021585137 | 0.014809109 | 0.015978249 | 0.018966052 |
| 96:00:00  | 0 | 0 | 0 | 0.00777895  | 0.010011287 | 0.011140464 | 0.01210947  | 0.012847264 | 0.014835692 | 0.021347222 | 0.01464588  | 0.015802134 | 0.018757005 |
| 96:30:00  | 0 | 0 | 0 | 0.007693209 | 0.009900941 | 0.011017672 | 0.011975998 | 0.012705659 | 0.014672171 | 0.021111929 | 0.014484451 | 0.01562796  | 0.018550262 |
| 97:00:00  | 0 | 0 | 0 | 0.007608413 | 0.009791811 | 0.010896233 | 0.011843996 | 0.012565615 | 0.014510452 | 0.02087923  | 0.014324801 | 0.015455706 | 0.018345797 |
| 97:30:00  | 0 | 0 | 0 | 0.007524551 | 0.009683884 | 0.010776133 | 0.01171345  | 0.012427114 | 0.014350515 | 0.020649095 | 0.01416691  | 0.015285351 | 0.018143587 |
| 98:00:00  | 0 | 0 | 0 | 0.007441615 | 0.009577147 | 0.010657357 | 0.011584342 | 0.01229014  | 0.014192341 | 0.020421497 | 0.01401076  | 0.015116873 | 0.017943605 |
| 98:30:00  | 0 | 0 | 0 | 0.007359592 | 0.009471586 | 0.010539889 | 0.011456657 | 0.012154676 | 0.01403591  | 0.020196408 | 0.013856331 | 0.014950252 | 0.017745827 |
| 99:00:00  | 0 | 0 | 0 | 0.007278473 | 0.009367188 | 0.010423717 | 0.01133038  | 0.012020705 | 0.013881204 | 0.019973799 | 0.013703604 | 0.014785468 | 0.01755023  |
| 99:30:00  | 0 | 0 | 0 | 0.007198248 | 0.009263941 | 0.010308825 | 0.011205494 | 0.011888211 | 0.013728203 | 0.019753644 | 0.013552561 | 0.0146225   | 0.017356788 |
| 100:00:00 | 0 | 0 | 0 | 0.007118908 | 0.009161833 | 0.010195199 | 0.011081985 | 0.011757177 | 0.013576888 | 0.019535916 | 0.013403182 | 0.014461328 | 0.017165478 |
| 100:30:00 | 0 | 0 | 0 | 0           | 0.009060849 | 0.010082826 | 0.010959838 | 0.011627587 | 0.013427241 | 0.019320588 | 0.01325545  | 0.014301932 | 0.016976278 |
| 101:00:00 | 0 | 0 | 0 | 0           | 0.008960979 | 0.009971691 | 0.010839037 | 0.011499426 | 0.013279244 | 0.019107633 | 0.013109346 | 0.014144294 | 0.016789162 |
| 101:30:00 | 0 | 0 | 0 | 0           | 0.008862209 | 0.009861781 | 0.010719567 | 0.011372677 | 0.013132878 | 0.018897025 | 0.012964852 | 0.013988393 | 0.016604109 |
| 102:00:00 | 0 | 0 | 0 | 0           | 0.008764529 | 0.009753083 | 0.010601414 | 0.011247326 | 0.012988125 | 0.018688739 | 0.012821951 | 0.013834211 | 0.016421095 |
| 102:30:00 | 0 | 0 | 0 | 0           | 0.008667924 | 0.009645583 | 0.010484563 | 0.011123356 | 0.012844968 | 0.018482748 | 0.012680625 | 0.013681727 | 0.016240099 |
| 103:00:00 | 0 | 0 | 0 | 0           | 0.008572385 | 0.009539268 | 0.010369    | 0.011000752 | 0.012703388 | 0.018279028 | 0.012540857 | 0.013530925 | 0.016061098 |
| 103:30:00 | 0 | 0 | 0 | 0           | 0.008477899 | 0.009434124 | 0.010254712 | 0.0108795   | 0.012563369 | 0.018077554 | 0.01240263  | 0.013381785 | 0.01588407  |
| 104:00:00 | 0 | 0 | 0 | 0           | 0.008384454 | 0.00933014  | 0.010141682 | 0.010759584 | 0.012424893 | 0.0178783   | 0.012265926 | 0.013234288 | 0.015708993 |
| 104:30:00 | 0 | 0 | 0 | 0           | 0.008292039 | 0.009227301 | 0.010029899 | 0.01064099  | 0.012287944 | 0.017681242 | 0.012130729 | 0.013088418 | 0.015535845 |
| 105:00:00 | 0 | 0 | 0 | 0           | 0.008200643 | 0.009125596 | 0.009919348 | 0.010523703 | 0.012152504 | 0.017486356 | 0.011997022 | 0.012944155 | 0.015364607 |
| 105:30:00 | 0 | 0 | 0 | 0           | 0.008110254 | 0.009025012 | 0.009810015 | 0.010407709 | 0.012018557 | 0.017293618 | 0.011864788 | 0.012801482 | 0.015195255 |
| 106:00:00 | 0 | 0 | 0 | 0           | 0.008020861 | 0.008925537 | 0.009701887 | 0.010292993 | 0.011886086 | 0.017103005 | 0.011734012 | 0.012660382 | 0.01502777  |
| 106:30:00 | 0 | 0 | 0 | 0           | 0.007932454 | 0.008827158 | 0.009594951 | 0.010179542 | 0.011755076 | 0.016914493 | 0.011604678 | 0.012520837 | 0.014862132 |
| 107:00:00 | 0 | 0 | 0 | 0           | 0.007845021 | 0.008729864 | 0.009489194 | 0.010067342 | 0.011625509 | 0.016728058 | 0.011476769 | 0.01238283  | 0.014698319 |
| 107:30:00 | 0 | 0 | 0 | 0           | 0.007758551 | 0.008633641 | 0.009384602 | 0.009956377 | 0.011497371 | 0.016543679 | 0.01135027  | 0.012246344 | 0.014536311 |
| 108:00:00 | 0 | 0 | 0 | 0           | 0.007673035 | 0.00853848  | 0.009281164 | 0.009846637 | 0.011370645 | 0.016361331 | 0.011225166 | 0.012111363 | 0.014376089 |
| 108:30:00 | 0 | 0 | 0 | 0           | 0.007588462 | 0.008444367 | 0.009178865 | 0.009738105 | 0.011245316 | 0.016180994 | 0.01110144  | 0.011977869 | 0.014217634 |
| 109:00:00 | 0 | 0 | 0 | 0           | 0.00750482  | 0.008351292 | 0.009077694 | 0.00963077  | 0.011121368 | 0.016002644 | 0.010979078 | 0.011845847 | 0.014060924 |
| 109:30:00 | 0 | 0 | 0 | 0           | 0.007422101 | 0.008259243 | 0.008977638 | 0.009524618 | 0.010998786 | 0.01582626  | 0.010858065 | 0.01171528  | 0.013905942 |
| 110:00:00 | 0 | 0 | 0 | 0           | 0.007340293 | 0.008168208 | 0.008878685 | 0.009419636 | 0.010877555 | 0.01565182  | 0.010738385 | 0.011586152 | 0.013752669 |
| 110:30:00 | 0 | 0 | 0 | 0           | 0.007259387 | 0.008078176 | 0.008780822 | 0.009315811 | 0.010757661 | 0.015479303 | 0.010620025 | 0.011458448 | 0.013601084 |
| 111:00:00 | 0 | 0 | 0 | 0           | 0.007179373 | 0.007989137 | 0.008684039 | 0.009213131 | 0.010639088 | 0.015308687 | 0.010502969 | 0.011332151 | 0.013451171 |
| 111:30:00 | 0 | 0 | 0 | 0           | 0.007100241 | 0.00790108  | 0.008588322 | 0.009111582 | 0.010521822 | 0.015139952 | 0.010387203 | 0.011207246 | 0.013302909 |
| 112:00:00 | 0 | 0 | 0 | 0           | 0           | 0.007813992 | 0.00849366  | 0.009011152 | 0.010405849 | 0.014973077 | 0.010272714 | 0.011083717 | 0.013156282 |
| 112:30:00 | 0 | 0 | 0 | 0           | 0           | 0.007727865 | 0.008400041 | 0.00891183  | 0.010291154 | 0.014808041 | 0.010159486 | 0.010961551 | 0.013011272 |
| 113:00:00 | 0 | 0 | 0 | 0           | 0           | 0.007642687 | 0.008307454 | 0.008813602 | 0.010177723 | 0.014644824 | 0.010047506 | 0.010840731 | 0.012867859 |
| 113:30:00 | 0 | 0 | 0 | 0           | 0           | 0.007558448 | 0.008215888 | 0.008716457 | 0.010065542 | 0.014483406 | 0.009936761 | 0.010721242 | 0.012726027 |
| 114:00:00 | 0 | 0 | 0 | 0           | 0           | 0.007475138 | 0.008125331 | 0.008620383 | 0.009954598 | 0.014323768 | 0.009827236 | 0.010603071 | 0.012585759 |
| 114:30:00 | 0 | 0 | 0 | 0           | 0           | 0.007392745 | 0.008035772 | 0.008525367 | 0.009844877 | 0.014165889 | 0.009718919 | 0.010486202 | 0.012447036 |
| 115:00:00 | 0 | 0 | 0 | 0           | 0           | 0.007311261 | 0.0079472   | 0.008431399 | 0.009736365 | 0.01400975  | 0.009611795 | 0.010370621 | 0.012309843 |
