Google Streetview October 2024

Streetview Image at the road bridge on the B4591 (NGR 324437, 189789) facing upstream (adjacent to site boundary). Image extracted on 24/10/2024.

Streetview Image at the road bridge on the B4591 (NGR 324437, 189789) facing downstream (adjacent to site boundary). Image extracted on 24/10/2024.

Streetview Image at the bridge on Dan y Graig Road (NGR 323621,190544) facing upstream. Image extracted on 24/10/2024

# 8 ANNEX - SUPPORTING INFORMATION

## 8.2 Hydrology Methodology and NRW Correspondence

# 15679 – Land at Pontymister, Risca
# Proposed hydraulic modelling methodology for NRW comment – Existing NRW Model Build

**March 2024**

## Background

We are currently undertaking hydraulic modelling of the River Ebbw through Risca to inform a Flood Consequences Assessment for a proposed commercial development site at Commercial Street, Risca, Newport, NP11 6EE (NGR: 324398, 189871). A location plan and aerial image is included in Appendix A.

Prior to progressing works further, we are seeking your advice and comment with regard to our proposed modelling methodology. We find that discussing our approach with Natural Resources Wales (NRW) at the early stage saves all parties involved time and ensures your team's site-specific requirements are fully accounted for. As such, please find below our proposed methodology for your consideration. Your advice or comment would be very much appreciated.

## Model Details & Requirements

Waterco have been provided with the NRW River Ebbw Integrated Catchment model (2019) in a recent data request (January 2024 – ATI 26398a). A detailed review of the existing model has been carried out by Waterco to assess its suitability for use to inform the flood risk to the proposed development. The results of the model review are as follows:

- The site is located within the Risca domain. At this stage, we are not proposing to truncate the model, however if run times or model stability becomes an issue, then this would be reviewed.
- There are a sensible number of cross sections in the vicinity of the site, spaced ~20m to ~50m apart.
- The downstream boundary of the model is tidally influenced. There is no tidal influence at the site and therefore tidal calculations will not be updated. This will also not be applicable if the model is truncated at a later date.
- The model will be run in the latest versions of the software.
- Most recent climate change allowances would need to be considered on the appropriate events. Please see below for more details.
- The model DTM will be reviewed against latest available data. If there are differences in levels within the model extent then the latest data will be used within the model.

Based on the findings of the model review, it is believed the model is fit for purpose (post review updates) to provide an up-to-date, site-specific assessment of flood risk at the existing (EXG) site. Therefore, we propose to utilise the current NRW hydraulic model of the River Ebbw to provide the required output data. Given the existing model was a detailed and thorough assessment of the flood risk to the catchment, and that the nature of the development is 'less vulnerable' development, it is deemed a proportionate approach. The existing model will also be used to quantify the impact of the development on flood risk elsewhere (if any) through simulation and comparison of the proposed development (DEV) site arrangement. Model outputs will then be used to support the Flood Consequences Assessment being prepared for the development.

Please advise if you are your team are aware of any pre-existing issues with the model – any additional information at this stage is useful. Thank you.

The site is shown to be located within NRW Defended Flood Zone 3 on the 'NRW Flood Map for Planning – Rivers'.

## Model and Simulation Type

| | |
|---|---|
| Software: | FMP-TUFLOW |
| Approach: | Fluvial and Tidal. |
| Extent: | Please find the model extent included in Appendix B. |

## Hydrological Calculations

A robust and detailed hydrology assessment was carried out by NRW (July 2019) to produce the model inflows. The flows were also calibrated to local data to improve confidence in the model inflows. Due to the detail of the previous hydrology assessment carried out in the existing model, we propose to utilise the existing watercourse inflows and boundary conditions contained in the model and simply re-run with site-specific updates. We trust this is acceptable.

## Events / Scenarios Considered

Model study to simulate and compare the flood risk at the site for the existing (EXG) and proposed development (DEV) level. Table 1 provides a summary of the proposed events and scenarios.

Proposed Climate Change Allowance (CCA) for this site during the 3.33%, 1% AEP and 0.1% AEP events are + 25% (Central – CC1) and 70% (Upper – CC2) in accordance with NRW guidance (Site located in River Severn River Basin; development considered 'less vulnerable' with predicted 100 year lifetime).

Site located in the Severn River Basin Management Catchment District.

Development considered 'less vulnerable'.

## Blockage Scenario

Blockage scenarios based on the latest NRW blockage guidance document will be carried out simulating a 25% blockage of the B4591 Road Bridge (at approximately NGR: 324440, 189784) during the 1% AEP plus CC1, 1% AEP plus CC2 and 0.1% AEP events only. A 25% blockage has been deemed applicable due to the size of the bridge.

## Sensitivity Tests

Sensitivity Tests (ST) will not be considered as we are proposing to utilise the existing NRW model, which has undergone sensitivity testing and calibration previously. However, if the model is truncated at a later stage, a sensitivity test will be carried out on the downstream boundary.

**Table 1 Summary Table of Proposed Model Scenarios and Events**

| Event (AEP) | Scenario | | |
|---|---|---|---|
| | Existing site layout and level (EXG) | Proposed site layout and levels (DEV) | Blockage (BL) |
| 5% | ✓ | ✓ | |
| 3.3% | ✓ | ✓ | |
| 3.3% + CC1 | ✓ | ✓ | |
| 3.3% + CC2 | ✓ | ✓ | |
| 1% | ✓ | ✓ | |
| 1% + CC1 | ✓ | ✓ | ✓ |
| 1% + CC2 | ✓ | ✓ | ✓ |
| 0.1% | ✓ | ✓ | ✓ |
| 0.1% + CC1 | ✓ | ✓ | |
| 0.1% + CC2 | ✓ | ✓ | |

## For Your Consideration

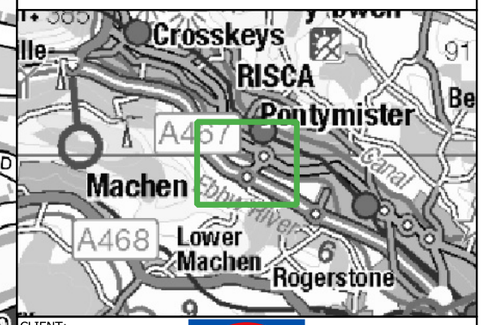
Please provide comment on our above methodology and whether you are in agreement with the approach outlined? Please also confirm if any hydrology updates are required?

## Appendix A Location Plan and Aerial Image

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Location of NRW Flood Defences
- Watercourses
- Waterbodies




CLIENT:

www.waterco.co.uk

SCHEME:

Land at Pontymister, Risca

PLOT TITLE:

Location Plan

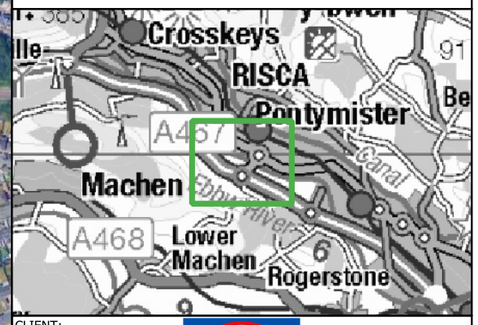
| PLOT STATUS: | | | DATE: |
|---|---|---|---|
| FINAL | | | 28-02-2024 |
| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
| RM | AMR | AP | 1:5000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_Location_Plan | - |


Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

Site Boundary




CLIENT:

www.waterco.co.uk

SCHEME:

Land at Pontymister, Risca

PLOT TITLE:

Aerial Plan

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 28-02-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| RM | AMR | AP | 1:5000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_Aerial_Plan | - |

# Appendix B Proposed Model Extent

N

Map Scale At A3: 1:20000

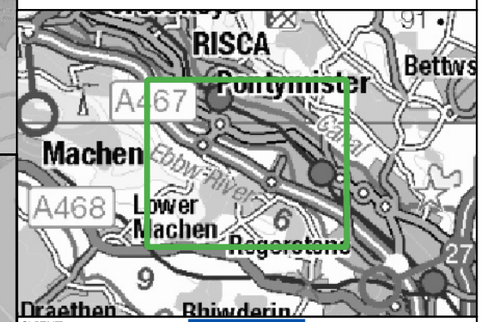
0 2,000 4,000 6,000 8,000 m

0 250 500 750 1,000 m

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

**LEGEND**

- Site Boundary
- Existing NRW Model Extent
- Existing NRW Risca 2D Domain
- Existing NRW 1D Network Channel
- Waterco Proposed Blockage Location




CLIENT:

LIDL

waterco
www.waterco.co.uk

SCHEME:
Land at Pontymister, Risca

PLOT TITLE:
Proposed Model Extent Plan

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 28-02-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| RM | AMR | AP | 1:110000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_Proposed_Model_Extent_Plan | - |

**Bethan Lloyd Jones**

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**From:** Derrick, Richard <Richard.Derrick@cyfoethnaturiolcymru.gov.uk>
**Sent:** 08 August 2024 12:21
**To:** Martha Hughes
**Subject:** RE: 15679 - Land at Pontymister, Risca - Proposed Hydraulic Modelling Methodology

**Categories:** Info



Good afternoon Martha

Thank you for your email outlining your methodology for a proposed hydraulic modelling study for Risca, please accept my sincere apologies for the delay in replying to you.

