Proof of Evidence, Flood Risk on behalf of Greenfield Environmental

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Wallingford Mineral Workings

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Contents

Glossary of Terms

1 in 100 year return period	A flow event with a 1% chance of occurring in any one year.
1 in 200 year return period	A flow event with a 0.5% change of occurring in any one year.
Climate change factor	A factor specified in the Planning Policy Guidance which is applied to river flows to allow for climate change over the lifetime of the building.
Upper End Climate Change	The Upper Central climate change projection is the higher of the two climate change scenarios contained in this document. The Upper End projection is based on a statistical assessment of a wide range of climate models and takes information from the 90th percentile to provide recommended increases in flow within a river or sea level rise.
Higher Central Climate Change	The Higher Central climate change allowance is the lower of the two climate change scenarios contained in this document. The Higher Central projection is commensurate with the 70th percentile scenario. (N.B. An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it is exceeded by 30%. At the 90th percentile it is exceeded by 10%.)
Flood Zone 1 (Low Probability)	A planning boundary defined on the Environment Agency's (EA) flood risk maps (rivers and seas) which is not subject to flooding in a 1 in 1000 year flood event.
Flood Zone 2 (Medium Probability)	A planning boundary on the EA's flood risk maps (rivers and seas) which shows an area which will flood in a in a 1 in 1000 year flood event (undefended and unblocked).
Flood Zone 3 (High Probability)	A planning boundary on the EA's flood risk maps (rivers and seas) which shows an area which will flood in a in a 1 in 100 year flood event (undefended and unblocked).
Hydraulic Model	The representation of a river and its floodplains.
Hydrology	The calculation of catchment based flow rates over time (i.e. 1 in 100 and 1 in 1000 year return period events).
FRA	Flood Risk Assessment.

Introduction

1. My name is John Young. I am a Chartered Civil Engineer, Member of the Institution of Civil Engineers, Member of the Chartered Institution of Water and Environmental Engineers. I was awarded a BEng at Sheffield University in 1981 in Civil and Structural Engineering. My professional training was with British Railways Eastern Region and I became a Chartered Member of the Institution of Civil Engineers in 1986 (CEng, MICE). In 1988, I obtained an MSc(Eng) from the University of Liverpool in Maritime Civil Engineering; and in 1990, I became a Chartered Member of the Chartered Institution of the Institution of Water and Environmental Managers (CWem MCIWEM).

2. On completion of my MSc, I worked for: Sir William Halcrow and Partners (1988 - 1990); Binnie and Partners (1990 - 1998) and Buro Happold (1998 - 2002). In these roles, I was responsible for civil engineering and hydraulic modelling projects. I was a founding partner of Edenvale Young in 2004, and the Partnership was incorporated as Edenvale Young Associates Ltd in 2006. Edenvale Young is a civil engineering consultancy with 17 staff specialising in fluvial and coastal engineering. It is particularly well known for its expertise in hydrology and hydraulic modelling.

3. Between 2010 and 2013, I was an Ove Arup Foundation / Royal Academy of Engineers visiting lecturer in design at the University of Bath on the Hydraulics, Offshore and Coastal Engineering module of the Civil Engineering MEng degree course. I have been actively involved in sponsorship of PhD research on breach failure of flood defences in extreme flood events. I was a visiting lecturer at the University of Bath between 2014 and 2017 responsible for the 4th year industrial design projects in fluvial and coastal engineering.

4. I have been responsible for four projects which have gained awards from the Institution of Civil Engineers (ICE) and New Civil Engineer. This includes:

    - ICE West Midlands Small Project Award 2019 Dukes Lake. The National Defence Rehabilitation Centre Stamford.

    - NCE 100 Award for Design Innovation 2018 in relation to the development of Distributed Hydrological Modelling.

    - ICE Wales Rhiwbina Flood Alleviation Scheme 2018 (Roy Edwards Award).

    - ICE Wales Pont Briwet Bridge Transport Improvement Project 2018 (George Gibby Special Award for Innovation).

5. My special area of expertise is the use and application of the industry standard hydraulic modelling program for 1D-2D analysis called (FMP-TUFLOW). Flood Modeller Pro (FMP) and TUFLOW are powerful hydraulic modelling packages used to analyse flooding and flood risk and are extensively used throughout the UK including by the Environment Agency (EA).

