

The Paddocks, Goose Lane, Bollow,  
Westbury-on-Severn GL14 1QX

Flood Risk from River Severn

Ref: CWC084b

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## Quality assurance record

Contributors for Corner Water Consulting:

Name	Role
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Document Status and Revision History:

Version	Date	Report Contact	Status / Comment
1	30/05/2022	AC	First Issue

### Limitation of liability and use

The work described in this report was undertaken for the party or parties stated; for the purpose or purposes stated; to the time and budget constraints stated. No liability is accepted for use by other parties or for other purposes, or unreasonably beyond the terms and parameters of its commission and its delivery to normal professional standards.

# 1. Introduction

## 1.1 Purpose of this Report

This report provides an assessment via hydraulic modelling of peak flood levels at The Paddocks, Goose Lane, Bollow, Westbury-on-Severn. Also how the Environment Agency River Severn model outputs of peak water levels relate to the existing ground levels. Environment Agency Product 4 model outputs were produced on 12 May 2022.

The site is located at The Paddocks, Goose Lane, Bollow, Westbury-on-Severn, GL14 1QX grid reference 375088/214284, see Figure 1.



Figure 1: The Paddocks Site Location Plan

## 1.2 Sources of Information

This Report has been informed by:

- Site Location plus topographical data from 1:2500 scale Ordnance Survey mapping;
- Published flood data;
- Environment Agency Product 4 data;
- EA Product 7 Hydraulic Model.

### 1.3 Site Details

The site is in Bollow, Westbury-on-Severn and is located along a tidal stretch of the River Severn, south of Gloucester.

The Flood Map for Planning shows the site is within Flood Zone 3, see Figure 2.

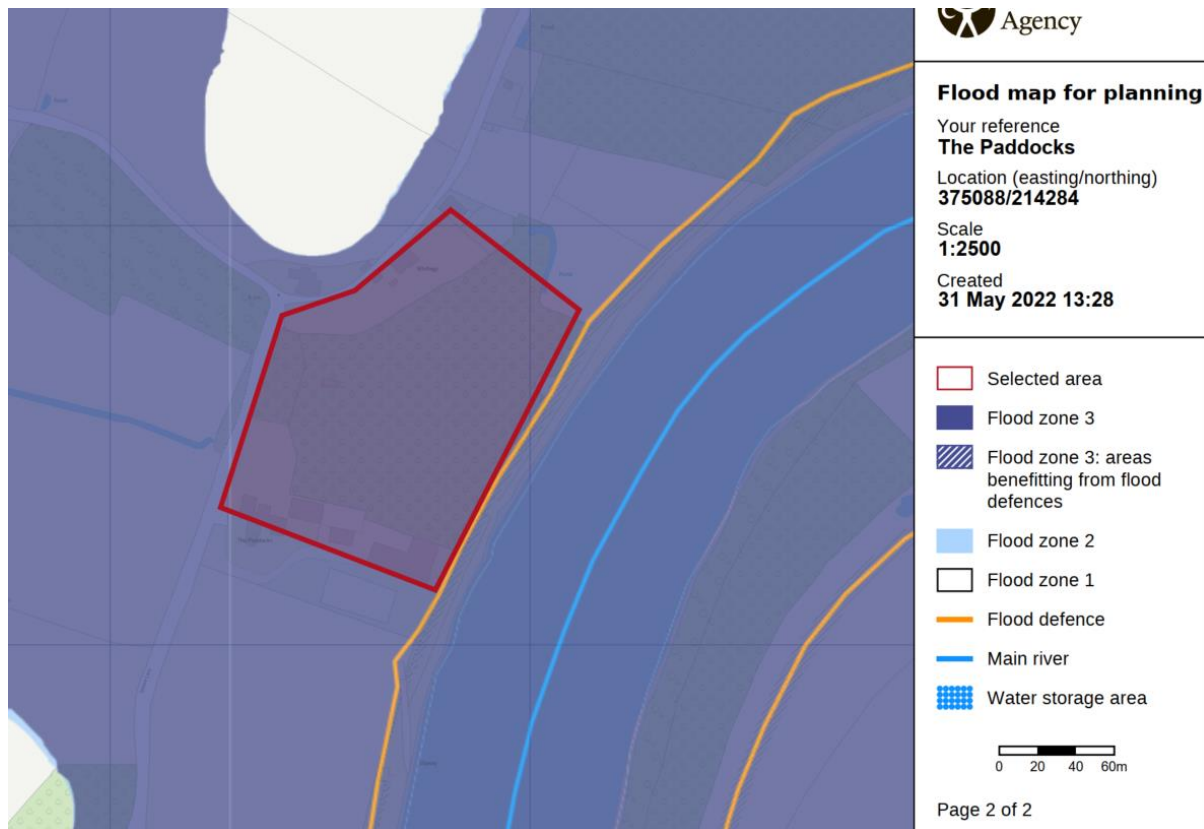


Figure 2: The Paddocks Flood Map for Planning

### 1.4 Study Methodology

The following steps were undertaken:

- Obtain EA 2007 River Severn hydraulic model outputs (Product 4) that include river flows plus 20% climate change allowances as model was rerun in 2020;
- Obtain EA 2007 River Severn Hydraulic Model (Product 7) open model and test it runs. Then run the model for the current 2022 river 37% inflows allowance;
- Increase the sea level within the EA hydraulic model, to account for August 2021 published sea level rises due to climate change.