With regards to using the existing hydrology, our Hydrology team make the following comment:
1) there have been a number of dataset and software changes since 2019 and so revised hydrology would be recommended.

With regards to your methodology it is acceptable, however, I make the following comments:
1) We are not aware of any pre-existing issues with the model
2) There is new LiDAR available flown between 2020 and 2022 which is available from DataMapWales
3) If the model is to be truncated then we would recommend carrying out sensitivity analysis on the downstream boundary.

I hope this is of assistance to you but do please get in touch if I can be of further assistance.

Kind Regards

**Richard Derrick**
**Arweinydd Tim Dadansoddi Perygl Llifogydd**/ Team Leader Flood Risk Analysis
**Rheoli Llifogydd a Dwr** / Flood and Water Management

**Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.**
Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

## Bethan Lloyd Jones

**From:** Martha Hughes
**Sent:** 09 August 2024 15:47
**To:** 'Derrick, Richard'
**Subject:** RE: 15679 - Land at Pontymister, Risca - Proposed Hydraulic Modelling Methodology

Hi Richard,

Thank you for your reply. In terms of the hydrology, please could you confirm whether these are recommended (advisable), or are the updates necessary to ensure the model is suitable to support a planning application i.e. would NRW likely object to a planning application if the hydrology in the model was not updated.

Kind Regards,

Martha Hughes MSc
Hydraulic Modeller

martha.hughes@waterco.co.uk

**Bethan Lloyd Jones**

**From:** Derrick, Richard <Richard.Derrick@cyfoethnaturiolcymru.gov.uk>
**Sent:** 23 August 2024 13:36
**To:** Martha Hughes
**Subject:** RE: 15679 - Land at Pontymister, Risca - Proposed Hydraulic Modelling Methodology



Good afternoon Martha

Sorry for the delay in replying, I have spoken to our Hydrology team and they have confirmed that the updated hydrology is required and they will reject any modelling based on the existing hydrology.

Hope this clarifies the position, please come back to me if there's anything else I can do to help.

Kind Regards
Rich

**Richard Derrick**
**Arweinydd Tim Dadansoddi Perygl Llifogydd**/ Team Leader Flood Risk Analysis
**Rheoli Llifogydd a Dwr** / Flood and Water Management

**Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.**
Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

## Bethan Lloyd Jones

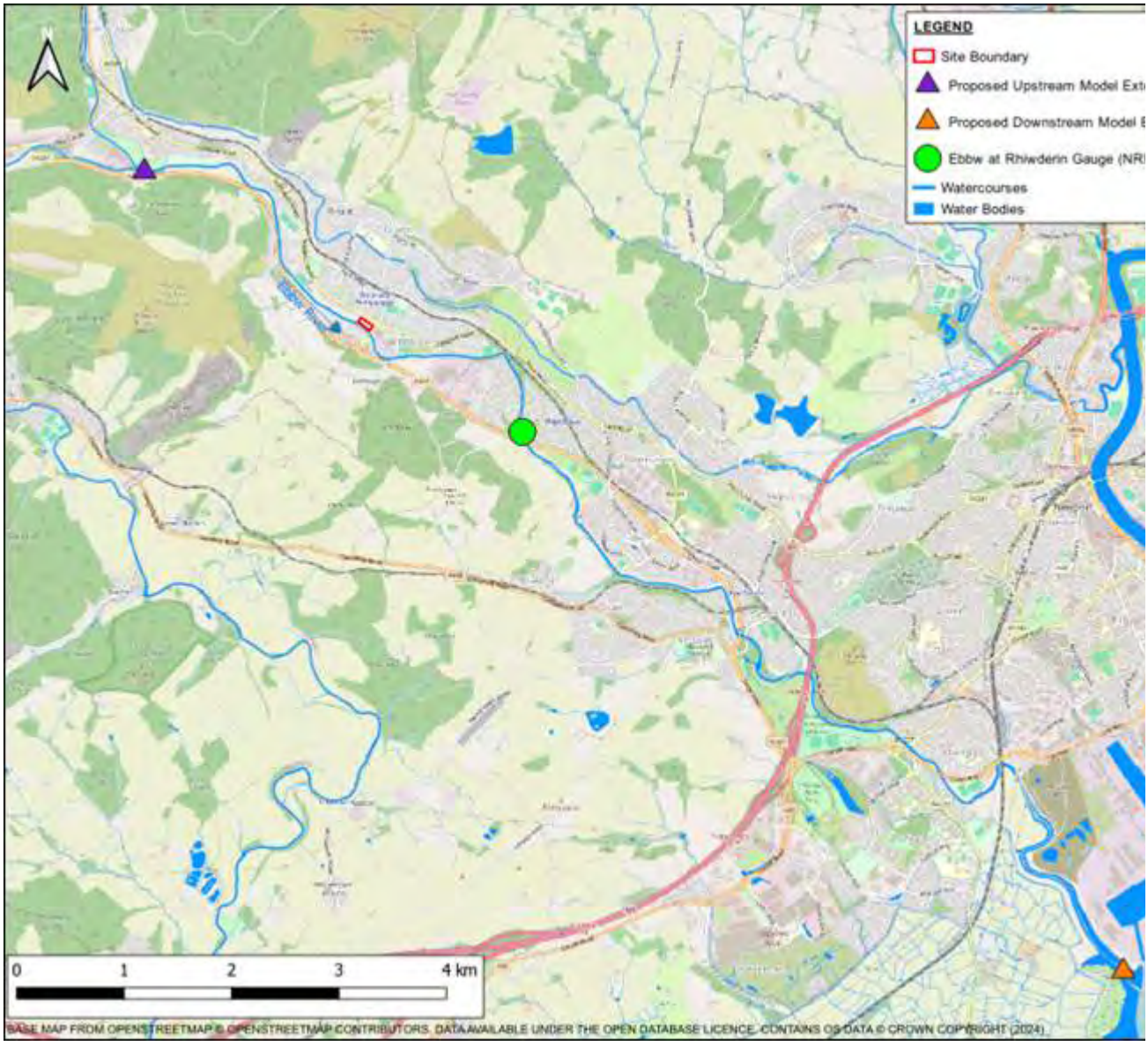
**From:** Martha Hughes
**Sent:** 29 August 2024 16:37
**To:** 'Derrick, Richard'
**Cc:** Bethan Lloyd Jones
**Subject:** RE: 15679 - Land at Pontymister, Risca - Proposed Hydraulic Modelling Methodology

Good afternoon Richard,

Further to your email below, we have reviewed the Ebbw River Hydrology Assessment Report provided (Ebbw Baseline Hydrology and Addendum to the Ebbw Baseline Hydrology, 2017) and the hydraulic model (EbbwLowerICM_5_V1.0_2018). Please see below an outline plan for the completion of the updated hydrology for your comment.

**Proposed Methodology**

- Model extent - the upstream extent of the hydraulic model will be truncated to the confluence between the Ebbw River and the Sirhowy River. The downstream extent of the model is to be maintained as per the NRW model. See extent outlined below.



- Due to the locations of the upstream and downstream boundaries of the hydraulic model and the large catchment area (>200km$^2$), a single inflow will be required for the hydraulic model.
- A single inflow is also recommended by our hydrology team due to the presence of a reliable gauging station 2.2km downstream of the subject site (Ebbw at Rhiwderin, NRFA ID 56002). There is a small catchment area difference between the catchment adjacent to the subject site and the catchment at the gauging station. The catchment area adjacent to the site is 207.34km$^2$ and at the gauging station is 211km$^2$, a difference in catchment area of 2%.
- A single catchment assessment will be carried out at the Ebbw at Rhiwderin gauging station using the enhanced single site analysis method. Gauged data has been requested from NRW for this station. The data will be used for two purposes, the first is to ensure that the number of AMAX years includes the most recent data and the second is to use the 15 minute gauge data for the AMAX floods to compare the real hydrograph shape with that of REFH2 and then possibly to use the real shape as the shape of the design hydrograph. **Please advise if you have any concerns about us using this particular station.**
- The results will be compared with historical flood records and the AMAX data on record.
- The two methods investigated will be ReFH2 and FEH Statistical Enhanced Single Site. ReFH2 will unlikely be the chosen method to produce the final peak flows due to the seemingly reliable gauge near to the site.
- Given the size of the model extent further downstream of our proposed calculation point, we propose to maintain the existing NRW hydrology within the hydraulic model downstream of our calculation point. Given the distance (~2.2km) from the site this will have negligible impact on water levels at the site. The reason for including the hydrology is to ensure the model still simulates.
- Gauged data for the three gauging stations located within the catchment (Ebbw at Rhiwderin, Sirhowy at Wattsville and Ebbw at Aberbeeg), any rain gauges and historical flood information has been requested.