6. Since 2009, I have organised the European TUFLOW conference. The conference is aimed at flood modelling professionals from the EA, Natural Resources Wales (NRW), Scottish Environmental Protection Agency (SEPA), local authorities, academics and civil engineering and flood risk consultants. It regularly attracts professionals from overseas including the US, Australia, Czech Republic, Italy, France and Ireland.

Overview

7. The site itself is agricultural land situated on the right bank of the River Thames, south of Nosworthy Way (A4130) and east of Reading Road (A329).

8. Mineral extraction is planned over approximately five years, after which the entire site will be restored to its original levels, ensuring that there is no long-term change in flood risk compared to the present. The primary concern regarding flood risk is during the operational five-year period of mineral extraction.

9. The purpose of this proof of evidence is to evaluate whether recent changes to flood risk mapping have materially impacted the application of the National Planning Policy Framework (NPPF) and Planning Policy Guidance to this scheme and the conclusions of the Flood Risk Assessment (FRA) prepared by Edenvale Young in 2023[1].

10. The Environment Agency has withdrawn all objections associated with the hydraulic modelling and FRA. In their correspondence to Oxfordshire County Council dated April 24, 2024, they imposed a number of conditions on the site's development. Some of these conditions pertain to flood risk and the Flood Risk Assessment.

11. This proof of evidence will be structured as follows:

    - A discussion on changes to the flood risk mapping.
    - An assessment of the impact of changes to flood risk mapping on the Flood Risk Assessment prepared in 2023.
    - Conclusions.

Flood Risk Mapping

12. Flood risk mapping for England was updated in December 2024. Figure 1 shows the flood risk mapping for planning for Flood Zones which was downloaded from the Gov.uk website in August 2023 (see also Figure 3.2 of the FRA), while Figure 2 shows the current Flood Zone mapping downloaded on 11 June 2025.

[1] Wallingford Mineral Workings, Flood Risk Assessment, Revision D: 14 November 2023

13. Information on the scope of the December 2025 changes to the flood risk mapping is detailed on the Gov.uk website[2] and in the Environment Agency's "Flood Zones and supporting datasets" (see Appendix A) [3]. The most significant change is the incorporation of climate change. Both of these documents confirms that the mapping incorporates allowances for climate change based on the Central Climate Change scenario.

14. The climate change allowances relevant to the site, taken from the Environment Agency's Planning Policy Guidance for Flood Risk Assessments[4], are as follows:

	Central	Higher	Upper
2020s	12%	17%	30%
2050s	14%	22%	42%
2080s	31%	43%	76%

15. Accordingly, it is assumed that Flood Zone 2 and 3 now incorporates a 31% uplift to peak flood flows for the 2080s epoch.

16. Inspection of the 2021 and 2025 flood risk mapping confirms that there is negligible change in the extent of Flood Zones 2 and 3. The majority of the site remains within Flood Zone 3, with the northwestern area in Flood Zone 2.