### 1.5 Topography and Layout

Details of the sites topography is provided by the 1:2500 Ordnance Survey map outputs.

## 1.6 Environment Agency Product 4 Results

On 12 May 2022 the EA provided their 2007 River Severn hydraulic model outputs via Product 4, see Appendix A for full details. These model outputs include river flows plus 20% climate change allowances as model was rerun in 2020. As can be seen from Figure 3 model node SEV13 is close to the site.

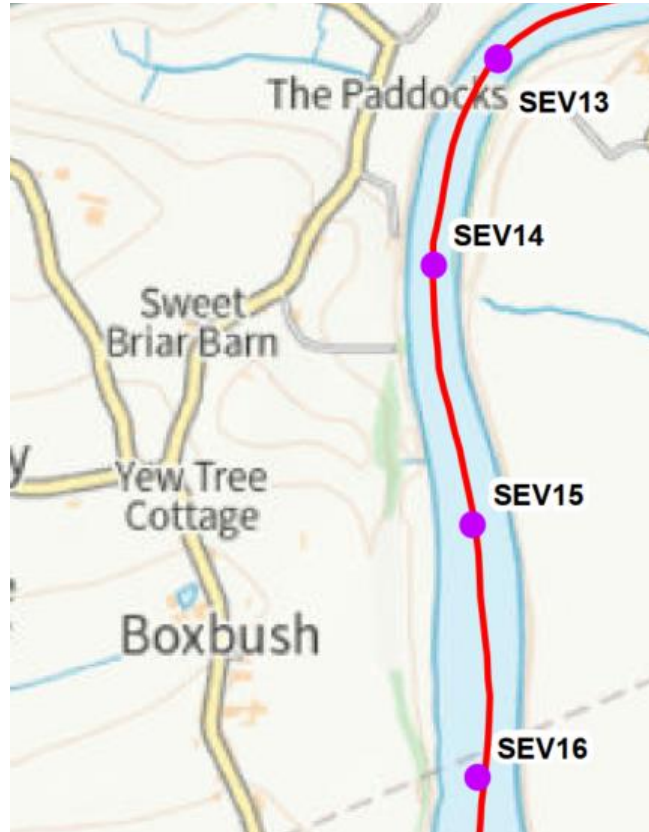


Figure 3: EA Model Node Extract

The EA data shows that:

- Node SEV13 will provide details for this study.
- The Product 4 data uses the 2007 model and although rerun in 2020 only included fluvial climate change allowances of 20% thus should not be used anymore. Therefore EA provided the River Severn Model on 8 March 2022.
- Information is provided for two critical events - the 0.5% or 1 in 200 year Tidal plus the 1% or 1 in 100-year Fluvial, both events in combination with a smaller Fluvial or Tidal event.
- The higher of the two critical events is to be used.
- Excluding climate change allowances this gave peak water levels for the critical events of Model Node SEV13 at 10.41mAOD, then with a 20% increase in river inflows the peak level is 10.52mAOD.

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Water Levels (m AOD) (defended)									
			20% Fluvial, 1.33% Tidal	20% Fluvial, 1% Tidal	20% Fluvial, 0.5% Tidal	20% Fluvial, 0.5% inc. 20% increase in inflows	20% Fluvial, 0.1% Tidal	1.33% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal inc. 20% increase in inflows	0.5% Fluvial, 50% Tidal	0.1% Fluvial, 50% Tidal
SEV6	375592	215769	10.26	10.27	10.29	10.43	10.34	10.34	10.35	10.55	10.40	10.51
SEV7	375537	215221	10.30	10.31	10.32	10.50	10.39	10.36	10.37	10.51	10.40	10.52
SEV8	375620	215029	10.30	10.31	10.32	10.46	10.37	10.36	10.37	10.51	10.40	10.52
SEV9	375763	214924	10.36	10.37	10.38	10.50	10.39	10.38	10.39	10.51	10.42	10.52
SEV11	375969	214571	10.37	10.38	10.38	10.49	10.40	10.39	10.40	10.52	10.43	10.51
SEV12	375726	214469	10.33	10.34	10.34	10.49	10.37	10.38	10.40	10.51	10.43	10.52
SEV13	375254	214299	10.38	10.39	10.39	10.51	10.41	10.40	10.41	10.52	10.45	10.52
SEV14	375116	213856	10.40	10.41	10.43	10.51	10.44	10.41	10.42	10.53	10.46	10.53
SEV15	375201	213299	10.36	10.37	10.38	10.50	10.39	10.38	10.39	10.50	10.42	10.53
SEV16	375209	212756	10.38	10.39	10.40	10.50	10.42	10.38	10.39	10.51	10.42	10.48

Figure 4: EA Product 4 Outputs

## 1.7 Updated Modelling with 2022 Climate Change Allowances

The EA model has been used and amended as follows in accordance with the EA Climate Change guidance in Appendix A dated August 2021. River flows have been increased by 37%.

Sea levels follows the modelling report by JBA for the 200 year or 0.5% Tidal event plus how the EA model that has been provided was set up. In the EA model sea level is set as a basic 9.03mAOD and in the version provided the EA added 0.37m to that level to give 9.4mAOD.