If you do have any comments on the details above, please do not hesitate to let us know.

Kind Regards,

Martha Hughes MSc
Hydraulic Modeller

martha.hughes@waterco.co.uk

**Bethan Lloyd Jones**

**From:** Derrick, Richard <Richard.Derrick@cyfoethnaturiolcymru.gov.uk>
**Sent:** 18 September 2024 09:54
**To:** Martha Hughes
**Subject:** RE: 15679 - Land at Pontymister, Risca - Proposed Hydraulic Modelling Methodology



Good morning Martha

Apologies for the delay in replying I've been on leave and am catching up on emails, our Hydrology team have confirmed that your methodology is suitable.

Kind regards

**Richard Derrick**
**Arweinydd Tim Dadansoddi Perygl Llifogydd**/ Team Leader Flood Risk Analysis
**Rheoli Llifogydd a Dwr** / Flood and Water Management

**Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.**
Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

# 8 ANNEX - SUPPORTING INFORMATION

## 8.3 Historical Review

# 4 Historic Flooding

The River Ebbw benefits from river flow and level gaugings at a number of locations. The 2005 study carried out by JBA[2] undertook a historic review of flooding. This identified several flood occurrences with specific reference to the Ebbw catchment (as opposed to more general flooding in South Wales) from as early as 1768. There are 10 major floods in the Ebbw since the middle of the nineteenth century, 3 of which are captured by the gauged period and floods in 1960 and 1979 are reported to have caused significant flooding to land and property. However, a lack of specific references to levels at defined locations in the historic period and uncertainties in the gauged record means that these flood events have not been ranked. Furthermore, it has not been possible to use the historic information to validate the assigned return periods of the recent maximum gauged floods.

The historical information is useful in illustrating the potential for floods of different kinds. Of the 10 major floods since 1875, 8 have been predominantly winter events and mainly due to prolonged rainfall. 2 were severe events which occurred in the summer months: July 1875; and May 1931. Due to the intensity of the rainfall, flooding was caused by surface water runoff from the steep hill sides, as well as the main rivers.

The following table summarises the more relevant data that have been extracted from local newspaper reporting, as reported in previous studies for the River Ebbw catchment.

Table 3 – Summary of reported historical flood events, extracted from the 2005 JBA study *note that these are largely anecdotal accounts of flooding.

| Date | Quotation |
|---|---|
| 1607 | Very serious flooding in South Wales that is said to have taken 2000 lives in 'lamentable news out of Monmouthshire' drowning infinite numbers of cattell (sic), sheep, oxen and horses, with the immersion of 26 parishes. The Severn having been driven landwards by a violent south-westerly wind, continuing for 3 days. The flood swept across the coast and for a distance of four miles inland along reach of coast centred on the Usk/Ebbw estuary…. |
| 1768 | On Tuesday the flood was so violent at Baffeleg (sic) on the lower Ebbw that Tredegar Park was overflowed, and many deer carried down by the current, but most of them were taken up by boats. There had been heavy snow during the previous week. |
| 1875 | Widespread heavy rain – in both the eastern and western valleys (including the Ebbw) scores of cottages were rendered uninhabitable and houses abandoned. On the Ebbw from Abercarn to Tredegar Park, low-lying land was under water and the roads impassable. At Pontymister, Risca and villages higher up desolation prevails'.<br><br>The greatest amount of damage in this valley is in the neighbourhood of Abercarn where the vale is narrow, and the waters are penned in…<br><br>At Cross Keys two separate torrents came down upon the line, and taxed all the energies of a gang of men to prevent the rails and sleepers being carried away…<br><br>Two houses were badly flooded at Tyrphil, New Tredegar on the River Sirhowy and one person was drowned… |

[2] EAW River Ebbw Flood Risk Mapping Final Report v3.0, 2005

| Date | Quotation |
|---|---|
| 1925 | Heavy rain affected South Wales. On the Ebbw catchment damage was done … At Cwm, the Duffryn Schools playground was flooded to a depth of several feet, whilst many houses in Cwm were isolated by the flood. |
| 1929 | Very serious and prolonged rainfall in November brought flooding on more than one occasion to South Wales valleys.<br><br>At Cwm on the Ebbw, water was up to the doors of huses in Oak Street whilst allotments and football fields were under water…Many houses in Cwm and Ebbw Vale were flooded, with people stranded in upstairs rooms. Duffryn School yard was flooded along with the boiler house but not the school itself. The Glyn Milwr pond above Blaina overflowed along Henwain Street to the Abertillery Road; culvert capacity was insufficient and houses in Jubilee Terrace were flooded.<br><br>At Aberbeeg, the recreation grounds were covered. The concrete bridge at Llanhilleth Colliery was under water for several hours whilst at Abercarn the cricket pitch was inundated. At Pandy Park Farm at Cross Keys, water reached the ceiling of the kitchen and the occupants had to be rescued. At Risca the Palace Cinema was flooded with water down the adjacent road for 400 yards. Shops and a café were flooded. Houses were flooded in Shaftesbury Street and there was 2 feet of water in the gasworks. Occupants of 2 and 3 Tredegar Terrace were obliged to abandon house; the water was 13 inches in the house. Fields between Risca and Bassaleg were covered to a depth of several feet, and the Welfare football ground was flooded…<br><br>At Bassaleg, the road between the railway and the river bridges was under water. |
| 1931 | At Crumlin the flood 'broke down the mountainside' near the Navigation Hotel, flooding the Mill Cottage to the bedrooms. The square was flooded. At Newbridge, houses were flooded at Pant Side, Golden Grove and Meredith Terrace.<br><br>Houses were flooded at Pontymister, Risca and Cross Keys. At the Kings Head, Cross Keys, water was over the railway line. Water was four feet deep on the road under the rail bridge. |
| 1933 | Heavy rain fell on the 9th and 10th (October)<br><br>The River Ebbw overflowed in the Western valleys and caused much damage to property but principally from water coming off the hillside.<br><br>At Llanhilleth the park and bowling green were under water for the third time in 10 years since construction. Some houses in Meadow Street, Llanhilleth were flooded.<br><br>At Cross Keys water was one foot deep under the railway bridge. |
| 1960 | North Road Newbridge was flooded to a depth of 6 feet on the low-lying side of the road next to the railway line; about 20 houses were affected.<br><br>Meadow Street and Railway Street, Llanhilleth were flooded to a depth of three feet with an estimated 87 homes affected.<br><br>Homes were also flooded at New Woodland Terrace, Aberbeeg. The river rose above two of the bridges at River Row, flooding a warehouse.<br><br>At Basselleg the road was deeply flooded from Pye Corner railway bridge to the road bridge. Several houses were flooded. |

| Date | Quotation |
|---|---|
| 1979 | Western Mail reported that locally 6 inches of rain fell in 12 hours. 5 major roads were affected including: Aberbeeg to Ebbw Vale; Blackwood to Tredegar; Ebbw Vale Steelworks Road.<br><br>At Aberbeeg, 14 houses were evacuated at Railway Terrace as water gushed through; two houses lost extensions.<br><br>Risca: worst flooding in area. 693 houses were flooded. A 3-mile stretch of the river embankment 'devastated'. The service road at the back of Commercial Street was badly damaged and no longer accessible. Commercial Road was flooded to a depth of 5-6 feet.<br><br>The flood overtopped the banks upstream from the footbridge at Grover Road and came out onto the main road at Exchange Inn. Grove Street was cut off but the houses not flooded.<br><br>Risca floodbanks were built or renewed in the early 1980s in response to the flood with a substantial earth embankment upstream from the footbridge and there has been no flooding since 1979. |
| 1998 | Reviewing the available information for the October 1998 flood event identified that there were no reports of flooding within the reaches of the River Ebbw that are being modelled.<br><br>There were however reports of flooding at Tredegar, which is upstream of Ynysddu on the River Sirhowy. |

Historical data should be considered with caution, as the following issues can arise:

Reliability and completeness of observations;
Channel geometry has changed at the site of observation or at the control;
Catchment potential for flooding has changed over historic period;
Climate has changed;
Difficulty of comparison with gauged floods;

Notably, the accounts of flooding for the 1998 event differ from the Environment Agency Wales Overview of the October 1998 Floods in Wales. An extract from this document for the Ebbw, Sirhowy and Llwyd catchment confirms that: *"In historical terms the levels experienced on the Ebbw in October were the highest on record at Aberbeeg, Risca and Rhiwderin. Records have been maintained for these sites for between 10 and 23 years. The only report of flooding in this catchment was at Tredegar where 32 properties were reported to have flooded when a highway culvert became blocked by debris. There have been no reports of property flooding from 'main river'."* It may be that the reported flooding refers to surface water flooding rather than inundation from a fluvial source.