| 115:30:00 | 0 | 0 | 0 | 0           | 0           | 0.007230675 | 0.007859605 | 0.008338467 | 0.009629049 | 0.013855332 | 0.009505852 | 0.010256314 | 0.012174162 |
| 116:00:00 | 0 | 0 | 0 | 0           | 0           | 0.007150977 | 0.007772975 | 0.008246559 | 0.009522916 | 0.013702616 | 0.009401077 | 0.010143267 | 0.012039976 |
| 116:30:00 | 0 | 0 | 0 | 0           | 0           | 0.007072158 | 0.0076873   | 0.008155664 | 0.009417953 | 0.013551583 | 0.009297457 | 0.010031466 | 0.011907269 |
| 117:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.007602569 | 0.008065771 | 0.009314146 | 0.013402215 | 0.009194978 | 0.009920898 | 0.011776025 |
| 117:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.007518772 | 0.007976868 | 0.009211484 | 0.013254494 | 0.00909363  | 0.009811548 | 0.011646228 |
| 118:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.007435899 | 0.007888946 | 0.009109953 | 0.0131084   | 0.008993398 | 0.009703403 | 0.011517861 |
| 118:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.007353939 | 0.007801992 | 0.009009542 | 0.012963917 | 0.008894271 | 0.009596451 | 0.011390909 |
| 119:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.007272883 | 0.007715997 | 0.008910237 | 0.012821027 | 0.008796237 | 0.009490677 | 0.011265356 |

|           |   |   |   |   |   |   |            |             |             |             |             |             |             |
|-----------|---|---|---|---|---|---|------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 119:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00719272 | 0.00763095  | 0.008812027 | 0.012679711 | 0.008699283 | 0.009386069 | 0.011141188 |
| 120:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00711344 | 0.007546841 | 0.008714899 | 0.012539953 | 0.008603398 | 0.009282614 | 0.011018387 |
| 120:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007463658 | 0.008618842 | 0.012401735 | 0.00850857  | 0.009180299 | 0.010896941 |
| 121:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007381392 | 0.008523844 | 0.012265041 | 0.008414787 | 0.009079113 | 0.010776833 |
| 121:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007300033 | 0.008429892 | 0.012129854 | 0.008322038 | 0.008979041 | 0.010658049 |
| 122:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007219571 | 0.008336977 | 0.011996156 | 0.008230311 | 0.008880072 | 0.010540574 |
| 122:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007139996 | 0.008245085 | 0.011863933 | 0.008139595 | 0.008782195 | 0.010424394 |
| 123:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0.007061297 | 0.008154206 | 0.011733166 | 0.008049879 | 0.008685396 | 0.010309494 |
| 123:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.008064329 | 0.011603841 | 0           | 0           | 0           |
| 124:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007975443 | 0.011475942 | 0           | 0           | 0           |
| 124:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007887536 | 0.011349452 | 0           | 0           | 0           |
| 125:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007800598 | 0.011224356 | 0           | 0           | 0           |
| 125:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007714618 | 0.011100639 | 0           | 0           | 0           |
| 126:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007629587 | 0.010978286 | 0           | 0           | 0           |
| 126:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007545492 | 0.010857282 | 0           | 0           | 0           |
| 127:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007462324 | 0.010737611 | 0           | 0           | 0           |
| 127:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007380073 | 0.010619259 | 0           | 0           | 0           |
| 128:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007298729 | 0.010502211 | 0           | 0           | 0           |
| 128:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007218281 | 0.010386454 | 0           | 0           | 0           |
| 129:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.00713872  | 0.010271973 | 0           | 0           | 0           |
| 129:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0.007060035 | 0.010158753 | 0           | 0           | 0           |
| 130:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.010046782 | 0           | 0           | 0           |
| 130:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009936044 | 0           | 0           | 0           |
| 131:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009826528 | 0           | 0           | 0           |
| 131:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009718218 | 0           | 0           | 0           |
| 132:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009611102 | 0           | 0           | 0           |
| 132:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009505167 | 0           | 0           | 0           |
| 133:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009400399 | 0           | 0           | 0           |
| 133:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009296786 | 0           | 0           | 0           |
| 134:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009194315 | 0           | 0           | 0           |
| 134:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.009092974 | 0           | 0           | 0           |
| 135:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.00899275  | 0           | 0           | 0           |
| 135:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.00889363  | 0           | 0           | 0           |
| 136:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008795603 | 0           | 0           | 0           |
| 136:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008698656 | 0           | 0           | 0           |
| 137:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008602778 | 0           | 0           | 0           |
| 137:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008507957 | 0           | 0           | 0           |
| 138:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.00841418  | 0           | 0           | 0           |
| 138:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008321438 | 0           | 0           | 0           |
| 139:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008229717 | 0           | 0           | 0           |