August 2021 EA climate change guidance, see Figure 5, shows that 0.351m should be added for events up to 2125 which is 100 years in the future. This assessment has thus added 0.351m to the Tidal element of the hydraulic model giving a level of 9.38mAOD.

### Sea Level rise allowances

Table 3 of the guidance (extract below) indicates that net sea level risk is as follows (updated from the 2013 version).

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
South West	Higher central	5.8 (203)	8.8 (264)	11.7 (351)	13.1 (393)	1.21
South West	Upper end	7 (245)	11.4 (342)	16 (480)	18.4 (552)	1.62

**Note - For sites utilising the Severn tidal model the above allowances should be considered and applied. As of August 2020, specific updated flood level data is now available for the 2096 to 2125 epoch based upon the Environment Agency's Tidal Severn model within the West Midlands area and will be provided where relevant as part of our Request For Information service; contact [Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)**

Figure 5: EA Climate Change Guidance August 2021

### Hydraulic Modelling

The peak extreme tide levels for the 2yr, 100yr, 200yr and 1000yr return periods were obtained from the ABPmer Report (October 2005). No peak tide level was available in the ABPmer Report for the 75yr tide so, in agreement with the Environment Agency, the level was interpolated from the values of the 50yr and 100yr tides. The table below gives a summary of the peak fluvial flows and tide levels required for hydraulic modelling.

Summary of Peak Fluvial Flows and Tide Levels Required

Return Period (and Equivalent AEP)	Peak Fluvial Inflow (m <sup>3</sup> /s)	Peak Tide Level (from ABPmer Report, mAOD)
1 in 2-year (50% AEP)	Not required	8.40
1 in 5-year (20% AEP)	658	Not required
1 in 75-year (1.33% AEP)	1007	<b>8.91</b>
1 in 100-year (1% AEP)	1045	8.95
1 in 200-year (0.5% AEP)	1126	9.03
1 in 1000-year (0.1% AEP)	1610	9.21

Note: Value shown in bold is interpolated between values given in the ABPmer report for other return periods.

In order to model flood storage downstream of Sharpness a series of new reservoir cells were developed based on the Filtered LiDAR digital elevation model (DEM). The DEM was trimmed and contoured to 0.5m for each reservoir cell and an area-level relationship was calculated that could be used to add geometry to the reservoir units in ISIS. Spill units into each reservoir were identified and crest heights assigned for each length of spill.

The undefended model is based on the updated and stabilised version of the defended model, as described above. Due to the extent and complexity of the Severn tidal floodplain, and therefore the model, it was agreed with the Environment Agency that undefended model runs were to be carried out on a scheme-by-scheme basis. Each set of spills was lowered to be consistent with the height of the LiDAR on the in-bank side.

### Climate Change

The values used for climate change in this study are based on a supplementary note on climate change impacts released by Defra as part of Flood and Coastal Appraisal Guidance.

#### Sea Levels

The regional net sea level rises given in the document for South West and Wales suggest that net sea level rise for the Severn Estuary is in the order of 3.5mm per year between 1990 and 2025, and 8mm per year between 2025 and 2055. Furthermore, the indicative sensitivity ranges suggest that between 1990 and 2055 a 5% increase in offshore wind speed and extreme wave height should be assumed.

#### Fluvial

The precautionary allowances for peak river flow volume given in the document remain unchanged from existing guidance at 20%. The applicability of this allowance is supported to at least the 2080s. The guidance does not however make clear whether both design flood peaks and flood volumes should be increased by 20%.

Figure 6: JBA Modelling Report Extracts

Rerunning the EA hydraulic model with 37% increase in river flows gives the values in Figure 7.

Node	1% Fluvial, 50% Tidal from EA Product 4	1% Fluvial, 50% Tidal inc. 20% increase in inflows, from Product 4	20% Fluvial, 0.5% Tidal inc. 37% increase in inflows, from updated model
SEV14	10.41	10.52	10.538

Figure 7: Product 4 versus 2022 Modelled Levels



At The Paddocks the bend on Goose Lane has an elevation of 8.1mAOD with the 10m and 15m contours slightly further North – hence the white dry oval on the flood map for planning. All of The Paddocks is below the flood level and any buildings will need to be set above ground level.

## 1.8 Flood Risk Mitigation

The internal space of any new building should be set above the peak flood level – with an allowance for freeboard to allow for uncertainty and wave action, etc. The freeboard is typically taken as 600mm.

This suggests a finished floor level of 10.541mAOD as modelled, plus 600mm giving 11.138mAOD.

Any site occupants should sign up to the EA Flood Warning Service, which will provide many hours of advance warning as to the onset of high-water levels in the River Severn. As the River Severn is a major river it does not react to rainfall or tides in a very rapid manner.

## 1.9 Summary

The site is in Bollow, Westbury-on-Severn GL14 1QX and this study has been requested to determine peak river flood levels.

Environment Agency Product 4 data has been obtained alongside the EA hydraulic model for the River Severn. The EA Product 4 model outputs include a 20% Climate Change allowance for fluvial river flows plus a sea levels rise value.