Recorded levels are available from the 1979 event, which have been supplied by NRW. Numerous surveyed water level points were taken which have been used as part of subsequent studies to verify model outputs. JBA used the recorded levels to compare modelled water depths against recorded

levels at numerous places within Risca, as part of the Risca Hazard Mapping Study[3] (Aug 2009). However, it is worth remembering that various improvement works have been undertaken following the 1979 flood event (including construction of flood defences, channel improvements and removal of some structures) and, as some of these have been included in the model runs, only a tentative comparison can be made between the 1979 event and the modelled events.

It is reported in the Risca 2009 study that a review of the Rhiwderin Gauge was undertaken after the initial study as the model was giving significantly higher water levels than recorded spot gauging for the same flows. Notably, the draft results from this study showed widespread flooding for a 1 in 20 year event, which was considered comparable to October 1998 where no flooding was experienced. This highlighted a significant discrepancy between modelled and observed flooding. This meant that the model results at Rhiwderin Gauge did not correlate well with the 1998 flood event and other recorded historic events. This prompted a review of the data, which was subsequently carried out by Royal Haskoning in March 2011.

A review of the gauge data at Rhiwderin and Aberbeeg will be undertaken in order to identify notable events within the gauged record. These selected flood events will be used to provide a 'sensibility check' of the model outputs.

In summary, NRW has provided some historic flood outline and other historic evidence which has been geo-referenced to support the development of the model as part of this study. It is noted that an existing model report published by JBA in 2009 indicates that the sparse coverage of gauging stations and poor quality of data suggests that model calibration using these data, particularly 56019 Ebbw @ Aberbeeg, could potentially misrepresent the hydrological processes occurring within the catchment. The report suggested that the Aberbeeg gauge be reviewed to check that ratings perform well at high flows.

In response to a 'Flood Warning' being issued for the Cwm area during a large fluvial event in February 2016, NRW undertook a post-event walk over and survey of wrack marks at Cwm. Observations were also made of flood levels at locations downstream.

[3] SFRM Framework Risca Hazard Mapping Study; August 2009, FINAL REPORT

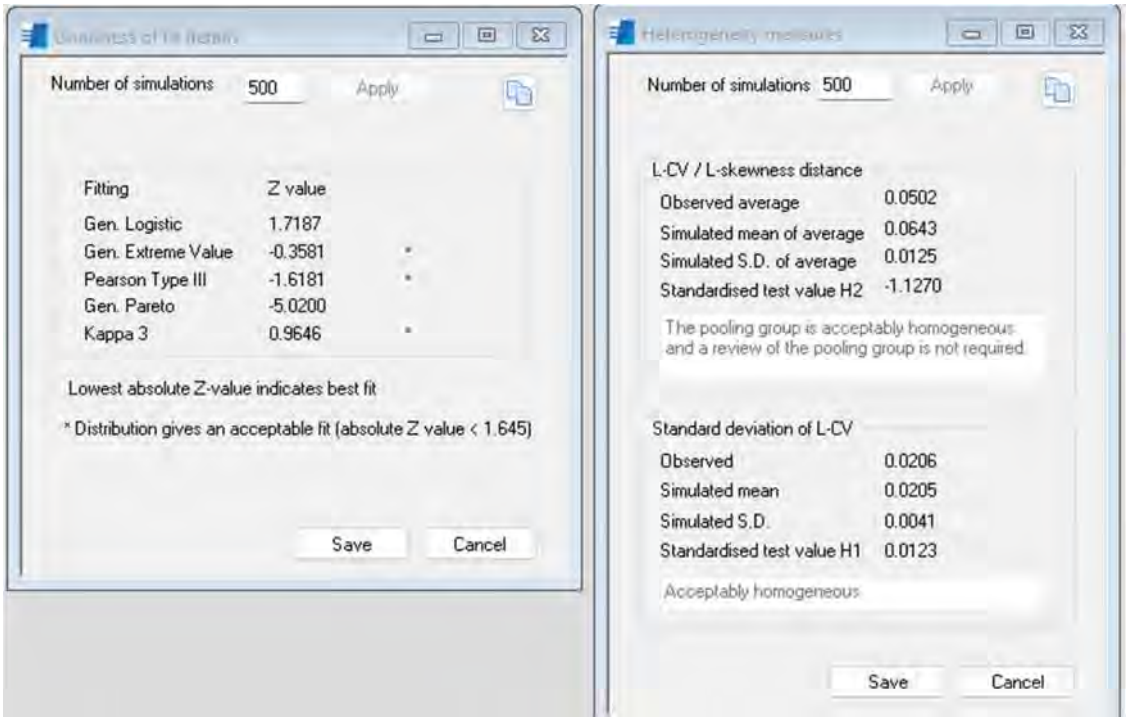
### 8.4 Pooling Group

## Annex 8.4

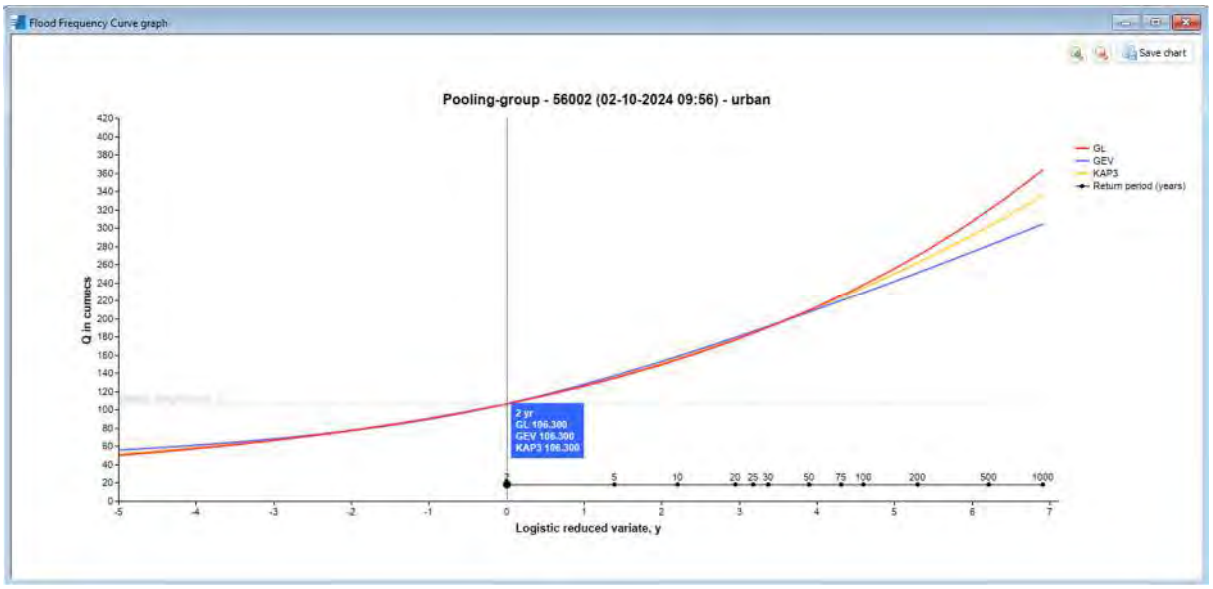
| Original Pooling group | DISTANCE SDM | Years of data | AREA | SAAR | FPEXT | FARL | URBEXT2000 | BFIHOST19 | DPLBAR | DPSBAR | PROPWET |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **56002 (Ebbw @ Rhiwderin)** | 0 | 65 | 211.82 | 1454 | 0.039 | 0.975 | 0.074 | 0.499 | 22.27 | 182.3 | 0.49 |
| **49001 (Camel @ Denby)** | 0.186 | 55 | 209.942 | 1338 | 0.034 | 0.987 | 0.012 | 0.481 | 15.94 | 87.9 | 0.45 |
| **27096 (Wharfe @ Netherside Hall)** | 0.225 | 20 | 215.22 | 1583 | 0.035 | 0.998 | 0.002 | 0.363 | 16.96 | 165.4 | 0.62 |
| **60013 (Cothi @ Pont Ynys Brechfa)** | 0.267 | 10 | 243.005 | 1538 | 0.034 | 0.997 | 0.001 | 0.439 | 21.21 | 169.1 | 0.57 |
| **8013 (Feshie @ Feshie Bridge)** | 0.285 | 31 | 229.627 | 1286 | 0.041 | 0.993 | 0 | 0.385 | 18.61 | 180.8 | 0.70 |
| **79005 (Cluden Water @ Fiddlers Ford)** | 0.312 | 60 | 237.225 | 1422 | 0.062 | 0.985 | 0.001 | 0.468 | 23.35 | 129.8 | 0.64 |
| **72005 (Lune @ Killington)** | 0.315 | 54 | 219.235 | 1670 | 0.048 | 0.995 | 0.002 | 0.39 | 21.58 | 174.5 | 0.71 |
| **76021 (Eden @ Great Musgrave Bridge)** | 0.315 | 23 | 223.025 | 1270 | 0.047 | 0.997 | 0.004 | 0.414 | 13.54 | 117.8 | 0.66 |
| **25018 (Tees @ Middleton in Teesdale)** | 0.317 | 50 | 242.012 | 1533 | 0.034 | 0.939 | 0.001 | 0.31 | 19.15 | 109.3 | 0.6 |
| **63001 (Ystwyth @ Pont Llolwyn)** | 0.333 | 62 | 170.1 | 1456 | 0.047 | 0.99 | 0.001 | 0.43 | 19.16 | 159.8 | 0.63 |
| **15013 (Almond @ Almondbank)** | 0.334 | 37 | 173.28 | 1394 | 0.031 | 0.996 | 0.001 | 0.422 | 28.84 | 196.9 | 0.61 |
| **54038 (Tanat @ Llanyblodwel)** | 0.338 | 50 | 241.125 | 1274 | 0.038 | 0.996 | 0.001 | 0.427 | 19.42 | 202.4 | 0.51 |
| **56006 (Usk @ Trallong)** | 0.34 | 44 | 184.735 | 1674 | 0.036 | 0.963 | 0.002 | 0.424 | 13.11 | 136.4 | 0.62 |
| **48011 (Fowey @ Restormel)** | 0.341 | 22 | 167.2 | 1435 | 0.035 | 0.985 | 0.003 | 0.45 | 17.2 | 113.3 | 0.46 |

