

Appendix 8

FLUVIAL MODELLING STUDY

Proposed Residential Development, Uplands, West
Ashton Road, Trowbridge on Behalf of Hills Homes
Developments Limited

Date: July 2026
Issue No. 2



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1.0 INTRODUCTION

1.1 This *Fluvial Modelling Study* has been prepared by Cole Easdon Consultants Limited (CE) on behalf of Hills Homes Developments Limited in support of a planning application for residential development on land at Uplands, West Ashton Road, Trowbridge, Wiltshire, BA14 6DW. Refer to CE Figure 9740/500 Figure 1(A) [*Site Location Plan*] in Appendix 1.

1.2 The development proposals comprise the demolition of the existing property (Uplands) and the construction of 40 residential dwellings, with site access, parking and landscaping. This study is based on Drawing No. 3164/150 Rev F [*Proposed Site Plan*] (by Ian Sullivan Architecture Ltd). Refer to Appendix 3.

Need for Study

1.3 The purpose of this study is to determine flood levels and the extent of fluvial flooding at the site associated with the flooding of the Blackball Brook which forms the southern site boundary, for the 1:100 year + climate change event.

1.4 The Environment Agency (EA) has advised that detailed flood risk modelling is not available for Blackball Brook and as such modelled flood levels and extent are not available for the site.

1.5 The results of this Study have been used to inform a *Flood Risk Assessment* to support a planning application for the proposed development.

Scope of Study

1.6 In Section 2.0, we describe the characteristics of the local catchment. In Section 3.0, we assess the existing hydrology. In Sections 4.0 and 5.0, we describe the hydraulic modelling process and results. Finally, conclusions are presented in Section 6.0.

1.7 The following abbreviations are used in this Report:

- CC – Climate Change;
- EA – Environment Agency;
- FEH – Flood Estimation Handbook;
- FSR – Flood Studies Report;
- FZM – Flood Zone Map prepared by the EA;
- mAOD – Metres above Ordnance Datum;
- NRFA – National River Flow Archive; and
- ReFH – Revitalised Flood Hydrograph.

2.0 THE LOCAL CATCHMENT

- 2.1 The River Biss drains the wider local catchment. It rises near Salisbury Plain and passes through Westbury and Trowbridge, following a northerly course discharging to the River Avon approximately 600m to the north of Trowbridge at Widbrook Wood near Staverton.
- 2.2 The study area is drained by the Blackball Brook, a tributary of the River Biss. Blackball Brook rises from the Stourton Water Lake and flows in a westerly direction to the south of Trowbridge. An un-named tributary joins Blackball Brook upstream of the site, to the west of the Leap Gate highway.
- 2.3 The study site comprises a parcel of land to the north of the Blackball Brook totalling some 5.447ha. The development site is bounded to the south by Blackball Brook. The western boundary is formed by West Ashton Road, with residential properties forming the northern boundary. Access to the development site is taken from West Ashton Road.
- 2.4 Environment Agency mapping indicates the southern part of the site lies within Flood Zone 2/3, with the remainder of the site indicated to be in Flood Zone 1. Refer to Figure 2.1 below. However, the EA relate that the current flood extent for the development site is not based on detailed hydraulic modelling and as such does not provide any flood levels or depths at the site. Additionally, the EA flood zone outlines do not take into consideration the presence of a culvert below West Ashton Road at Blackball Bridge. Therefore, the available flood zone outlines are not considered suitable for the preparation of a site-specific *Flood Risk Assessment*.



Figure 2.1: EA Flood Map for Planning
Source : <https://flood-map-for-planning.service.gov.uk/>

Blackball Brook Study Area - Site Survey

- 2.5 Topographical survey (referenced to Ordnance Datum) of Blackball Brook and the development site has been carried out by AP Land Surveys in November 2017 and September 2024. Refer to Drawing No. APLS-1595-001 [*Trowbridge Channel Survey – 3 No. Sheets*] and Drawing No. APLS-0609-001 [Topographic Survey] in Appendix 3.
- 2.6 Blackball Brook has been surveyed along its length commencing at a point some 567m upstream of the site and extending some 189m downstream of the Blackball Bridge beneath West Ashton Road. Where possible the dimensions of all online structures in the study area have been recorded by the survey.

Flood History

- 2.7 EA Product 4 Flood Data was obtained in November 2024. Refer to Appendix 6. The Product 4 letter outlines that the EA's historic records indicate fluvial flooding in the vicinity of the site in 1925, 1932 and 1960.
- 2.8 The Wiltshire Council Strategic Flood Risk Assessment (SFRA) contains records of historical flooding throughout the locality. There is no record within the SFRA of flooding at the site.

Flood Mechanism

- 2.9 Possible mechanisms of fluvial flooding of the site have been identified as:
- Rainfall events causing peak flows to exceed the in-bank capacity of the channel and culvert beneath West Ashton Road; and
 - Blockage of the culvert beneath West Ashton Road during peak rainfall events.

3.0 HYDROLOGY

Refer to Flood Estimation Report in Appendix 2.

Approach to Hydrology

- 3.1 Hydrological analysis is based on the FEH Statistical Method and REFH2 method. Flood peak data has been obtained from the NFRA peak flows dataset, Version 14.0.1 (September 2025).

ReFH2 Analysis

- 3.2 The parameters for the hydrological analysis have been obtained from the FEH, which includes a GIS database containing catchment descriptor values that characterise the response of the catchment to rainfall. A river catchment can be selected and the relevant catchment descriptors obtained. Descriptors for catchments associated with Blackball Brook have been obtained in this way. Additional descriptors were also obtained for the un-named tributary of Blackball Brook. Three flow estimation points have been calculated; one on Blackball Brook (TRIB02), one on the un-named tributary (TRIB01) and one immediately upstream of the Blackball Brook's confluence with the River Biss (TROW01).
- 3.3 The critical storm duration for the Blackball Brook catchment area considered in the Report has been identified by the ReFH method as being the 7-hour winter storm.
- 3.4 The intervening area between TRIB01 and 02 and TROW01, where the site is located, is too small (0.45km²) for use within the ReFH2 and FEH Statistical method. Inflows for this area have therefore been produced using area weighting from the downstream catchment (TROW01) and have been applied as a series of lateral inflows along Blackball Brook.

Statistical Analysis

- 3.5 A statistical analysis has been undertaken to check reliability of the ReFH generated flow data. The statistical analysis is a recognised method for flow determination and is based on a pooling group analysis of gauged catchments which have similar FEH descriptors similar to the host catchments.
- 3.6 Comparison of the results from the two methods show that the FEH Statistical method produces equal or larger flows for both the 50% AEP and 1% AEP events, with the difference increasing for the 1% AEP event. The ReFH2 method is based on catchment descriptors alone, whilst the FEH Statistical Method uses donors and pooling groups. It should also be noted that the Statistical method is often preferred to design event approaches as it is based on a much larger dataset of flood events and has been more directly calibrated to reproduce flood frequency on

UK catchments. The FEG also states that the Statistical method is preferred if 'there are lakes or other water bodies in the catchment, and you are not planning to use flood routing to represent them'. As a result, based on the original 2024 Report, the Statistical method has been chosen due to the presence of Stourton Water (Rood Ashton Lake) within the catchment.

- 3.7 The FEG advises that the FEH Statistical method 1% AEP (1:1000 year) event peak flow estimates should have the ReFH2 0.1%/1% ratio applied for the 0.1% AEP (1:1000 year) event.
- 3.8 Ratios derived from the Statistical method peak flow estimates and the ReFH2 individual storm duration peak flows for each location have been applied to the hydrographs generated for the 7-hour critical storm duration and applied as point inflows to the hydraulic model.

4.0 HYDRAULIC MODELLING

Refer to CE Plans 9740/512(A) [*Existing Schematic Plan*] and 9740/513(A) [*Proposed Schematic Plan*] in Appendix 4.

- 4.1 Hydraulic modelling has been carried out using Flood Modeller software (version 7.3.9224.28920). This is a hydraulic modelling package capable of handling one-dimension, two-dimension and 1D-2D linked models; the latter has been used in the construction of the Blackball Brook model. For the 1D element of the model the software can represent the river system as a series of nodes and links, with sections of the river channel applied to the model as nodes and the chainages between each section as links between each node. Flow through the channel is modelled in terms of changes in water level (or 'stage') at each cross-section.
- 4.2 For the linked 2D element the software can model the floodplain as a grid, using the 2D equations of flow to calculate the water depth and 'depth averaged' velocity over the grid. The 1D river model can be linked to the 2D floodplain model using 'head', 'flow', or 'weir' links, whereby the 1D model supplies stage or flow data at a pre-defined point into the 2D model.

1D Hydraulic Model Extent along Blackball Brook

- 4.3 The 1D model commences along the Blackball Brook some 567m to the north-east of the development site and extends some 189m downstream of the culvert beneath West Ashton Road. Culverts have been picked up by the topographical survey and have been included within the model.
- 4.4 Interpolated sections have been placed between surveyed sections (such as stretches of the watercourse featuring increased sinuosity or rapid changes in width or depth) in order to aid the stability of the model.
- 4.5 Initial conditions for each of the modelled scenarios have been generated using the steady state (direct) method.

Structures

- 4.6 Dimensions of structures modelled within the study area have been taken from the topographical survey undertaken by AP Land Surveys. Refer to Appendix 3.
- 4.7 Three culverts have been included within the hydraulic model. Two culverts are located beneath the Leap Gate highway, one on the Blackball Brook and one on the unnamed tributary. A third culvert is located below the West Ashton Road at Blackball Bridge. All culverts have been

modelled as orifice units as they act as potential points of flow constriction. The opening through the culvert below the unnamed tributary beneath the Leap Gate highway has been modelled as 1.500m wide and 1.765m high. The opening through the culvert below the Blackball Brook crossing beneath the Leap Gate highway has been modelled as 4.900m wide and 1.410m high. The opening through Blackball Bridge has been modelled as 3.000m wide and 1.441m high. Spill units have been added to the 1D network with levels obtained from the topographical survey.

1D Hydraulic Roughness

- 4.8 Channel roughness has been simulated in the Flood Modeller software through the specification of appropriate Manning's 'n' values for each modelled cross-section. The modelled Manning's 'n' values adopted have been estimated from onsite photos taken during the surveying process and ariel imagery. Mannings 'n' values adopted for the watercourse channel and floodplain vary within the range of 0.013-0.07 in accordance with the values recommended for a winding stream with vegetated floodplain in *Open – Channel Hydraulics* (Chow, 1959).

1D Boundary Conditions

Upstream Boundary Condition

- 4.9 Flow hydrographs obtained from JBA's hydrological analysis have been used as upstream boundary input flows in the hydraulic model. Refer to Section 3.0, Appendix 2 and CE Plan 9740/512(A) [*Existing Schematic Plan*] in Appendix 4.
- 4.10 The existing attenuation basin to the east of the site discharges at a peak rate of 110l/s. This peak inflow has been included in the model as a hydrograph at node BLACK0423. The model conservatively assumes that 0.11m³/s is applied at this point for the entire model duration.

Downstream Boundary Condition

- 4.11 The downstream extent of the model was terminated some 189m downstream of the Blackball Bridge. To ensure no water is lost from the model the 1D downstream boundary has been replaced with a spill unit which has been added upstream of the head time boundary unit and connected to a 1D-2D flow link line to convey water into the 2D domain.

2D Hydraulic Model Extent along Blackball Brook

- 4.12 The 2D domain is defined by an 'active area' which is a polygon determining active computation grid cells within a 2D model. The elevation data (or terrain model) on which the 2D model bases its computation has been obtained from topographical survey within the site extent and DTM LiDAR used for areas outside of the topographical survey's extent. It was converted to ASC

format using GIS software with a grid resolution of 1m. 1m resolution LiDAR data was also downloaded in August 2024 for use in this modelling study. Two polygons have been created in the model to represent the 'active area'; these extend in all directions around the site to allow the model to represent how flood flow could affect the site. Refer to Figure 4.1 below. A 2m x 2m grid cell size has been specified as this is deemed sufficient for accurate flood flow mapping at this location.

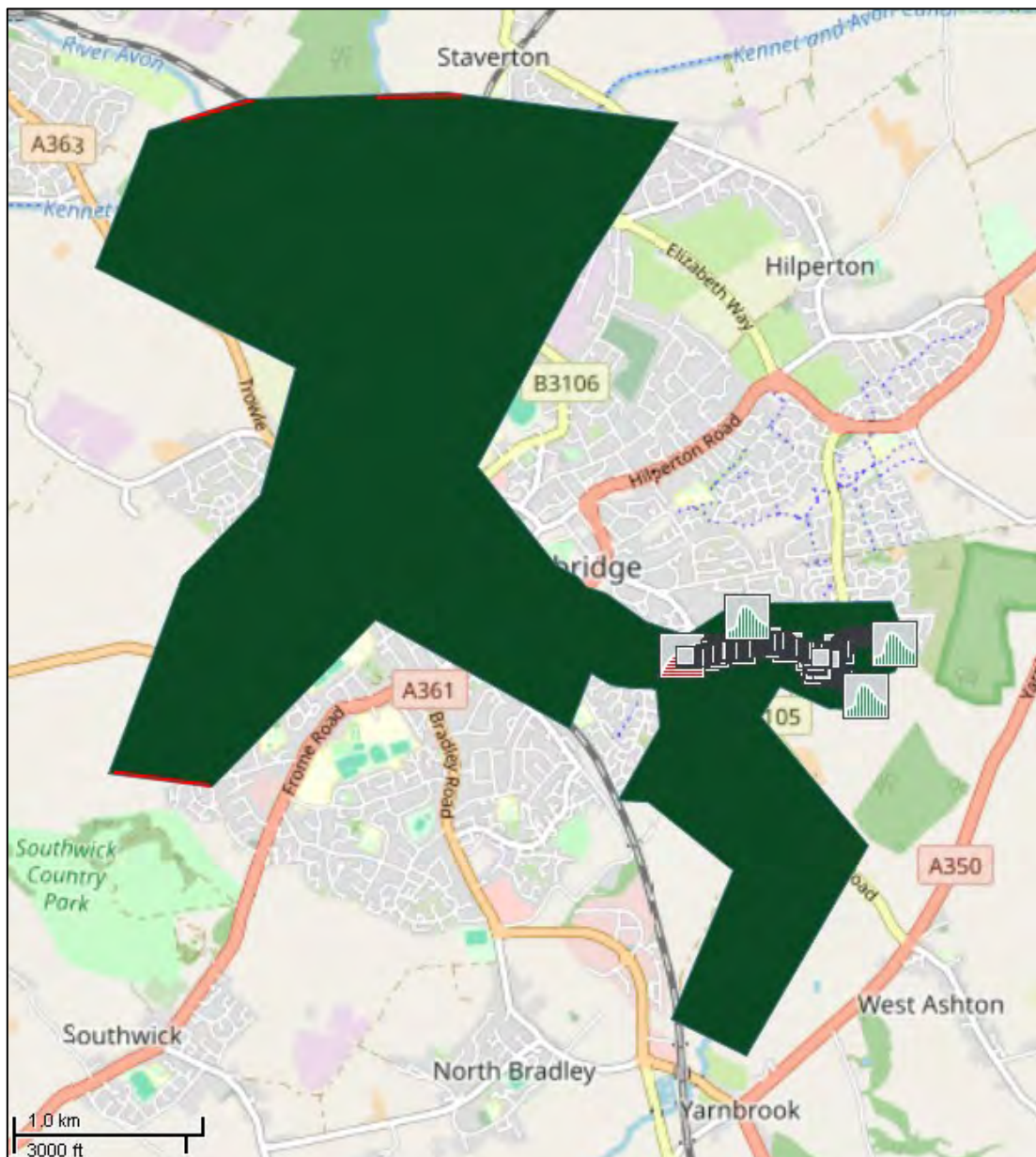


Figure 4.1: Existing Site Model: Modelled 2D Floodplain Domain

- 4.13 1D-2D link lines have been created along the length of the Blackball Brook and the unnamed tributary on both banks to allow flood flow to spill into the floodplain. Link line data has been generated using either the section data or LiDAR ground model data.

Downstream Boundary Condition

- 4.14 The 2D active area extends some 5km northwards along the River Biss to its confluence with the River Avon. This is to allow the impact of the River Biss on the levels within the Blackball Brook to be accurately simulated and ensure any backup effect from the River Biss is accounted for. The water has been allowed to flow for a reasonable distance downstream of the site (5km) to prevent any unrealistic back up occurring from flows reaching the end of the model. A number of 2D boundary lines have been applied to the downstream end of the model with a gradient of 0.001 used within the boundary line shapefile based upon the estimated gradient of the channel.

River Biss

- 4.15 To simulate the correct flows, and therefore water levels within the River Biss, flow data has been extracted from the River Biss & Bitham Brook SFRA Model undertaken by Capita Symonds in 2006. The model formed part of the Bristol Avon Standard of Protection Study – 2012/13 and comprised of an Estry-TUFLOW model. The flows for the various simulated events were extracted from NODE 5079 located immediately upstream of the confluence between the Blackball Brook and River Biss. The data was extracted using Notepad++ and then inserted into the model using a 2D hydrograph.

2D Hydraulic Roughness

- 4.16 Hydraulic roughness has been simulated in Flood Modeller through the specification of appropriate Manning's 'n' values within the 2D domain. A default roughness value of 0.035 has been used in the 2D domain. This relates to the maximum manning's 'n' value for short grass (Chow, 1959). Existing ground roughness conditions have been incorporated into the model via individual shapefiles linked to a lookup table (.fric). A roughness patch has been used within the 2D aspect of the model to aid in model stability in vegetated areas and an urban roughness patch has been used in the wider model to simulate urban areas. Refer to Table 4.1 below.

Table 4.1: Manning Values (Chow 1959) used within the 2D Domain

Surface Feature	Manning's <i>n</i> roughness value
Buildings	0.3
Roads	0.013
Vegetated Patch	0.03
Brush	0.08
Urban Patch	0.013

Climate Change Allowances

- 4.17 In February 2016, the EA produced peak river flow allowances by river basin district. The development site falls within the Avon Bristol and North Somerset Streams Management Catchment. The proposed development is classified as 'more vulnerable'. The impact of the 26% climate change allowance has therefore been assessed as part of this study and the 1:100 year + 26% Climate Change (CC) event is considered to be the design event.

Model Calibration

- 4.18 No flood event data was available at the time of writing to use for model calibration.

Modelled Scenarios – Existing Situation

- 4.19 The model has been run for the 1:30-year, 1:100-year and 1:1000-year events using catchment hydrographs generated for each event. The 1:100-year + 26% climate change storm event has also been modelled, with inflow data scaled from the 1:100 year catchment hydrograph. Refer to Appendix 2. This, so as to determine the baseline flood extent associated with each event.

Modelled Scenarios – Post Development

- 4.20 Development proposals include the demolition of an existing residential building and access in order to facilitate a residential development comprising 40 no. dwellings with associated parking and landscaping.
- 4.21 Under the post development scenario, the site will discharge surface water runoff at an attenuated rate of 3.0l/s to the watercourse. Therefore, an inflow of 0.003m³/s has been applied at the closest 1D node to the proposed outfall location.
- 4.22 The model has been run for the 1:100-year + 26% climate change storm event.

Modelled Scenarios – Sensitivity Testing

- 4.23 Sensitivity testing has been undertaken for the post development 1:100-year + 26% climate change event scenario for blockage and Manning's 'n' values.
- 4.24 The model has been tested for a 50% blockage of the culvert beneath Blackball Bridge to determine the impact on floodplain extent and level.
- 4.25 Sensitivity testing was run with variation of Mannings 'n' by +20% and -20%.

5.0 HYDRAULIC MODEL RESULTS

Refer to CE Plans 9740/513(A) [*Proposed Schematic Plan*], 9740/514(A) [*Hydraulic Model Results – 100 year +26% CC Fluvial Flood Event - Proposed Development Layout*] and 9740/515(A) [*Hydraulic Model Results – Comparison of the 1:30, 1:100 and 1:1000 year Fluvial Flood Event Extents Proposed Site Layout*] in Appendix 4.

Modelled Scenarios – Existing Situation (Baseline)

5.1 The existing site model has been run for the following events

- i) 1:30-year return period;
- ii) 1:100-year return period;
- iii) 1:1000-year return period;
- iv) 1:100-year + 26% climate change return period;

5.2 Results have been used to define the floodplain extents associated with each return period within the development site and surrounding area. Peak water levels at modelled cross locations are summarised in Tables 5.1 below.

Table 5.1: Existing Model – Maximum Stage (mAOD)

Model 1D Node Reference	Return Period Event			
	1:30 yr	1:100 yr	1:100 yr + 26% CC	1:1000 yr storm
BLACK0423	38.862	38.915	38.939	38.947
BLACK0567	38.406	38.477	38.584	38.717
BLACK0697	37.981	38.058	38.075	38.081
BLACK0842	37.553	37.642	37.925	38.043
BLACK0977	37.134	37.190	37.267	37.433

1:30-year return period

5.3 The 1:30-year storm defines the floodplain outline for Flood Zone 3b (functional floodplain). Flooding occurs along the left bank of the Blackball Brook (offsite). No flooding occurs within the development site. Refer to Figure 5.1 below.