| 139:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008139008 | 0           | 0           | 0           |
| 140:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.008049298 | 0           | 0           | 0           |
| 140:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.007960578 | 0           | 0           | 0           |
| 141:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.007872835 | 0           | 0           | 0           |
| 141:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.007786059 | 0           | 0           | 0           |
| 142:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.00770024  | 0           | 0           | 0           |
| 142:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.007615366 | 0           | 0           | 0           |
| 143:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0          | 0           | 0           | 0.007531428 | 0           | 0           | 0           |

|           |   |   |   |   |   |   |   |   |   |             |   |   |   |
|-----------|---|---|---|---|---|---|---|---|---|-------------|---|---|---|
| 143:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.007448416 | 0 | 0 | 0 |
| 144:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.007366318 | 0 | 0 | 0 |
| 144:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.007285125 | 0 | 0 | 0 |
| 145:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.007204827 | 0 | 0 | 0 |
| 145:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.007125414 | 0 | 0 | 0 |

| Time     | 1-Year      | 2-Year      | 5-Year      | 10-Year     | 30-Year     | 50-Year     | 75-Year     | 100-Year    | 200-Year    | 1000-Year   | 100-Year+14CC | 100-Year+23CC | 100-Year+46CC |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|---------------|---------------|
| 00:00:00 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.013094548 | 0.014927784   | 0.016106293   | 0.019118039   |
| 00:30:00 | 0.013417188 | 0.013505583 | 0.013795229 | 0.013997675 | 0.014316215 | 0.014469488 | 0.014597095 | 0.014691509 | 0.014933391 | 0.015642047 | 0.01674832    | 0.018070556   | 0.021449603   |
| 01:00:00 | 0.015244801 | 0.015689982 | 0.017129256 | 0.0181237   | 0.019689767 | 0.020443915 | 0.021072082 | 0.021537024 | 0.022728864 | 0.026226451 | 0.024552207   | 0.026490539   | 0.031444054   |
| 01:30:00 | 0.019961155 | 0.021275837 | 0.025505403 | 0.028416497 | 0.033009129 | 0.035224314 | 0.03707123  | 0.03843928  | 0.041950216 | 0.052287111 | 0.043820779   | 0.047280315   | 0.056121349   |
| 02:00:00 | 0.030068913 | 0.033208158 | 0.04331367  | 0.050279289 | 0.061304681 | 0.066638353 | 0.071093103 | 0.074397375 | 0.082895015 | 0.108059296 | 0.084813008   | 0.091508772   | 0.108620168   |
| 02:30:00 | 0.048858661 | 0.055382933 | 0.076446633 | 0.091024114 | 0.114211917 | 0.125478681 | 0.134913135 | 0.141925219 | 0.160013041 | 0.214027519 | 0.16179475    | 0.17456802    | 0.20721082    |
| 03:00:00 | 0.075675731 | 0.087049504 | 0.123879011 | 0.149468731 | 0.190362089 | 0.210313125 | 0.227059377 | 0.239529048 | 0.271784161 | 0.368838248 | 0.273063115   | 0.294620729   | 0.34971241    |
| 03:30:00 | 0.105962978 | 0.122830662 | 0.177607191 | 0.215803202 | 0.277062447 | 0.307044107 | 0.332255895 | 0.351055965 | 0.39978889  | 0.547267227 | 0.400203801   | 0.431798837   | 0.51254171    |
| 04:00:00 | 0.134816093 | 0.156951789 | 0.22900707  | 0.279399483 | 0.360455941 | 0.400227808 | 0.433721421 | 0.458725583 | 0.523650015 | 0.721022021 | 0.522947165   | 0.564232468   | 0.669739352   |
| 04:30:00 | 0.156930454 | 0.183151962 | 0.268690643 | 0.328670958 | 0.425403052 | 0.472974423 | 0.513088769 | 0.543065843 | 0.621019112 | 0.858948826 | 0.619095061   | 0.667970987   | 0.792876131   |
| 05:00:00 | 0.167407866 | 0.19563017  | 0.287874148 | 0.352709305 | 0.457513694 | 0.509158057 | 0.552756938 | 0.585366835 | 0.670277401 | 0.930345106 | 0.667318192   | 0.720001207   | 0.854635579   |
| 05:30:00 | 0.166549051 | 0.194705847 | 0.28686156  | 0.35174257  | 0.456792358 | 0.508630276 | 0.552427696 | 0.585206349 | 0.67063406  | 0.932918181 | 0.667135238   | 0.71980381    | 0.85440127    |
| 06:00:00 | 0.15761232  | 0.184204364 | 0.271290617 | 0.332647203 | 0.432062274 | 0.481150037 | 0.522638534 | 0.553697598 | 0.634676085 | 0.883563009 | 0.631215261   | 0.681048045   | 0.808398493   |
| 06:30:00 | 0.144613644 | 0.168868444 | 0.248286659 | 0.304228934 | 0.394852723 | 0.439591763 | 0.47740094  | 0.505703391 | 0.579486243 | 0.806188173 | 0.576501865   | 0.62201517    | 0.73832695    |
| 07:00:00 | 0.130667443 | 0.152388426 | 0.223448078 | 0.273449345 | 0.354364124 | 0.39427407  | 0.427984768 | 0.453209237 | 0.518929509 | 0.720545571 | 0.51665853    | 0.557447361   | 0.661685486   |
| 07:30:00 | 0.117452065 | 0.136759938 | 0.19983467  | 0.244139557 | 0.31571188  | 0.350961103 | 0.380709534 | 0.402954481 | 0.46085542  | 0.638023774 | 0.459368108   | 0.495634011   | 0.588313542   |
| 08:00:00 | 0.105287155 | 0.122371613 | 0.178082243 | 0.217127812 | 0.280065326 | 0.311003035 | 0.337084252 | 0.356570507 | 0.407227682 | 0.561715933 | 0.406490378   | 0.438581724   | 0.52059294    |
| 08:30:00 | 0.094460201 | 0.109570037 | 0.158746156 | 0.193129174 | 0.248416663 | 0.275536677 | 0.29837171  | 0.315416576 | 0.359665368 | 0.494107034 | 0.359574897   | 0.387962389   | 0.460508201   |
| 09:00:00 | 0.08484036  | 0.098203706 | 0.141608225 | 0.171879797 | 0.220432021 | 0.244195261 | 0.264178145 | 0.279079177 | 0.317705263 | 0.434595538 | 0.318150262   | 0.343267388   | 0.407455599   |
| 09:30:00 | 0.076125625 | 0.087913397 | 0.126115507 | 0.152685227 | 0.195181295 | 0.215929623 | 0.233352461 | 0.246330155 | 0.279915412 | 0.381099582 | 0.280816376   | 0.30298609    | 0.359642026   |
| 10:00:00 | 0.068406907 | 0.078801203 | 0.112401121 | 0.135695181 | 0.172830904 | 0.190910111 | 0.20606623  | 0.217340794 | 0.24646172  | 0.333730796 | 0.247768505   | 0.267329177   | 0.317317559   |
| 10:30:00 | 0.062115133 | 0.071374278 | 0.101218196 | 0.121832918 | 0.154574641 | 0.170461912 | 0.183754636 | 0.193628008 | 0.219071828 | 0.294845146 | 0.220735929   | 0.23816245    | 0.282696892   |
| 11:00:00 | 0.057161266 | 0.065527988 | 0.09241205  | 0.110909372 | 0.140169108 | 0.154315382 | 0.166126129 | 0.17488401  | 0.197396228 | 0.263969833 | 0.199367772   | 0.215107333   | 0.255330655   |
| 11:30:00 | 0.053041445 | 0.060668118 | 0.085094434 | 0.101830757 | 0.128190103 | 0.140884286 | 0.151458069 | 0.159284358 | 0.179346264 | 0.23821409  | 0.181584168   | 0.19591976    | 0.232555162   |