River Ebbw

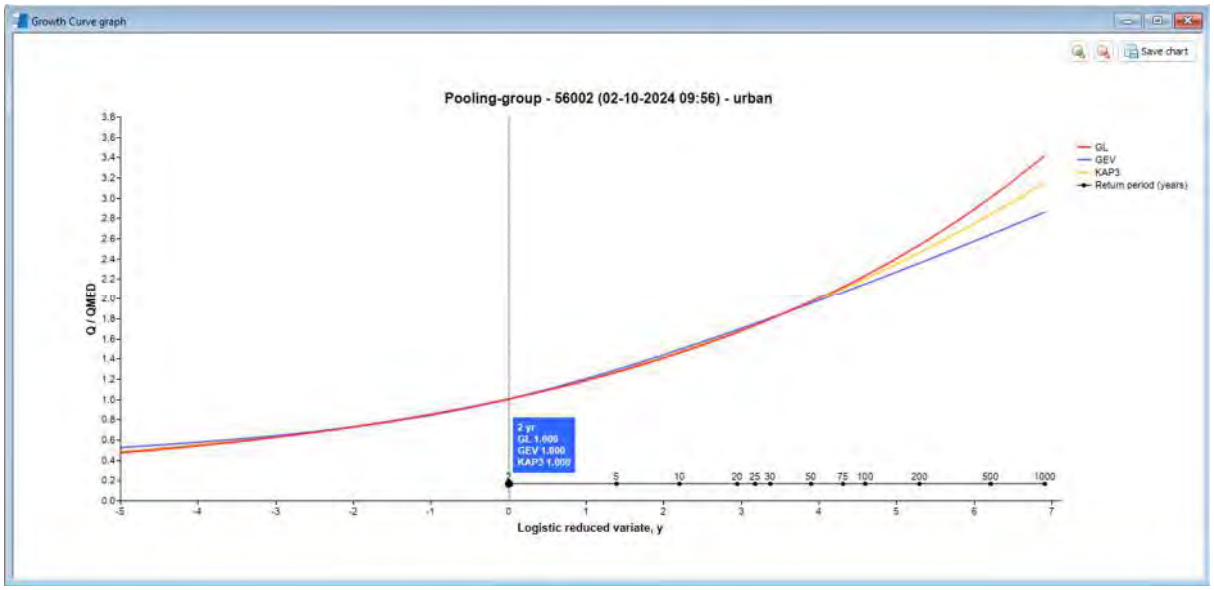
## Heterogeneity and Goodness of Fit




## Flood Frequency Curve



## Growth Curve



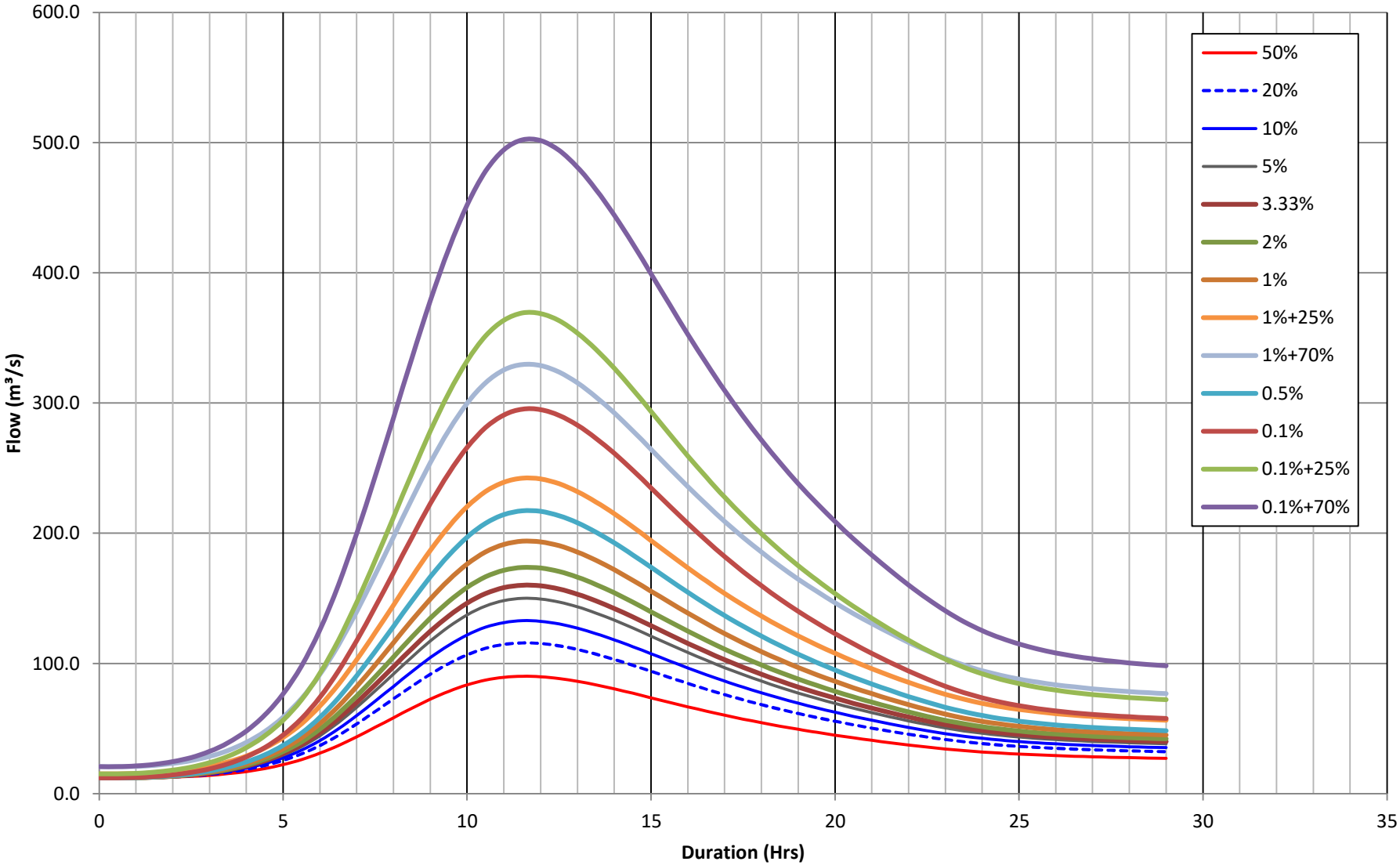
# 8 ANNEX - SUPPORTING INFORMATION

## 8.5 ReFH2 Hydrographs

# Design Hydrographs (ReFH2)

**Ebbw River**

Land at Pontymister, Risca




Printed on: 24/10/2024

# UK Design Flood Estimation

Generated on 30 September 2024 13:29:39 by Bethan.LloydJones
Printed from the ReFH2 Flood Modelling software package, version 4.1.8704.23947