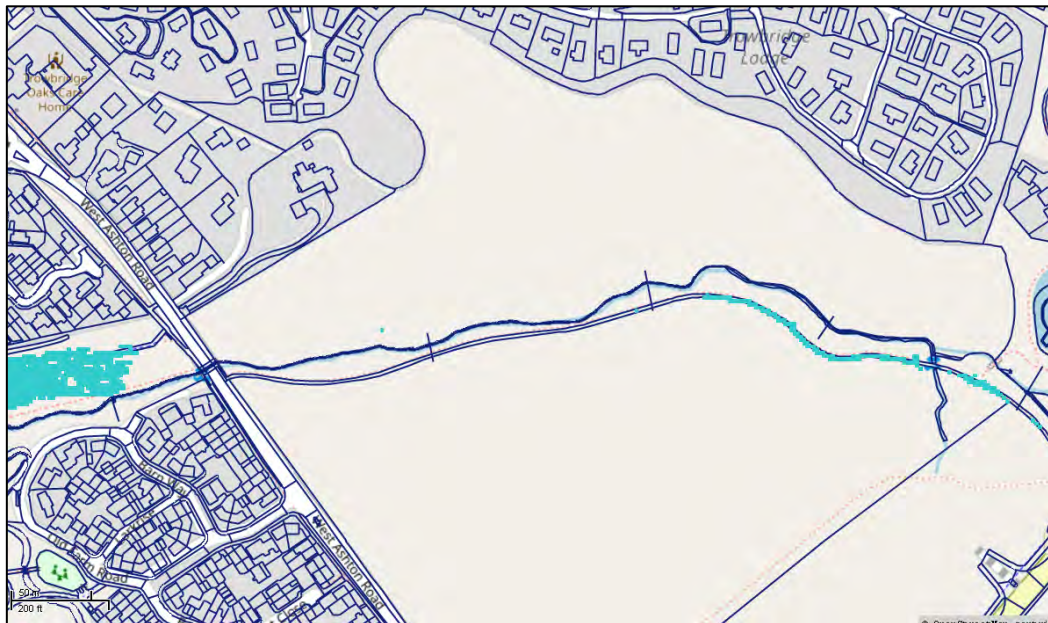


Figure 5.1: Extent of flooding from Blackball Brook for the 1:30-year event

1:100-year return period

- 5.4 The 1:100-year storm defines the floodplain outline for Flood Zone 3a. Flooding occurs along both left and right banks of the Blackball Brook. Flooding occurs within the southwestern most extent of the site. Refer to Figure 5.2 below.
- 5.5 Flooding within the site reaches a depth of between 20mm – 110mm at the deepest part of the flood extent.



Figure 5.2: Extent of flooding from Blackball Brook for the 1:100-year event

1:1000-year return period

- 5.6 The 1:1000-year storm defines the floodplain outline for Flood Zone 2. Flooding occurs along both left and right banks of the Blackball Brook. The majority of the flooding issues out of the right bank (within the site). Flooding occurs within the southernmost extents of the site. Refer to Figure 5.3 below.
- 5.7 Flooding within the site reaches a depth of between 20mm – 500mm at the deepest part of the flood extent.



Figure 5.3: Extent of flooding from Blackball Brook for the 1:1000-year event

1:100-year return period + 26% climate change return period

- 5.8 Flooding occurs along both left and right banks of the Blackball Brook. The majority of the flooding issues out of the right bank. Flooding occurs within the southernmost extents of the site. Refer to Figure 5.4 below.

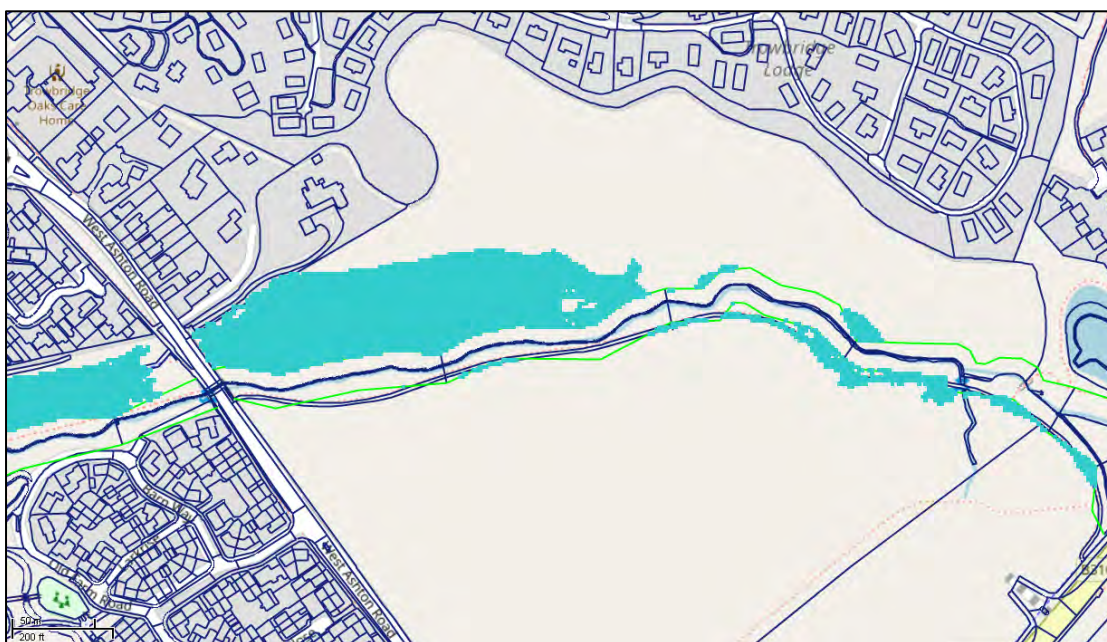


Figure 5.4: Extent of flooding from Blackball Brook for the 1:100-year + 26% climate change event

Modelled Scenarios – Post Development

- 5.9 The post development model has been run for the following events:
- i) 1:100-year + 26% climate change return period;
 - i) Variation of Mannings 'n' by +20% and -20% (1:100-year + 26% return period); and
 - ii) 50% blockage of the Blackball Bridge culvert (1:100-year +26% return period).
- 5.10 Results have been used to define the floodplain extents associated with the design flood event within the development site and surrounding area. Peak water levels at modelled cross locations are summarised in Tables 5.2 and 5.3 below.

Table 5.2: Proposed Model – Maximum Stage (mAOD)

Model 1D Node Reference	Return Period Event
	100yr + 26% CC
BLACK0423	38.939
BLACK0567	38.584
BLACK0697	38.075
BLACK0842	37.925
BLACK0977	37.267

Table 5.3: Sensitivity Testing – Maximum Stage (mAOD)

Model 1D Node Reference	1:100 yr + 26% CC n +20%	1:100 yr + 26% CC n -20%	1:100 yr + 26% CC 50% culvert blockage	1:100 yr + 26%
BLACK0423	39.030	38.923	38.941	38.939
BLACK0567	38.593	38.479	38.574	38.584
BLACK0697	38.210	38.064	38.066	38.075
BLACK0842	37.877	37.651	37.968	37.925
BLACK0977	37.438	37.310	37.724	37.267

Impact on Masterplan Layout

- 5.11 The modelled baseline results have been used to inform the masterplan layout to ensure that development does not encroach upon the 1:100 year + 26% modelled floodplain extents.

1:100-year return period + 26% climate change return period

- 5.12 No proposed residential properties are located in the 1:100-year + 26% Climate Change floodplain. The westernmost extent of the proposed access road at the site entrance would be located within the 1:100-year + 26% Climate Change floodplain. Refer to Figure 5.5 below. The proposed access road will be raised above the design flood at this location with compensatory storage provided.

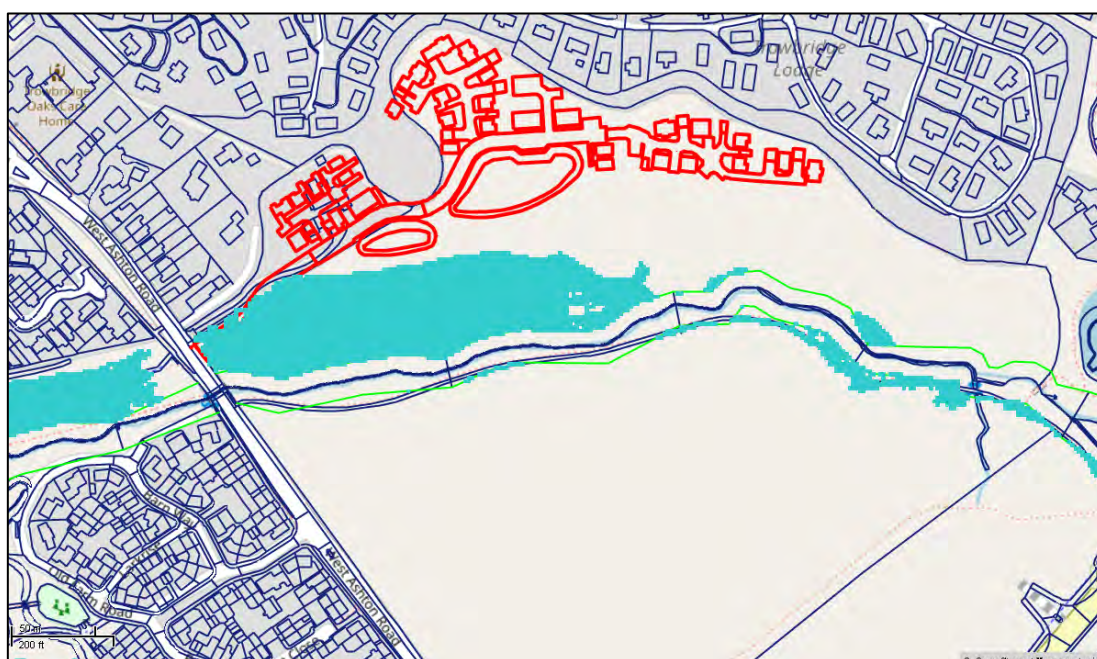


Figure 5.5: Extent of flooding from Blackball Brook for the 1:100-year + 26% climate change event (Post Development)

Sensitivity Analysis: Variation of Manning's 'n' by +20% and -20% (1:100-year return period + 26% climate change return period)

- 5.13 The sensitivity analysis shows that an increase in channel and floodplain roughness of +20% within the 1D model will, on average, increase flood depth within the channel. The location of the proposed residential dwellings is not impacted by the variation in Manning's 'n'.

Manning's 'n' -20%

- 5.14 Flood depths within the 1D section of the model are slightly reduced when compared with the 1:100-year + 26% climate change event. Table 5.3 indicates that peak flood levels within the channel are slightly lower with levels differences up to -274mm when compared to the 1:100-year + 26% event.

Manning's 'n' +20%

- 5.15 Flood depths within the 1D model are slightly increased when compared with the 1:100-year + 26% climate change event. Table 5.3 indicates that peak flood levels within the channel are slightly higher with levels differences up to +171mm when compared to the 1:100-year + 26% event.

Sensitivity Analysis: 50% Blockage of West Ashton Road Culvert (1:100-year return period + 26% climate change return period)

- 5.16 A 50% blockage has been modelled using a blockage unit in Flood Modeller. The blockage has been modelled to simulate debris, such as a fallen tree, blocking the flow of water beneath the Blackball Bridge.
- 5.17 Water depths within the channel adjacent to the site increase between 2mm at the furthest section from the blockage (BLACK0423) to 457mm immediately adjacent to the blockage (BLACK0977). The maximum 1D water level in proximity to the development extents is 38.066mAOD. No residential properties are located in the 1:100-year + 26% Climate Change floodplain during a 50% blockage scenario event. Refer to Figure 5.6 below.
- 5.18 The western extent of the access road at the site entrance would be located within floodplain, as will West Ashton Road immediately downstream of Blackball Bridge. During the blockage scenario, floodwaters would flow across the West Ashton Road and flow westwards towards the River Biss.



Figure 5.6: Extent of flooding from Blackball Brook for the 1:100-year + 26% climate change event with 50% blockage

Summary of Impact on Masterplan Layout

- 5.19 The modelled baseline results have been used to inform the masterplan layout to ensure that development does not encroach upon the 1:100 year + 26% modelled floodplain extents. The impacts of the modelling on the development layout can be summarised as follows:-
- The proposed built development area lies outside of functional floodplain;
 - Flooding affects the southernmost parts of the development site for all modelled events except the 1:30yr;
 - The location of residential dwellings is outside of the 1:100-year + 26% climate change design flood event;
 - The existing access at the location of the site entrance floods during the 1:100-year + 26% climate change design event. However, the affected extent of access will be raised out of floodplain and compensatory storage provided;
 - The Manning's 'n' sensitivity analysis demonstrates that the location of proposed residential dwellings will not be impacted by a '+' or '-' 20% variation in 'n' values; and
 - A 50% blockage of the culvert under Blackball Bridge results in flood flows over West Ashton Road and across the site access, as well as increased flood depths within the channel and floodplain. However, the location of proposed residential dwellings is not impacted by a 50% blockage of the Blackball Bridge culvert.

Model Accuracy

Mass Balance Error

- 5.20 The mass balance values in the 2D domain were within +/- 1% for all modelled scenarios. Therefore, the model is considered to be accurate.
- 5.21 The default settings have been used for all model runs with the exception of the 50% blockage which required an increase of the DFLood value from 3 to 8. Overall, the results from the sensitivity runs show a marginal difference in flood level, therefore the impact of these setting changes is considered insignificant to results. The proposed residential buildings remain in Flood Zone 1 during all sensitivity runs.

Convergence

- 5.22 The 2D model convergence for all runs is within tolerance and therefore the model is deemed suitably stable.

Error Messages and Warnings

- 5.23 Several error messages/warnings, including negative depth warnings, are present. They are primarily located in the 2D domain and are a result of the imported LIDAR data. They are remote from the development site and therefore unlikely to have significant impact on modelled results within the development site. All proposed residential dwellings are located in Flood Zone 1 according to modelled results.

Limitations

- 5.24 The sensitivity analysis has been run within the 1D model only.

6.0 CONCLUSIONS

- 6.1 This Study has been prepared by CE on behalf of Hills Homes Developments Ltd to describe hydraulic modelling work carried out as part of a fluvial flood risk study in respect of land at Uplands, West Ashton Road, Trowbridge.
- 6.2 The purpose of the Study has been to determine flood levels and the extent of fluvial flooding at the site associated with flooding of the Blackball Brook. Flows arising from a range of events, including the impact of climate change have been considered. The Study area is currently the subject of a residential development proposal.
- 6.3 The watercourse and surrounding floodplain within the study area has been surveyed in detail along with all online structures present, where accessible. This data has been used to build the hydraulic model.
- 6.4 Appropriate input hydrographs have been generated and have been input into the model as upstream boundary conditions.

Flood Mechanism

- 6.5 Possible mechanisms of flooding of the site have been identified as rainfall events causing peak flows to exceed the in-bank capacity of the channel and culvert beneath West Ashton Road and blockage of the culvert beneath West Ashton Road during peak rainfall events.

Modelled Scenarios

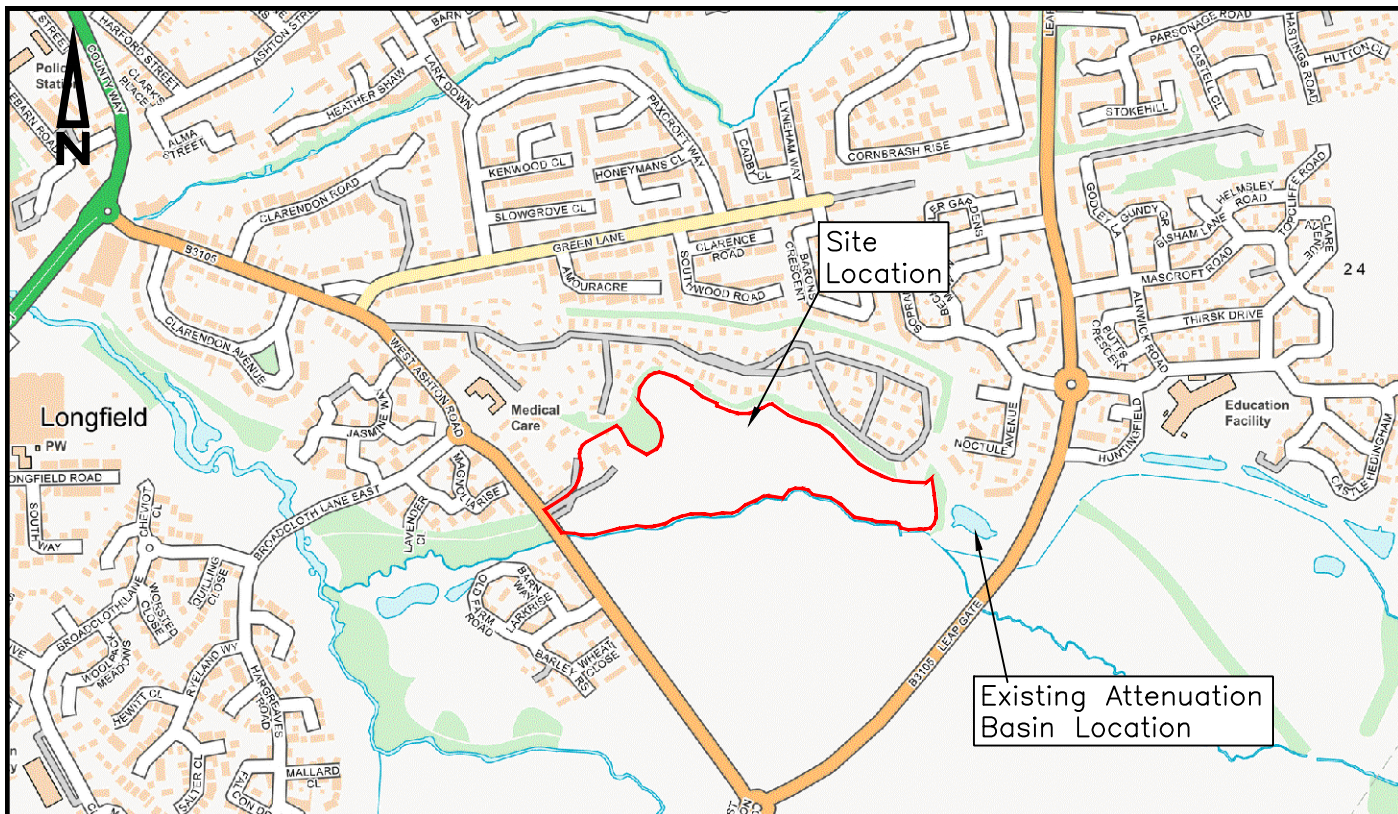
- 6.6 The modelled baseline results have been used to inform the masterplan layout to ensure that development does not encroach upon the 1:100 year + 26% modelled floodplain extents. The impacts of the modelling on the development layout can be summarised as follows:-
- The proposed built development area lies outside of functional floodplain;
 - Flooding affects the southernmost parts of the development site for all modelled events except the 1:30yr;
 - The location of residential dwellings is outside of the 1:100-year + 26% climate change design flood event;
 - The existing access at the location of the site entrance floods during the 1:100-year + 26% climate change design event. However, the affected extent of access will be raised out of floodplain and compensatory storage provided;
 - The Manning's 'n' sensitivity analysis demonstrates that the location of proposed residential dwellings will not be impacted by a '+' or '-' 20% variation in 'n' values; and

- A 50% blockage of the culvert under Blackball Bridge results in flood flows over West Ashton Road and across the site access, as well as increased flood depths within the channel and floodplain. However, the location of proposed residential dwellings is not impacted by a 50% blockage of the Blackball Bridge culvert.