By using the EA model and rerunning it with a 37% Climate Change increase in river flows plus an appropriate sea level rise this assessment has been able to include the current or 2022 Climate Change peak flood level of 10.538mAOD.

The key findings are shown below:

- The Product 4 peak water level for the 1% Fluvial and 0.5% Tidal are 10.41 and 10.39mAOD so the higher 1% Fluvial in combination event is critical;
- The Product 4 peak water level for the 1% Fluvial and 0.5% Tidal allowing for 20% increase in inflows are 10.52 and 10.51mAOD respectively – so the fluvial is critical;
- The peak water level for the 0.1% Fluvial or 1 in 1000 year event with 50% Tidal is 10.52mAOD and is higher than the 0.1% or 1 in 1000 year in combination Tidal event;
- The modelled peak water level for the 20% Fluvial with 0.5% Tidal plus 37% increase in inflows at SEV14 is 10.538mAOD;
- Ground levels across the site are below 10mAOD and rise to the northwest;
- The recommended floor levels are 11.138mAOD.

Any occupants of the site should sign up to the EA Flood Warning Service, which will provide many hours of advance warning as to the onset of high-water levels in the River Severn which being a major river does not react in a very rapid manner.

## Appendix A EA Product 4 Data



### Product 4 (Detailed Flood Risk Data) for 'The Paddocks and The Coombs', East of Goose Lane, Bollow, GL14 1QX

Reference number: 255055

Date of issue: 12 May 2022

#### Model Information

The following information and attached maps contain a summary of the modelled information relevant to the area of interest. The information provided is based on the best available data as of the date of issue.

Model Name	Release Date
Tidal Severn	2007
Tidal Severn Climate Change Re-run	2020

#### Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring in any year for fluvial (river) flooding (Flood Zone 3). It also shows the extent of the Extreme Flood Outlines (Flood Zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The Flood Zones refer to the land at risk of flooding and **do not** refer to individual properties. It is possible for properties to be built at a level above the floodplain but still fall within the risk area.

The Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered that flooding may occur from other sources such as surface water, sewers, road drainage, etc.

To find out which flood zone a location is in please use: <https://flood-map-for-planning.service.gov.uk/>

#### Definition of flood zones

- **Zone 1** - The area is within the lowest probability of flooding from rivers and the sea, where the chance of flooding in any one year is less than 0.1% (i.e. a 1000 to 1 chance).
- **Zone 2** - The area which falls between the extent of a flood with an annual probability of 0.1% (i.e. a 1000 to 1 chance) fluvial and tidal, or greatest recorded historic flood, whichever is greater, and the extent of a flood with an annual probability of 1% (i.e. a 100 to 1 chance) fluvial / 0.5% (i.e. a 200 to 1 chance) tidal. (Land shown in light blue on the Flood Map).
- **Zone 3** - The chance of flooding in any one year is greater than or equal to 1% (i.e. a 100 to 1 chance) for river flooding and greater than or equal to 0.5% (i.e. a 200 to 1 chance) for coastal and tidal flooding.

Email: [Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)  
Website: [www.gov.uk/government/organisations/environment-agency](http://www.gov.uk/government/organisations/environment-agency)



Note: The Flood Zones shown on the Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the [Strategic Flood Risk Assessment](#) when considering location and potential future flood risks to developments and land uses.