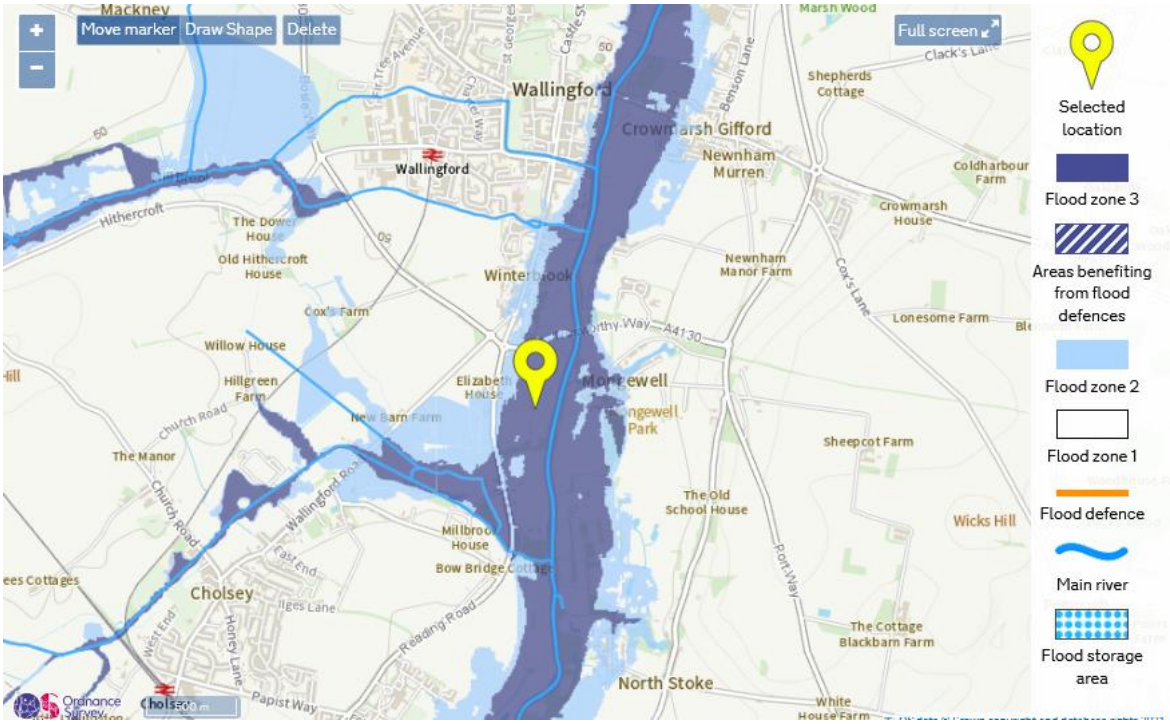

Figure 1 - Environment Agency Flood Rosk Mapping: August 2021 (see Figure 3.2 of the FRA)

[2] https://environment.data.gov.uk/dataset/610d6830-0637-4f5b-b6ce-61f5fa5635d3
[3] Flood Zones and supporting datasets – Product Description: 30/01/2025
[4] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