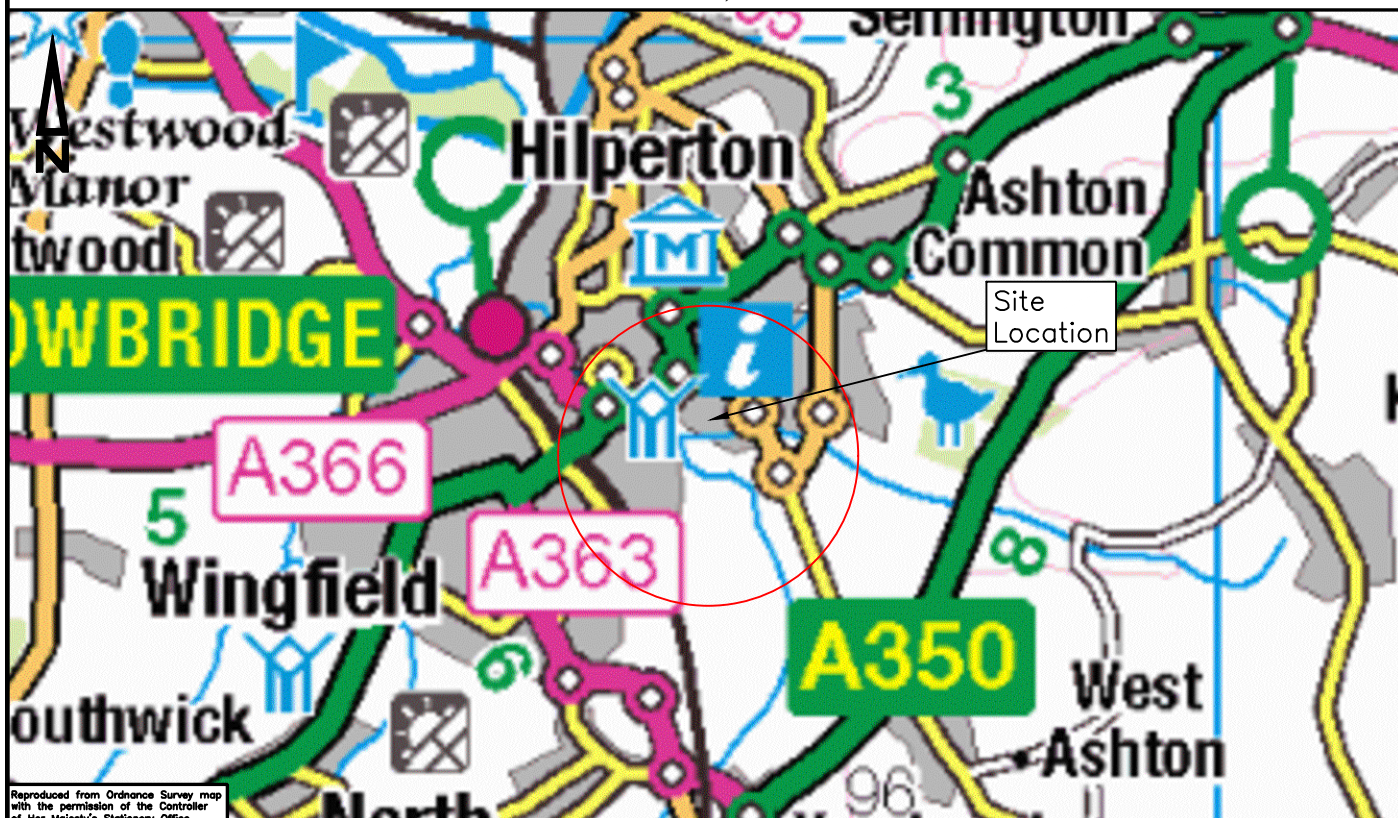
6.7 The results of this Study have been used to inform a *Flood Risk Assessment* which has been prepared to support a planning application for the development site.

Cole Easdon Consultants Limited
July 2026

Appendix 1



Scale: 1:10,000



Scale: 1:50,000

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Job Title:
Uplands,
West Ashton Road
Trowbridge,
BA14 6DW

Drawing Title:
Site Location Plan

A | JP | 30.06.26 | Update client details

Client:
Hills Homes Developments
Limited

Drawn By

BT

Checked By

NJ

Date Drawn

April 2026

Drawing No.

9740/500 Figure 1

Drawing Status:

CONSTRUCTION AT CLIENT AND/OR CONTRACTOR RISK	FOR COMMENT	
	FOR PLANNING	
	FOR TENDER	
	FOR APPROVAL	
	FOR CONSTRUCTION	
	AS BUILT	

Scale

As Shown (A4)

Revision

A

Appendix 2

ReFH2 Scaled to FEH Stats peaks

Hours	Trib01	Trib02	Trow01	TrowIA
0.0	0.027	0.100	0.149	0.009609
1.0	0.033	0.107	0.156	0.010088
2.0	0.060	0.144	0.199	0.012851
3.0	0.134	0.253	0.324	0.020963
4.0	0.284	0.507	0.617	0.039901
5.0	0.486	0.905	1.089	0.070454
6.0	0.639	1.356	1.642	0.106265
7.0	0.655	1.748	2.171	0.140499
8.0	0.573	1.933	2.532	0.163813
9.0	0.460	1.900	2.606	0.168595
10.0	0.351	1.744	2.484	0.160714
11.0	0.259	1.543	2.266	0.146652
12.0	0.186	1.363	2.025	0.13106
13.0	0.140	1.215	1.825	0.118068
14.0	0.116	1.082	1.659	0.107373
15.0	0.105	0.954	1.510	0.097677
16.0	0.100	0.830	1.363	0.088181
17.0	0.096	0.717	1.215	0.078607
18.0	0.093	0.636	1.071	0.069317
19.0	0.089	0.590	0.948	0.061349
20.0	0.086	0.565	0.868	0.056135
21.0	0.083	0.550	0.822	0.053174
22.0	0.080	0.539	0.795	0.051425
23.0	0.077	0.527	0.777	0.050248
24.0	0.074	0.516	0.760	0.049189
25.0	0.071	0.505	0.744	0.048152
26.0	0.069	0.495	0.728	0.047137
27.0	0.066	0.484	0.713	0.046144
28.0	0.064	0.474	0.698	0.045171
29.0	0.061	0.464	0.683	0.044219
30.0	0.059	0.454	0.669	0.043287
31.0	0.057	0.445	0.655	0.042375
32.0	0.055	0.435	0.641	0.041482
33.0	0.053	0.426	0.628	0.040607
34.0	0.051	0.417	0.614	0.039752
35.0	0.049	0.408	0.601	0.038914
36.0	0.047	0.400	0.589	0.038094
37.0	0.045	0.391	0.576	0.037291
38.0	0.044	0.383	0.564	0.036505
39.0	0.042	0.375	0.552	0.035735
40.0	0.041	0.367	0.541	0.034982
41.0	0.039	0.359	0.529	0.034245
42.0	0.038	0.352	0.518	0.033523
43.0	0.036	0.344	0.507	0.032816
44.0	0.035	0.337	0.496	0.032125
45.0	0.034	0.330	0.486	0.031448
46.0	0.032	0.323	0.476	0.030785
47.0	0.031	0.316	0.466	0.030136

48.0	0.030	0.309	0.456	0.029501
49.0	0.029	0.303	0.446	0.028879
50.0	0.028	0.296	0.437	0.02827
51.0	0.000	0.290	0.428	0.027675
52.0	0.000	0.284	0.419	0.027091
53.0	0.000	0.278	0.410	0.02652
54.0	0.000	0.272	0.401	0.025961
55.0	0.000	0.266	0.393	0.025414
56.0	0.000	0.261	0.384	0.024878
57.0	0.000	0.255	0.376	0.024354
58.0	0.000	0.250	0.368	0.023841
59.0	0.000	0.245	0.361	0.023338
60.0	0.000	0.239	0.353	0.022846
61.0	0.000	0.234	0.346	0.022365
62.0	0.000	0.229	0.338	0.021893
63.0	0.000	0.225	0.331	0.021432
64.0	0.000	0.220	0.324	0.02098
65.0	0.000	0.215	0.317	0.020538
66.0	0.000	0.211	0.311	0.020105
67.0	0.000	0.206	0.304	0.019681
68.0	0.000	0.202	0.298	0.019267
69.0	0.000	0.198	0.291	0.018861
70.0	0.000	0.193	0.285	0.018463
71.0	0.000	0.189	0.279	0.018074
72.0	0.000	0.185	0.273	0.017693
73.0	0.000	0.181	0.268	0.01732
74.0	0.000	0.178	0.262	0.016955
75.0	0.000	0.174	0.257	0.016598
76.0	0.000	0.170	0.251	0.016248
77.0	0.000	0.167	0.246	0.015905
78.0	0.000	0.163	0.241	0.01557
79.0	0.000	0.160	0.236	0.015242
80.0	0.000	0.156	0.231	0.014921
81.0	0.000	0.153	0.226	0.014606
82.0	0.000	0.150	0.221	0.014298
83.0	0.000	0.147	0.216	0.013997
84.0	0.000	0.143	0.212	0.013702
85.0	0.000	0.140	0.207	0.013413
86.0	0.000	0.137	0.203	0.01313
87.0	0.000	0.135	0.199	0.012854
88.0	0.000	0.132	0.194	0.012583
89.0	0.000	0.129	0.190	0.012318
90.0	0.000	0.126	0.186	0.012058
91.0	0.000	0.124	0.182	0.011804
92.0	0.000	0.121	0.179	0.011555
93.0	0.000	0.118	0.175	0.011312
94.0	0.000	0.116	0.171	0.011073
95.0	0.000	0.113	0.168	0.01084
96.0	0.000	0.111	0.164	0.010611
97.0	0.000	0.109	0.161	0.010388

98.0	0.000	0.106	0.157	0.010169
99.0	0.000	0.000	0.154	0.009954
100.0	0.000	0.000	0.151	0.009745
101.0	0.000	0.000	0.000	0
102.0	0.000	0.000	0.000	0
25.750	0.000	0.000	0.000	0
26.000	0.000	0.000	0.000	0
26.250	0.000	0.000	0.000	0
26.500	0.000	0.000	0.000	0
26.750	0.000	0.000	0.000	0
27.000	0.000	0.000	0.000	0
27.250	0.000	0.000	0.000	0
27.500	0.000	0.000	0.000	0
27.750	0.000	0.000	0.000	0
28.000	0.000	0.000	0.000	0
28.250	0.000	0.000	0.000	0
28.500	0.000	0.000	0.000	0
28.750	0.000	0.000	0.000	0
29.000	0.000	0.000	0.000	0
29.250	0.000	0.000	0.000	0
29.500	0.000	0.000	0.000	0
29.750	0.000	0.000	0.000	0
30.000	0.000	0.000	0.000	0
30.250	0.000	0.000	0.000	0
30.500	0.000	0.000	0.000	0
30.750	0.000	0.000	0.000	0
31.000	0.000	0.000	0.000	0
31.250	0.000	0.000	0.000	0
31.500	0.000	0.000	0.000	0
31.750	0.000	0.000	0.000	0
32.000	0.000	0.000	0.000	0
32.250	0.000	0.000	0.000	0
32.500	0.000	0.000	0.000	0
32.750	0.000	0.000	0.000	0
33.000	0.000	0.000	0.000	0
33.250	0.000	0.000	0.000	0
33.500	0.000	0.000	0.000	0
33.750	0.000	0.000	0.000	0
34.000	0.000	0.000	0.000	0
34.250	0.000	0.000	0.000	0
34.500	0.000	0.000	0.000	0
34.750	0.000	0.000	0.000	0
35.000	0.000	0.000	0.000	0
35.250	0.000	0.000	0.000	0
35.500	0.000	0.000	0.000	0
35.750	0.000	0.000	0.000	0
36.000	0.000	0.000	0.000	0
36.250	0.000	0.000	0.000	0
36.500	0.000	0.000	0.000	0
36.750	0.000	0.000	0.000	0

37.000	0.000	0.000	0.000	0
37.250	0.000	0.000	0.000	0
37.500	0.000	0.000	0.000	0
37.750	0.000	0.000	0.000	0
38.000	0.000	0.000	0.000	0
38.250	0.000	0.000	0.000	0
38.500	0.000	0.000	0.000	0
38.750	0.000	0.000	0.000	0
39.000	0.000	0.000	0.000	0
39.250	0.000	0.000	0.000	0
39.500	0.000	0.000	0.000	0
39.750	0.000	0.000	0.000	0
40.000	0.000	0.000	0.000	0
40.250	0.000	0.000	0.000	0
40.500	0.000	0.000	0.000	0
40.750	0.000	0.000	0.000	0
41.000	0.000	0.000	0.000	0
41.250	0.000	0.000	0.000	0
41.500	0.000	0.000	0.000	0
41.750	0.000	0.000	0.000	0
42.000	0.000	0.000	0.000	0
42.250	0.000	0.000	0.000	0
42.500	0.000	0.000	0.000	0
42.750	0.000	0.000	0.000	0
43.000	0.000	0.000	0.000	0
43.250	0.000	0.000	0.000	0
43.500	0.000	0.000	0.000	0
43.750	0.000	0.000	0.000	0
44.000	0.000	0.000	0.000	0
44.250	0.000	0.000	0.000	0
44.500	0.000	0.000	0.000	0
44.750	0.000	0.000	0.000	0
45.000	0.000	0.000	0.000	0
45.250	0.000	0.000	0.000	0
45.500	0.000	0.000	0.000	0
45.750	0.000	0.000	0.000	0
46.000	0.000	0.000	0.000	0
46.250	0.000	0.000	0.000	0
46.500	0.000	0.000	0.000	0
46.750	0.000	0.000	0.000	0
47.000	0.000	0.000	0.000	0
47.250	0.000	0.000	0.000	0
47.500	0.000	0.000	0.000	0
47.750	0.000	0.000	0.000	0
48.000	0.000	0.000	0.000	0
48.250	0.000	0.000	0.000	0
48.500	0.000	0.000	0.000	0

ReFH2 Scaled to FEH Stats peaks

Hours	Trib01	Trib02	Trow01	TrowIA
0.0	0.027	0.094	0.139	0.009021
1.0	0.034	0.103	0.149	0.009649
2.0	0.069	0.149	0.201	0.013031
3.0	0.164	0.282	0.355	0.022941
4.0	0.358	0.596	0.716	0.046311
5.0	0.624	1.095	1.304	0.084349
6.0	0.828	1.666	1.998	0.129253
7.0	0.850	2.167	2.666	0.172502
8.0	0.744	2.410	3.127	0.202325
9.0	0.595	2.375	3.228	0.208861
10.0	0.450	2.181	3.079	0.199233
11.0	0.328	1.927	2.807	0.181624
12.0	0.231	1.698	2.503	0.161955
13.0	0.170	1.511	2.249	0.14554
14.0	0.139	1.343	2.041	0.132065
15.0	0.125	1.182	1.853	0.119899
16.0	0.119	1.026	1.669	0.10802
17.0	0.114	0.883	1.484	0.096039
18.0	0.110	0.780	1.304	0.084387
19.0	0.106	0.722	1.149	0.074352
20.0	0.102	0.690	1.047	0.067766
21.0	0.098	0.671	0.990	0.064045
22.0	0.095	0.657	0.956	0.061883
23.0	0.091	0.643	0.934	0.060458
24.0	0.088	0.630	0.915	0.059184
25.0	0.085	0.616	0.895	0.057936
26.0	0.082	0.603	0.877	0.056715
27.0	0.079	0.591	0.858	0.05552
28.0	0.076	0.578	0.840	0.05435
29.0	0.073	0.566	0.822	0.053204
30.0	0.070	0.554	0.805	0.052083
31.0	0.068	0.542	0.788	0.050985
32.0	0.065	0.531	0.771	0.04991
33.0	0.063	0.520	0.755	0.048858
34.0	0.060	0.509	0.739	0.047829
35.0	0.058	0.498	0.724	0.046821
36.0	0.056	0.487	0.708	0.045834
37.0	0.054	0.477	0.693	0.044868
38.0	0.052	0.467	0.679	0.043922
39.0	0.050	0.457	0.664	0.042996
40.0	0.048	0.448	0.650	0.04209
41.0	0.046	0.438	0.637	0.041203
42.0	0.045	0.429	0.623	0.040335
43.0	0.043	0.420	0.610	0.039484
44.0	0.041	0.411	0.597	0.038652
45.0	0.040	0.402	0.585	0.037838
46.0	0.038	0.394	0.572	0.03704
47.0	0.037	0.385	0.560	0.036259

48.0	0.036	0.377	0.549	0.035495
49.0	0.034	0.369	0.537	0.034747
50.0	0.033	0.362	0.526	0.034015
51.0	0.032	0.354	0.515	0.033298
52.0	0.031	0.346	0.504	0.032596
53.0	0.030	0.339	0.493	0.031909
54.0	0.028	0.332	0.483	0.031236
55.0	0.027	0.325	0.473	0.030578
56.0	0.000	0.318	0.463	0.029934
57.0	0.000	0.311	0.453	0.029303
58.0	0.000	0.305	0.443	0.028685
59.0	0.000	0.298	0.434	0.02808
60.0	0.000	0.292	0.425	0.027489
61.0	0.000	0.286	0.416	0.026909
62.0	0.000	0.280	0.407	0.026342
63.0	0.000	0.274	0.399	0.025787
64.0	0.000	0.268	0.390	0.025243
65.0	0.000	0.262	0.382	0.024711
66.0	0.000	0.257	0.374	0.02419
67.0	0.000	0.252	0.366	0.023681
68.0	0.000	0.246	0.358	0.023181
69.0	0.000	0.241	0.351	0.022693
70.0	0.000	0.236	0.343	0.022215
71.0	0.000	0.231	0.336	0.021746
72.0	0.000	0.226	0.329	0.021288
73.0	0.000	0.221	0.322	0.020839
74.0	0.000	0.217	0.315	0.0204
75.0	0.000	0.212	0.309	0.01997
76.0	0.000	0.208	0.302	0.019549
77.0	0.000	0.203	0.296	0.019137
78.0	0.000	0.199	0.290	0.018734
79.0	0.000	0.195	0.283	0.018339
80.0	0.000	0.191	0.277	0.017952
81.0	0.000	0.187	0.272	0.017574
82.0	0.000	0.183	0.266	0.017204
83.0	0.000	0.179	0.260	0.016841
84.0	0.000	0.175	0.255	0.016486
85.0	0.000	0.171	0.249	0.016139
86.0	0.000	0.168	0.244	0.015798
87.0	0.000	0.164	0.239	0.015465
88.0	0.000	0.161	0.234	0.01514
89.0	0.000	0.157	0.229	0.01482
90.0	0.000	0.154	0.224	0.014508
91.0	0.000	0.151	0.219	0.014202
92.0	0.000	0.148	0.215	0.013903
93.0	0.000	0.144	0.210	0.01361
94.0	0.000	0.141	0.206	0.013323
95.0	0.000	0.138	0.202	0.013042
96.0	0.000	0.135	0.197	0.012767
97.0	0.000	0.133	0.193	0.012498

98.0	0.000	0.130	0.189	0.012235
99.0	0.000	0.000	0.185	0.011977
100.0	0.000	0.000	0.181	0.011725
101.0	0.000	0.000	0.177	0.011477
102.0	0.000	0.000	0.174	0.011236
103.0	0.000	0.000	0.170	0.010999
104.0	0.000	0.000	0.166	0.010767
105.0	0.000	0.000	0.163	0.01054
106.0	0.000	0.000	0.159	0.010318
107.0	0.000	0.000	0.156	0.0101
108.0	0.000	0.000	0.153	0.009887
109.0	0.000	0.000	0.150	0.009679
110.0	0.000	0.000	0.146	0.009475
111.0	0.000	0.000	0.143	0.009275
112.0	0.000	0.000	0.140	0.00908
113.0	0.000	0.000	0.000	0
114.0	0.000	0.000	0.000	0
28.750	0.000	0.000	0.000	0
29.000	0.000	0.000	0.000	0
29.250	0.000	0.000	0.000	0
29.500	0.000	0.000	0.000	0
29.750	0.000	0.000	0.000	0
30.000	0.000	0.000	0.000	0
30.250	0.000	0.000	0.000	0
30.500	0.000	0.000	0.000	0
30.750	0.000	0.000	0.000	0
31.000	0.000	0.000	0.000	0
31.250	0.000	0.000	0.000	0
31.500	0.000	0.000	0.000	0
31.750	0.000	0.000	0.000	0
32.000	0.000	0.000	0.000	0
32.250	0.000	0.000	0.000	0
32.500	0.000	0.000	0.000	0
32.750	0.000	0.000	0.000	0
33.000	0.000	0.000	0.000	0
33.250	0.000	0.000	0.000	0
33.500	0.000	0.000	0.000	0
33.750	0.000	0.000	0.000	0
34.000	0.000	0.000	0.000	0
34.250	0.000	0.000	0.000	0
34.500	0.000	0.000	0.000	0
34.750	0.000	0.000	0.000	0
35.000	0.000	0.000	0.000	0
35.250	0.000	0.000	0.000	0
35.500	0.000	0.000	0.000	0
35.750	0.000	0.000	0.000	0
36.000	0.000	0.000	0.000	0
36.250	0.000	0.000	0.000	0
36.500	0.000	0.000	0.000	0
36.750	0.000	0.000	0.000	0

37.000	0.000	0.000	0.000	0
37.250	0.000	0.000	0.000	0
37.500	0.000	0.000	0.000	0
37.750	0.000	0.000	0.000	0
38.000	0.000	0.000	0.000	0
38.250	0.000	0.000	0.000	0
38.500	0.000	0.000	0.000	0
38.750	0.000	0.000	0.000	0
39.000	0.000	0.000	0.000	0
39.250	0.000	0.000	0.000	0
39.500	0.000	0.000	0.000	0
39.750	0.000	0.000	0.000	0
40.000	0.000	0.000	0.000	0
40.250	0.000	0.000	0.000	0
40.500	0.000	0.000	0.000	0
40.750	0.000	0.000	0.000	0
41.000	0.000	0.000	0.000	0
41.250	0.000	0.000	0.000	0
41.500	0.000	0.000	0.000	0
41.750	0.000	0.000	0.000	0
42.000	0.000	0.000	0.000	0
42.250	0.000	0.000	0.000	0
42.500	0.000	0.000	0.000	0
42.750	0.000	0.000	0.000	0
43.000	0.000	0.000	0.000	0
43.250	0.000	0.000	0.000	0
43.500	0.000	0.000	0.000	0
43.750	0.000	0.000	0.000	0
44.000	0.000	0.000	0.000	0
44.250	0.000	0.000	0.000	0
44.500	0.000	0.000	0.000	0
44.750	0.000	0.000	0.000	0
45.000	0.000	0.000	0.000	0
45.250	0.000	0.000	0.000	0
45.500	0.000	0.000	0.000	0
45.750	0.000	0.000	0.000	0
46.000	0.000	0.000	0.000	0
46.250	0.000	0.000	0.000	0
46.500	0.000	0.000	0.000	0
46.750	0.000	0.000	0.000	0
47.000	0.000	0.000	0.000	0
47.250	0.000	0.000	0.000	0
47.500	0.000	0.000	0.000	0
47.750	0.000	0.000	0.000	0
48.000	0.000	0.000	0.000	0
48.250	0.000	0.000	0.000	0
48.500	0.000	0.000	0.000	0