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

**Site details** Checksum: E31A-6357

Site name: Updated - FEH_Catchment_Descriptors_325850_188900_v5_0_1

Easting: 325850

Northing: 188900

Country: England, Wales or Northern Ireland

Catchment Area (km²): 211.82

Using plot scale calculations: No

Model: 2.3

Site description: None

# Model run: 100 year

## Summary of results

| | | | |
|---|---|---|---|
| Rainfall - FEH22 (mm): | 95.65 | Total runoff (ML): | 5931.62 |
| Total Rainfall (mm): | 75.58 | Total flow (ML): | 16006.72 |
| Peak Rainfall (mm): | 8.57 | Peak flow (m³/s): | 193.94 |

## Parameters

*Where the user has overriden 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) | 11:30:00 | No |
| Timestep (hh:mm:ss) | 00:30:00 | No |
| SCF (Seasonal correction factor) | 0.87 | No |
| ARF (Areal reduction factor) | 0.91 | No |
| Seasonality | Winter | No |

**Loss model parameters**

| Name | Value | User-defined? |
|---|---|---|
| Cini (mm) | 91.13 | No |
| Cmax (mm) | 377.2 | 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) | 4.89 | No |
| Up | 0.65 | No |
| Uk | 0.8 | No |

**Baseflow model parameters**

| Name | Value | User-defined? |
|---|---|---|
| BF0 ($m^3/s$) | 13.06 | No |
| BL (hr) | 55.52 | No |
| BR | 1.93 | No |

**Urbanisation parameters**

| Name | Value | User-defined? |
|---|---|---|
| Sewer capacity ($m^3/s$) | 0 | No |
| Exporting drained area ($km^2$) | 0 | No |
| Urban area ($km^2$) | 33.04 [32.56] | Yes |
| Effective URBEXT2000 | 0.1 | 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 (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 00:00:00 | 0.687 | 0.000 | 0.187 | 0.000 | 12.241 | 12.241 |
| 00:30:00 | 0.881 | 0.000 | 0.244 | 0.089 | 12.131 | 12.221 |
| 01:00:00 | 1.127 | 0.000 | 0.316 | 0.385 | 12.026 | 12.411 |
| 01:30:00 | 1.442 | 0.000 | 0.409 | 0.950 | 11.926 | 12.875 |
| 02:00:00 | 1.842 | 0.000 | 0.530 | 1.861 | 11.836 | 13.697 |
| 02:30:00 | 2.349 | 0.000 | 0.688 | 3.221 | 11.761 | 14.982 |
| 03:00:00 | 2.990 | 0.000 | 0.896 | 5.163 | 11.706 | 16.870 |
| 03:30:00 | 3.797 | 0.000 | 1.171 | 7.860 | 11.681 | 19.541 |
| 04:00:00 | 4.807 | 0.000 | 1.534 | 11.518 | 11.695 | 23.212 |
| 04:30:00 | 6.052 | 0.000 | 2.015 | 16.351 | 11.762 | 28.113 |
| 05:00:00 | 7.530 | 0.000 | 2.636 | 22.712 | 11.900 | 34.612 |
| 05:30:00 | 8.573 | 0.000 | 3.177 | 30.949 | 12.133 | 43.081 |
| 06:00:00 | 7.530 | 0.000 | 2.944 | 41.454 | 12.487 | 53.941 |
| 06:30:00 | 6.052 | 0.000 | 2.470 | 54.229 | 12.993 | 67.221 |
| 07:00:00 | 4.807 | 0.000 | 2.028 | 68.760 | 13.678 | 82.438 |
| 07:30:00 | 3.797 | 0.000 | 1.644 | 84.393 | 14.564 | 98.957 |
| 08:00:00 | 2.990 | 0.000 | 1.320 | 100.462 | 15.663 | 116.126 |
| 08:30:00 | 2.349 | 0.000 | 1.053 | 116.267 | 16.981 | 133.248 |
| 09:00:00 | 1.842 | 0.000 | 0.835 | 131.045 | 18.513 | 149.558 |
| 09:30:00 | 1.442 | 0.000 | 0.660 | 143.971 | 20.247 | 164.218 |
| 10:00:00 | 1.127 | 0.000 | 0.520 | 154.284 | 22.160 | 176.444 |
| 10:30:00 | 0.881 | 0.000 | 0.408 | 161.458 | 24.219 | 185.677 |
| 11:00:00 | 0.687 | 0.000 | 0.320 | 165.101 | 26.376 | 191.477 |
| 11:30:00 | 0.000 | 0.000 | 0.000 | 165.364 | 28.579 | 193.943 |
| 12:00:00 | 0.000 | 0.000 | 0.000 | 162.679 | 30.778 | 193.457 |
| 12:30:00 | 0.000 | 0.000 | 0.000 | 157.560 | 32.928 | 190.488 |
| 13:00:00 | 0.000 | 0.000 | 0.000 | 150.612 | 34.995 | 185.607 |
| 13:30:00 | 0.000 | 0.000 | 0.000 | 142.364 | 36.951 | 179.315 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 14:00:00 | 0.000 | 0.000 | 0.000 | 133.232 | 38.775 | 172.007 |
| 14:30:00 | 0.000 | 0.000 | 0.000 | 123.542 | 40.455 | 163.997 |
| 15:00:00 | 0.000 | 0.000 | 0.000 | 113.591 | 41.982 | 155.573 |
| 15:30:00 | 0.000 | 0.000 | 0.000 | 103.682 | 43.355 | 147.037 |
| 16:00:00 | 0.000 | 0.000 | 0.000 | 94.123 | 44.575 | 138.698 |
| 16:30:00 | 0.000 | 0.000 | 0.000 | 84.989 | 45.649 | 130.638 |
| 17:00:00 | 0.000 | 0.000 | 0.000 | 76.435 | 46.584 | 123.019 |
| 17:30:00 | 0.000 | 0.000 | 0.000 | 68.478 | 47.391 | 115.869 |
| 18:00:00 | 0.000 | 0.000 | 0.000 | 61.068 | 48.076 | 109.144 |
| 18:30:00 | 0.000 | 0.000 | 0.000 | 54.187 | 48.649 | 102.837 |
| 19:00:00 | 0.000 | 0.000 | 0.000 | 47.827 | 49.116 | 96.943 |
| 19:30:00 | 0.000 | 0.000 | 0.000 | 41.956 | 49.482 | 91.438 |
| 20:00:00 | 0.000 | 0.000 | 0.000 | 36.523 | 49.753 | 86.276 |
| 20:30:00 | 0.000 | 0.000 | 0.000 | 31.480 | 49.934 | 81.414 |
| 21:00:00 | 0.000 | 0.000 | 0.000 | 26.796 | 50.029 | 76.825 |
| 21:30:00 | 0.000 | 0.000 | 0.000 | 22.452 | 50.043 | 72.495 |
| 22:00:00 | 0.000 | 0.000 | 0.000 | 18.421 | 49.982 | 68.403 |
| 22:30:00 | 0.000 | 0.000 | 0.000 | 14.736 | 49.850 | 64.586 |
| 23:00:00 | 0.000 | 0.000 | 0.000 | 11.467 | 49.655 | 61.122 |
| 23:30:00 | 0.000 | 0.000 | 0.000 | 8.700 | 49.405 | 58.105 |
| 24:00:00 | 0.000 | 0.000 | 0.000 | 6.471 | 49.109 | 55.581 |
| 24:30:00 | 0.000 | 0.000 | 0.000 | 4.727 | 48.778 | 53.505 |
| 25:00:00 | 0.000 | 0.000 | 0.000 | 3.382 | 48.420 | 51.803 |
| 25:30:00 | 0.000 | 0.000 | 0.000 | 2.353 | 48.042 | 50.395 |
| 26:00:00 | 0.000 | 0.000 | 0.000 | 1.577 | 47.650 | 49.227 |
| 26:30:00 | 0.000 | 0.000 | 0.000 | 1.005 | 47.248 | 48.253 |
| 27:00:00 | 0.000 | 0.000 | 0.000 | 0.595 | 46.840 | 47.435 |
| 27:30:00 | 0.000 | 0.000 | 0.000 | 0.314 | 46.429 | 46.743 |
| 28:00:00 | 0.000 | 0.000 | 0.000 | 0.135 | 46.017 | 46.152 |
| 28:30:00 | 0.000 | 0.000 | 0.000 | 0.036 | 45.606 | 45.643 |
| 29:00:00 | 0.000 | 0.000 | 0.000 | 0.001 | 45.198 | 45.199 |
| 29:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 44.793 | 44.793 |
| 30:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 44.391 | 44.391 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 30:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 43.993 | 43.993 |
| 31:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 43.599 | 43.599 |
| 31:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 43.208 | 43.208 |
| 32:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 42.820 | 42.820 |
| 32:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 42.437 | 42.437 |
| 33:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 42.056 | 42.056 |
| 33:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 41.679 | 41.679 |
| 34:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 41.305 | 41.305 |
| 34:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 40.935 | 40.935 |
| 35:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 40.568 | 40.568 |
| 35:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 40.204 | 40.204 |
| 36:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 39.844 | 39.844 |
| 36:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 39.487 | 39.487 |
| 37:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 39.133 | 39.133 |
| 37:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 38.782 | 38.782 |
| 38:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 38.434 | 38.434 |
| 38:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 38.090 | 38.090 |
| 39:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 37.748 | 37.748 |
| 39:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 37.410 | 37.410 |
| 40:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 37.074 | 37.074 |
| 40:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 36.742 | 36.742 |
| 41:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 36.413 | 36.413 |
| 41:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 36.086 | 36.086 |
| 42:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 35.763 | 35.763 |
| 42:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 35.442 | 35.442 |
| 43:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 35.124 | 35.124 |
| 43:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 34.809 | 34.809 |
| 44:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 34.497 | 34.497 |
| 44:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 34.188 | 34.188 |
| 45:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 33.882 | 33.882 |
| 45:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 33.578 | 33.578 |
| 46:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 33.277 | 33.277 |
| 46:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 32.978 | 32.978 |
| 47:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 32.683 | 32.683 |
| 47:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 32.390 | 32.390 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 48:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 32.099 | 32.099 |
| 48:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 31.812 | 31.812 |
| 49:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 31.526 | 31.526 |
| 49:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 31.244 | 31.244 |
| 50:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 30.964 | 30.964 |
| 50:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 30.686 | 30.686 |
| 51:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 30.411 | 30.411 |
| 51:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 30.138 | 30.138 |
| 52:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 29.868 | 29.868 |
| 52:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 29.600 | 29.600 |
| 53:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 29.335 | 29.335 |
| 53:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 29.072 | 29.072 |
| 54:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 28.811 | 28.811 |
| 54:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 28.553 | 28.553 |
| 55:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 28.297 | 28.297 |
| 55:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 28.043 | 28.043 |
| 56:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 27.792 | 27.792 |
| 56:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 27.543 | 27.543 |
| 57:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 27.296 | 27.296 |
| 57:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 27.051 | 27.051 |
| 58:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 26.809 | 26.809 |
| 58:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 26.568 | 26.568 |
| 59:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 26.330 | 26.330 |
| 59:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 26.094 | 26.094 |
| 60:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 25.860 | 25.860 |
| 60:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 25.628 | 25.628 |
| 61:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 25.399 | 25.399 |
| 61:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 25.171 | 25.171 |
| 62:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 24.945 | 24.945 |
| 62:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 24.722 | 24.722 |
| 63:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 24.500 | 24.500 |
| 63:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 24.280 | 24.280 |
| 64:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 24.063 | 24.063 |
| 64:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 23.847 | 23.847 |
| 65:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 23.633 | 23.633 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 65:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 23.421 | 23.421 |
| 66:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 23.211 | 23.211 |
| 66:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 23.003 | 23.003 |
| 67:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 22.797 | 22.797 |
| 67:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 22.593 | 22.593 |
| 68:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 22.390 | 22.390 |
| 68:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 22.189 | 22.189 |
| 69:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.990 | 21.990 |
| 69:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.793 | 21.793 |
| 70:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.598 | 21.598 |
| 70:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.404 | 21.404 |
| 71:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.212 | 21.212 |
| 71:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 21.022 | 21.022 |
| 72:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 20.834 | 20.834 |
| 72:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 20.647 | 20.647 |
| 73:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 20.462 | 20.462 |
| 73:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 20.278 | 20.278 |
| 74:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 20.097 | 20.097 |
| 74:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.916 | 19.916 |
| 75:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.738 | 19.738 |
| 75:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.561 | 19.561 |
| 76:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.386 | 19.386 |
| 76:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.212 | 19.212 |
| 77:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 19.039 | 19.039 |
| 77:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.869 | 18.869 |
| 78:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.700 | 18.700 |
| 78:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.532 | 18.532 |
| 79:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.366 | 18.366 |
| 79:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.201 | 18.201 |
| 80:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 18.038 | 18.038 |
| 80:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.876 | 17.876 |
| 81:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.716 | 17.716 |
| 81:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.557 | 17.557 |
| 82:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.400 | 17.400 |
| 82:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.244 | 17.244 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 83:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 17.089 | 17.089 |
| 83:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.936 | 16.936 |
| 84:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.784 | 16.784 |
| 84:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.634 | 16.634 |
| 85:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.485 | 16.485 |
| 85:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.337 | 16.337 |
| 86:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.190 | 16.190 |
| 86:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 16.045 | 16.045 |
| 87:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.901 | 15.901 |
| 87:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.759 | 15.759 |
| 88:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.617 | 15.617 |
| 88:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.477 | 15.477 |
| 89:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.339 | 15.339 |
| 89:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.201 | 15.201 |
| 90:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 15.065 | 15.065 |
| 90:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.930 | 14.930 |
| 91:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.796 | 14.796 |
| 91:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.663 | 14.663 |
| 92:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.532 | 14.532 |
| 92:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.402 | 14.402 |
| 93:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.273 | 14.273 |
| 93:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.145 | 14.145 |
| 94:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 14.018 | 14.018 |
| 94:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.892 | 13.892 |
| 95:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.768 | 13.768 |
| 95:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.644 | 13.644 |
| 96:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.522 | 13.522 |
| 96:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.401 | 13.401 |
| 97:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.280 | 13.280 |
| 97:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.161 | 13.161 |
| 98:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 13.043 | 13.043 |
| 98:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.926 | 12.926 |
| 99:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.811 | 12.811 |
| 99:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.696 | 12.696 |
| 100:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.582 | 12.582 |