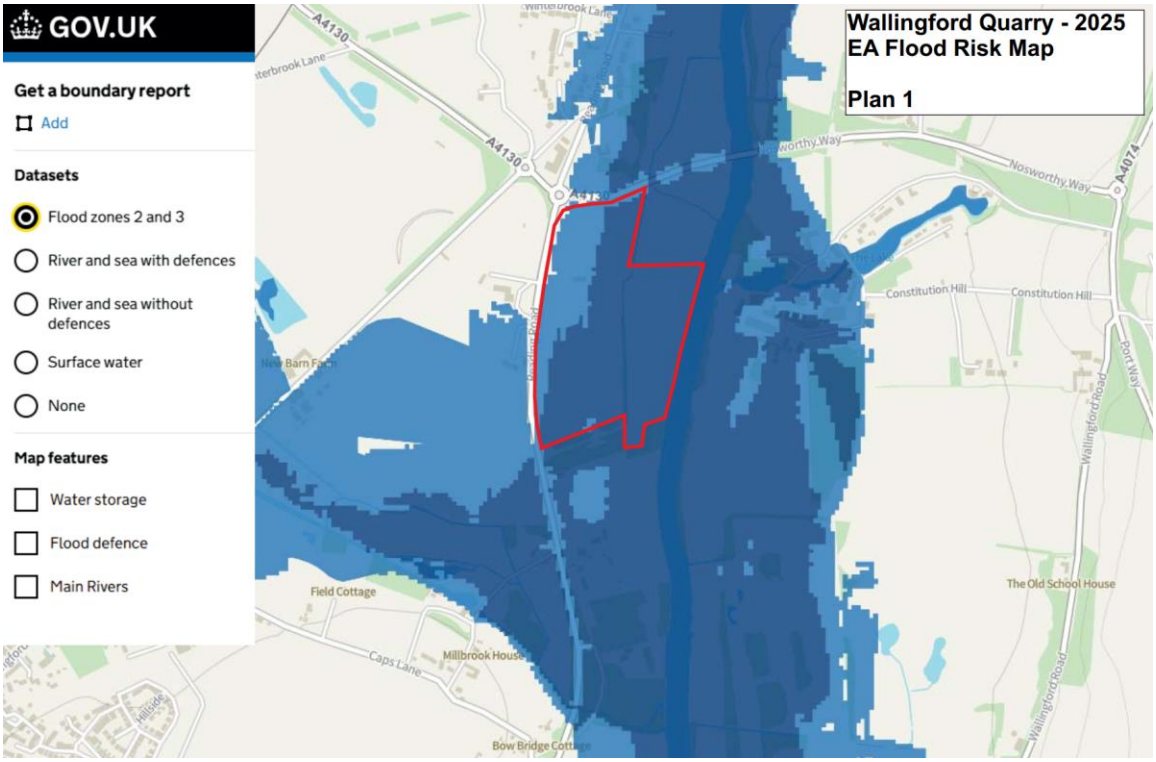

Figure 2 - Environment Agency Flood Risk Mapping: 11 June 2025

The FRA

17. The FRA established that the majority of the scheme is situated in Flood Zones 2 and 3 (see Figure 3.2 of the FRA). However, the Oxfordshire County Council, Minerals and Waste Strategic Flood Risk Assessment also confirmed the site falls within Flood Zone 3b. Irrespective of the fact that the Flood Risk Mapping shows the majority of the site is in Flood Zones 2 and 3, the Flood Zone 3b classification dictates how the site is tested in relation to planning as discussed below.

18. Table 2 of Annex 3 of the National Planning Policy Framework confirms that sand and mineral workings are classified as water compatible development. The Environment Agency's Planning Policy Guidance for flood risk and coastal change[5] indicates that sand and mineral workings are compatible with Flood Zone 3b. There has been no change in in policy or guidance since 2023 which affects this status, or the application of the policy / guidance used in the FRA.

19. The following flood risk tests are given in the Environment Agency's Planning Policy Guidance[6] and they remain unchanged from 2023 to 2025. The guidance states that Water Compatible development in Flood Zone 3b must:

    - Remain operational and safe for users in times of flood;

[5] https://www.gov.uk/guidance/flood-risk-and-coastal-change#table2
[6] https://www.gov.uk/guidance/flood-risk-and-coastal-change#table2

- result in no net loss of floodplain storage and
- not impede water flows and not increase flood risk elsewhere.

20. Because the site will only remain operational for five years, the appropriate climate change allowance for the site is 12%.

21. Hydraulic modelling using the 12% allowance for climate change confirmed that there was:

    - No measurable or material change in flood extent and level when comparing the pre-development baseline model with the staged excavation models and
    - no increase in off-site water levels for a 1 in 100 year event.

22. As stated in the FRA there is no requirement for the site to remain operational during flooding. There will be no net loss of floodplain storage, and the works do not impede flood flows. The conclusions contained in the FRA remain unchanged.

Conclusions

23. With respect to planning policy:

    - The Oxfordshire County Council, Minerals and Waste Strategic Flood Risk Assessment confirmed the site falls within Flood Zone 3b (the highest classification on the site). The Flood Zone 3b classification dictates how the whole site should be assessed in relation to flood risk. There has been no change in the Flood Zone 3b classification for the purposes of planning.
    - Sand and gravel working are classified as Water Compatible development which is compatible with Flood Zone 3b. There have been no changes in this status with respect to the NPPF and Planning Policy Guidance as a result of the updates to the flood risks for planning maps.

24. Mineral extraction is planned over approximately five years, after which the entire site will be restored to near original levels, ensuring that there is no long-term change in flood risk compared to the present. The primary concern regarding flood risk is during the operational five-year period of mineral extraction.

25. Hydraulic modelling of the pre-development baseline and the staged excavation scenarios during the five-year operational phase has confirmed that there is:

    - No measurable or material change in flood levels resulting from the phasing of the works and
    - no increase in off-site water levels for a 1 in 100-year event.

26. There is no requirement for the site to remain operational during flooding. There will be no net loss of floodplain storage, and the works do not impede flood flows.

27. The tests contained in the Planning Policy Guidance are therefore passed and the conclusions contained in the FRA remain unaffected by the change in flood risk mapping.

Appendix

Flood Zones and supporting datasets - Product Description

Published: 30/01/2025

Contents

What are the Flood Zones and supporting datasets

Flood Zones Overview

The Environment Agency categorises land based on its likelihood of flooding. Flood Zones represent an annual probability of flooding from rivers and the sea and do not take account of the presence and effect of flood defences, unless they increase the area potentially at risk of flooding.

Why Flood Zones are created

The Environment Agency has the delegated responsibility from UK government to produce mapped extents for Flood Zones 2 and 3; and to make them available to planning authorities in England to support the implementation of government planning policy. Flood Zones are designed for both strategic spatial and development planning purposes in England.