ReFH2 Scaled to FEH Stats peaks

Hours	Trib01	Trib02	Trow01	TrowIA
0.0	0.034	0.118	0.176	0.011367
1.0	0.043	0.130	0.188	0.012157
2.0	0.087	0.187	0.254	0.016419
3.0	0.207	0.355	0.447	0.028906
4.0	0.452	0.751	0.902	0.058352
5.0	0.786	1.380	1.642	0.106279
6.0	1.043	2.099	2.517	0.162859
7.0	1.072	2.731	3.359	0.217352
8.0	0.937	3.036	3.940	0.25493
9.0	0.749	2.992	4.067	0.263165
10.0	0.567	2.748	3.880	0.251034
11.0	0.413	2.428	3.537	0.228846
12.0	0.292	2.139	3.154	0.204064
13.0	0.215	1.903	2.834	0.18338
14.0	0.176	1.692	2.572	0.166402
15.0	0.158	1.490	2.335	0.151073
16.0	0.150	1.292	2.103	0.136105
17.0	0.144	1.113	1.870	0.121009
18.0	0.139	0.983	1.643	0.106327
19.0	0.134	0.909	1.448	0.093683
20.0	0.129	0.869	1.320	0.085385
21.0	0.124	0.846	1.247	0.080697
22.0	0.119	0.828	1.205	0.077973
23.0	0.115	0.811	1.177	0.076177
24.0	0.111	0.794	1.152	0.074572
25.0	0.107	0.777	1.128	0.073
26.0	0.103	0.760	1.104	0.071461
27.0	0.099	0.744	1.081	0.069955
28.0	0.095	0.729	1.058	0.068481
29.0	0.092	0.713	1.036	0.067037
30.0	0.088	0.698	1.014	0.065624
31.0	0.085	0.683	0.993	0.064241
32.0	0.082	0.669	0.972	0.062887
33.0	0.079	0.655	0.951	0.061562
34.0	0.076	0.641	0.931	0.060264
35.0	0.073	0.627	0.912	0.058994
36.0	0.071	0.614	0.893	0.057751
37.0	0.068	0.601	0.874	0.056533
38.0	0.065	0.589	0.855	0.055342
39.0	0.063	0.576	0.837	0.054175
40.0	0.061	0.564	0.820	0.053034
41.0	0.058	0.552	0.802	0.051916
42.0	0.056	0.540	0.785	0.050822
43.0	0.054	0.529	0.769	0.04975
44.0	0.052	0.518	0.753	0.048702
45.0	0.050	0.507	0.737	0.047675
46.0	0.048	0.496	0.721	0.04667
47.0	0.047	0.486	0.706	0.045687

48.0	0.045	0.475	0.691	0.044724
49.0	0.043	0.465	0.677	0.043781
50.0	0.042	0.456	0.662	0.042858
51.0	0.040	0.446	0.648	0.041955
52.0	0.039	0.437	0.635	0.041071
53.0	0.037	0.427	0.621	0.040205
54.0	0.036	0.418	0.608	0.039358
55.0	0.035	0.409	0.595	0.038528
56.0	0.000	0.401	0.583	0.037716
57.0	0.000	0.392	0.571	0.036921
58.0	0.000	0.384	0.559	0.036143
59.0	0.000	0.376	0.547	0.035381
60.0	0.000	0.368	0.535	0.034636
61.0	0.000	0.360	0.524	0.033906
62.0	0.000	0.353	0.513	0.033191
63.0	0.000	0.345	0.502	0.032491
64.0	0.000	0.338	0.492	0.031807
65.0	0.000	0.331	0.481	0.031136
66.0	0.000	0.324	0.471	0.03048
67.0	0.000	0.317	0.461	0.029838
68.0	0.000	0.310	0.451	0.029209
69.0	0.000	0.304	0.442	0.028593
70.0	0.000	0.297	0.433	0.02799
71.0	0.000	0.291	0.423	0.0274
72.0	0.000	0.285	0.415	0.026823
73.0	0.000	0.279	0.406	0.026258
74.0	0.000	0.273	0.397	0.025704
75.0	0.000	0.267	0.389	0.025162
76.0	0.000	0.262	0.381	0.024632
77.0	0.000	0.256	0.373	0.024113
78.0	0.000	0.251	0.365	0.023605
79.0	0.000	0.245	0.357	0.023107
80.0	0.000	0.240	0.350	0.02262
81.0	0.000	0.235	0.342	0.022143
82.0	0.000	0.230	0.335	0.021677
83.0	0.000	0.225	0.328	0.02122
84.0	0.000	0.220	0.321	0.020772
85.0	0.000	0.216	0.314	0.020335
86.0	0.000	0.211	0.308	0.019906
87.0	0.000	0.207	0.301	0.019487
88.0	0.000	0.202	0.295	0.019076
89.0	0.000	0.198	0.289	0.018674
90.0	0.000	0.194	0.283	0.01828
91.0	0.000	0.190	0.277	0.017895
92.0	0.000	0.186	0.271	0.017518
93.0	0.000	0.182	0.265	0.017148
94.0	0.000	0.178	0.259	0.016787
95.0	0.000	0.174	0.254	0.016433
96.0	0.000	0.171	0.249	0.016087
97.0	0.000	0.167	0.243	0.015748

98.0	0.000	0.164	0.238	0.015416
99.0	0.000	0.000	0.233	0.015091
100.0	0.000	0.000	0.228	0.014773
101.0	0.000	0.000	0.223	0.014462
102.0	0.000	0.000	0.219	0.014157
103.0	0.000	0.000	0.214	0.013858
104.0	0.000	0.000	0.210	0.013566
105.0	0.000	0.000	0.205	0.01328
106.0	0.000	0.000	0.201	0.013
107.0	0.000	0.000	0.197	0.012726
108.0	0.000	0.000	0.193	0.012458
109.0	0.000	0.000	0.188	0.012196
110.0	0.000	0.000	0.185	0.011939
111.0	0.000	0.000	0.181	0.011687
112.0	0.000	0.000	0.177	0.011441
113.0	0.000	0.000	0.000	0
114.0	0.000	0.000	0.000	0
28.750	0.000	0.000	0.000	0
29.000	0.000	0.000	0.000	0
29.250	0.000	0.000	0.000	0
29.500	0.000	0.000	0.000	0
29.750	0.000	0.000	0.000	0
30.000	0.000	0.000	0.000	0
30.250	0.000	0.000	0.000	0
30.500	0.000	0.000	0.000	0
30.750	0.000	0.000	0.000	0
31.000	0.000	0.000	0.000	0
31.250	0.000	0.000	0.000	0
31.500	0.000	0.000	0.000	0
31.750	0.000	0.000	0.000	0
32.000	0.000	0.000	0.000	0
32.250	0.000	0.000	0.000	0
32.500	0.000	0.000	0.000	0
32.750	0.000	0.000	0.000	0
33.000	0.000	0.000	0.000	0
33.250	0.000	0.000	0.000	0
33.500	0.000	0.000	0.000	0
33.750	0.000	0.000	0.000	0
34.000	0.000	0.000	0.000	0
34.250	0.000	0.000	0.000	0
34.500	0.000	0.000	0.000	0
34.750	0.000	0.000	0.000	0
35.000	0.000	0.000	0.000	0
35.250	0.000	0.000	0.000	0
35.500	0.000	0.000	0.000	0
35.750	0.000	0.000	0.000	0
36.000	0.000	0.000	0.000	0
36.250	0.000	0.000	0.000	0
36.500	0.000	0.000	0.000	0
36.750	0.000	0.000	0.000	0

37.000	0.000	0.000	0.000	0
37.250	0.000	0.000	0.000	0
37.500	0.000	0.000	0.000	0
37.750	0.000	0.000	0.000	0
38.000	0.000	0.000	0.000	0
38.250	0.000	0.000	0.000	0
38.500	0.000	0.000	0.000	0
38.750	0.000	0.000	0.000	0
39.000	0.000	0.000	0.000	0
39.250	0.000	0.000	0.000	0
39.500	0.000	0.000	0.000	0
39.750	0.000	0.000	0.000	0
40.000	0.000	0.000	0.000	0
40.250	0.000	0.000	0.000	0
40.500	0.000	0.000	0.000	0
40.750	0.000	0.000	0.000	0
41.000	0.000	0.000	0.000	0
41.250	0.000	0.000	0.000	0
41.500	0.000	0.000	0.000	0
41.750	0.000	0.000	0.000	0
42.000	0.000	0.000	0.000	0
42.250	0.000	0.000	0.000	0
42.500	0.000	0.000	0.000	0
42.750	0.000	0.000	0.000	0
43.000	0.000	0.000	0.000	0
43.250	0.000	0.000	0.000	0
43.500	0.000	0.000	0.000	0
43.750	0.000	0.000	0.000	0
44.000	0.000	0.000	0.000	0
44.250	0.000	0.000	0.000	0
44.500	0.000	0.000	0.000	0
44.750	0.000	0.000	0.000	0
45.000	0.000	0.000	0.000	0
45.250	0.000	0.000	0.000	0
45.500	0.000	0.000	0.000	0
45.750	0.000	0.000	0.000	0
46.000	0.000	0.000	0.000	0
46.250	0.000	0.000	0.000	0
46.500	0.000	0.000	0.000	0
46.750	0.000	0.000	0.000	0
47.000	0.000	0.000	0.000	0
47.250	0.000	0.000	0.000	0
47.500	0.000	0.000	0.000	0
47.750	0.000	0.000	0.000	0
48.000	0.000	0.000	0.000	0
48.250	0.000	0.000	0.000	0
48.500	0.000	0.000	0.000	0

ReFH2 Scaled to FEH Stats peaks

Hours	Trib01	Trib02	Trow01	TrowIA
0.0	0.037	0.131	0.194	0.012539
1.0	0.047	0.143	0.149	0.009649
2.0	0.096	0.207	0.201	0.013031
3.0	0.228	0.392	0.355	0.022941
4.0	0.498	0.829	0.716	0.046311
5.0	0.867	1.522	1.304	0.084349
6.0	1.151	2.316	1.998	0.129253
7.0	1.182	3.012	2.666	0.172502
8.0	1.034	3.350	3.127	0.202325
9.0	0.827	3.301	3.228	0.208861
10.0	0.625	3.031	3.079	0.199233
11.0	0.456	2.678	2.807	0.181624
12.0	0.322	2.360	2.503	0.161955
13.0	0.237	2.100	2.249	0.14554
14.0	0.194	1.866	2.041	0.132065
15.0	0.174	1.643	1.853	0.119899
16.0	0.165	1.426	1.669	0.10802
17.0	0.159	1.228	1.484	0.096039
18.0	0.153	1.084	1.304	0.084387
19.0	0.147	1.003	1.149	0.074352
20.0	0.142	0.959	1.047	0.067766
21.0	0.137	0.933	0.990	0.064045
22.0	0.132	0.914	0.956	0.061883
23.0	0.127	0.894	0.934	0.060458
24.0	0.122	0.875	0.915	0.059184
25.0	0.118	0.857	0.895	0.057936
26.0	0.113	0.839	0.877	0.056715
27.0	0.109	0.821	0.858	0.05552
28.0	0.105	0.804	0.840	0.05435
29.0	0.101	0.787	0.822	0.053204
30.0	0.098	0.770	0.805	0.052083
31.0	0.094	0.754	0.788	0.050985
32.0	0.090	0.738	0.771	0.04991
33.0	0.087	0.722	0.755	0.048858
34.0	0.084	0.707	0.739	0.047829
35.0	0.081	0.692	0.724	0.046821
36.0	0.078	0.678	0.708	0.045834
37.0	0.075	0.663	0.693	0.044868
38.0	0.072	0.649	0.679	0.043922
39.0	0.070	0.636	0.664	0.042996
40.0	0.067	0.622	0.650	0.04209
41.0	0.065	0.609	0.637	0.041203
42.0	0.062	0.596	0.623	0.040335
43.0	0.060	0.584	0.610	0.039484
44.0	0.058	0.571	0.597	0.038652
45.0	0.056	0.559	0.585	0.037838
46.0	0.053	0.547	0.572	0.03704
47.0	0.051	0.536	0.560	0.036259

48.0	0.050	0.524	0.549	0.035495
49.0	0.048	0.513	0.537	0.034747
50.0	0.046	0.503	0.526	0.034015
51.0	0.044	0.492	0.515	0.033298
52.0	0.043	0.482	0.504	0.032596
53.0	0.041	0.471	0.493	0.031909
54.0	0.040	0.461	0.483	0.031236
55.0	0.038	0.452	0.473	0.030578
56.0	0.000	0.442	0.463	0.029934
57.0	0.000	0.433	0.453	0.029303
58.0	0.000	0.424	0.443	0.028685
59.0	0.000	0.415	0.434	0.02808
60.0	0.000	0.406	0.425	0.027489
61.0	0.000	0.397	0.416	0.026909
62.0	0.000	0.389	0.407	0.026342
63.0	0.000	0.381	0.399	0.025787
64.0	0.000	0.373	0.390	0.025243
65.0	0.000	0.365	0.382	0.024711
66.0	0.000	0.357	0.374	0.02419
67.0	0.000	0.350	0.366	0.023681
68.0	0.000	0.342	0.358	0.023181
69.0	0.000	0.335	0.351	0.022693
70.0	0.000	0.328	0.343	0.022215
71.0	0.000	0.321	0.336	0.021746
72.0	0.000	0.314	0.329	0.021288
73.0	0.000	0.308	0.322	0.020839
74.0	0.000	0.301	0.315	0.0204
75.0	0.000	0.295	0.309	0.01997
76.0	0.000	0.289	0.302	0.019549
77.0	0.000	0.282	0.296	0.019137
78.0	0.000	0.276	0.290	0.018734
79.0	0.000	0.271	0.283	0.018339
80.0	0.000	0.265	0.277	0.017952
81.0	0.000	0.259	0.272	0.017574
82.0	0.000	0.254	0.266	0.017204
83.0	0.000	0.248	0.260	0.016841
84.0	0.000	0.243	0.255	0.016486
85.0	0.000	0.238	0.249	0.016139
86.0	0.000	0.233	0.244	0.015798
87.0	0.000	0.228	0.239	0.015465
88.0	0.000	0.223	0.234	0.01514
89.0	0.000	0.219	0.229	0.01482
90.0	0.000	0.214	0.224	0.014508
91.0	0.000	0.209	0.219	0.014202
92.0	0.000	0.205	0.215	0.013903
93.0	0.000	0.201	0.210	0.01361
94.0	0.000	0.196	0.206	0.013323
95.0	0.000	0.192	0.202	0.013042
96.0	0.000	0.188	0.197	0.012767
97.0	0.000	0.184	0.193	0.012498

98.0	0.000	0.180	0.189	0.012235
99.0	0.000	0.000	0.185	0.011977
100.0	0.000	0.000	0.181	0.011725
101.0	0.000	0.000	0.177	0.011477
102.0	0.000	0.000	0.174	0.011236
103.0	0.000	0.000	0.170	0.010999
104.0	0.000	0.000	0.166	0.010767
105.0	0.000	0.000	0.163	0.01054
106.0	0.000	0.000	0.159	0.010318
107.0	0.000	0.000	0.156	0.0101
108.0	0.000	0.000	0.153	0.009887
109.0	0.000	0.000	0.150	0.009679
110.0	0.000	0.000	0.146	0.009475
111.0	0.000	0.000	0.143	0.009275
112.0	0.000	0.000	0.140	0.00908
113.0	0.000	0.000	0.000	0
114.0	0.000	0.000	0.000	0
28.750	0.000	0.000	0.000	0
29.000	0.000	0.000	0.000	0
29.250	0.000	0.000	0.000	0
29.500	0.000	0.000	0.000	0
29.750	0.000	0.000	0.000	0
30.000	0.000	0.000	0.000	0
30.250	0.000	0.000	0.000	0
30.500	0.000	0.000	0.000	0
30.750	0.000	0.000	0.000	0
31.000	0.000	0.000	0.000	0
31.250	0.000	0.000	0.000	0
31.500	0.000	0.000	0.000	0
31.750	0.000	0.000	0.000	0
32.000	0.000	0.000	0.000	0
32.250	0.000	0.000	0.000	0
32.500	0.000	0.000	0.000	0
32.750	0.000	0.000	0.000	0
33.000	0.000	0.000	0.000	0
33.250	0.000	0.000	0.000	0
33.500	0.000	0.000	0.000	0
33.750	0.000	0.000	0.000	0
34.000	0.000	0.000	0.000	0
34.250	0.000	0.000	0.000	0
34.500	0.000	0.000	0.000	0
34.750	0.000	0.000	0.000	0
35.000	0.000	0.000	0.000	0
35.250	0.000	0.000	0.000	0
35.500	0.000	0.000	0.000	0
35.750	0.000	0.000	0.000	0
36.000	0.000	0.000	0.000	0
36.250	0.000	0.000	0.000	0
36.500	0.000	0.000	0.000	0
36.750	0.000	0.000	0.000	0

37.000	0.000	0.000	0.000	0
37.250	0.000	0.000	0.000	0
37.500	0.000	0.000	0.000	0
37.750	0.000	0.000	0.000	0
38.000	0.000	0.000	0.000	0
38.250	0.000	0.000	0.000	0
38.500	0.000	0.000	0.000	0
38.750	0.000	0.000	0.000	0
39.000	0.000	0.000	0.000	0
39.250	0.000	0.000	0.000	0
39.500	0.000	0.000	0.000	0
39.750	0.000	0.000	0.000	0
40.000	0.000	0.000	0.000	0
40.250	0.000	0.000	0.000	0
40.500	0.000	0.000	0.000	0
40.750	0.000	0.000	0.000	0
41.000	0.000	0.000	0.000	0
41.250	0.000	0.000	0.000	0
41.500	0.000	0.000	0.000	0
41.750	0.000	0.000	0.000	0
42.000	0.000	0.000	0.000	0
42.250	0.000	0.000	0.000	0
42.500	0.000	0.000	0.000	0
42.750	0.000	0.000	0.000	0
43.000	0.000	0.000	0.000	0
43.250	0.000	0.000	0.000	0
43.500	0.000	0.000	0.000	0
43.750	0.000	0.000	0.000	0
44.000	0.000	0.000	0.000	0
44.250	0.000	0.000	0.000	0
44.500	0.000	0.000	0.000	0
44.750	0.000	0.000	0.000	0
45.000	0.000	0.000	0.000	0
45.250	0.000	0.000	0.000	0
45.500	0.000	0.000	0.000	0
45.750	0.000	0.000	0.000	0
46.000	0.000	0.000	0.000	0
46.250	0.000	0.000	0.000	0
46.500	0.000	0.000	0.000	0
46.750	0.000	0.000	0.000	0
47.000	0.000	0.000	0.000	0
47.250	0.000	0.000	0.000	0
47.500	0.000	0.000	0.000	0
47.750	0.000	0.000	0.000	0
48.000	0.000	0.000	0.000	0
48.250	0.000	0.000	0.000	0
48.500	0.000	0.000	0.000	0

ReFH2 Scaled to FEH Stats peaks

Hours	Trib01	Trib02	Trow01	TrowIA
0.0	0.027	0.094	0.139	0.009021
1.0	0.039	0.109	0.157	0.010139
2.0	0.095	0.185	0.243	0.01572
3.0	0.250	0.407	0.498	0.032215
4.0	0.575	0.948	1.117	0.072267
5.0	1.031	1.830	2.147	0.138934
6.0	1.393	2.860	3.385	0.219001
7.0	1.442	3.788	4.597	0.297449
8.0	1.259	4.262	5.456	0.353045
9.0	0.997	4.225	5.670	0.366852
10.0	0.741	3.886	5.419	0.350621
11.0	0.527	3.427	4.933	0.31918
12.0	0.358	3.010	4.381	0.283484
13.0	0.250	2.670	3.919	0.25357
14.0	0.196	2.367	3.541	0.229154
15.0	0.172	2.080	3.204	0.207315
16.0	0.162	1.798	2.877	0.186135
17.0	0.156	1.539	2.546	0.164764
18.0	0.150	1.349	2.223	0.143866
19.0	0.145	1.240	1.942	0.125689
20.0	0.140	1.183	1.756	0.113653
21.0	0.134	1.150	1.652	0.106905
22.0	0.129	1.126	1.593	0.103099
23.0	0.125	1.102	1.556	0.100694
24.0	0.120	1.079	1.523	0.098572
25.0	0.116	1.056	1.491	0.096494
26.0	0.111	1.034	1.460	0.094461
27.0	0.107	1.012	1.429	0.09247
28.0	0.103	0.991	1.399	0.090521
29.0	0.100	0.970	1.369	0.088613
30.0	0.096	0.949	1.341	0.086745
31.0	0.092	0.929	1.312	0.084917
32.0	0.089	0.909	1.285	0.083127
33.0	0.086	0.890	1.258	0.081375
34.0	0.082	0.871	1.231	0.07966
35.0	0.079	0.853	1.205	0.077981
36.0	0.077	0.835	1.180	0.076337
37.0	0.074	0.817	1.155	0.074728
38.0	0.071	0.800	1.131	0.073153
39.0	0.068	0.783	1.107	0.071611
40.0	0.066	0.767	1.083	0.070102
41.0	0.063	0.751	1.061	0.068625
42.0	0.061	0.735	1.038	0.067178
43.0	0.059	0.719	1.016	0.065762
44.0	0.057	0.704	0.995	0.064376
45.0	0.055	0.689	0.974	0.063019
46.0	0.053	0.675	0.953	0.061691
47.0	0.051	0.660	0.933	0.060391