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

| Time (hh:mm:ss) | Rain (mm) | Sewer Loss ($m^3/s$) | Net Rain (mm) | Runoff ($m^3/s$) | Baseflow ($m^3/s$) | Total Flow ($m^3/s$) |
|---|---|---|---|---|---|---|
| 100:30:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.469 | 12.469 |
| 101:00:00 | 0.000 | 0.000 | 0.000 | 0.000 | 12.357 | 12.357 |

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

## Appendix

**Catchment descriptors ***

| Name | Value | User-defined value used? |
|---|---|---|
| Area ($km^2$) | 211.82 | No |
| ALTBAR | 317 | No |
| ASPBAR | 183 | No |
| ASPVAR | 0.18 | No |
| BFIHOST | 0.54 | No |
| BFIHOST19 | 0.5 | No |
| DPLBAR (km) | 22.27 | No |
| DPSBAR ($mkm^{-1}$) | 182.3 | No |
| FARL | 0.98 | No |
| LDP | 41.98 | No |
| PROPWET | 0.49 | No |
| RMED1H | 11.8 | No |
| RMED1D | 52.7 | No |
| RMED2D | 70 | No |
| SAAR (mm) | 1454 | No |
| SAAR4170 (mm) | 1529 | No |
| SPRHOST | 29.79 | No |
| URBEXT2000 | 0.1 [0.1] | **Yes** |
| URBEXT1990 | 0.08 | No |
| URBCONC | 0.74 | No |
| URBLOC | 0.95 | No |
| DDF parameter C | -0.03 | No |
| DDF parameter D1 | 0.46 | No |
| DDF parameter D2 | 0.44 | No |
| DDF parameter D3 | 0.35 | No |
| DDF parameter E | 0.29 | No |
| DDF parameter F | 2.54 | No |
| DDF parameter C (1km grid value) | -0.03 | No |
| DDF parameter D1 (1km grid value) | 0.44 | No |
| DDF parameter D2 (1km grid value) | 0.41 | No |
| DDF parameter D3 (1km grid value) | 0.36 | No |
| DDF parameter E (1km grid value) | 0.28 | No |
| DDF parameter F (1km grid value) | 2.46 | No |