The Flood Zones are shared, alongside other supporting datasets, through the Flood Map for Planning digital service and the Defra Data Services Platform to raise awareness of flood risk for informing planning policy with our partner organisations.

What they show

Flood Zones

The Flood Zones show the extent of land at present day risk of flooding from rivers and the sea, ignoring the benefits of flood defences, for the following annual probabilities which are defined in Table 1 of the Planning Practice Guidance:

- Flood Zone 1 – Land having a less than 0.1% (1 in 1000) annual probability of flooding
- Flood Zone 2 – Land having between 0.1% - 1% (1 in 1000 and 1 in 100) annual probability of flooding from rivers or between 0.1% - 0.5% (1 in 1000 and 1 in 200) annual probability of flooding from the sea, or accepted recorded flood outlines
- Flood Zone 3 – Areas shown to be at a 1% (1 in 100) or greater annual probability of flooding from rivers or 0.5% (1 in 200) or greater annual probability of flooding from the sea

Flood Zone 3b represents the Functional Floodplain. This zone shows land where water has to flow or be stored in times of flood. The Environment Agency are not required to map the outer boundary of the extent of Flood Zone 3b, and it is usually included within our mapped extent of Flood Zone 3.

We have produced a Defended 3.3% (1 in 30) annual exceedance probability (AEP) dataset to support conversations related to the Functional Floodplain, however, it is the responsibility of the Local Authority to define the Functional Floodplain.

Supporting datasets

As well as the primary Flood Zone dataset, several additional flood risk datasets are available to support the use of Flood Zones in the planning process. Like the Flood Zones, the supporting datasets present the extent of land at risk of flooding to a defined annual exceedance probability (AEP).

These include datasets showing the risk of flooding from rivers and sea, and surface water, for the following scenarios:

Present Day scenarios:

- Undefended: 0.1% AEP (1 in 1000) Rivers/Sea
- Undefended: 1% AEP (1 in 100) Rivers/ 0.5% (1 in 200) Sea
- Defended: 0.1% AEP (1 in 1000) Rivers/Sea
- Defended: 1% AEP (1 in 100) Rivers/ 0.5% (1 in 200) Sea
- Defended: 3.3% AEP (1 in 30) Rivers/Sea
- 0.1% AEP (1 in 1000) Surface Water
- 1% AEP (1 in 100) Surface Water
- 3.3% AEP (1 in 30) Surface Water

Climate Change scenarios:

- Undefended: 0.1% AEP (1 in 1000) Rivers/Sea
- Undefended: 1% AEP (1 in 100) Rivers/ 0.5% (1 in 200) Sea
- Defended: 0.1% AEP (1 in 1000) Rivers/Sea
- Defended: 1% AEP (1 in 100) Rivers/ 0.5% (1 in 200) Sea
- Defended: 3.3% AEP (1 in 30) Rivers/Sea

The **undefended** datasets show flood extents that ignore the presence and condition of flood defences.

The **defended** datasets take into account the presence of flood defences and assume that they operate in the way they were intended (or designed) to function. This does not include any asset failure (or removal) scenarios.

Climate change scenarios have been produced to indicate the predicted impacts of climate change on future risk. The climate change allowances are based on the latest UK Climate Projections (UKCP18) from the Met Office, using the Representative Concentration Pathway (RCP) 8.5.

The datasets shown on Flood Map for Planning are aimed at supporting planners and developers to make long-term decisions about the location and design of development and the use of land. Such decisions need to account for the full anticipated lifetime of the development being planned. We have therefore chosen:

- the ‘Central’ allowance for the 2080s epoch (2070-2125) for risk of flooding from rivers
- the ‘Upper End’ allowance for risk of flooding from the sea, accounting for cumulative sea level rise to 2125

For climate change scenarios, it is assumed existing flood defences continue to function in the same way as present day. No allowance is made for any future changes to flood defences design or operation.

The Flood Map for Planning will also display **surface water flood risk** for the first time. This increases the visibility of this important source of flooding so it can better inform the location and design of development. LLFAs remain the lead risk management authority for this source of flooding and a statutory consultee on all major planning applications.

How the Flood Zones and supporting datasets are managed

How they are created

Flood Zones

The Flood Zones are created using local flood model outputs, recorded flood outlines and national flood model information. These are combined to generate extents of land at flood risk, with the aim of using the best available flood risk information in any one location.