| 12:00:00 | 0.049451322 | 0.056435036 | 0.078724414 | 0.093928188 | 0.11776114  | 0.129189526 | 0.138684585 | 0.145698195 | 0.163621564 | 0.215755961 | 0.166095943   | 0.17920878    | 0.212719365   |
| 12:30:00 | 0.046357176 | 0.052788472 | 0.073239355 | 0.087122529 | 0.108775217 | 0.119109872 | 0.127672201 | 0.133982753 | 0.150054655 | 0.196348337 | 0.152740338   | 0.164798786   | 0.195614819   |
| 13:00:00 | 0.043897884 | 0.049893381 | 0.068891378 | 0.08172883  | 0.101651794 | 0.111117384 | 0.11893794  | 0.12468901  | 0.139286173 | 0.180916652 | 0.142145471   | 0.153367482   | 0.182045955   |
| 13:30:00 | 0.042204231 | 0.047907218 | 0.065930964 | 0.078067992 | 0.096833663 | 0.10571833  | 0.113043309 | 0.118420736 | 0.132033583 | 0.170556252 | 0.134999639   | 0.145657506   | 0.172894275   |
| 14:00:00 | 0.041058188 | 0.046573185 | 0.063975765 | 0.075670422 | 0.093711784 | 0.102235623 | 0.109254093 | 0.114401177 | 0.127410065 | 0.164048873 | 0.130417342   | 0.140713448   | 0.167025719   |
| 14:30:00 | 0.040228827 | 0.045616901 | 0.062606006 | 0.074011233 | 0.091586683 | 0.099881766 | 0.106707524 | 0.111710702 | 0.124345789 | 0.159847148 | 0.1273502     | 0.137404163   | 0.163097625   |
| 15:00:00 | 0.03957816  | 0.044873783 | 0.061566911 | 0.072769455 | 0.090025882 | 0.09816742  | 0.104865325 | 0.1097739   | 0.12216659  | 0.156957622 | 0.125142246   | 0.135021897   | 0.160269894   |
| 15:30:00 | 0.039016918 | 0.044237127 | 0.060692262 | 0.071734852 | 0.088744482 | 0.096769403 | 0.103371279 | 0.108209425 | 0.120424092 | 0.15471358  | 0.123358744   | 0.133097592   | 0.15798576    |
| 16:00:00 | 0.038468682 | 0.04361554  | 0.05983946  | 0.070726888 | 0.087497512 | 0.095409672 | 0.101918784 | 0.106688948 | 0.118731984 | 0.152539662 | 0.1216254     | 0.131227406   | 0.155765863   |
| 16:30:00 | 0.037928149 | 0.043002688 | 0.058998641 | 0.069733087 | 0.086268063 | 0.094069048 | 0.100486698 | 0.105189835 | 0.117063652 | 0.15039629  | 0.119916412   | 0.129383497   | 0.153577159   |
| 17:00:00 | 0.037395211 | 0.042398446 | 0.058169637 | 0.068753251 | 0.08505589  | 0.092747261 | 0.099074735 | 0.103711787 | 0.115418762 | 0.148283035 | 0.118231437   | 0.127565498   | 0.151419209   |
| 17:30:00 | 0.036869762 | 0.041802696 | 0.057352281 | 0.067787182 | 0.083860749 | 0.091444046 | 0.097682612 | 0.102254508 | 0.113796985 | 0.146199474 | 0.116570139   | 0.125773044   | 0.149291581   |
| 18:00:00 | 0.036351696 | 0.041215316 | 0.05654641  | 0.066834688 | 0.082682401 | 0.090159144 | 0.09631005  | 0.100817705 | 0.112197996 | 0.14414519  | 0.114932183   | 0.124005777   | 0.147193849   |
| 18:30:00 | 0.03584091  | 0.040636189 | 0.055751863 | 0.065895578 | 0.08152061  | 0.088892296 | 0.094956774 | 0.099401091 | 0.110621474 | 0.142119771 | 0.113317243   | 0.122263341   | 0.145125592   |
| 19:00:00 | 0.0353373   | 0.0400652   | 0.05496848  | 0.064969663 | 0.080375144 | 0.087643249 | 0.093622513 | 0.098004382 | 0.109067105 | 0.140122811 | 0.111724995   | 0.120545389   | 0.143086397   |
| 19:30:00 | 0.034840767 | 0.039502234 | 0.054196104 | 0.064056758 | 0.079245774 | 0.086411752 | 0.092307    | 0.096627298 | 0.107534577 | 0.138153912 | 0.11015512    | 0.118851577   | 0.141075855   |
| 20:00:00 | 0.034351211 | 0.038947179 | 0.053434582 | 0.063156681 | 0.078132272 | 0.085197559 | 0.091009972 | 0.095269565 | 0.106023582 | 0.136212677 | 0.108607304   | 0.117181564   | 0.139093564   |
| 20:30:00 | 0.033868534 | 0.038399923 | 0.052683759 | 0.062269251 | 0.077034416 | 0.084000428 | 0.089731169 | 0.093930909 | 0.104533819 | 0.13429872  | 0.107081236   | 0.115535018   | 0.137139127   |
| 21:00:00 | 0.033392639 | 0.037860356 | 0.051943487 | 0.061394291 | 0.075951987 | 0.082820117 | 0.088470335 | 0.092611063 | 0.103064989 | 0.132411656 | 0.105576611   | 0.113911607   | 0.135212151   |
| 21:30:00 | 0.032923431 | 0.037328371 | 0.051213616 | 0.060531625 | 0.074884767 | 0.081656392 | 0.087227216 | 0.091309762 | 0.101616798 | 0.130551107 | 0.104093129   | 0.112311007   | 0.133312253   |
| 22:00:00 | 0.032460816 | 0.036803861 | 0.050494001 | 0.05968108  | 0.073832543 | 0.080509018 | 0.086001565 | 0.090026746 | 0.100188955 | 0.128716702 | 0.102630491   | 0.110732898   | 0.13143905    |
| 22:30:00 | 0.032004701 | 0.036286721 | 0.049784498 | 0.058842487 | 0.072795104 | 0.079377766 | 0.084793137 | 0.088761759 | 0.098781176 | 0.126908072 | 0.101188405   | 0.109176963   | 0.129592168   |
| 23:00:00 | 0.031554995 | 0.035776847 | 0.049084964 | 0.058015677 | 0.071772242 | 0.07826241  | 0.083601688 | 0.087514546 | 0.097393177 | 0.125124856 | 0.099766582   | 0.107642891   | 0.127771236   |

|          |             |             |             |             |             |             |             |             |             |             |             |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 23:30:00 | 0.031111608 | 0.035274138 | 0.048395259 | 0.057200484 | 0.070763753 | 0.077162725 | 0.08242698  | 0.086284857 | 0.096024682 | 0.123366696 | 0.098364737 | 0.106130375 | 0.125975892 |
| 24:00:00 | 0.030674451 | 0.034778493 | 0.047715246 | 0.056396746 | 0.069769434 | 0.076078493 | 0.081268778 | 0.085072448 | 0.094675416 | 0.121633241 | 0.09698259  | 0.104639111 | 0.124205774 |
| 24:30:00 | 0.030243437 | 0.034289811 | 0.047044787 | 0.055604302 | 0.068789087 | 0.075009496 | 0.080126851 | 0.083877074 | 0.093345109 | 0.119924143 | 0.095619865 | 0.103168801 | 0.122460528 |
| 25:00:00 | 0.029818479 | 0.033807997 | 0.046383749 | 0.054822992 | 0.067822515 | 0.073955519 | 0.079000969 | 0.082698497 | 0.092033494 | 0.118239059 | 0.094276287 | 0.101719151 | 0.120739806 |
| 25:30:00 | 0.029399492 | 0.033332953 | 0.045732    | 0.054052661 | 0.066869524 | 0.072916352 | 0.077890907 | 0.08153648  | 0.090740309 | 0.116577653 | 0.092951587 | 0.100289871 | 0.119043261 |
| 26:00:00 | 0.028986393 | 0.032864583 | 0.045089408 | 0.053293154 | 0.065929924 | 0.071891787 | 0.076796443 | 0.080390791 | 0.089465295 | 0.114939592 | 0.091645502 | 0.098880673 | 0.117370555 |
| 26:30:00 | 0.028579098 | 0.032402795 | 0.044455846 | 0.052544319 | 0.065003527 | 0.070881618 | 0.075717358 | 0.079261201 | 0.088208196 | 0.113324548 | 0.090357769 | 0.097491277 | 0.115721353 |
| 27:00:00 | 0.028177526 | 0.031947495 | 0.043831186 | 0.051806006 | 0.064090146 | 0.069885643 | 0.074653435 | 0.078147482 | 0.086968761 | 0.111732197 | 0.08908813  | 0.096121403 | 0.114095324 |