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

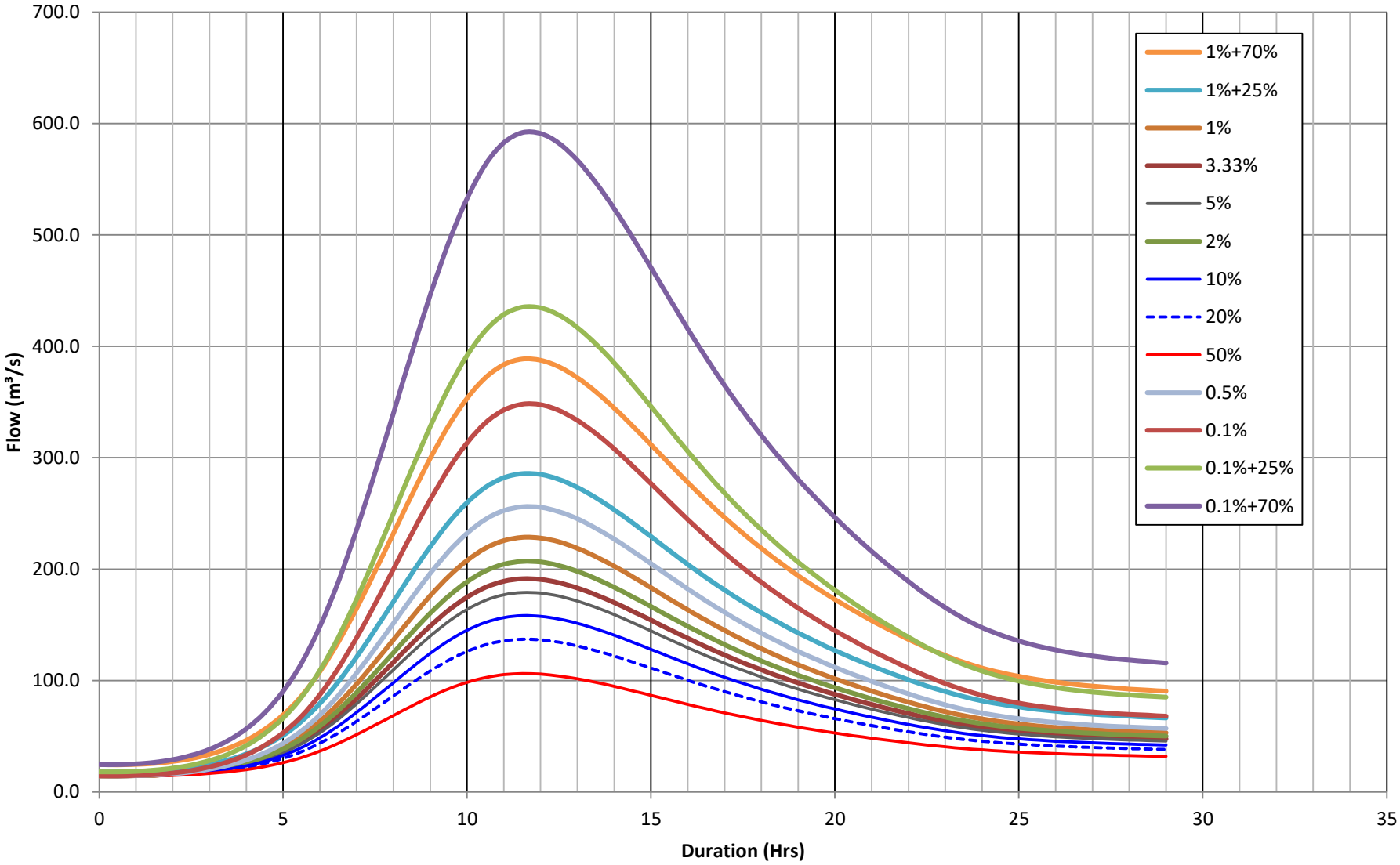
**The URBEXT2000 has been modified so that the 'Urban' proportion does not exceed 1.*

### 8.6 ReFH2 Design Hydrographs

# Design Hydrographs

**River Ebbw at Rhiwderin Gauge**

Land at Pontymister, Risca




Printed on: 24/10/2024

# Appendix G Simulated Flood Maps

## Normal Conditions Scenario

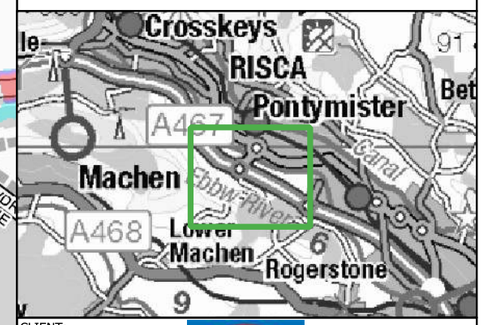
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

**LEGEND**

- Site Boundary

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m




CLIENT:

LIDL

waterco
www.waterco.co.uk

SCHEME:

Land at Pontymister, Risca

PLOT TITLE:
Maximum Flood Depth
1% AEP Fluvial Event
Existing Scenario (EXG)
Defended Scenario
Normal Conditions

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 26-11-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| MH | AA | LS | 1:6000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_EBBW_Q100_DEF_EXG_NC_023_d_Max | - |

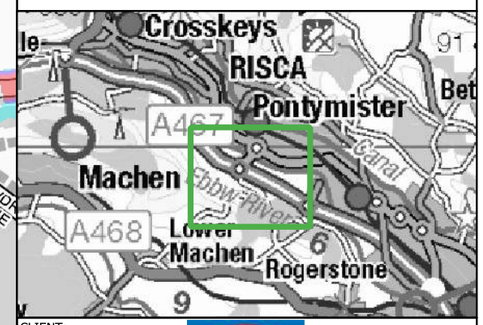
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

**LEGEND**

- Site Boundary
- Proposed Store

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m




0 25 50 m

Plot scale at A3 1:1500

0 100 200 300 400 500 m

CLIENT: LIDL

waterco
www.waterco.co.uk

SCHEME:
Land at Pontymister, Risca

PLOT TITLE:
Maximum Flood Depth
1% AEP Fluvial Event
Proposed Development Scenario (DEV)
Defended Scenario
Normal Conditions

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 26-11-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| MH | AA | LS | 1:6000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_EBBW_Q100_DEF_DEV_NC_027_d_Max | - |

Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

**LEGEND**

- Site Boundary
- Proposed Store

Maximum Flood Depth Difference

- > -100mm
- -50mm to -100mm
- -5mm to -50mm
- No Change (+/- 5mm)
- +5mm to +50mm
- +50mm to +100mm
- > +100mm

0 25 50 m

Plot scale at A3 1:1500

0 100 200 300 400 500 m

CLIENT: LIDL

waterco
www.waterco.co.uk

SCHEME:
Land at Pontymister, Risca

PLOT TITLE: Maximum Flood Depth Difference
1% AEP Fluvial Event
DEV-EXG
Defended Scenario
Normal Conditions

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 26-11-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| MH | AA | LS | 1:6000 |

PLOT NAME: 15679_EBBW_Q100_DEF_DEV-EXG_NC_027_d-Diff

REVISION: -

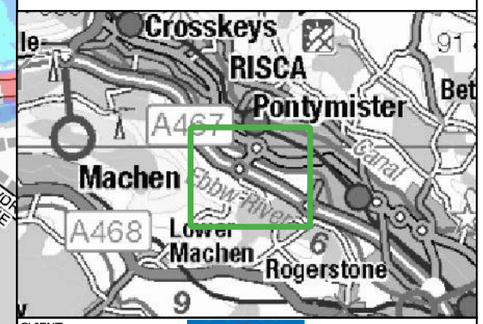
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

**LEGEND**

- Site Boundary

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m




0 25 50 m

Plot scale at A3 1:1500

0 100 200 300 400 500 m

CLIENT: LIDL

waterco
www.waterco.co.uk

SCHEME:
Land at Pontymister, Risca

PLOT TITLE:
Maximum Flood Depth
1% AEP Plus 25% Climate Change Fluvial Event
Existing Scenario (EXG)
Defended Scenario
Normal Conditions

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 26-11-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| MH | AA | LS | 1:6000 |

| PLOT NAME: | REVISION: |
|---|---|
| 15679_EBBW_Q100CC25_DEF_EXG_NC_023_d_Max | - |

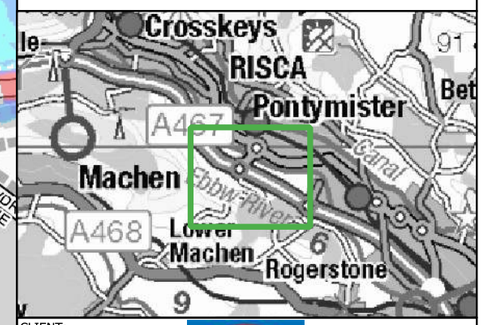
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise.

**LEGEND**

- Site Boundary
- Proposed Store

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m




0 25 50 m

Plot scale at A3 1:1500

0 100 200 300 400 500 m

CLIENT: LIDL

waterco
www.waterco.co.uk

SCHEME:
Land at Pontymister, Risca

PLOT TITLE:
Maximum Flood Depth
1% AEP Plus 25% Climate Change Fluvial Event
Proposed Development Scenario (DEV)
Defended Scenario
Normal Conditions

| PLOT STATUS: | DATE: |
|---|---|
| FINAL | 26-11-2024 |

| DRAWN: | CHECKED: | APPROVED: | PLOT SCALE AT A3: |
|---|---|---|---|
| MH | AA | LS | 1:6000 |

PLOT NAME: 15679_EBBW_Q100CC25_DEF_DEV_NC_027_d_Max

REVISION: -