### **Areas Benefitting From Defences**

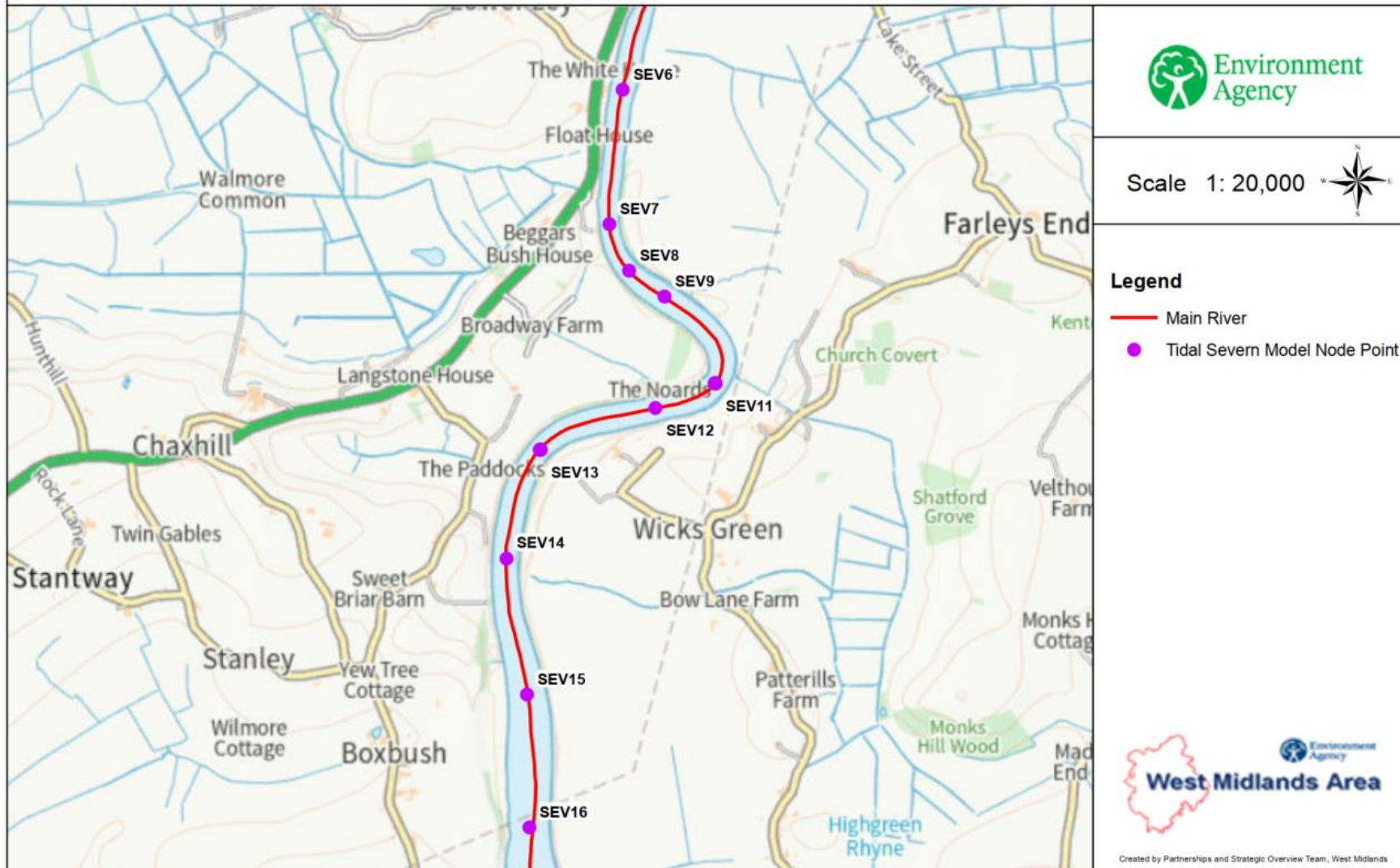
Where possible we show the areas that benefit from the flood defences, in the event of flooding:

- from rivers with a 1% (1 in 100) chance in any given year, or;
- from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would flood. Please note that we do not show all areas that benefit from flood defences.

The associated Dataset is available here: <https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences>

### Tidal Severn Model Node Location Map including GL14 1QX - created 29/03/2022 [255055]



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Contact us: National Customer Contact Center, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon - Fri 8-6). Email: enquiries@environment-agency.gov.uk



**Node Data / Modelled Levels**

The node point map will show a selection of model node points near to your site. The tidal & fluvial levels for these node points are shown below.

**Flood Levels (m AOD)**

The modelled levels are given in m AOD (N), m AOD indicates metres Above Ordnance Datum (Newlyn).

The information is taken from the model referenced above and may not include the updated climate change figures.

Annual Exceedance Probability - Maximum Water Levels (m AOD) (defended)												
Node Label	Easting	Northing	20% Fluvial, 1.33% Tidal	20% Fluvial, 1% Tidal	20% Fluvial, 0.5% Tidal	20% Fluvial, 0.5% inc. 20% increase in inflows	20% Fluvial, 0.1% Tidal	1.33% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal inc. 20% increase in inflows	0.5% Fluvial, 50% Tidal	0.1% Fluvial, 50% Tidal
SEV6	375592	215769	10.26	10.27	10.29	10.43	10.34	10.34	10.35	10.55	10.40	10.51
SEV7	375537	215221	10.30	10.31	10.32	10.50	10.39	10.36	10.37	10.51	10.40	10.52
SEV8	375620	215029	10.30	10.31	10.32	10.46	10.37	10.36	10.37	10.51	10.40	10.52
SEV9	375763	214924	10.36	10.37	10.38	10.50	10.39	10.38	10.39	10.51	10.42	10.52
SEV11	375969	214571	10.37	10.38	10.38	10.49	10.40	10.39	10.40	10.52	10.43	10.51
SEV12	375726	214469	10.33	10.34	10.34	10.49	10.37	10.38	10.40	10.51	10.43	10.52
SEV13	375254	214299	10.38	10.39	10.39	10.51	10.41	10.40	10.41	10.52	10.45	10.52
SEV14	375116	213856	10.40	10.41	10.43	10.51	10.44	10.41	10.42	10.53	10.46	10.53
SEV15	375201	213299	10.36	10.37	10.38	10.50	10.39	10.38	10.39	10.50	10.42	10.53
SEV16	375209	212756	10.38	10.39	10.40	10.50	10.42	10.38	10.39	10.51	10.42	10.48



Climate Change Scenarios – Maximum Water Levels (m AOD) (defended)