| 27:30:00 | 0.027781597 | 0.031498593 | 0.043215304 | 0.051078067 | 0.0631896   | 0.068903663 | 0.073604461 | 0.077049413 | 0.085746742 | 0.110162221 | 0.087836331 | 0.094770778 | 0.112492143 |
| 28:00:00 | 0.027391231 | 0.031055999 | 0.042608075 | 0.050360357 | 0.062301708 | 0.06793548  | 0.072570227 | 0.075966773 | 0.084541894 | 0.108614305 | 0.086602121 | 0.093439131 | 0.110911488 |
| 28:30:00 | 0.02700635  | 0.030619623 | 0.042009378 | 0.049652731 | 0.061426291 | 0.066980903 | 0.071550525 | 0.074899345 | 0.083353975 | 0.107088139 | 0.085385254 | 0.092126195 | 0.109353044 |
| 29:00:00 | 0.026626877 | 0.03018938  | 0.041419094 | 0.048955048 | 0.060563176 | 0.066039738 | 0.070545151 | 0.073846916 | 0.082182748 | 0.105583417 | 0.084185485 | 0.090831707 | 0.107816498 |
| 29:30:00 | 0.026252737 | 0.029765181 | 0.040837105 | 0.048267169 | 0.059712188 | 0.065111797 | 0.069553904 | 0.072809275 | 0.081027978 | 0.104099839 | 0.083002574 | 0.089555409 | 0.106301542 |
| 30:00:00 | 0.025883853 | 0.029346944 | 0.040263293 | 0.047588955 | 0.058873157 | 0.064196895 | 0.068576585 | 0.071786215 | 0.079889434 | 0.102637107 | 0.081836285 | 0.088297044 | 0.104807873 |
| 30:30:00 | 0.025520153 | 0.028934583 | 0.039697543 | 0.046920271 | 0.058045916 | 0.063294849 | 0.067612999 | 0.070777529 | 0.078766888 | 0.101194928 | 0.080686383 | 0.087056361 | 0.103335192 |
| 31:00:00 | 0.025161563 | 0.028528016 | 0.039139743 | 0.046260983 | 0.057230299 | 0.062405478 | 0.066662952 | 0.069783017 | 0.077660116 | 0.099773013 | 0.079552639 | 0.08583311  | 0.101883204 |
| 31:30:00 | 0.024808012 | 0.028127162 | 0.038589781 | 0.045610959 | 0.056426142 | 0.061528603 | 0.065726255 | 0.068802478 | 0.076568894 | 0.098371078 | 0.078434825 | 0.084627049 | 0.100451619 |
| 32:00:00 | 0.024459428 | 0.02773194  | 0.038047547 | 0.044970068 | 0.055633284 | 0.06066405  | 0.064802719 | 0.067835718 | 0.075493006 | 0.096988842 | 0.077332719 | 0.083437933 | 0.099040148 |
| 32:30:00 | 0.024115743 | 0.027342272 | 0.037512932 | 0.044338183 | 0.054851568 | 0.059811645 | 0.06389216  | 0.066882542 | 0.074432236 | 0.095626029 | 0.076246098 | 0.082265527 | 0.097648511 |
| 33:00:00 | 0.023776887 | 0.026958079 | 0.036985828 | 0.043715176 | 0.054080835 | 0.058971217 | 0.062994396 | 0.065942759 | 0.07338637  | 0.094282364 | 0.075174745 | 0.081109594 | 0.096276428 |
| 33:30:00 | 0.023442792 | 0.026579284 | 0.036466131 | 0.043100924 | 0.053320932 | 0.058142598 | 0.062109246 | 0.065016181 | 0.0723552   | 0.09295758  | 0.074118447 | 0.079969903 | 0.094923625 |
| 34:00:00 | 0.023113391 | 0.026205812 | 0.035953737 | 0.042495302 | 0.052571707 | 0.057325622 | 0.061236534 | 0.064102623 | 0.07133852  | 0.09165141  | 0.07307699  | 0.078846226 | 0.09358983  |
| 34:30:00 | 0.02278862  | 0.025837588 | 0.035448542 | 0.04189819  | 0.051833009 | 0.056520126 | 0.060376085 | 0.063201902 | 0.070336125 | 0.090363594 | 0.072050168 | 0.077738339 | 0.092274776 |
| 35:00:00 | 0.022468411 | 0.025474538 | 0.034950446 | 0.041309469 | 0.05110469  | 0.055725948 | 0.059527726 | 0.062313836 | 0.069347815 | 0.089093873 | 0.071037773 | 0.076646019 | 0.090978201 |
| 35:30:00 | 0.022152702 | 0.025116589 | 0.034459349 | 0.040729019 | 0.050386606 | 0.054942929 | 0.058691287 | 0.061438249 | 0.068373392 | 0.087841993 | 0.070039604 | 0.075569047 | 0.089699844 |
| 36:00:00 | 0.021841429 | 0.02476367  | 0.033975152 | 0.040156726 | 0.049678612 | 0.054170912 | 0.057866602 | 0.060574966 | 0.067412661 | 0.086607704 | 0.069055461 | 0.074507208 | 0.08843945  |
| 36:30:00 | 0.02153453  | 0.024415709 | 0.033497759 | 0.039592474 | 0.048980565 | 0.053409744 | 0.057053504 | 0.059723812 | 0.066465429 | 0.085390758 | 0.068085146 | 0.073460289 | 0.087196765 |
| 37:00:00 | 0.021231943 | 0.024072638 | 0.033027074 | 0.03903615  | 0.048292327 | 0.05265927  | 0.056251831 | 0.058884618 | 0.065531507 | 0.084190912 | 0.067128465 | 0.07242808  | 0.085971542 |
| 37:30:00 | 0.020933608 | 0.023734388 | 0.032563002 | 0.038487644 | 0.04761376  | 0.051919342 | 0.055461423 | 0.058057216 | 0.064610708 | 0.083007925 | 0.066185226 | 0.071410376 | 0.084763535 |
| 38:00:00 | 0.020639464 | 0.02340089  | 0.032105452 | 0.037946845 | 0.046944728 | 0.051189811 | 0.054682121 | 0.05724144  | 0.063702847 | 0.08184156  | 0.065255242 | 0.070406971 | 0.083572502 |
| 38:30:00 | 0.020349454 | 0.023072078 | 0.03165433  | 0.037413644 | 0.046285096 | 0.05047053  | 0.053913769 | 0.056437127 | 0.062807743 | 0.080691584 | 0.064338324 | 0.069417666 | 0.082398205 |
| 39:00:00 | 0.020063519 | 0.022747887 | 0.031209547 | 0.036887936 | 0.045634733 | 0.049761357 | 0.053156214 | 0.055644115 | 0.061925216 | 0.079557767 | 0.063434291 | 0.068442261 | 0.081240408 |
| 39:30:00 | 0.019781602 | 0.022428251 | 0.030771015 | 0.036369615 | 0.044993508 | 0.049062148 | 0.052409303 | 0.054862246 | 0.06105509  | 0.078439882 | 0.06254296  | 0.067480562 | 0.080098879 |
| 40:00:00 | 0.019503646 | 0.022113106 | 0.030338643 | 0.035858576 | 0.044361293 | 0.048372763 | 0.051672887 | 0.054091363 | 0.06019719  | 0.077337704 | 0.061664154 | 0.066532376 | 0.07897339  |
| 40:30:00 | 0.019229595 | 0.021802389 | 0.029912348 | 0.035354719 | 0.043737962 | 0.047693066 | 0.050946819 | 0.053331312 | 0.059351344 | 0.076251013 | 0.060797696 | 0.065597514 | 0.077863716 |
| 41:00:00 | 0.018959395 | 0.021496039 | 0.029492042 | 0.034857941 | 0.043123389 | 0.047022919 | 0.050230953 | 0.052581941 | 0.058517384 | 0.075179591 | 0.059943413 | 0.064675787 | 0.076769634 |
| 41:30:00 | 0.018692992 | 0.021193993 | 0.029077642 | 0.034368144 | 0.042517452 | 0.046362189 | 0.049525145 | 0.051843099 | 0.057695142 | 0.074123225 | 0.059101133 | 0.063767012 | 0.075690925 |
| 42:00:00 | 0.018430333 | 0.020896191 | 0.028669065 | 0.033885228 | 0.041920029 | 0.045710742 | 0.048829255 | 0.051114639 | 0.056884454 | 0.073081701 | 0.058270689 | 0.062871006 | 0.074627373 |
| 42:30:00 | 0.018171364 | 0.020602573 | 0.028266229 | 0.033409099 | 0.041331    | 0.045068449 | 0.048143144 | 0.050396415 | 0.056085156 | 0.072054812 | 0.057451913 | 0.06198759  | 0.073578766 |
| 43:00:00 | 0.017916033 | 0.020313082 | 0.027869054 | 0.03293966  | 0.040750248 | 0.044435182 | 0.047466673 | 0.049688283 | 0.05529709  | 0.071042353 | 0.056644642 | 0.061116588 | 0.072544893 |
| 43:30:00 | 0.017664291 | 0.020027657 | 0.027477459 | 0.032476816 | 0.040177657 | 0.043810812 | 0.046799707 | 0.0489901   | 0.054520097 | 0.070044119 | 0.055848715 | 0.060257824 | 0.071525547 |