For particular areas, sections of a previous Flood Zone dataset have been retained. These are due to be replaced in the future.

Supporting datasets

Defended data

The defended supporting data are created using defended scenarios from local and national models.

Undefended data

The undefended supporting data are created using undefended scenarios from local and national models.

Climate Change data

Climate change data are created for the **defended** and **undefended** datasets using available information from local and national modelling for the agreed climate change allowances.

Note! Climate change scenarios are **not** produced for Flood Zones.

Surface Water data

For further information on the Risk of Flooding from Surface Water datasets and how they were created, please see: Risk of Flooding from Surface Water

Update frequency

In the future we plan to publish the data every three months and update it in locations where new local flood model information is available. Updates on these timescales can be found on Updates to national flood and coastal erosion risk information - GOV.UK

Uses and limitations

Who uses these datasets and why

The Flood Zones are used by local planning authorities to know when to consult the Environment Agency on planning applications in line with Schedule 4 of the Town and Country Planning (Development Management Procedure) Order 2015.

Flood Zones are also used by decision-makers when applying government policy and guidance to proposed development.

Suitability and limitations

The Flood Zones and supporting datasets are designed to only give an indication of flood risk from rivers and the sea to an area of land and are not suitable for showing whether an individual property is at risk of flooding. This is because we cannot know all the details about each property.

Locations may also be at risk from other sources of flooding, such as high groundwater levels, or failure of infrastructure such as sewers and storm drains. These sources **are not** represented in this dataset.

The mapping of Flood Zones and supporting datasets covers all of England, down to catchments with an area of 3km^2. Where we have suitable data for smaller catchments, we will also show this.

It is important to note that not all rivers are included in the maps and, if a development is to take place near one of these rivers, further investigations and modelling may be required. In these locations it should therefore not be assumed that there is no flood risk. Flood Zones are a planning tool and they do not necessarily mean somewhere will or will not flood.

How to access them

Flood Map for Planning digital service

The Environment Agency presents the flood zones and supporting datasets on maps via GOV.UK where anyone can access them if they have a place name, postcode or co-ordinates.

On this digital service the data is presented as a multi-layered map which displays the latest Flood Zones and supporting datasets, plus information on flood defences and water storage areas.

From this service customers can also request a Flood Risk Assessment (FRA) Product 1 (Flood Zone Map) and Product 4 (Detailed FRA map).

Data Services Platform (DSP)/ data.gov.uk

The Flood Zones and supporting datasets are available in a variety of formats from the Defra Data Services Platform and data.gov.uk

Note! Risk of Flooding from Surface Water extents are available to download from the Data Services Platform but the depth information is not structured in a way that is suitable for planning purposes, as it describes the chance of flooding to a given depth, rather than the depth of flooding expected in the flood events considered through planning.

Note! The climate change information currently available for surface water flood risk is also not sufficient for use in planning. This is because the time-horizons and climate change scenarios used are likely to fall short of what's needed to assess planned development. We plan to publish surface water climate change data relevant to planning time horizons in later updates.

Product Contents and Schemas

Schemas for the datasets available on the Defra Data Services Platform schemas are provided on the following pages and describe the geometry and the attributes of the data. When delivered, some file formats may truncate the fieldnames.

Flood Map for Planning - Flood Zones

File Geodatabase Name: FMfP_Flood_Zones_vYYYYMM.gdb

Simple Feature Class					Geometry:		Polygon	
Flood_Zones_2_3_Rivers_and_Sea					Contains M Values: [1]		No	
					Contains Z Values: [2]		No	
Field name	Description	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Unique object identifier	Object ID						
Shape	Geometry data type	Geometry						
Origin	Source of data (modelled, recorded, direct rainfall model, local evidence)	Text	Yes	-	-			64
Flood_zone	Assigned Flood Zone (Flood Zone 2 or 3)	Text	Yes	-	-			3
Flood_source	Source of flooding (river and/or sea and/or undefined)	Text	Yes	-	-			32

A layer file is also provided alongside this dataset for use in ESRI applications. This contains the recommended symbology information, reflecting how the data is displayed on Environment Agency systems. Users of other GIS applications can apply the symbology for each flood likelihood category manually using the RGB information provided in the table below:

	Flood Zone	**RGB**	**HEX#**
	Flood Zone 3	58-68-135	3A4487
	Flood Zone 2	156-208-252	9CD0FC

Flood Map for Planning – Present day extents (defended and undefended)

File Geodatabase Name: FMfP_Extents_vYYYYMM.gdb

Simple Feature Class					Geometry:		Polygon	
Rivers_1in100_Sea_1in200_Defended_Extents Rivers_1in1000_Sea_1in1000_Defended_Extents Rivers_1in100_Sea_1in200_Undefended_Extents Rivers_1in1000_Sea_1in1000_Undefended_Extents					Contains M Values: [1]		No	
					Contains Z Values: [2]		No	
Field name	Description	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Unique object identifier	Object ID						
Shape	Geometry data type	Geometry						
Flood_source	Source of flooding (river and/or sea and/or undefined)	Text	Yes	-	-			16

A layer file is also provided alongside this dataset for use in ESRI applications. This contains the recommended symbology information, reflecting how the data is displayed on Environment Agency systems. Users of other GIS applications can apply the symbology manually using the RGB information provided in the table below:

	RGB	HEX#
	43-140-190	2B8CBE

Flood Map for Planning – 3.3% AEP defended (present day)

File Geodatabase Name: FMfP_1in30_vYYYYMM.gdb

Simple Feature Class					Geometry:		Polygon	
Rivers_1in30_Sea_1in30_Defended_Extents					Contains M Values: [1]		No	
					Contains Z Values: [2]		No	
Field name	Description	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Unique object identifier	Object ID						
Shape	Geometry data type	Geometry						
AEP	Annual Exceedance Probability	Text	Yes	-	-			10
Origin	Source of data (modelled, recorded, direct rainfall model, local evidence)	Text	Yes	-	-			64
Flood_source	Source of flooding (river and/or sea and/or undefined)	Text	Yes	-	-			16

A layer file is also provided alongside this dataset for use in ESRI applications. This contains the recommended symbology information, reflecting how the data is displayed on Environment Agency systems. Users of other GIS applications can apply the symbology manually using the RGB information provided in the table below:

	RGB	HEX#
	43-140-190	2B8CBE

Flood Map for Planning – Climate Change Extents (defended and undefended)

File Geodatabase Name: FMfP_Climate_Change_Extents_vYYYYMM.gdb

Simple Feature Class					Geometry:		Polygon	
Rivers_1in100_Sea_1in200_Defended_Extents_CC P1 Rivers_1in1000_Sea_1in1000_Defended_Extents_CCP1 Rivers_1in100_Sea_1in200_Undefended_Extents_CCP1 Rivers_1in1000_Sea_1in1000_Undefended_Extents_CCP1					Contains M Values: [1] Contains Z Values: [2]		No No	
Field name	Description	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Unique object identifier	Object ID						
Shape	Geometry data type	Geometry						
Flood_source	Source of flooding (river and/or sea and/or undefined)	Text	Yes	-	-			16

A layer file is also provided alongside this dataset for use in ESRI applications. This contains the recommended symbology information, reflecting how the data is displayed on Environment Agency systems. Users of other GIS applications can apply the symbology manually using the RGB information provided in the table below:

	RGB	HEX#
	43-140-190	2B8CBE

Flood Map for Planning – 3.3% AEP defended (Climate Change)

File Geodatabase Name: FMfP_Climate_Change_1in30_vYYYYMM.gdb

Simple Feature Class					Geometry:		Polygon	
Rivers_1in30_Sea_1in30_Defended_Extents_CCP1					Contains M Values: [1]		No	
					Contains Z Values: [2]		No	
Field name	Description	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Unique object identifier	Object ID						
Shape	Geometry data type	Geometry						
AEP	Annual Exceedance Probability	Text	Yes	-	-			10
Origin	Source of data (modelled, recorded, direct rainfall model, local evidence)	Text	Yes	-	-			64
Flood_source	Source of flooding (river and/or sea and/or undefined)	Text	Yes	-	-			16

A layer file is also provided alongside this dataset for use in ESRI applications. This contains the recommended symbology information, reflecting how the data is displayed on Environment Agency systems. Users of other GIS applications can apply the symbology using the RGB information provided in the table below:

	RGB	**HEX#**
	43-140-190	2B8CBE