Node Label	Easting	Northing	Fluvial 2020 HC	Tidal 2020 HC	Fluvial 2020 UE	Tidal 2020 UE	Fluvial 2040 HC	Tidal 2040 HC	Fluvial 2040 UE	Tidal 2040 UE
SEV6	375592	215769	10.37	10.29	10.40	10.30	10.40	10.33	10.44	10.35
SEV7	375537	215221	10.36	10.33	10.40	10.33	10.40	10.37	10.45	10.39
SEV8	375620	215029	10.37	10.31	10.40	10.32	10.40	10.35	10.45	10.37
SEV9	375763	214924	10.38	10.37	10.40	10.37	10.40	10.38	10.45	10.39
SEV11	375969	214571	10.40	10.39	10.42	10.39	10.42	10.39	10.43	10.40
SEV12	375726	214469	10.41	10.35	10.43	10.35	10.43	10.36	10.44	10.38
SEV13	375254	214299	10.43	10.40	10.44	10.40	10.44	10.41	10.45	10.41
SEV14	375116	213856	10.43	10.41	10.45	10.41	10.45	10.42	10.46	10.43
SEV15	375201	213299	10.41	10.38	10.43	10.38	10.43	10.39	10.46	10.39
SEV16	375209	212756	10.40	10.39	10.41	10.40	10.41	10.41	10.42	10.41



Climate Change Scenarios – Maximum Water Levels (m AOD) (defended)										
Node Label	Easting	Northing	Fluvial 2070 HC	Tidal 2070 HC	Fluvial 2070 UE	Tidal 2070 UE	Fluvial 2125 HC	Tidal 2125 HC	Fluvial 2125 UE	Tidal 2125 UE
SEV6	375592	215769	10.42	10.41	10.53	10.45	10.42	10.70	10.53	10.90
SEV7	375537	215221	10.43	10.48	10.50	10.52	10.43	10.75	10.50	10.94
SEV8	375620	215029	10.43	10.45	10.48	10.49	10.43	10.71	10.48	10.91
SEV9	375763	214924	10.43	10.48	10.49	10.53	10.43	10.74	10.49	10.92
SEV11	375969	214571	10.43	10.47	10.48	10.52	10.43	10.72	10.48	10.92
SEV12	375726	214469	10.43	10.47	10.48	10.52	10.43	10.73	10.48	10.91
SEV13	375254	214299	10.45	10.49	10.48	10.54	10.45	10.74	10.48	10.92
SEV14	375116	213856	10.46	10.49	10.48	10.54	10.46	10.74	10.48	10.92
SEV15	375201	213299	10.46	10.48	10.48	10.53	10.46	10.73	10.48	10.91
SEV16	375209	212756	10.42	10.49	10.47	10.54	10.42	10.74	10.47	10.92

**Note;**

All Climate Change levels detailed above represent respective high risk events in each instance (i.e. a 1% or 1 in 100 year for fluvial, 0.5% or 1 in 200 year for tidal).

HC = Higher Central

UE = Upper End

## **Modelled Flood Extents**

Available modelled flood outlines produced as part of the detailed modelling have been provided to you in GIS format, these show modelled flood extents taking into account flood defences. Climate change will increase flood risk due to overtopping of defences.

Please note; there are currently no available GIS layers for the respective Tidal Severn Model Climate Change scenarios.

<https://ea.sharefile.com/d-s38674e346cc471f8>

## **Climate Change**

The '[Flood Risk Assessments: Climate Change Allowances](#)' are published on gov.uk. This is in replacement of previous climate change allowances for planning applications. You will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding. The climate change factors are now more complex and a single uplift percentage across England cannot be justified.

It remains the applicant's responsibility to demonstrate through their proposal and flood risk assessments that new developments will be safe in flood risk terms for its lifetime.

## **Recorded Flood Outlines**

Please find tabulated information below for records of historic flood events.

<b>Flood Event Date</b>	<b>Source of Flooding</b>	<b>Cause of Flooding</b>
November 2000	River Severn	Channel capacity exceeded (no raised defences)

The corresponding recorded flood outline/s can be accessed here:

<https://data.gov.uk/dataset/recorded-flood-outlines1>

**Please note:** the records of flooding from between October 2019 and March 2020 and beyond are still being reviewed, the outcomes of which have not yet been published or reflected within this request for information.

The Recorded Flood Outlines take into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding. It includes flood extents that may have been affected by overtopping, breaches or blockages. Any flood extents shown do not necessarily indicate that properties were flooded internally. It is also possible that the pattern of flooding in this area has changed and that this area would now flood or not flood under different circumstances.

Please note that our records are not comprehensive and that the map is an indicative outline of areas which have previously flooded, not all properties within this area will have flooded. It is possible that other flooding may have occurred that we do not have records for.

You may also wish to contact your Local Authority or Internal Drainage Board (where relevant), to see if they have other relevant local flood information.

Email: [Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)  
Website: [www.gov.uk/government/organisations/environment-agency](http://www.gov.uk/government/organisations/environment-agency)



### **Defence Data**

Flood defences do not completely remove the chance of flooding. They can be overtopped by water levels which exceed the capacity of the defences.

If flood defences are located in your area, you can access this data here:

<https://data.gov.uk/dataset/spatial-flood-defences-including-standardised-attributes>

### **Supporting Information**

**River modelling: technical standards and assessment guidance**

The link below contains standards for the flood risk management industry on how to build and review hydraulic models and provide evidence for flood risk management decisions.

<https://www.gov.uk/government/publications/river-modelling-technical-standards-and-assessment>

### **Surface Water**

Managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities. The 'risk of flooding from surface water' map has been produced by the Environment Agency on behalf of government, using Lead Local Flood Authority surface water information.

You may wish to contact your Local Authority who may be able to provide information on surface water.