| 44:00:00 | 0.017416085 | 0.019746244 | 0.027091366 | 0.032020477 | 0.039613111 | 0.043195216 | 0.046142113 | 0.048301729 | 0.053754022 | 0.069059912 | 0.055063971 | 0.059411126 | 0.070520524 |
| 44:30:00 | 0.017171368 | 0.019468785 | 0.026710699 | 0.031570549 | 0.039056497 | 0.042588269 | 0.045493759 | 0.047623029 | 0.052998711 | 0.068089535 | 0.054290253 | 0.058576326 | 0.069529623 |
| 45:00:00 | 0.016930089 | 0.019195224 | 0.02633538  | 0.031126944 | 0.038507705 | 0.041989851 | 0.044854515 | 0.046953866 | 0.052254014 | 0.067132792 | 0.053527408 | 0.057753256 | 0.068552645 |
| 45:30:00 | 0.0166922   | 0.018925507 | 0.025965335 | 0.030689571 | 0.037966624 | 0.041399841 | 0.044224253 | 0.046294106 | 0.05151978  | 0.066189493 | 0.052775281 | 0.056941751 | 0.067589395 |
| 46:00:00 | 0.016457654 | 0.01865958  | 0.02560049  | 0.030258345 | 0.037433145 | 0.040818122 | 0.043602847 | 0.045643617 | 0.050795863 | 0.065259448 | 0.052033723 | 0.056141648 | 0.06663968  |
| 46:30:00 | 0.016226403 | 0.01839739  | 0.025240772 | 0.029833177 | 0.036907163 | 0.040244577 | 0.042990173 | 0.045002267 | 0.050082118 | 0.064342472 | 0.051302584 | 0.055352788 | 0.06570331  |
| 47:00:00 | 0.015998402 | 0.018138884 | 0.024886107 | 0.029413984 | 0.036388572 | 0.03967909  | 0.042386108 | 0.044369929 | 0.049378402 | 0.06343838  | 0.050581719 | 0.054575013 | 0.064780097 |

|          |             |             |             |             |             |             |             |             |             |             |             |             |             |
|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 47:30:00 | 0.015773605 | 0.01788401  | 0.024536427 | 0.029000681 | 0.035877267 | 0.03912155  | 0.04179053  | 0.043746476 | 0.048684574 | 0.062546992 | 0.049870983 | 0.053808166 | 0.063869856 |
| 48:00:00 | 0.015551966 | 0.017632717 | 0.024191659 | 0.028593185 | 0.035373147 | 0.038571844 | 0.041203321 | 0.043131784 | 0.048000495 | 0.061668129 | 0.049170234 | 0.053052094 | 0.062972405 |
| 48:30:00 | 0.015333441 | 0.017384956 | 0.023851736 | 0.028191416 | 0.03487611  | 0.038029861 | 0.040624363 | 0.042525729 | 0.047326028 | 0.060801615 | 0.048479331 | 0.052306647 | 0.062087564 |
| 49:00:00 | 0.015117988 | 0.017140676 | 0.02351659  | 0.027795291 | 0.034386057 | 0.037495494 | 0.040053541 | 0.04192819  | 0.046661039 | 0.059947277 | 0.047798136 | 0.051571673 | 0.061215157 |
| 49:30:00 | 0.014905561 | 0.016899828 | 0.023186152 | 0.027404733 | 0.03390289  | 0.036968636 | 0.039490739 | 0.041339046 | 0.046005393 | 0.059104943 | 0.047126513 | 0.050847027 | 0.060355008 |
| 50:00:00 | 0.014696119 | 0.016662364 | 0.022860358 | 0.027019662 | 0.033426513 | 0.036449181 | 0.038935845 | 0.040758181 | 0.04535896  | 0.058274445 | 0.046464327 | 0.050132563 | 0.059506945 |
| 50:30:00 | 0.014489621 | 0.016428237 | 0.022539142 | 0.026640002 | 0.032956829 | 0.035937024 | 0.038388748 | 0.040185478 | 0.04472161  | 0.057455617 | 0.045811445 | 0.049428138 | 0.058670798 |
| 51:00:00 | 0.014286023 | 0.0161974   | 0.022222439 | 0.026265677 | 0.032493744 | 0.035432064 | 0.037849338 | 0.039620822 | 0.044093216 | 0.056648294 | 0.045167737 | 0.048733611 | 0.0578464   |
| 51:30:00 | 0.014085287 | 0.015969806 | 0.021910186 | 0.025896612 | 0.032037167 | 0.0349342   | 0.037317508 | 0.0390641   | 0.043473652 | 0.055852315 | 0.044533074 | 0.048048844 | 0.057033587 |
| 52:00:00 | 0.013887371 | 0.015745411 | 0.021602321 | 0.025532732 | 0.031587005 | 0.034443331 | 0.03679315  | 0.038515201 | 0.042862793 | 0.05506752  | 0.043907329 | 0.047373698 | 0.056232194 |
| 52:30:00 | 0.013692236 | 0.015524168 | 0.021298781 | 0.025173966 | 0.031143168 | 0.033959359 | 0.036276161 | 0.037974015 | 0.042260517 | 0.054293753 | 0.043290377 | 0.046708038 | 0.055442062 |
| 53:00:00 | 0.013499843 | 0.015306034 | 0.020999507 | 0.02482024  | 0.030705568 | 0.033482188 | 0.035766436 | 0.037440433 | 0.041666704 | 0.053530858 | 0.042682093 | 0.046051732 | 0.054663032 |
| 53:30:00 | 0.013310154 | 0.015090966 | 0.020704438 | 0.024471485 | 0.030274116 | 0.033011722 | 0.035263873 | 0.036914348 | 0.041081235 | 0.052778683 | 0.042082357 | 0.045404648 | 0.053894948 |
| 54:00:00 | 0           | 0.014878919 | 0.020413514 | 0.02412763  | 0.029848727 | 0.032547866 | 0.034768371 | 0.036395656 | 0.040503993 | 0.052037077 | 0.041491047 | 0.044766656 | 0.053137657 |
| 54:30:00 | 0           | 0.014669851 | 0.020126679 | 0.023788607 | 0.029429316 | 0.032090528 | 0.034279833 | 0.035884251 | 0.039934861 | 0.051305892 | 0.040908046 | 0.044137629 | 0.052391007 |
| 55:00:00 | 0           | 0.014463722 | 0.019843874 | 0.023454347 | 0.029015797 | 0.031639616 | 0.033798158 | 0.035380033 | 0.039373727 | 0.05058498  | 0.040333238 | 0.043517441 | 0.051654848 |
| 55:30:00 | 0           | 0.014260488 | 0.019565043 | 0.023124785 | 0.028608089 | 0.03119504  | 0.033323252 | 0.034882899 | 0.038820477 | 0.049874198 | 0.039766505 | 0.042905966 | 0.050929033 |
| 56:00:00 | 0           | 0.014060111 | 0.01929013  | 0.022799853 | 0.02820611  | 0.030756711 | 0.032855019 | 0.034392751 | 0.038275001 | 0.049173404 | 0.039207737 | 0.042303084 | 0.050213417 |
| 56:30:00 | 0           | 0.013862549 | 0.01901908  | 0.022479486 | 0.027809779 | 0.030324541 | 0.032393365 | 0.03390949  | 0.03773719  | 0.048482456 | 0.038656819 | 0.041708673 | 0.049507856 |
| 57:00:00 | 0           | 0.013667763 | 0.018751838 | 0.022163622 | 0.027419017 | 0.029898444 | 0.031938198 | 0.03343302  | 0.037206935 | 0.047801217 | 0.038113643 | 0.041122615 | 0.048812209 |
| 57:30:00 | 0           | 0.013475714 | 0.018488351 | 0.021852195 | 0.027033746 | 0.029478333 | 0.031489427 | 0.032963244 | 0.036684132 | 0.047129551 | 0.037578099 | 0.040544791 | 0.048126337 |
| 58:00:00 | 0           | 0.013286363 | 0.018228567 | 0.021545145 | 0.026653888 | 0.029064126 | 0.031046961 | 0.03250007  | 0.036168674 | 0.046467322 | 0.03705008  | 0.039975086 | 0.047450102 |
| 58:30:00 | 0           | 0           | 0.017972433 | 0.021242409 | 0.026279368 | 0.028655739 | 0.030610713 | 0.032043403 | 0.035660459 | 0.045814398 | 0.03652948  | 0.039413386 | 0.046783369 |
| 59:00:00 | 0           | 0           | 0.017719898 | 0.020943926 | 0.02591011  | 0.02825309  | 0.030180594 | 0.031593154 | 0.035159385 | 0.045170649 | 0.036016195 | 0.038859579 | 0.046126005 |
| 59:30:00 | 0           | 0           | 0.017470911 | 0.020649638 | 0.025546041 | 0.027856099 | 0.029756519 | 0.031149231 | 0.034665352 | 0.044535945 | 0.035510123 | 0.038313554 | 0.045477877 |