48.0	0.049	0.646	0.914	0.059118
49.0	0.047	0.633	0.894	0.057872
50.0	0.045	0.619	0.876	0.056652
51.0	0.044	0.606	0.857	0.055458
52.0	0.042	0.593	0.839	0.054289
53.0	0.040	0.581	0.821	0.053145
54.0	0.039	0.569	0.804	0.052025
55.0	0.037	0.557	0.787	0.050928
56.0	0.036	0.545	0.770	0.049855
57.0	0.035	0.533	0.754	0.048804
58.0	0.033	0.522	0.738	0.047776
59.0	0.032	0.511	0.723	0.046769
60.0	0.031	0.500	0.708	0.045783
61.0	0.030	0.490	0.693	0.044818
62.0	0.029	0.479	0.678	0.043873
63.0	0.028	0.469	0.664	0.042949
64.0	0.000	0.459	0.650	0.042043
65.0	0.000	0.450	0.636	0.041157
66.0	0.000	0.440	0.623	0.04029
67.0	0.000	0.431	0.610	0.039441
68.0	0.000	0.422	0.597	0.038609
69.0	0.000	0.413	0.584	0.037796
70.0	0.000	0.404	0.572	0.036999
71.0	0.000	0.396	0.560	0.036219
72.0	0.000	0.387	0.548	0.035456
73.0	0.000	0.379	0.536	0.034708
74.0	0.000	0.371	0.525	0.033977
75.0	0.000	0.363	0.514	0.033261
76.0	0.000	0.356	0.503	0.03256
77.0	0.000	0.348	0.493	0.031873
78.0	0.000	0.341	0.482	0.031202
79.0	0.000	0.334	0.472	0.030544
80.0	0.000	0.326	0.462	0.0299
81.0	0.000	0.320	0.452	0.02927
82.0	0.000	0.313	0.443	0.028653
83.0	0.000	0.306	0.433	0.028049
84.0	0.000	0.300	0.424	0.027458
85.0	0.000	0.293	0.415	0.026879
86.0	0.000	0.287	0.407	0.026313
87.0	0.000	0.281	0.398	0.025758
88.0	0.000	0.275	0.390	0.025215
89.0	0.000	0.269	0.381	0.024684
90.0	0.000	0.264	0.373	0.024164
91.0	0.000	0.258	0.366	0.023654
92.0	0.000	0.253	0.358	0.023156
93.0	0.000	0.247	0.350	0.022668
94.0	0.000	0.242	0.343	0.02219
95.0	0.000	0.237	0.336	0.021722
96.0	0.000	0.232	0.329	0.021264
97.0	0.000	0.227	0.322	0.020816

98.0	0.000	0.222	0.315	0.020377
99.0	0.000	0.000	0.308	0.019948
100.0	0.000	0.000	0.302	0.019527
101.0	0.000	0.000	0.295	0.019116
102.0	0.000	0.000	0.289	0.018713
103.0	0.000	0.000	0.283	0.018319
104.0	0.000	0.000	0.277	0.017933
105.0	0.000	0.000	0.271	0.017555
106.0	0.000	0.000	0.266	0.017185
107.0	0.000	0.000	0.260	0.016822
108.0	0.000	0.000	0.255	0.016468
109.0	0.000	0.000	0.249	0.016121
110.0	0.000	0.000	0.244	0.015781
111.0	0.000	0.000	0.239	0.015448
112.0	0.000	0.000	0.234	0.015123
113.0	0.000	0.000	0.000	0
114.0	0.000	0.000	0.000	0
28.750	0.000	0.000	0.000	0
29.000	0.000	0.000	0.000	0
29.250	0.000	0.000	0.000	0
29.500	0.000	0.000	0.000	0
29.750	0.000	0.000	0.000	0
30.000	0.000	0.000	0.000	0
30.250	0.000	0.000	0.000	0
30.500	0.000	0.000	0.000	0
30.750	0.000	0.000	0.000	0
31.000	0.000	0.000	0.000	0
31.250	0.000	0.000	0.000	0
31.500	0.000	0.000	0.000	0
31.750	0.000	0.000	0.000	0
32.000	0.000	0.000	0.000	0
32.250	0.000	0.000	0.000	0
32.500	0.000	0.000	0.000	0
32.750	0.000	0.000	0.000	0
33.000	0.000	0.000	0.000	0
33.250	0.000	0.000	0.000	0
33.500	0.000	0.000	0.000	0
33.750	0.000	0.000	0.000	0
34.000	0.000	0.000	0.000	0
34.250	0.000	0.000	0.000	0
34.500	0.000	0.000	0.000	0
34.750	0.000	0.000	0.000	0
35.000	0.000	0.000	0.000	0
35.250	0.000	0.000	0.000	0
35.500	0.000	0.000	0.000	0
35.750	0.000	0.000	0.000	0
36.000	0.000	0.000	0.000	0
36.250	0.000	0.000	0.000	0
36.500	0.000	0.000	0.000	0
36.750	0.000	0.000	0.000	0

37.000	0.000	0.000	0.000	0
37.250	0.000	0.000	0.000	0
37.500	0.000	0.000	0.000	0
37.750	0.000	0.000	0.000	0
38.000	0.000	0.000	0.000	0
38.250	0.000	0.000	0.000	0
38.500	0.000	0.000	0.000	0
38.750	0.000	0.000	0.000	0
39.000	0.000	0.000	0.000	0
39.250	0.000	0.000	0.000	0
39.500	0.000	0.000	0.000	0
39.750	0.000	0.000	0.000	0
40.000	0.000	0.000	0.000	0
40.250	0.000	0.000	0.000	0
40.500	0.000	0.000	0.000	0
40.750	0.000	0.000	0.000	0
41.000	0.000	0.000	0.000	0
41.250	0.000	0.000	0.000	0
41.500	0.000	0.000	0.000	0
41.750	0.000	0.000	0.000	0
42.000	0.000	0.000	0.000	0
42.250	0.000	0.000	0.000	0
42.500	0.000	0.000	0.000	0
42.750	0.000	0.000	0.000	0
43.000	0.000	0.000	0.000	0
43.250	0.000	0.000	0.000	0
43.500	0.000	0.000	0.000	0
43.750	0.000	0.000	0.000	0
44.000	0.000	0.000	0.000	0
44.250	0.000	0.000	0.000	0
44.500	0.000	0.000	0.000	0
44.750	0.000	0.000	0.000	0
45.000	0.000	0.000	0.000	0
45.250	0.000	0.000	0.000	0
45.500	0.000	0.000	0.000	0
45.750	0.000	0.000	0.000	0
46.000	0.000	0.000	0.000	0
46.250	0.000	0.000	0.000	0
46.500	0.000	0.000	0.000	0
46.750	0.000	0.000	0.000	0
47.000	0.000	0.000	0.000	0
47.250	0.000	0.000	0.000	0
47.500	0.000	0.000	0.000	0
47.750	0.000	0.000	0.000	0
48.000	0.000	0.000	0.000	0
48.250	0.000	0.000	0.000	0
48.500	0.000	0.000	0.000	0



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Flood Estimation Report- Trowbridge, Wiltshire

Version 1

Prepared for
Cole Easdon
Consultants

Date
January
2026



Cole Easdon

Description

This report template is based on a supporting document to the Environment Agency's Flood Estimation Guidelines Version 10, dated 08 September 2025. It provides a record of the hydrological context, the method statement, the calculations, the decisions made, and the results of flood estimation.

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Approval

Revision stage	Analyst	Approved by	Amendments	Date
Method statement	N/A	N/A	N/A	N/A
Calculations - Revision 1	Erica Godsland BSc (Hons) MCIWEM C.WEM	Samantha Cogan BSc MSc	N/A	12/01/2026
Calculations - Revision 2				

Revision history

Revision reference	Date issued	Amendments	Issued to
Version 1	January 2026		Cole Easdon Consultants

Abbreviations

Abbreviation	Definition
AEP	Annual Exceedance Probability
AMAX	Annual Maximum
AMAX[x]	x-largest AMAX peak flow in an available period of record
AREA	catchment area (km ²)
ARF	Areal Reduction Factor
BF0	Base flow initial condition for the ReFH2 model
BFI	Base Flow Index
BFIHOST19	Base Flow Index derived using the HOST soil classification, revised in 2019
BFIHOST19scaled	Updated version of BFIHOST19, removing erroneous influence of waterbodies in calculations
BL	Base flow Lag parameter for the ReFH2 model
BR	Base flow Recharge parameter for the ReFH2 model
Cini	Soil moisture initial condition for the ReFH2 model
CMAX	Soil moisture model parameter for the ReFH2 model
CPRE	Council for the Protection of Rural England
DTM	Digital Terrain Model
FARL	FEH index of flood attenuation due to reservoirs and lakes
FARL2015	Updated FARL with improved watercourse connectivity representation
FEH	Flood Estimation Handbook
FPEXT	Flood Plain Extent
FSR	Flood Studies Report
GEV	Generalised Extreme Value pooling distribution
GL	Generalised Logistic pooling distribution
HOST	Hydrology of Soil Types
IF	Impervious Fraction (parameter of the Urban ReFH2 model)
IRF	Impervious Runoff Factor (parameter of the Urban ReFH2 model)
KAP3	Kappa 3 pooling distribution
LMED	Median annual peak level, with and AEP of 50% / return period of 2 years
LMAX[x]	x-largest AMAX level, from an available period of record
mAOD	Metres Above Ordnance Datum

Abbreviation	Definition
mASD	Metres Above Stage Datum
NGR	National Grid Reference
NRFA	National River Flow Archive
OS	Ordnance Survey
P3	Pearson Type 3 pooling distribution
POT	Peak Over a Threshold
PROPWET	Index of proportion of time when catchment soils are wet
QMED	Median annual flood, with and AEP of 50% / return period of 2 years
ReFH2	Revitalised Flood Hydrograph (version 2) method
SAAR	Standard Average Annual Rainfall (mm/year), for the 1961 – 1990 reference period
SAAR9120	Standard Average Annual Rainfall (mm/year), for the 1991 – 2020 reference period
TP	Time to peak of the instantaneous unit hydrograph
UKFE	United Kingdom Flood Estimation (R package for implementing flood hydrology methods)
URBAN	Flood Studies Report index of fractional urban extent
URBEXT2000	FEH index of urban extent
URBEXT2015	Updated FEH index of urban extent from 2015 land cover maps
WINFAP	Windows Frequency Analysis Package (software applying the FEH Statistical method)

1 Summary of assessment

1.1 Summary

1.1.1 Catchment location:

The main site of interest is an area of greenfield land located to the east of West Ashton Road in Trowbridge, Wiltshire. An unnamed tributary of the River Biss flows along the southern boundary of the site in a westerly direction. Flooding at this location is likely to be caused by peak flows exceeding the capacity of the watercourse.

1.1.2 Purpose of study and complexity:

JBA Consulting were commissioned by Cole Easdon Consultants in December 2025 to update a previous hydrological assessment undertaken in 2024 to provide hydraulic model inflows for a proposed development site, following the updates to the Flood Estimation Guidelines and NRFA peak flow datasets in September 2025.

1.1.3 Key catchment features:

The study catchment is small at 6.8km² and is predominantly comprised of agricultural land with small areas of woodland. The catchment contains two areas of urbanisation; located to the east in Steeple Ashton and to the west on the outskirts of Trowbridge.

There are no reservoirs within the catchment. Stourton Lake (locally known as Rood Ashton Lake) is located within the centre of the catchment, however the FARL value for the study catchments are >0.90, therefore Stourton Lake is not considered to have a major reservoir influence on the catchment.

The topography of the catchment is moderately steep with a decline from approximately 100mAOD in the south to approximately 34mAOD in the west.

1.1.4 Flooding mechanisms:

The study site is at risk of fluvial and surface water flooding. The site is shown to be in Flood Zone 2 and 3 for Rivers, affected by the unnamed tributary of the River Biss. This study will focus only on the risk of fluvial flooding from the unnamed tributary, as the primary flood risk to the site is likely to be driven by peak flows exceeding the capacity of this watercourse.

1.1.5 Gauged / ungauged:

The catchment is ungauged.

1.1.6 Final choice of method:

FEH Statistical peak flow estimates with the ReFH2 0.1%/1% ratio applied for the 0.1% AEP event.

1.1.7 Key limitations / uncertainties in results:

The catchment is small, and the modelled reach is ungauged (flow) which leads to a high degree of uncertainty in the results.

1.2 Flood frequencies

The frequency of a flood can be quoted in terms of a return period, which is defined as the average time between years with at least one larger flood, or as an annual exceedance probability (AEP), which is the inverse of the return period. The table below enables quick conversion between return periods and annual exceedance probabilities.

AEP (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
AEP	0.5	0.2	0.1	0.05	0.033	0.02	0.013	0.01	0.005	0.001
Return period (yrs)	2	5	10	20	30	50	75	100	200	1,000

2 Method statement

2.1 Requirements for flood estimates

2.1.1 Overview

In 2024 JBA Consulting were commissioned by Cole Easdon Consultants to undertake a hydrological assessment and provide hydraulic model inflows for a proposed development site. The proposed development site is currently greenfield land located along a reach of unnamed watercourse in Trowbridge, Wiltshire. The study site is at risk of fluvial and surface water flooding. The site is shown to be in Flood Zone 2 and 3 for Rivers, affected by an unnamed tributary of the River Biss. The objective of the study was to accurately assess the fluvial flood risk to the site. A hydrological assessment was undertaken to derive inflow hydrographs for input to the hydraulic model, which was undertaken by Cole Eason Consultants.

However, in September 2025 the Flood Estimation Guidelines and NRFA peak flow datasets were updated to Versions 10 and 14 respectively. Cole Easdon Consultants have therefore commissioned JBA Consulting in December 2025 to update the previous assessment to follow the latest methods, software, guidance, and data.

Design event peak flow estimates and hydrographs are required for the 3.3%, 1% and 0.1% AEP events. Peak flow estimates were also generated for the 50% AEP event, for information for the FEH Statistical method. The effects of climate change will be accounted for, using the latest guidance¹, by applying a 26% and 39% uplift to the 1% AEP event peak flow estimate. These represent both the central and higher estimates for the 2080s epoch for the Avon Bristol and North Somerset Streams Management Catchment.

2.2 The catchment

Catchment description:

The study catchment (Figure 2-1) is small at 6.8km² and is predominantly comprised of agricultural land, with small areas of woodland. The catchment contains two areas of urbanisation; located to the east in Steeple Ashton and to the west on the outskirts of Trowbridge.

The proposed development, shown in Figure 2-2, is located along the unnamed tributary of the River Biss. The unnamed tributary flows from Acreshort Lane near

¹ <https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow>
 RPQ-JBA-XX-XX-RP-HO-0001-S3-P01-
 Trowbridge_Flood_Estimation_Report.docx

Steeple Ashton in a westerly direction, before joining the River Biss approximately 320m west of the site.

There are no reservoirs within the catchment, however Stourton Lake (locally known as Rood Ashton Lake) is located within the centre of the catchment. A number of small attenuation basins are also located within the catchment providing surface water storage for the residential development to the northwest of the catchment and Castle Mead School.

The topography of the catchment is moderately steep with a decline from approximately 100mAOD in the south to approximately 34mAOD in the west, as shown in Figure 2-3.

The Geology of Britain GeoIndex (onshore) Viewer² (shown in Figure 2-4) shows the catchment to be predominantly comprised of mudstone, siltstone and sandstone within the lower half of the catchment (northwest) and limestone, sandstone, siltstone and mudstone in the upper half of the catchment (east and south).

The soils in the catchment³ are mixed and are comprised of the following:

- Loamy and clayey floodplain soils with naturally high groundwater along the lower reach of the watercourse.
- Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils to the northwest and southwest of the catchment.
- Shallow lime-rich soils over chalk or limestone to the south and east of the catchment.
- Lime-rich loamy and clayey soils with impeded drainage within a small area to the north of the catchment.

The geology and soils above highlight that the catchment response to rainfall and runoff will be mixed due the variety of bedrock and soils identified.