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual site level. Further information can be found on the Agency's website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

### **Additional Details**

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments:

<https://www.gov.uk/planning-applications-assessing-flood-risk>

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

Email: [Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)  
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## Flood Risk and Coastal Change

### Climate Change allowances for planning (SHWG area)

August 2021

The National Planning Practice Guidance refers to Environment Agency guidance on considering climate change in planning decisions which is available online: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

This has been updated and replaces the March 2016 guidance.

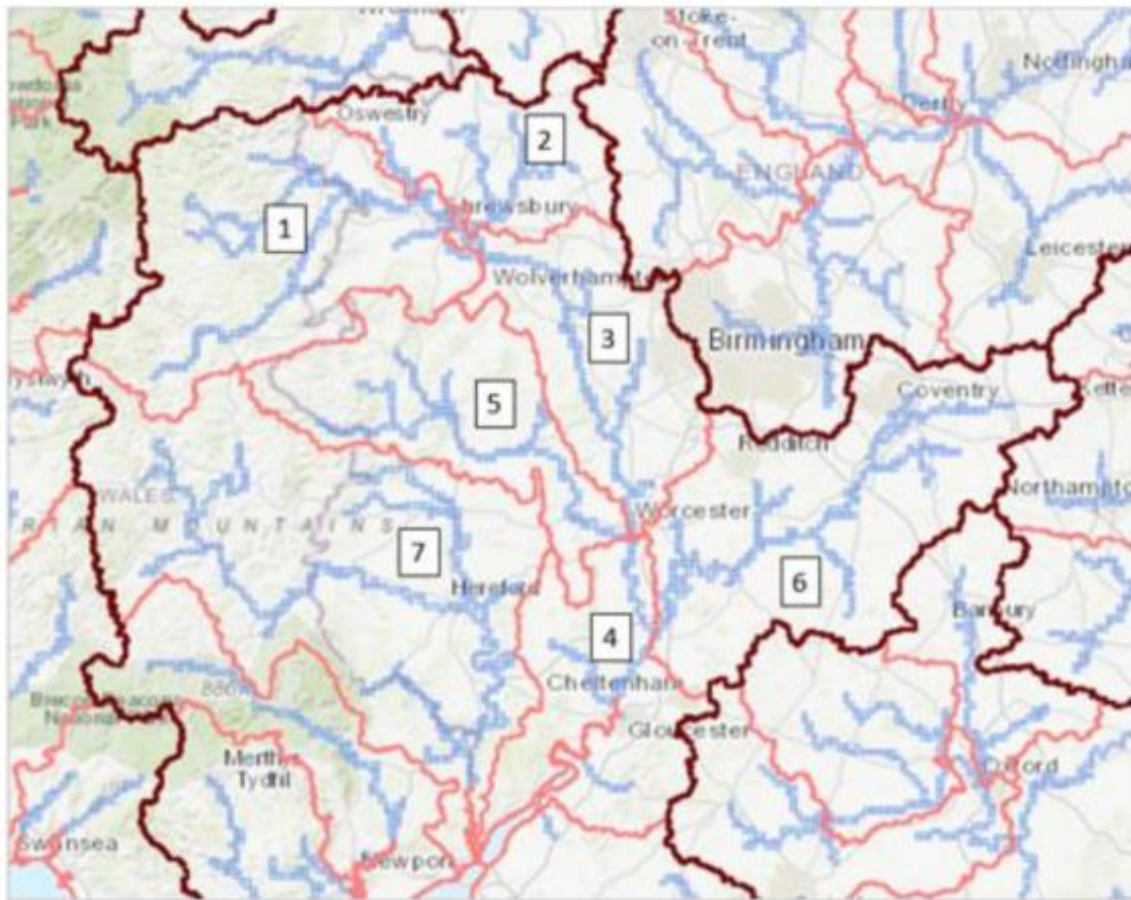
It should be used to help planners, developers and advisors implement the National Planning Policy Framework (NPPF)'s policies and practice guidance on flood risk. It will help inform Flood Risk Assessments (FRA's) for planning applications, local plans, neighbourhood plans and other projects.

#### Fluvial flooding – peak river flows

NPPG advises that an allowance should be added to 'peak river flows' to account for 'climate change' which should be specific to a 'management catchment' and development type (vulnerability). To work out which management catchment allowances to use, you need to: access the climate change allowances for [peak river flow map](#)

In Shropshire, Herefordshire, Worcestershire and Gloucestershire area, we would refer you to the map extract on page 2 below. This outlines the '**peak river flows**' within the specific 'Management catchments' for the Severn River Basin District, and specifies the range of percentage allowances to reflect individual development's vulnerability and lifetime. The following allowances should be used:

Development Vulnerability	Allowance (lifetime)
Essential Infrastructure	Higher Central - 2080's
Highly Vulnerable and More Vulnerable (residential)	Central - 2080's
Less Vulnerable and Water Compatible	Central - 2050's