| 60:00:00 | 0           | 0           | 0.017225423 | 0.020359485 | 0.025187087 | 0.027464686 | 0.029338403 | 0.030711545 | 0.034178261 | 0.04391016  | 0.035011162 | 0.037775201 | 0.044838856 |
| 60:30:00 | 0           | 0           | 0.016983385 | 0.020073409 | 0.024833177 | 0.027078773 | 0.028926162 | 0.03028001  | 0.033698014 | 0.043293168 | 0.034519211 | 0.037244412 | 0.044208814 |
| 61:00:00 | 0           | 0           | 0.016744747 | 0.019791353 | 0.02448424  | 0.026698283 | 0.028519714 | 0.029854538 | 0.033224515 | 0.042684845 | 0.034034173 | 0.036721082 | 0.043587626 |
| 61:30:00 | 0           | 0           | 0.016509462 | 0.019513259 | 0.024140206 | 0.026323139 | 0.028118976 | 0.029435045 | 0.032757669 | 0.04208507  | 0.033555951 | 0.036205105 | 0.042975165 |
| 62:00:00 | 0           | 0           | 0.016277484 | 0.019239074 | 0.023801006 | 0.025953266 | 0.027723869 | 0.029021446 | 0.032297383 | 0.041493722 | 0.033084448 | 0.035696378 | 0.042371311 |
| 62:30:00 | 0           | 0           | 0.016048765 | 0.018968741 | 0.023466572 | 0.02558859  | 0.027334315 | 0.028613658 | 0.031843565 | 0.040910684 | 0.032619571 | 0.0351948   | 0.041775941 |
| 63:00:00 | 0           | 0           | 0.01582326  | 0.018702207 | 0.023136838 | 0.025229039 | 0.026950234 | 0.028211601 | 0.031396123 | 0.040335838 | 0.032161225 | 0.034700269 | 0.041188937 |
| 63:30:00 | 0           | 0           | 0.015600924 | 0.018439417 | 0.022811737 | 0.024874539 | 0.026571549 | 0.027815193 | 0.030954969 | 0.039769069 | 0.03170932  | 0.034212687 | 0.040610181 |
| 64:00:00 | 0           | 0           | 0.015381711 | 0.018180321 | 0.022491203 | 0.024525021 | 0.026198186 | 0.027424355 | 0.030520013 | 0.039210264 | 0.031263764 | 0.033731956 | 0.040039558 |
| 64:30:00 | 0           | 0           | 0.015165579 | 0.017924864 | 0.022175174 | 0.024180414 | 0.025830069 | 0.027039008 | 0.030091169 | 0.038659311 | 0.03082447  | 0.03325798  | 0.039476952 |
| 65:00:00 | 0           | 0           | 0.014952484 | 0.017672998 | 0.021863585 | 0.023840649 | 0.025467124 | 0.026659077 | 0.02966835  | 0.0381161   | 0.030391348 | 0.032790664 | 0.038922252 |
| 65:30:00 | 0           | 0           | 0.014742383 | 0.01742467  | 0.021556375 | 0.023505659 | 0.02510928  | 0.026284484 | 0.029251473 | 0.037580521 | 0.029964311 | 0.032329915 | 0.038375346 |
| 66:00:00 | 0           | 0           | 0.014535234 | 0.017179832 | 0.021253481 | 0.023175375 | 0.024756463 | 0.025915154 | 0.028840454 | 0.037052468 | 0.029543275 | 0.031875639 | 0.037836125 |
| 66:30:00 | 0           | 0           | 0.014330996 | 0.016938434 | 0.020954843 | 0.022849732 | 0.024408604 | 0.025551014 | 0.028435209 | 0.036531835 | 0.029128156 | 0.031427747 | 0.03730448  |
| 67:00:00 | 0           | 0           | 0.014129628 | 0.016700428 | 0.020660401 | 0.022528665 | 0.024065633 | 0.02519199  | 0.028035659 | 0.036018517 | 0.028718869 | 0.030986148 | 0.036780306 |
| 67:30:00 | 0           | 0           | 0.013931089 | 0.016465766 | 0.020370097 | 0.022212109 | 0.023727481 | 0.024838011 | 0.027641723 | 0.035512412 | 0.028315333 | 0.030550754 | 0.036263497 |
| 68:00:00 | 0           | 0           | 0.01373534  | 0.016234402 | 0.020083872 | 0.021900001 | 0.02339408  | 0.024489007 | 0.027253323 | 0.035013419 | 0.027917467 | 0.030121478 | 0.03575395  |
| 68:30:00 | 0           | 0           | 0.013542341 | 0.016006288 | 0.019801668 | 0.021592279 | 0.023065364 | 0.024144906 | 0.02687038  | 0.034521437 | 0.027525192 | 0.029698234 | 0.035251562 |
| 69:00:00 | 0           | 0           | 0.013352054 | 0.01578138  | 0.01952343  | 0.021288881 | 0.022741267 | 0.02380564  | 0.026492817 | 0.034036367 | 0.027138429 | 0.029280937 | 0.034756234 |
| 69:30:00 | 0           | 0           | 0.013164441 | 0.015559632 | 0.019249102 | 0.020989745 | 0.022421724 | 0.023471141 | 0.02612056  | 0.033558114 | 0.0267571   | 0.028869503 | 0.034267866 |
| 70:00:00 | 0           | 0           | 0           | 0.015341    | 0.018978628 | 0.020694813 | 0.022106671 | 0.023141342 | 0.025753534 | 0.033086581 | 0.02638113  | 0.028463851 | 0.033786359 |
| 70:30:00 | 0           | 0           | 0           | 0.01512544  | 0.018711955 | 0.020404026 | 0.021796045 | 0.022816177 | 0.025391665 | 0.032621673 | 0.026010442 | 0.028063898 | 0.033311619 |
| 71:00:00 | 0           | 0           | 0           | 0.014912908 | 0.018449029 | 0.020117324 | 0.021489783 | 0.022495582 | 0.02503488  | 0.032163298 | 0.025644963 | 0.027669566 | 0.032843549 |

|          |   |   |   |             |             |             |             |             |             |             |             |             |             |
|----------|---|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 71:30:00 | 0 | 0 | 0 | 0.014703363 | 0.018189797 | 0.01983465  | 0.021187825 | 0.022179491 | 0.024683109 | 0.031711364 | 0.02528462  | 0.027280774 | 0.032382057 |
| 72:00:00 | 0 | 0 | 0 | 0.014496763 | 0.017934207 | 0.019555949 | 0.02089011  | 0.021867841 | 0.024336281 | 0.03126578  | 0.024929339 | 0.026897445 | 0.031927048 |
| 72:30:00 | 0 | 0 | 0 | 0.014293065 | 0.01768221  | 0.019281163 | 0.020596578 | 0.021560571 | 0.023994326 | 0.030826457 | 0.024579051 | 0.026519502 | 0.031478434 |
| 73:00:00 | 0 | 0 | 0 | 0.01409223  | 0.017433753 | 0.019010239 | 0.02030717  | 0.021257618 | 0.023657176 | 0.030393307 | 0.024233685 | 0.02614687  | 0.031036123 |
| 73:30:00 | 0 | 0 | 0 | 0.013894217 | 0.017188787 | 0.018743121 | 0.020021829 | 0.020958922 | 0.023324763 | 0.029966243 | 0.023893171 | 0.025779474 | 0.030600026 |
| 74:00:00 | 0 | 0 | 0 | 0.013698986 | 0.016947263 | 0.018479757 | 0.019740497 | 0.020664423 | 0.022997021 | 0.02954518  | 0.023557443 | 0.025417241 | 0.030170058 |
| 74:30:00 | 0 | 0 | 0 | 0.013506498 | 0.016709133 | 0.018220094 | 0.019463119 | 0.020374062 | 0.022673884 | 0.029130033 | 0.023226431 | 0.025060097 | 0.029746131 |
| 75:00:00 | 0 | 0 | 0 | 0.013316715 | 0.016474349 | 0.017964079 | 0.019189638 | 0.020087782 | 0.022355288 | 0.02872072  | 0.022900071 | 0.024707971 | 0.029328161 |
| 75:30:00 | 0 | 0 | 0 | 0           | 0.016242864 | 0.017711661 | 0.01892     | 0.019805523 | 0.022041168 | 0.028317158 | 0.022578297 | 0.024360794 | 0.028916064 |
| 76:00:00 | 0 | 0 | 0 | 0           | 0.016014631 | 0.01746279  | 0.01865415  | 0.019527231 | 0.021731463 | 0.027919267 | 0.022261043 | 0.024018494 | 0.028509757 |
| 76:30:00 | 0 | 0 | 0 | 0           | 0.015789606 | 0.017217416 | 0.018392036 | 0.019252849 | 0.021426109 | 0.027526967 | 0.021948248 | 0.023681004 | 0.02810916  |