² <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>

³ <https://www.landis.org.uk/soilscapes/>

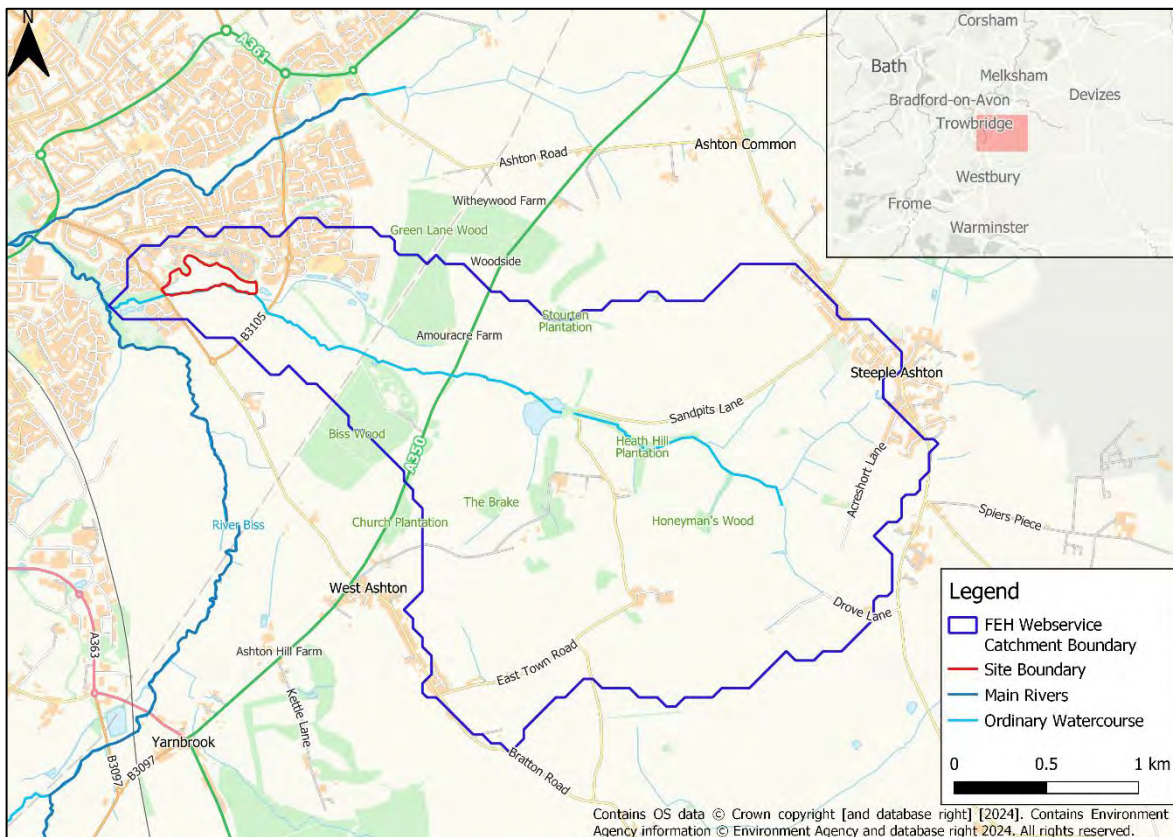


Figure 2-1: Catchment overview

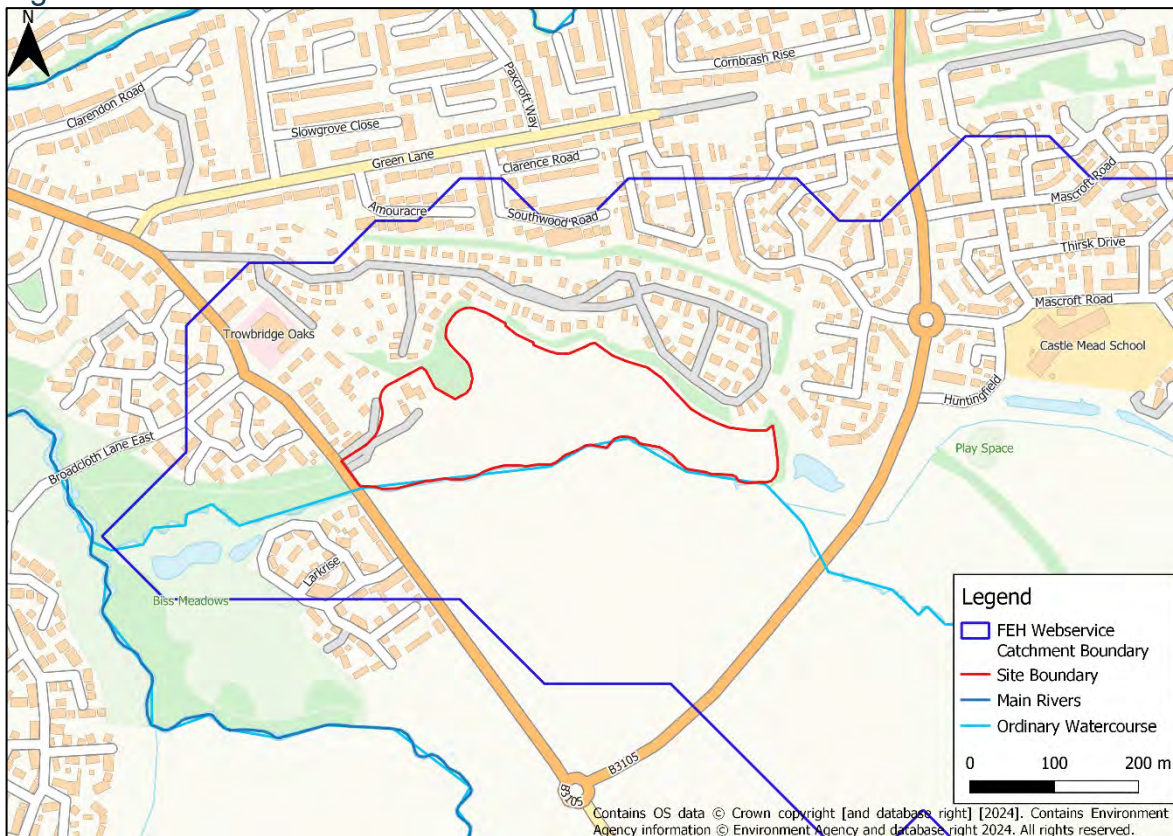


Figure 2-2: Site Boundary

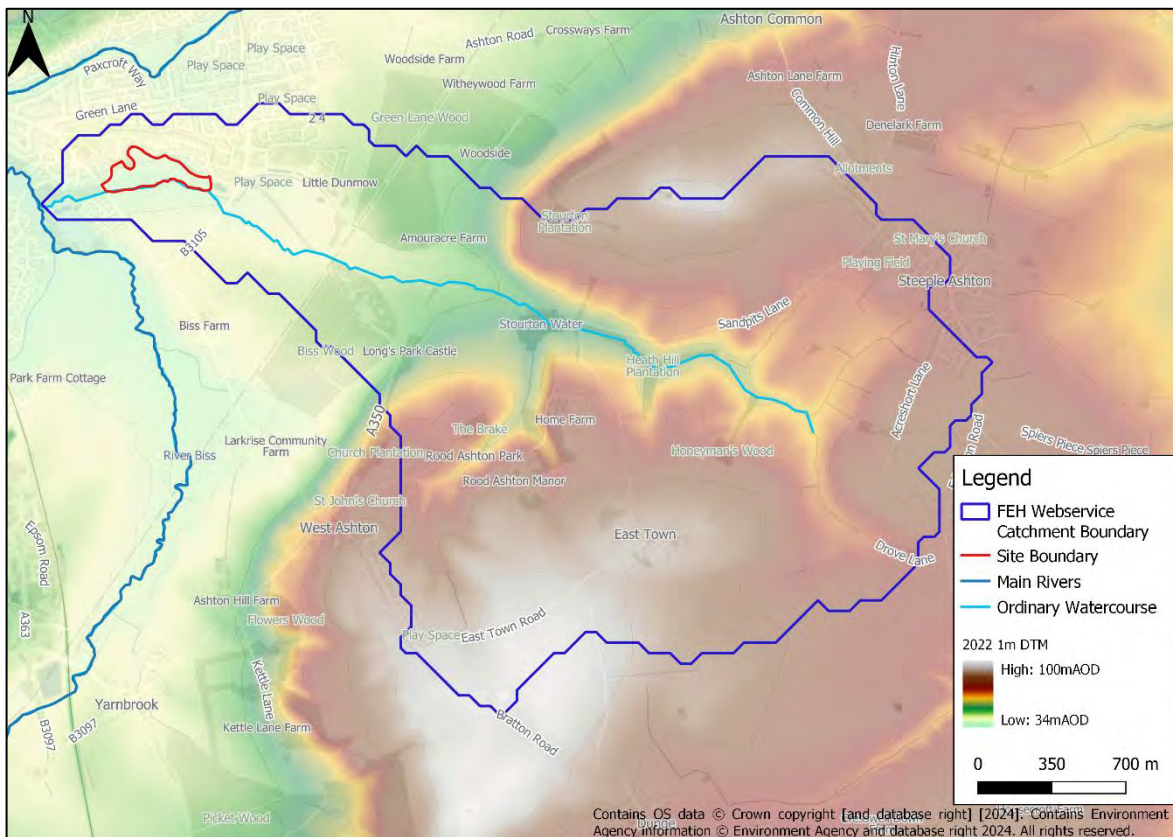


Figure 2-3: Catchment topography

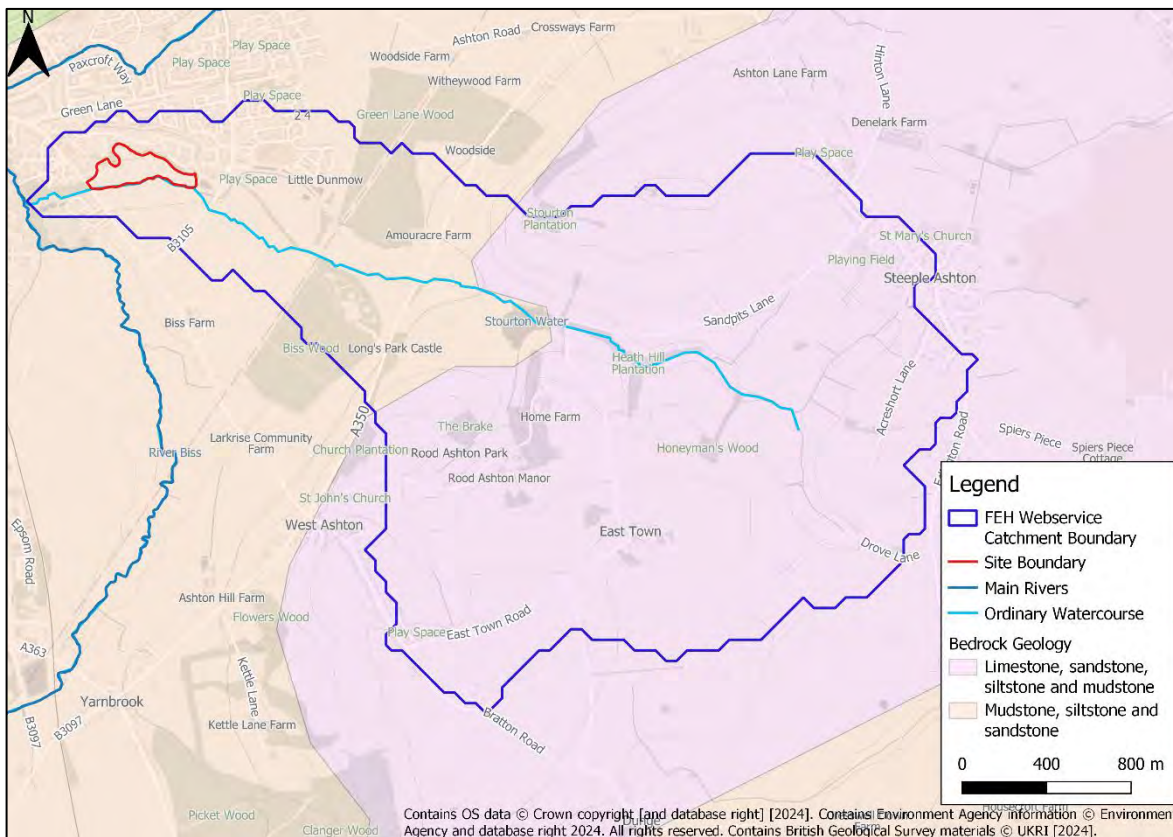


Figure 2-4: Catchment geology

2.3 Data review

The catchment is ungauged. A review of flood history has been carried out and is detailed in Section 2.3.1.

2.3.1 Flood history

Data available

Event date	Flooding source	Details
1925 1932	River Biss	EA Recorded Flood Outlines - channel capacity exceeded (no raised defences) – shown to impact the confluence to the River Biss and approximately 800m upstream along the unnamed tributary.
1960 1974	River Biss	EA Recorded Flood Outlines - channel capacity exceeded (no raised defences) – shown to impact a small area at the confluence to the River Biss.

Uses of the data for this study:

The EA's Recorded Flood Outlines dataset shows flooding within a small area at the downstream end (west) of the catchment. Flood history data / information is used to understand the impacts of observed flooding events and may be useful to compare to hydraulic modelling results.

2.3.2 Previous Reporting

In September 2024 JBA Consulting undertook an initial hydrological assessment at Trowbridge (Ref: NXV-JBA-XX-XX-RP-HO-0001-S3-P01-Trowbridge_Flood_Estimation_Report).

Uses of the data for this study:

The basis of this report has been used within this assessment, with the appropriate updates to the FEH Statistical method and NRFA peak flows dataset following updates released in September 2025. As part of this report, the results will be compared to identify differences between the two assessments.

2.3.3 Conclusions of data review:

Data type	Suitability for flood estimation calculations	Suitability for hydraulic modelling	Any further comments
Flood history	N/A	Indicative	N/A

Data type	Suitability for flood estimation calculations	Suitability for hydraulic modelling purposes only	Any further comments

2.4 Hydrological understanding of the catchment

2.4.1 Conceptual model

The main site of interest is an area of greenfield land located to the east of West Ashton Road in Trowbridge, Wiltshire. An unnamed tributary of the River Biss flows along the southern boundary of the site in a westerly direction. Flooding at this location is likely to be caused by peak flows exceeding the capacity of the watercourse.

2.4.2 Unusual catchment features

Stourton Lake (locally known as Rood Ashton Lake) is located in the centre of the catchment.

A number of small attenuation basins are also located within the catchment providing surface water storage for the residential development to the northwest of the catchment and Castle Mead School. These basins are not shown to impact the FARL values within the catchment and are therefore unlikely to have a significant impact on flows.

2.5 Initial choice of approach

2.5.1 Are FEH methods appropriate?

Yes – while Stourton Water is located in the centre of the catchment, catchment descriptor assessment (Section 3.2) shows that FEH methods are still appropriate for use within this study

2.5.2 Initial choice of method(s) and reasons

Both the Statistical method and the ReFH2 method will be applied as both are appropriate for the study catchment.

There is no peak flow record available in the study catchment with which to improve the QMED estimate for the Statistical method. Therefore, data from local donors will be assessed and used in this method. The peak flow estimates derived from both methods will be compared and the most appropriate taken forward.

Flood Estimation Guidelines (2025) v10 states that the statistical method is based on a much larger dataset of flood events and has been more directly calibrated to

reproduce flood frequency on UK catchments, therefore it is often, but not always, preferable over design event (rainfall-runoff) approaches.

2.5.3 How will hydrograph shapes be derived, if needed?

Hydrographs were previously derived using the ReFH2 model, which remains unchanged from the 2024 assessment. ReFH2 hydrographs will be scaled to the new FEH Statistical peak flow estimates explored within this study.

2.5.4 Will the catchment be split into sub-catchments (lumped / distributed approach)? If so, how?

The purpose of this study is to create hydraulic model inflows; therefore, the catchment will be split into sub-catchments so that design event inflows can be produced for each sub-catchment to allow for varying peak flows. There will therefore be two upstream tributary FEPs, a downstream FEP and an intervening area, which will be applied laterally along the reach, as per the previous reporting.

2.5.5 Source of flood peak data & software to be used

- NRFA peak flow dataset, v14.0.1 (September 2025)
- FEH Web Service⁴
- WINFAP 5.3⁵
- ReFH 2.3-FEH22 Calibrated

⁴ CEH 2015. The Flood Estimation Handbook (FEH) Online Service, Centre for Ecology & Hydrology, Wallingford, UK.

⁵ WINFAP 5.3 © Wallingford HydroSolutions Limited 2025.

2.6 Selection of flood estimation locations

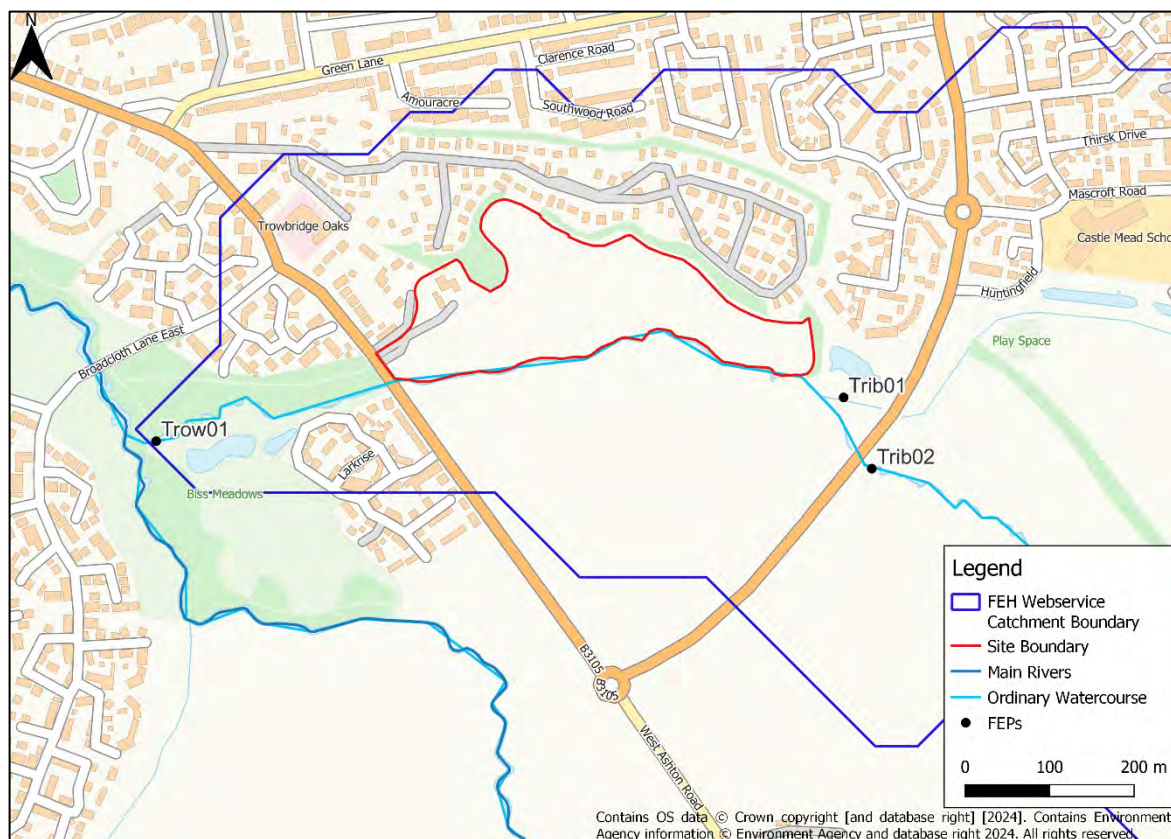


Figure 2-5: Flow estimation points

As discussed in the previous report, it should be noted that the flows for the two upstream model extents have been chosen just before the confluence of the two channels, which is slightly downstream of the proposed model reaches. The decision to do so will not result in overestimating flooding to properties, as there is considered to be nothing at risk between the proposed FEP locations and the upstream model extent.

Site code	Type of estimate	Watercourse	Site name / description	Easting	Northing	Indicative AREA (km ²)
Trib01	L	Unnamed watercourse	Northern upstream tributary of the unnamed watercourse	387150	157350	0.6

Site code	Type of estimate	Watercourse	Site name / description	Easting	Northing	Indicative AREA (km ²)
Trib02	L	Unnamed watercourse	Southern upstream tributary of the unnamed watercourse	387150	157250	5.8
Trow01	L	Unnamed watercourse	Downstream of the unnamed Watercourse	386400	157300	6.8

L = lumped catchment. Area in this table is indicative, see Section 3.4 for the final adopted AREA in calculations.

3 Flood estimation locations

3.1 Catchment boundary checks and revisions

The FEH Web Service catchment boundary was checked against 1m LiDAR, contour mapping and Ordnance Survey (OS) mapping and has been accepted without change. It should be noted that a small downstream area is shown to drain north outside of the catchment boundary, however the catchment has been left unchanged as the resulting area would equate to less than a 1% increase, which would be negligible within this study.

3.2 Other catchment descriptor checks and revisions

BFIHOST:

The FEH BFIHOST19 values for the study catchment appear to be a reasonable representation of local base flow conditions when compared with the geology and soils described in Section 2.2. Therefore, these values have been retained without amendment.

Version of BFIHOST:

BFIHOST19 for rainfall-runoff modelling. BFIHOST19scaled for FEH Statistical method calculations.

DPLBAR:

No DPLBAR adjustments were made.

FARL2015:

The FARL value for Trib01 is 1, which is reasonable considering no reservoirs/lakes are located within the catchment shown on the FEH Web Service.

The presence of Stourton Water is reflected in the FARL values of Trib02 and Trow01 (0.930 and 0.940 respectively) which is considered to be reasonable. As FARL is above 0.9 the use of the FEH Statistical method, with no reservoir routing applied, is considered appropriate.

As a result, these values have been retained without amendment.

URBEXT:

The URBEXT2015 values were checked against the urban extent layer on the FEH Web Service and current OS mapping and did not appear appropriate, with Trib01 showing a considerable increase from URBEXT2000. For consistency as URBEXT2000 was originally manually calculated in the previous project,

URBEXT2015 was manually amended using updated calculations. It should be noted that the URBEXT2000 value remains unchanged from the 2024 project.

Catchment	Trib01	Trib02	Trow01
Area from drawn 50k (m ²) (sum)	43,612	172,364	400,090
Area of catchment (m ²)	594,222	5,755,823	6,799,150
URBAN50k from drawn	0.073	0.030	0.059
URBEXT2000	0.046	0.019	0.037
URBEXT2015	0.057	0.023	0.046

Version of URBEXT:

URBEXT2000 for rainfall-runoff calculations. URBEXT2015 for FEH Statistical method calculations.

Method for updating URBEXT:

URBEXT2015 (for FEH Statistical method):

- $0.7806 * \text{URBAN50k}$, from Ordnance Survey 1:50,000 scale mapping⁶

URBEXT2000 (for rainfall-runoff methods):

- $0.629 * \text{URBAN50k}$, from Ordnance Survey 1:50,000 scale mapping⁷

3.3 Derivation of intervening area descriptors

As discussed within the original reporting (Ref: NXV-JBA-XX-XX-RP-HO-0001-S3-P01-Trowbridge_Flood_Estimation_Report) the intervening area is considered too small for use within ReFH2 and the FEH Statistical method at 0.45km². Inflows will therefore be produced using area weighting from the downstream catchment (Trow01) and has not been considered further.

⁶ Environment Agency (2025), Flood Estimation Guidelines, Version 10.

⁷ Bayliss, Black, Fava-Verde and Kjeldsen (2006), URBEXT2000 – A new FEH catchment descriptor – Calculation, dissemination and application, DEFRA/EA FCERM R&D Programme technical report FD1919/TR

3.4 Catchment descriptors

Final catchment descriptors at each subject site:

Site code	AREA on FEH Web Service (km ²)	Revised AREA (km ²)	BFIHOST19	BFIHOST19scaled	DPLBAR (km)	DPSBAR (m/km)	FARL2015	FPEXT	PROPWET	SAAR (mm)	SAAR9120 (mm)	URBEXT 2000	URBEXT2015
Trib01	0.6	-	0.356	0.356	1.0	18.9	1.000	0.277	0.35	724	740	0.0252 0.046	0.1576 0.057
Trib02	5.8	-	0.597	0.593	3.1	35.4	0.930	0.080	0.35	725	764	0.0098 0.019	0.0212 0.023
Trow01	6.8	-	0.568	0.564	3.6	32.5	0.940	0.110	0.35	724	760	0.0186 0.037	0.0548 0.046
Red values indicate values updated. [Blue] values indicate original values from the FEH Web Service.													

4 Stationary statistical methods

4.1 Method overview

Section 2.5 provides a full discussion of the preferred methods for this study. These calculations use the “FEH25” method⁸ released in September 2025, unless noted otherwise.

WINFAP’s default eight donors will be applied to adjust QMED, along with the GEV and KAP3 pooling distributions.

4.2 Estimating QMED

4.2.1 Search for potential donor sites / rejected donor sites

Trib01

A check was made to identify suitable donor sites. Both rural and urban donors have been considered as there is some urbanisation within the study catchment. Of the closest 10 donor stations to the study catchment most have a QMEDobs / QMEDcd ratio of >1, indicating that the catchment descriptor equation may be underestimating QMED and showing a regional trend.

The geographically closest donor 53029 (Biss @ Trowbridge) is located 4.8km from the catchment centroid, and on the River Biss located downstream of the catchment in Trowbridge. 53029 has an observed QMED of 12.05m³/s and QMED CDs Urban of 12.6m³/s. NRFA states that the gauge is suitable for QMED and Pooling. However, it should be noted that the FEG states that one donor should only be used if “The gauge is located close to the subject site on the same watercourse.” Therefore as 53029 is not located along Trib01 it is considered most appropriate and representative to apply the closest eight donors to adjust QMED.