<b>1. Severn Uplands Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>	<b>5. Teme Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>
Higher Central	17%	24%	43%	Higher Central	21%	33%	60%
Central	13%	18%	33%	Central	16%	24%	45%
<b>2. Severn Middle Shrops Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>	<b>6. Avon Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>
Higher Central	20%	25%	44%	Higher Central	12%	14%	32%
Central	15%	18%	33%	Central	7%	8%	21%
<b>3. Severn Middle Worcs River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>	<b>7. Wye Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>
Higher Central	16%	21%	40%	Higher Central	19%	27%	49%
Central	12%	15%	30%	Central	14%	20%	37%
<b>4. Severn Vale Peak River Flows</b>	<b>2020's</b>	<b>2050's</b>	<b>2080's</b>				
Higher Central	20%	28%	53%				
Central	14%	19%	37%				

**Extract: Management Catchments within the Severn River Basin District** – refer to interactive [peak river flow map](#) for more detail. The Environment Agency also provide these allowances in the [peak river flow climate change allowances by management catchment table](#) – you have to know your management catchment to get the information you need. (Allowances reflect the latest projections in UKCP18 and subsequent research that models how the latest rainfall projections are likely to affect peak river flows).

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## Sea Level rise allowances

Table 3 of the guidance (extract below) indicates that net sea level risk is as follows (updated from the 2013 version).

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
South West	Higher central	5.8 (203)	8.8 (264)	11.7 (351)	13.1 (393)	1.21
South West	Upper end	7 (245)	11.4 (342)	16 (480)	18.4 (552)	1.62

**Note - For sites utilising the Severn tidal model the above allowances should be considered and applied. As of August 2020, specific updated flood level data is now available for the 2096 to 2125 epoch based upon the Environment Agency's Tidal Severn model within the West Midlands area and will be provided where relevant as part of our Request For Information service; contact [Enquiries\\_Westmids@environment-agency.gov.uk](mailto:Enquiries_Westmids@environment-agency.gov.uk)**

## Flood Risk Assessment considerations:

The design flood (1% flood level fluvial, or 0.5% tidal, plus climate change allowance) should be used to inform the sequential test, including appropriate location of built development; consideration of flood risk impacts, mitigation/enhancement and ensure 'safe' development.

### Vulnerability classification

- Development classed as 'Essential Infrastructure' (as defined within Table 2 - Flood Risk Vulnerability Classification, Paragraph: 066 Reference ID: 7-066-20140306 of the NPPG) should be designed to the 'higher central' climate change allowance (2080).
- For highly vulnerable or more vulnerable development e.g. housing, the FRA should use the 'central' climate change allowance (2080), as a minimum, to inform built in resilience.
- For water compatible or less vulnerable development e.g. commercial, the FRA should use the 'central' climate change allowance (2050), as a minimum, to inform built in resilience.

### Assessing off-site impacts and calculating floodplain storage compensation

The appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. Use the central 2080 allowance for most cases (including where more vulnerable or highly vulnerable is affected) but apply the higher central allowance when the affected area contains essential infrastructure.

### Modelling approach

#### • Major Development:

For 'major' development (as defined within The Town and Country Planning Development Management Procedure (England) Order 2015)\*, see definition note below, we would expect a detailed FRA to provide an appropriate assessment (hydraulic model) of the 1% with relevant climate change ranges.

There are two options:

Scenario 1 - Produce a model and incorporate relevant climate change allowances within your Management catchment area location.

Scenario 2 - Re-run an existing model and incorporate relevant climate change allowances as specified in the Management catchment area data.

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• **Non Major Development:**

For 'non major' development, we would advise that a model is produced or existing model is re-run, similar to the above approach (Scenario 1 and 2). This would give a greater degree of certainty on the design flood extent to inform a safe development.

However, for 'non major' development only, in the absence of modelled climate change information it may be reasonable to utilise an alternative approach. To assist applicants and Local Planning Authorities we have provided some 'nominal' climate change allowances within the 'Table of nominal allowances' below. These should be considered as appropriate within any FRA. There are three additional options:

Scenario 3 - Where previous modelled data (for a variety of return periods) is available, you could interpolate your own climate change figure (see note iv below).

Scenario 4 - Where the 1% level is available from an existing model add on the relevant 'nominal climate change allowance' provided in the 'Table of nominal allowances' below.

Scenario 5 - Establish the 1% level, for example using topographical levels (including LiDAR) and assessment of watercourse flow and nature and then add on the relevant 'nominal climate change allowances' provided in the 'Table of nominal allowances' below.

- \*Note: For definitions of 'major' development see 'Interpretation 2.—(1)', on page 5, at: [www.legislation.gov.uk/ukxi/2015/595/pdfs/ukxi\\_20150595\\_en.pdf](http://www.legislation.gov.uk/ukxi/2015/595/pdfs/ukxi_20150595_en.pdf)

**Table of Nominal Allowances**

Watercourse	Central allowance (2050)	Central allowance (2080)
	Water compatible and Less Vulnerable.	More Vulnerable
Upper Severn	600mm	850mm
River Wye		
River Teme		
River Avon	200mm	400mm
Lower Severn	400mm	600mm
Tributaries and 'ordinary watercourses'	200mm	300mm

Notes to above:-

(i) Watercourse definition:

The "Upper Severn"/"Lower Severn" boundary is taken as Bevere Weir, North of Worcester, (national grid reference SO8376859428). These do not directly relate to management catchments.

Use of the Avon nominal is only valid upstream of the M5 crossing and downstream of that point the Lower Severn nominals should be used.

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