| 77:00:00 | 0 | 0 | 0 | 0           | 0.015567742 | 0.01697549  | 0.018133605 | 0.018982323 | 0.021125045 | 0.027140179 | 0.021639848 | 0.023348257 | 0.027714191 |
| 77:30:00 | 0 | 0 | 0 | 0           | 0.015348996 | 0.016736964 | 0.017878805 | 0.018715597 | 0.020828212 | 0.026758825 | 0.021335781 | 0.023020185 | 0.027324772 |
| 78:00:00 | 0 | 0 | 0 | 0           | 0.015133323 | 0.016501788 | 0.017627586 | 0.01845262  | 0.02053555  | 0.026382831 | 0.021035987 | 0.022696723 | 0.026940825 |
| 78:30:00 | 0 | 0 | 0 | 0           | 0.014920681 | 0.016269918 | 0.017379896 | 0.018193338 | 0.020247    | 0.026012119 | 0.020740405 | 0.022377805 | 0.026562273 |
| 79:00:00 | 0 | 0 | 0 | 0           | 0.014711027 | 0.016041305 | 0.017135687 | 0.017937699 | 0.019962504 | 0.025646616 | 0.020448977 | 0.022063369 | 0.02618904  |
| 79:30:00 | 0 | 0 | 0 | 0           | 0.014504319 | 0.015815905 | 0.01689491  | 0.017685652 | 0.019682006 | 0.02528625  | 0.020161643 | 0.021753352 | 0.025821052 |
| 80:00:00 | 0 | 0 | 0 | 0           | 0.014300515 | 0.015593672 | 0.016657515 | 0.017437146 | 0.019405449 | 0.024930946 | 0.019878347 | 0.02144769  | 0.025458234 |
| 80:30:00 | 0 | 0 | 0 | 0           | 0.014099575 | 0.015374561 | 0.016423456 | 0.017192133 | 0.019132779 | 0.024580635 | 0.019599031 | 0.021146323 | 0.025100514 |
| 81:00:00 | 0 | 0 | 0 | 0           | 0.013901459 | 0.01515853  | 0.016192686 | 0.016950562 | 0.018863939 | 0.024235247 | 0.019323641 | 0.020849191 | 0.02474782  |
| 81:30:00 | 0 | 0 | 0 | 0           | 0.013706126 | 0.014945533 | 0.015965159 | 0.016712385 | 0.018598878 | 0.023894712 | 0.019052119 | 0.020556234 | 0.024400083 |
| 82:00:00 | 0 | 0 | 0 | 0           | 0.013513538 | 0.01473553  | 0.015740829 | 0.016477556 | 0.01833754  | 0.023558961 | 0.018784413 | 0.020267394 | 0.024057231 |
| 82:30:00 | 0 | 0 | 0 | 0           | 0.013323656 | 0.014528478 | 0.01551965  | 0.016246026 | 0.018079875 | 0.023227929 | 0.018520469 | 0.019982611 | 0.023719197 |
| 83:00:00 | 0 | 0 | 0 | 0           | 0           | 0.014324334 | 0.01530158  | 0.016017749 | 0.01782583  | 0.022901547 | 0.018260234 | 0.019701831 | 0.023385913 |
| 83:30:00 | 0 | 0 | 0 | 0           | 0           | 0.01412306  | 0.015086574 | 0.015792679 | 0.017575355 | 0.022579752 | 0.018003655 | 0.019424996 | 0.023057312 |
| 84:00:00 | 0 | 0 | 0 | 0           | 0           | 0.013924613 | 0.014874589 | 0.015570773 | 0.0173284   | 0.022262478 | 0.017750681 | 0.01915205  | 0.022733328 |
| 84:30:00 | 0 | 0 | 0 | 0           | 0           | 0.013728955 | 0.014665582 | 0.015351984 | 0.017084914 | 0.021949663 | 0.017501262 | 0.01888294  | 0.022413896 |
| 85:00:00 | 0 | 0 | 0 | 0           | 0           | 0.013536046 | 0.014459513 | 0.015136269 | 0.01684485  | 0.021641243 | 0.017255347 | 0.018617611 | 0.022098953 |
| 85:30:00 | 0 | 0 | 0 | 0           | 0           | 0.013345848 | 0.014256338 | 0.014923586 | 0.016608159 | 0.021337157 | 0.017012888 | 0.018356011 | 0.021788436 |
| 86:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.014056019 | 0.014713891 | 0.016374793 | 0.021037343 | 0.016773836 | 0.018098086 | 0.021482281 |
| 86:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.013858515 | 0.014507143 | 0.016144707 | 0.020741742 | 0.016538143 | 0.017843785 | 0.021180428 |
| 87:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.013663785 | 0.014303299 | 0.015917854 | 0.020450295 | 0.016305761 | 0.017593058 | 0.020882817 |
| 87:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.013471792 | 0.01410232  | 0.015694188 | 0.020162943 | 0.016076645 | 0.017345854 | 0.020589387 |
| 88:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0.013282497 | 0.013904165 | 0.015473666 | 0.019879628 | 0.015850748 | 0.017102123 | 0.020300081 |
| 88:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0.013708794 | 0.015256241 | 0.019600295 | 0.015628025 | 0.016861817 | 0.020014839 |
| 89:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0.013516169 | 0.015041872 | 0.019324886 | 0.015408432 | 0.016624887 | 0.019733606 |
| 89:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0.01332625  | 0.014830515 | 0.019053348 | 0.015191925 | 0.016391287 | 0.019456324 |
| 90:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.014622128 | 0.018785624 | 0           | 0           | 0           |
| 90:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.014416669 | 0.018521663 | 0           | 0           | 0           |
| 91:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.014214097 | 0.018261411 | 0           | 0           | 0           |
| 91:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.014014371 | 0.018004815 | 0           | 0           | 0           |
| 92:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.013817452 | 0.017751825 | 0           | 0           | 0           |
| 92:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.013623299 | 0.01750239  | 0           | 0           | 0           |
| 93:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.013431875 | 0.01725646  | 0           | 0           | 0           |
| 93:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0.01324314  | 0.017013985 | 0           | 0           | 0           |
| 94:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0           | 0.016774917 | 0           | 0           | 0           |
| 94:30:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0           | 0.016539209 | 0           | 0           | 0           |
| 95:00:00 | 0 | 0 | 0 | 0           | 0           | 0           | 0           | 0           | 0           | 0.016306812 | 0           | 0           | 0           |

|          |   |   |   |   |   |   |   |   |   |             |   |   |   |
|----------|---|---|---|---|---|---|---|---|---|-------------|---|---|---|
| 95:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.016077681 | 0 | 0 | 0 |
| 96:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.01585177  | 0 | 0 | 0 |
| 96:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.015629033 | 0 | 0 | 0 |
| 97:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.015409425 | 0 | 0 | 0 |
| 97:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.015192904 | 0 | 0 | 0 |
| 98:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.014979425 | 0 | 0 | 0 |
| 98:30:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.014768945 | 0 | 0 | 0 |
| 99:00:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.014561423 | 0 | 0 | 0 |



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