⁸ Vesuviano and Griffin (2025), The FEH 2025 statistical method update, Issue number 1.3, UK Centre for Ecology & Hydrology

The 2025 FEH Statistical Method recommends that, in most cases, using multiple donors reduces the bias towards the catchment descriptor equation error at a single site. The 2025 update (Vesuviano and Griffin, 2025) tested using zero to twenty donors selected on distance. There was a clear improvement in model performance as the numbers of donors increased to eight. The study catchments are all under 70km² and falls under the (now partially superseded) Small Catchment guidance and procedures. Guidance on choice of method for flood estimation on small catchments recommended that preferability for donor selection should be given to proximity and recommended that only one donor should be selected based on geographical distance only. The 2008 version published in Science Report SC050050 and its subsequent adjustments, including the 2021 version for small catchments (Science Report SC090031) falls under the 2008 FEH Statistical method. Flood Estimation Guidelines (2025) v10 states that all new studies should use the 2025 version.

WINFAP v5.3 software was applied for donor catchment selection and adjustment. The software selected the top eight stations with the lowest geographic distance (using catchment centroids). The stations were selected from those in the [Station Manager](#), that:

- are deemed as 'suitable for QMED'; and
- have an URBEXT2015 value that is less than the threshold previously set. By default this is 0.03, categorised as 'essentially rural'.

A brief assessment of the eight selected donor provided no justification for the removal of any of the default stations. Within WINFAP,

The final QMED adjustment ratio is therefore shown to be 1.025.

Trow01

A check was made to identify suitable donor sites. Both rural and urban donors have been considered as there is some urbanisation within the study catchment. Of the closest 10 donor stations to the study catchment most have a QMEDobs / QMEDcd ratio of >1, indicating that the catchment descriptor equation may be underestimating QMED and showing a regional trend.

Similarly to Trib01, the geographically closest donor was 53029 (Biss @ Trowbridge), and as 53029 is not located along the watercourse of interest it is considered most appropriate and representative to apply the closest eight donors to adjust QMED.

It should be noted that the closest eight donors for Trow01 differs slightly to Trib01 with the inclusion of **43017** (West Avon @ Upavon West) instead of **53028** (By Brook @ Middlehill).

The final QMED adjustment ratio is shown to be 1.038.

It should be noted that due to similarities in catchment descriptors the QMED adjustment for Trow01 will be applied to Trib02.

4.2.2 Donor sites chosen and QMED adjustment factors

NRFA no.	Method	Adjustment for climatic variation?	QMED from flow data (m³/s)	Urban adjustment factor	De-urbanised QMED from flow data (m³/s) (A)	Rural QMED from catchment descriptors (m³/s) (B)	Adjustment ratio (A/B)
53029	AM	No	12.0	1.18	10.2	10.7	0.95
53018		No	166.6	1.08	154.9	145.0	1.07
53002		No	17.2	1.06	16.2	17.3	0.93
43028		No	2.0	1.01	1.9	1.8	1.09
43008		No	12.9	1.10	11.7	9.4	1.24
43012		No	4.6	1.19	3.9	4.7	0.83
53007		No	58.8	1.05	56.2	43.3	1.30
53028		No	10.7	1.05	10.2	8.3	1.24
43017		No	5.5	1.07	5.1	3.0	1.73

Methods: **AM** – Annual maxima.

4.2.3 QMED at ungauged subject sites

Site code	Method	Initial QMED (rural) from CDs (m ³ /s)	Donors used (NRFA numbers)	Donor distance from subject centroid (km)	Moderation term (α) value	Final donor adjustment factor	Urban adjustment factor	Final QMED (m ³ /s)
Trib01	DT8	0.3	Eight donors applied.			1.03	1.07	0.3
Trib02		0.8				1.04	1.05	0.8
Trow01		1.0				1.04	1.09	1.1

QMED estimation methods: **DT8** – catchment descriptors with default WINFAP eight catchment donor transfer.

Donor distance weighting method:

FEH25 moderation term applied.

Multiple donors:

Details of the WINFAP multi-donor approach are reproduced in the appendix. Calculation files are also supplied digitally alongside this report.

Parameters used for WINFAP v5 urban adjustment:

WINFAP v5.3⁸ method applied (subject site and donors). Impervious fraction (IF) and percentage runoff for impervious surfaces (PR_{imp}) set to default 0.30 and 0.70, respectively.

4.3 Estimating growth curves

4.3.1 Derivation of pooling groups

Name of group	Pooling group target site	Changes made to default pooling group and / or further investigations	Default as-rural pooled L-moment ratios	As-rural pooled L-moment ratios, after any membership changes	As-rural pooled L-moment ratios, after further non-flood-year adjustment
Trib01	Trib01	None. It should be noted that 49005 (Bolingey Stream @ Bolingey Cocks Bridge) was recorded as discordant due to a relatively short record length but there was no reason to remove the station from dataset, so this has been retained.	LCV = 0.247 LSK = 0.206	N/A	N/A
Trow01	Trow01	None.	LCV = 0.285 LSK = 0.184		

Unless otherwise stated, pooling groups are derived using the procedures from the FEH25 Statistical Method ⁸, with a default 800 station-years target for pooling group size.

Catchment selection for pooling group members was filtered to sites with URBEXT2015 values < 0.03 by default.

Pooling group composition is provided in the Appendix.

4.3.2 Derivation of growth curves at subject sites

Site code	Method	If P, name of pooling group	Distribution used and reason for choice	Urban adjustment applied and adjusted LCV	Parameters of distribution (location, scale, and shape after adjustments)	Growth factor for 1% AEP
Trib01	P	Trib01	KAP3 - Generalised Logistic (GL), Generalised Extreme Value (GEV) and Kappa 3 (KAP3) distributions all gave an acceptable fit to the data. The z-value for KAP3 was closest to zero indicating the best fit. KAP3 was therefore selected.	Yes LCVurban = 0.238	Location = 1 Scale = 0.292 Shape = -0.138	2.80
Trib02		Trow01	GEV Generalised Extreme Value (GEV) and Pearson Type 3 (P3) distributions gave an acceptable fit to	Yes LCVurban = 0.281	Location = 1 Scale = 0.437 Shape = -0.022	2.95
Trow01				Yes LCVurban = 0.277	Location = 1 Scale = 0.430 Shape = -0.022	2.92

Site code	Method	If P, name of pooling group	Distribution used and reason for choice	Urban adjustment applied and adjusted LCV	Parameters of distribution (location, scale, and shape after adjustments)	Growth factor for 1% AEP
			the data. The z-value for GEV was closest to zero, indicating the best fit. GEV was therefore selected.			

Methods: **P** - Pooled.

Pooled growth curves are derived using the procedures from the FEH25 Statistical Method⁸. Urban adjustments are carried out using FEH25 methods using URBEXT2015.

4.4 Final choice of QMED and growth curves

Site code	Final choice of QMED and reasons	Final choice of flood growth curve method and reasons
Trib01	QMED adjusted using WINFAP's default eight closest donors for Trib01.	Growth curves pooled using KAP3 (best-fit) distribution.
Trib02	QMED adjusted using WINFAP's default eight closest donors for Trow01.	Growth curves pooled using GEV (best-fit) distribution.
Trow01		

4.5 Final flood estimates from stationary statistical methods

Site code	50%	3.3%	1%	0.1%
Trib01	0.30	0.66	0.85	1.3
Trib02	0.82	1.9	2.4	3.4
Trow01	1.1	2.7	3.3	4.6

Flood peak in m³/s for the AEP (%) events

Note that the use of two decimal places is to show the change in peak flow between design events and does not imply a greater confidence in results.

5 Revitalised Flood Hydrograph 2 (ReFH2) method

5.1 Method overview

Section 2.5 provides a full discussion of the preferred methods for this study.

It should be noted that there have been no updates to the ReFH2 methods or software since the 2024 report. Therefore, the hydrographs generated as part of the original assessment remain valid. However, current guidance recommends using urban hydrographs rather than rural results. Consequently, a small assessment was undertaken to compare the difference between the hydrographs.

5.2 ReH2 model parameters

5.2.1 Summary of rural model parameters and initial conditions:

Site code	Method	Cini (mm)	Cmax (mm)	Tp rural (hours)	BF(0) (m ³ /s)	BL (hours)
Trib01	CD	124.73	279.29	2.45	0.03	26.62
Trib02		82.83	522.31	3.89	0.09	46.85
Trow01		87.01	484.41	4.35	0.13	46.94

Methods: **CD**: Catchment descriptors.

Unit Hydrograph shape parameters UP and UK are 0.65 and 0.80, respectively.

The Baseflow Recharge value (BR) is not reported above. BR is no longer a fixed parameter in the ReFH2.3 model⁹. It is now allowed to vary, changing with event severity to address overall mass-balance issues identified in earlier implementations. Initial values for BR can be viewed in the digital ReFH2 files provided alongside this report.

Is the catchment groundwater-dominated?

No

5.2.2 Summary of urban model parameters:

Default ReFH2 model parameters are applied across all flow estimation points as follows:

⁹ Wallingford HydroSolutions (2019), ReFH2 Science Report – Closing a Water Balance.

- Total urban area estimated from the approximate $1.567 * \text{URBEXT2000} * \text{AREA}$ relationship⁷.
- No modifications for urban drainage out of the topographic areas applied.
- IF (Impervious Fraction), IRF (Impervious Runoff Factor) and DS (Depression Storage) set to 0.40, 0.70 and 0.5mm, respectively.
- Unit hydrograph Time to peak adjustment factor for urbanisation (TPurban) set to 0.75.

Site code	Total urban area (km ²)	Urban area draining externally (km ²)	Sewer capacity (m ³ /s)	TP urban scaling factor	IF	IRF	DS (mm)
Trib01	0.04	0	0	0.75	0.4	0.7	0.5
Trib02	0.17						
Trow01	0.39						

5.3 Design event ReFH2 model inputs

5.3.1 Design events for individual lumped catchments

This section provides information for **individual site-specific** design event model inputs, for initial comparison purposes. These may be revised for final flows to be applied to a hydraulic model.

Which rainfall DDF model is used?

FEH22

Site code	Default storm duration (hrs)	Default design event seasonality	Areal Reduction Factor (ARF)	Seasonal Correction Factor (SCF)
Trib01	4.5	Winter	0.98	0.68
Trib02	6.5		0.96	0.71
Trow01	7.5		0.96	0.71

5.3.2 Design events optimised for distributed modelling

Design events for hydraulic model testing:

This section provides information for catchment-wide design storm settings to be assessed. These are applied consistently across all model inputs.

Following on from the previous study, as the ReFH2 methods remain unchanged, a small comparison was undertaken to assess the difference in the hydrograph peak and shape between using the rural and urban results for the previously agreed 7 hour critical storm duration.

Design storm testing results:

Comparisons indicated that switching from rural hydrographs, as used in the previous study, to the urban hydrographs recommended in updated guidance resulted in only minimal differences (shown in Figure 5-1). Therefore, it was agreed to retain the rural hydrographs and critical storm duration in line with the previous assessment, while scaling the hydrographs to reflect the updated FEH Statistical results.

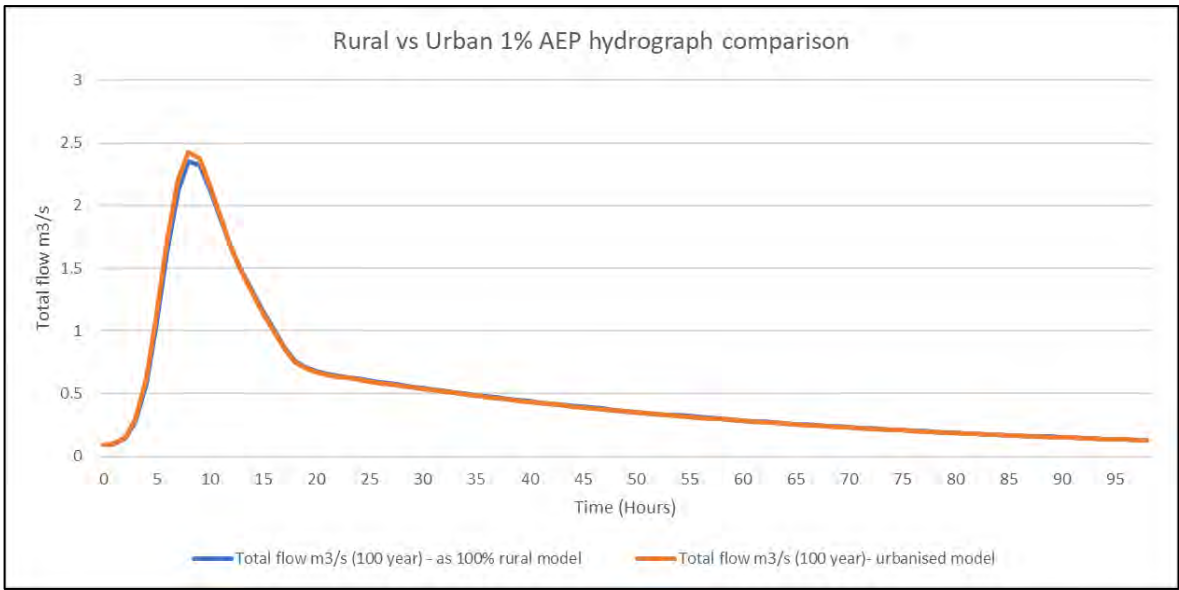


Figure 5-1 Rural vs Urban 1% AEP 7-hour duration hydrograph comparison

5.4 Final choice of ReFH2 flow estimates

5.4.1 Method choice and reasons:

Site code	Final choice of design inputs and model parameters
Trib01	Rural design inputs used to follow existing report. Winter season design events used. Catchment descriptors (CDs) used for model parameters. No changes to initial conditions (Cini and BF0).
Trib02	
Trow01	

Details for distributed modelling using a hydraulic model are provided in Section 6.3.

5.4.2 Final flood estimates from ReFH2 method

Results for individual catchment settings:

Site code	50%	3.3%	1%	0.1%
Trib01	0.28	0.62	0.80	1.3
Trib02	0.82	1.8	2.4	4.2
Trow01	1.0	2.3	3.0	5.3

Urban-adjusted flood peak in m^3/s for AEP (%) events.

Note that the use of two decimal places is to show the change in peak flow between design events and does not imply a greater confidence in results.

Section 6.6 provides peak flows used for distributed modelling.

6 Discussion and summary of results

6.1 Comparison of results from different methods

Site code	ReFH2 Method (X) peak flow (m3/s), 50% AEP	FEH Statistical method (Y) peak flow (m3/s), 50% AEP	ReFH2 Method (X) peak flow (m3/s), 1% AEP	FEH Statistical method (Y) peak flow (m3/s), 1% AEP
Trib01	0.28	0.30	0.80	0.85
Trib02	0.82	0.82	2.4	2.4
Trow01	1.0	1.1	3.0	3.3

Site code	Ratio (X / Y), 50% AEP	Ratio (X / Y), 1% AEP
Trib01	0.93	0.95
Trib02	1.00	0.98
Trow01	0.92	0.90

6.2 Final choice of method

6.2.1 Choice of method and reasons

Comparison of the results from the two methods show that the FEH Statistical method produces equal or larger flows for both the 50% AEP and 1% AEP events, with the difference increasing for the 1% AEP event. The study catchment considered within this study is small, ungauged and as such, all estimated design flows carry appreciable uncertainty.

The ReFH2 method is based on catchment descriptors alone, whilst the FEH Statistical Method uses donors and pooling groups. It should also be noted that the Statistical method is often preferred to design event approaches as it is based on a much larger dataset of flood events and has been more directly calibrated to reproduce flood frequency on UK catchments.

The FEG also states that the Statistical method is preferred if 'there are lakes or other water bodies in the catchment, and you are not planning to use flood routing to represent them'.

As a result, based on the original 2024 report, the Statistical method has been chosen due to the presence of Stourton Water (Rood Ashton Lake) within the catchment.

6.2.2 How are 0.1% AEP flows estimated?

The FEG advises that the FEH Statistical method 1% AEP event peak flow estimates should have the ReFH2 0.1%/1% ratio applied for the 0.1% AEP event.

Ratios derived from the Statistical method peak flow estimates and the ReFH2 individual storm duration peak flows for each location will be applied to the hydrographs generated for the 7-hour critical storm duration and applied as point inflows to the hydraulic model.

6.3 Application of inflows to a hydraulic model

6.3.1 How will the flows be applied to a hydraulic model?

For the two upstream tributary inflows and the downstream model inflow, ratios derived from the Statistical method peak flow estimates and the ReFH2 individual storm duration peak flows for each location will be applied to the hydrographs generated for the 7-hour critical storm duration and applied as point inflows to the hydraulic model. For the intervening area lateral inflow, the hydrograph will be derived using an area ratio method from the flows derived for the downstream location (Trow01) based on the remaining area between the model inflow catchments (Trib01 and Trib02) and Trow01, as discussed within the previous reporting.

6.4 Checks

6.4.1 Growth factor checks

Site code	1% AEP growth factor	0.1% AEP / 1% AEP ratio	Comments
Trib01	2.80	1.53	The FEH Statistical growth factors are all within the typical range of 2.1 – 4.0 (based on FSR regional growth curves).
Trib02	2.95	1.39	
Trow01	2.92	1.39	

6.4.2 Specific discharge checks

Flood peak in $\text{m}^3/\text{s}/\text{km}^2$ for the AEP (%) events:

Site code	50%	1%
Trib01	0.51	1.42
Trib02	0.14	0.42
Trow01	0.17	0.49

6.4.3 Spatial consistency of results:

Peak flow estimates derived for all design events increase downstream, this is as expected.

6.4.4 Frequency of notable gauged flood events:

There is no suitable gauge data to compare the results of the flood frequency estimation against.

6.4.5 Compatibility with longer-term flood history:

There is no local flow data against which to compare the design flow estimates and limited flood history information.

6.4.6 Comparisons with previous studies:

As discussed within the JBA Consulting 2024 reporting (Ref: NXV-JBA-XX-XX-RP-HO-0001-S3-P01-Trowbridge_Flood_Estimation_Report) the resulting conclusion was to use the FEH Statistical peak flow estimates with the ReFH2 0.1%/1% ratio applied for the 0.1% AEP event.

Table 6-1 and Table 6-2 show the direct comparison between these results and highlight a slight decrease in flows with the new FEH Statistical method and NRFA peak flow dataset.

It is of preference to use the 2026 results as they use the latest methods, data, software and guidance available.

Table 6-1 Previous 2024 results

Site code	50%	3.3%	1%	0.1%
Trib01	0.3	0.7	1.0	1.6
Trib02	0.8	2.1	2.8	4.9
Trow01	1.1	2.8	3.7	6.6

Table 6-2 New 2025 results

Site code	50%	3.3%	1%	0.1%
Trib01	0.3	0.7	0.8	1.4
Trib02	0.8	1.9	2.4	4.3
Trow01	1.1	2.7	3.3	5.8

6.5 Assumptions, limitations, and uncertainty

6.5.1 Assumptions

- The design peak flows derived are representative of those that would be observed during flood events.
- The catchment boundaries and descriptors have been assumed to be representative, with URBEXT2015 manually calculated for consistency with UREXT2000.
- Using the GEV and KAP3 distributions for the pooling groups is preferable as the z-values are closest to zero (hence indicating best fit).
- Selecting WINFAP's default eight closest donors to adjust the FEH Statistical method QMED estimate is appropriate and follows guidance.
- FEH Statistical is the preferred approach and the FEH Statistical results have had the ReFH2 ratio applied to the 0.1% event.
- Peak flows, rather than hydrograph volumes, are assumed to be the main control on flood risk at the site.

6.5.2 Limitations

- The main limitation is that the catchment is ungauged due to there being no river flow gauge data specific to the study area.
- There is no flood history information for the site against which to verify hydraulic model results based on the derived model inflows.

6.5.3 Uncertainty

Factorial Standard Error (FSE) can inform typical uncertainty bands in design flood calculations. Upper and lower Confidence Interval bounds around a calculated peak flow (Q_T) apply FSE as follows:

- 68% Confidence Interval: $[Q_T / FSE]$ to $[Q_T * FSE]$
- 95% Confidence Interval: $[Q_T / FSE^2]$ to $[Q_T * FSE^2]$

These errors are log-normally distributed around the “central” Q_T estimate (in other words, the distribution is not uniform; it is more likely that the true value of Q_T is closer to the centre of the quoted interval, rather than the extremes).

Section 6.6 presents 95% Confidence Intervals for the final design event peak flows, for selected AEP design events as follows:

- For the FEH25 Statistical Method from a 2025 Environment Agency addendum note ¹⁰ to the V10 Flood Estimation Guidelines:

¹⁰ Environment Agency (2025), Uncertainty estimates for FEH25 Statistical Method, National Flood Hydrology, Digital Data and Evidence team, published 06/10/2025

- o Table 1 from that note, for rural catchments with $URBEXT \leq 0.06$
- o Table 2 for $URBEXT_{2015} > 0.06$. These latter values may underestimate uncertainty on urban catchments due to a small underlying dataset to support the FSE analysis.

6.6 Final results

Final method applied: FEH Statistical peak flow estimates with the ReFH2 0.1%/1% ratio applied for the 0.1% AEP event.

Site code	50%	3.3%	1%	0.1%
Trib01	0.30	0.66	0.85	1.4
Trib02	0.82	1.9	2.4	4.3
Trow01	1.1	2.7	3.3	5.8

Flood peak in m³/s for the AEP (%) events.

Uncertainty:

Site code	50% AEP Lower 95%	50% AEP Upper 95%	1% AEP Lower 95%	1% AEP Upper 95%
Trib01	0.15	0.59	0.41	1.74
Trib02	0.42	1.62	1.19	4.97
Trow01	0.58	2.22	1.62	6.76

Upper and lower 95% confidence bounds for the flood peak in m³/s for the given AEP (%) events.

Climate change estimates:

Site code	1.0% AEP + 26% CC	1.0% AEP + 39% CC
Trib01	1.1	1.2
Trib02	2.6	2.9
Trow01	8.5	9.4

6.7 Recommendations

6.7.1 Suitability of results for future studies:

The design peak flow estimates were derived for the purposes of this study. If peak flow estimates and hydrographs are required for a different purpose, it is recommended that, at a minimum, a review of the results is carried out.

A Appendix – Supporting data

A.1 Digital files

All digital files are contained in the 'Supporting Files' folder issues alongside this report.

Input data:

- FEH Web Service catchment descriptors and shapefile boundary downloads.
- Updated FEH Web Service catchment descriptors.

Project or calculation files:

- WINFAP-FEH – rural and urban pooling groups.
- ReFH2 – project file.

Output data:

- ReFH2 exports – rural and urban results, PDF report for 1% AEP event.
- Model inflow hydrographs.

A.2 Other supporting information

A.2.1 Pooling groups

Trib01

Station	Distance (SDM)	Years of data	QMED AM	L-CV Deurbanised	L-SKEW Deurbanised	Non-flood years	Percentage Non-flood years	Discordancy
76011 (Coal Burn @ Coalburn)	4.414	47	1.813	0.17	0.3	0	0	1.004
27073 (Brompton Beck @ Snainton Ings)	4.725	44	0.816	0.215	0.025	2	4.55	0.93
27051 (Crimple @ Burn Bridge)	5.228	52	4.641	0.216	0.132	4	7.69	0.328
41020 (Bevern Stream @ Clappers Bridge)	5.412	55	13.9	0.201	0.161	3	5.45	0.661
72014 (Conder @ Galgate)	5.513	57	16.912	0.229	0.14	3	5.26	0.154
36010 (Bumpstead Brook @ Broad Green)	5.565	57	8.12	0.348	0.099	12	21.05	1.419
25019 (Leven @ Easby)	5.591	46	5.384	0.337	0.367	3	6.52	1.122
73015 (Keer @ High Keer Weir)	5.626	34	12.59	0.202	0.174	1	2.94	0.304
7009 (Mosset Burn @ Wardend Bridge)	5.636	26	7.486	0.358	0.324	3	11.54	1.376
33054 (Babingley @ Castle Rising)	5.654	48	1.132	0.255	0.281	2	4.17	0.634
45816 (Haddeo @ Upton)	5.656	31	3.456	0.283	0.41	1	3.23	0.881
28033 (Dove @ Hollinsclough)	5.663	49	4.15	0.233	0.359	1	2.04	0.79
33029 (Stringside @ Whitebridge)	5.673	58	2.722	0.257	-0.046	7	12.07	1.532
205005 (Ravernet @ Ravernet)	5.748	52	14.59	0.217	0.321	2	3.85	0.629
36003 (Box @ Polstead)	5.778	64	3.875	0.316	0.095	12	18.75	0.932
49003 (De Lank @ De Lank)	5.782	58	13.985	0.208	0.163	0	0	0.223
95004 (Abhainn a'Chnocain @ Elphin)	5.792	16	11.649	0.135	0.199	0	0	1.685
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	5.793	14	4.057	0.27	0.323	0	0	3.395

Trow01

Station	Distance (SDM)	Years of data	QMED AM	L-CV Deurbanised	L-SKEW Deurbanised	Non-flood years	Percentage Non-flood years	Discordancy
27073 (Brompton Beck @ Snainton Ings)	1.106	44	0.816	0.215	0.025	2	4.55	0.472
7009 (Mosset Burn @ Wardend Bridge)	1.951	26	7.486	0.358	0.324	3	11.54	0.383
26016 (Gypsy Race @ Kirby Grindalythe)	1.957	27	0.101	0.314	0.233	4	14.81	0.065
25019 (Leven @ Easby)	1.989	46	5.384	0.337	0.367	3	6.52	0.558
7011 (Black Burn @ Pluscarden Abbey)	2.221	12	4.752	0.474	0.558	1	8.33	2.604
33054 (Babingley @ Castle Rising)	2.236	48	1.132	0.255	0.281	2	4.17	1.542
49005 (Bolingey Stream @ Bolingey Cocks Bridge)	2.276	14	4.057	0.27	0.323	0	0	2.835
26013 (Driffield Trout Stream @ Driffield)	2.31	14	2.778	0.269	0.212	0	0	1.545
53017 (Boyd @ Bitton)	2.337	51	13.946	0.239	0.084	7	13.73	0.287
30004 (Lymn @ Partney Mill)	2.384	62	7.184	0.227	0.029	7	11.29	0.462
41020 (Bevern Stream @ Clappers Bridge)	2.416	55	13.9	0.201	0.161	3	5.45	1.74
26003 (Foston Beck @ Foston Mill)	2.426	63	1.797	0.255	0.033	6	9.52	0.589
33032 (Heacham @ Heacham)	2.435	56	0.442	0.302	0.138	9	16.07	0.278
28058 (Henmore Brook @ Ashbourne)	2.493	13	10.6	0.147	-0.046	0	0	1.426
36004 (Chad Brook @ Long Melford)	2.495	57	4.807	0.301	0.182	7	12.28	0.598
39033 (Winterbourne Stream @ Bagnor)	2.499	62	0.401	0.348	0.39	7	11.29	1.19
26014 (Water Forlornes @ Driffield)	2.517	26	0.431	0.322	0.189	3	11.54	0.48
36010 (Bumpstead Brook @ Broad Green)	2.519	57	8.12	0.348	0.099	12	21.05	1.893
9006 (Deskford Burn @ Cullen)	2.525	14	19.727	0.293	0.119	2	14.29	0.86
41022 (Lod @ Halfway Bridge)	2.526	54	16.755	0.292	0.157	4	7.41	0.194

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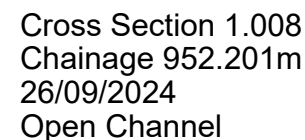
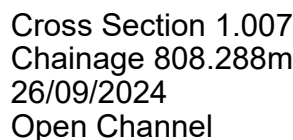
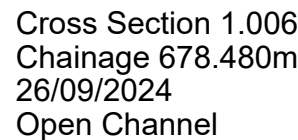
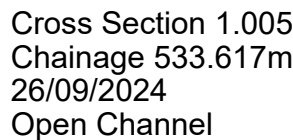
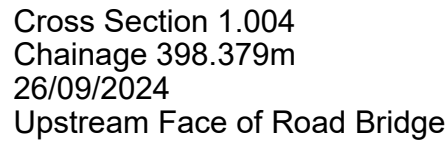
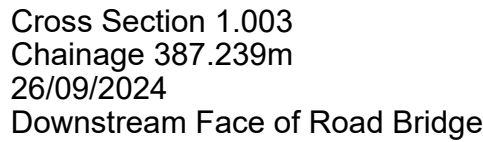
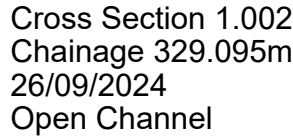
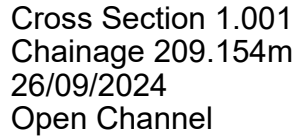
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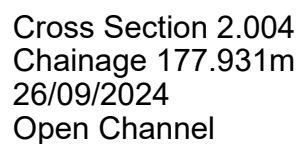
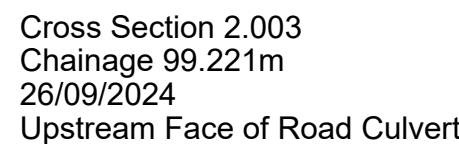
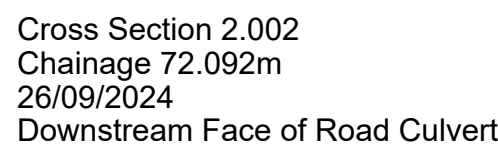
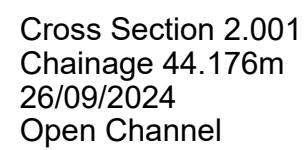
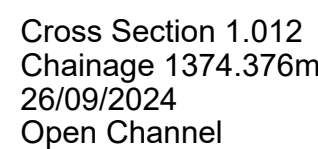
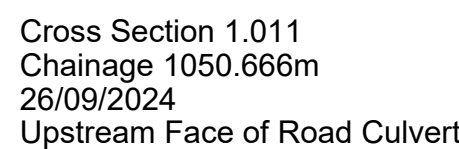
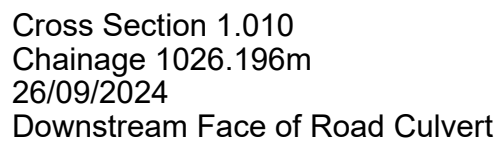
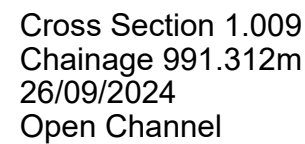
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Appendix 3





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PROJECT/WATERCOURSE

Trowbridge Channel Survey

SITE/LIMITS

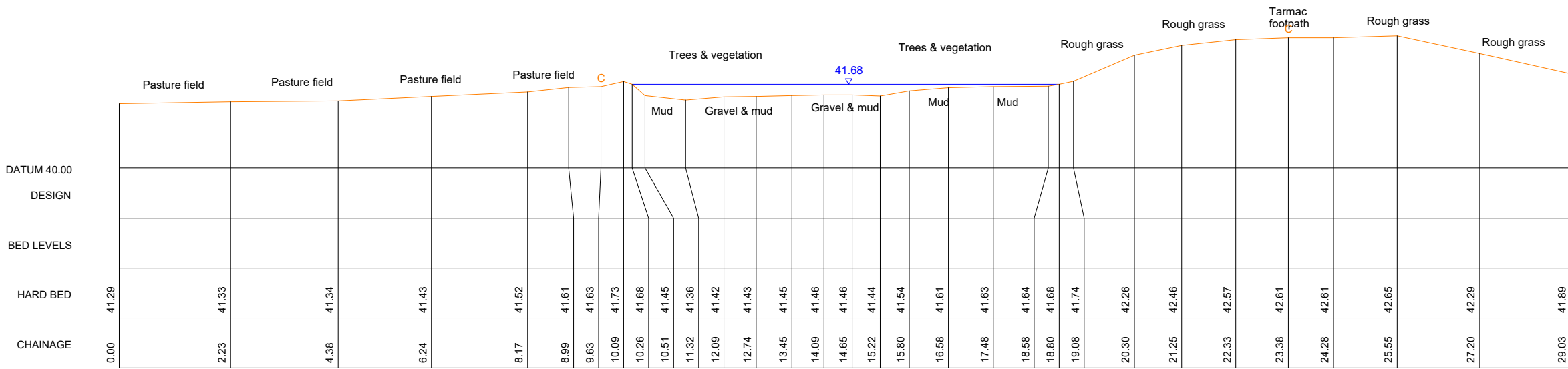
Channel Cross Sections
Sheet 2 of 3

SURVEYED BY:	AP Land Surveys	Ref: APLS-1595
SURVEY DATE:	SEPTEMBER 2024	

SCALE: 1:100@A1	DRN: AMP	CHKD: AJP
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DATUM: ODN (OSTN15)		DATE: SEPT 24	DATE: SEPT 24
GRID: NATIONAL (OSTN15)	DRAWING NO.		REV.
	10101505 000		

	APLS-1595-002	-
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Cross Section 2.005
Chainage 498.177m
26/09/2024
Open Channel

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2. ALL LEVELS SHOWN ARE IN METRES ABOVE ORDNANCE DATUM.
3. ALL SURVEY CO-ORDINATION DERIVED FROM OSTN15 & OSGM15.

NOTES:

SURVEY LEGEND					
AB	AIR BRICK	PH	FIRE HYDRANT	PWF	POST & WIRE FENCE
AV	AIR VALVE	PHM	FIRE HYDRANT MARKER	RE	RIDGE LEVEL
B	BOLLARD	FL	FLOOR LEVEL	RE	RODDING EYE
BS	BELGIAN BASIN	FP	FENCE POST	RS	ROAD SIGN
BOF	BOUNDARY	PWM	POLY WATER MANHOLE	RTW	RETAINING WALL
BH	BOREROLE	Q	QUILT	RWP	RAINWATER PIPE
BL	BED LEVEL	GL	GROUND LEVEL	SC	STOP COCK
BN	BROOKLINE	GP	GATE POST	SDP	STAND PIPE
BS	BUS STOP	GM	GAS METER	SL	SOAKAWAY
BMA	BENCH MARK	GV	GAS VALVE	SM	SLOTTED LEVEL
BW	BRICK WALL	HW	HEAD WALL	SMH	SURFACE WATER MANHOLE
BWP	BARBED WIRE FENCE	IC	INSPECTION CHAMBER	SMP	SHEET METAL PILING
CBF	CLOSE BOARD FENCE	IL	INLET LEVEL	SP	SHOE POST
CF	CORRUGATED IRON FENCE	IRF	IRON RAILING FENCE	STN	STATION
CL	COVER LEVEL	INF	INTERVIEW FENCE	SV	SURFACE VALVE
CLF	CHAIN LINK FENCE	JB	JUNCTION BOX	SWP	SOIL VENT PIPE
CONC	CONCRETE	KCF	KERB INLET GULLY	SWS	SHEEP WIRE FENCE
CP	CONCRETE POST	LB	LEFT BANK	TBM	TEMPORARY BENCH MARK
CPF	CHESTNUT PLANK FENCE	LIB	LEFT BANK	TC	TELECOM CABINET
CR	CYCLE RACK	LP	LAMP POST	TCB	TELEPHONE CALL BOX/POST
CTV	CABLE TV MANHOLE	MB	MOORING BOLLARD	TMH	TELECOM MANHOLE
CLL	CLL VERT	MP	MOORING POST	TL	TRAFFIC LIGHT
DK	DROP KERB	MH	MANHOLE	TL	TRAFFIC LIGHT
EL	EAVE LEVEL	MH	MANHOLE	TL	TRAFFIC LIGHT
DP	DRAIN PIPE	MP	MOORING POST	TP	TELEGRAPH POLE
DPC	DAMP PROOF COURSE	MP	MOORING POST	TR	TRANSFER RIGGING STRAP
DR	DRAIN	MS	MILE STONE	TS	TREE STUMP
DWB	DRAINAGE DRAIN	NS	NOTICE BOARD	TS	TURKISH STEEL RAILINGS
EL	EAVE LEVEL	NRA	NATIONAL RIVERS AUTHORITY	VP	VENT PIPE
EB	ELECTRICITY BOX	OC	OVERHEAD CABLE	WB	WATER BURN
ECF	ELECTRIC CABLE FENCE	OS	ORDNANCE SURVEY	WL	WATER LEVEL/WATER LINE
ECF	ELECTRICITY CABLE HT	OS	ORDNANCE SURVEY	WM	WATER METER
EMH	ELECTRICITY MANHOLE	OS	ORDNANCE SURVEY	WM	WATER METER
EP	ELECTRICITY POLE	OS	ORDNANCE SURVEY	WM	WATER METER
ETL	ELECTRICITY TRANSMISSION LINE	OS	ORDNANCE SURVEY	WM	WATER METER
FB	FOOTWAY BED	OS	ORDNANCE SURVEY	WM	WATER METER
FBR	FOOTBRIDGE	OS	ORDNANCE SURVEY	WM	WATER METER

Abbreviations apply to all Survey data only

REV.	AMENDMENT	DRN	CHKD	DATE

CONTROL USED:			STATIONS ESTABLISHED:		
TYPE	DESCRIPTION	LEVEL	NAME	CO-ORDINATES	LEVEL



PROJECT/WATERCOURSE			Trowbridge Channel Survey		
SITE/LIMITS			Channel Cross Sections Sheet 3 of 3		
SURVEYED BY: AP Land Surveys			Ref: APLS-1595		
SURVEY DATE: SEPTEMBER 2024					
SCALE: 1:100@A1		DRN: AMP	CHKD: AJP		
DATUM: ODN (OSTN15)		DATE: SEPT 24	DATE: SEPT 24		
GRID: NATIONAL (OSTN15)		DRAWING NO. APLS-1595-003		REV.	



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NOTES:

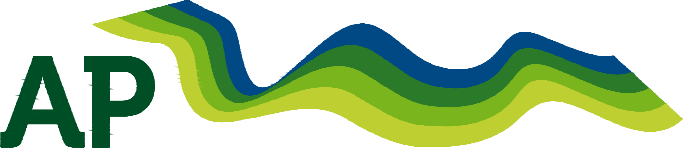
SURVEY LEGEND

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AV	AIR VALVE	PHM	FIRE HYDRANT MARKER	RE	RIDGE LEVEL
B	BOLLARD	FL	FLOOR LEVEL	RE	ROOFING EYE
BS	BELGIAN BEACON	FP	FENCE POST	RS	ROAD SIGN
BOF	BOUNDARY	PWM	FOLIAGE WATER MANHOLE	RTW	RETAINING WALL
BH	BORERHOLE	Q	QUAIL	RWP	RANWATER PIPE
BL	BED LEVEL	GL	GROUND LEVEL	SC	STOP COCK
BRK	BROOKSIDE	GP	GATE POST	SDP	STAND PIPE
BS	BUS STOP	GM	GAS METER	SL	SOFFIT LEVEL
BMA	BENCH MARK	GV	GAS VALVE	SM	SOIL METER
BRK	BRICK WALL	HW	HEAD WALL	SM	SHEET METAL PILING
BWP	BARRIED WIRE FENCE	IC	INSPECTION CHAMBER	SP	SHOULDER
CBF	CLOSE BOARD FENCE	IL	INLET LEVEL	STN	STATION
CJF	CORRUGATED IRON FENCE	IRF	IRON RAILING FENCE	SW	SURFACE WARE
CL	COVER LEVEL	IMP	INTERMOVING FENCE	SWP	SOIL VENT PIPE
CJF	CHAIN LINK FENCE	JB	JUNCTION BOX	SWT	SHEEP WIRE FENCE
CNC	CONCRETE	HCC	KEBBI INLET GULLY	TBM	TEMPORARY BENCH MARK
CP	CONCRETE POST	LB	LEFT BANK	TC	TELEPHONE CABLE BROWNSHIFT
CFF	CHESTNUT PLANK FENCE	LP	LAMP POST	TC	TELECOM CABINET
CR	CYCLE RACK	LP	LAMP POST	TMR	TELECOM MANHOLE
CTV	CABLE TV MANHOLE	MB	MOORING BOLLARD	TL	TRAFFIC LIGHT
CLV	CULVERT	MF	MISCELLANEOUS FENCING	TL	TRAFFIC LIGHT
DK	DROP KERB	MH	MANHOLE	TR	TRAILER LIGHT BOX
MR	MANHOLE	MP	MOORING PILE	TP	TELEGRAPH POLE
DP	DOWNPipe	MP	MOORING PILE	TR	TRAILER RUBBING STRIP
DMC	DAMP PROOF COURSE	MS	METAL RAILING FENCE	TS	TREE STUMP
DR	DRAIN	MS	MILE STONE	TS	TURBINE STEEL RAILINGS
DWB	DRAIN WASTE BIN	NS	NOTICE BOARD	VP	VENT PIPE
EL	EAVES LEVEL	NRA	NATIONAL RIVERS AUTHORITY	WB	WATER BIN
EB	ELECTRICITY BOX	OC	OVERHEAD CABLE	WL	WATER LEVEL/WATER LINE
ECF	ELECTRIC CABLE FENCE	OS	ORDNANCE SURVEY	WM	WATER METER
ECF	ELECTRICITY CABLE HT	OR	OPEN STEEL RAILINGS	WM	WATER METER
EMH	ELECTRICITY MANHOLE	P	PILLAR	WP	WOODEN POST
EP	ELECTRICITY POLE	PS	PILLAR BOX	WV	WATER VALVE
ETL	ELECTRICITY TRANSMISSION LINE	PD	POST	YD	YARD GULLY
FB	FOOTWAY BED	PRE	POST & RAIL FENCE		
FBR	FOOTBRIDGE	PTM	PARKING TICKET MACHINE		

(Abbreviations apply to all Survey data only)

REV.	AMENDMENT	DRN	CHKD	DATE

CONTROL USED:			STATIONS ESTABLISHED:		
TYPE	DESCRIPTION	LEVEL	NAME	CO-ORDINATES	LEVEL



21 Grandisson Drive, Ottery St Mary, Devon, EX11 1JD

PROJECT/WATERCOURSE

Trowbridge Channel Survey

SITE/LIMITS

Cross Section Location Plan

SURVEYED BY: AP Land Surveys		Ref: APLS-1595	
SURVEY DATE: SEPTEMBER 2024			
SCALE: 1:1,000@A1	DRN: AMP	CHKD: AJP	
DATUM: ODN (OSTN15)	DATE: SEPT 24	DATE: SEPT 24	
GRID: NATIONAL (OSTN15)	DRAWING NO. APLS-1595-004	REV. —	

