

TECHNICAL NOTE

JBA Project Code	2023s0381
Contract	Tunbridge Wells Borough Council Local Plan Support
Client	Tunbridge Wells Borough Council
Version / Date	V1 / September 2023
Author	Ben Gibson BSc MSc MCIWEM C.WEM
Reviewer / Sign-off	Alastair Dale BSc PGDip MIAHR
Subject	River Medway and River Teise updated climate change Flood Zone modelling and mapping



1 Introduction

JBA Consulting was commissioned by Tunbridge Wells Borough Council to prepare updated climate change fluvial flood modelling for the rivers Medway and Teise at the parishes of Capel and Paddock Wood.

The updated flood modelling and mapping is prepared for the 3.3%, 1% and 0.1% Annual Exceedance Probability (AEP) events, which relate to Flood Zone 3b, Flood Zone 3a, and Flood Zone 2, respectively. Flood Zone 3b reflects the defended case scenario, while Flood Zones 3a and 3b reflect the undefended case.

For Flood Zone 3b, the modelling includes allowance for the presence and operation of the Leigh Flood Storage Area (FSA) located on the River Medway upstream (west) of Tonbridge and so represents the defended case situation. For Flood Zone 3a and Flood Zone 2, the modelling represents an undefended case, in which Leigh FSA is not present/operating. Therefore, the mapping predictions for Flood Zones 3a and 2 do not represent the actual risk of flooding i.e. with defences in place/operating, which act to reduce flooding from the River Medway.

1.1 Climate change allowances

The modelling and mapping is prepared for flow allowances of +27% and +37%, reflecting the Central and Higher central estimates of climate change applicable to the catchment for the 2080s epoch (years 2070-2125) according to the latest guidance¹. Climate change modelling was available for the 1% AEP event for use in the published 2019 Strategic Flood Risk Assessment (SFRA), but this reflected the now superseded climate change flow allowances of +35% (Higher central) and +70% (Upper end). The August 2022 updates to the Planning Practice Guidance now introduce a requirement to consider climate change impacts as part of the Sequential Test, necessitating modelling of the 3.3% and 0.1% AEP events, in addition to the 1% AEP event.

1.2 Existing modelling

1.2.1 Original Environment Agency modelling

The flood modelling of the rivers Medway and Teise, as used to prepare mapping for the 2019 SFRA, is informed by the Environment Agency's modelling prepared as part of the Medway Catchment Mapping and Modelling project (2015)² which was simulated for the previous climate change allowances as part of the Environment Agency's Medway Scenario Modelling (2016)³ project. The specific model applicable to predicting flood levels in the Paddock Wood area is referred to as Model 3.

The Model 3 hydraulic model is divided into six regions, referred to as Output Zones (see Figure 1-1), within which different design event hydrology inputs inform a given

¹ Environment Agency, Flood risk assessments: climate change allowances. Last updated 27 May 2022. Available: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

² JBA Consulting for the Environment Agency. Medway Catchment Mapping and Modelling, Final Report, October 2015.

³ JBA Consulting for the Environment Agency. Medway Scenario Modelling project, 2016.

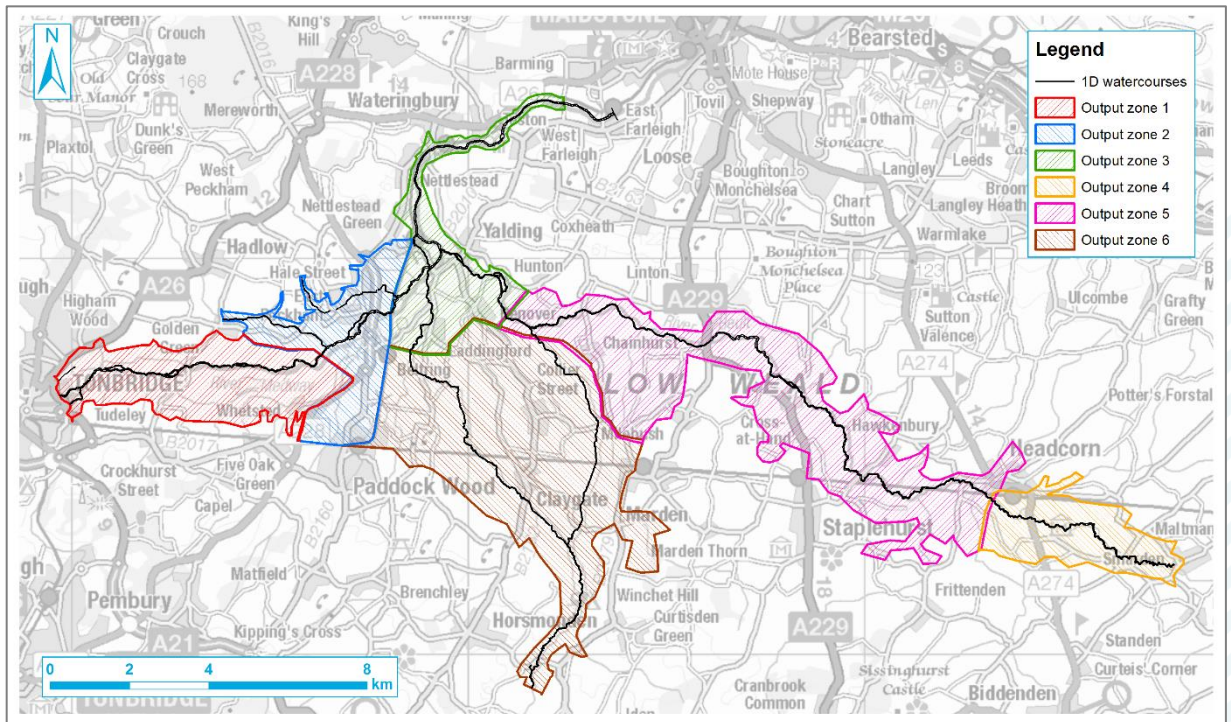
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Annual Exceedance Probability event e.g. Zone 1 has a different set of hydrology inputs to Zone 2 to produce the 1% AEP.

Flooding at or close to the Paddock Wood area is influenced by flood predictions from outputs zones 2 and 6. From the existing modelling projects, modelling and mapping was available for the following events/zones applicable to this project:

- 3.3% AEP defended case present day (output zones 2 and 6)
- 1% AEP undefended case present day (output zones 2 and 6)
- 0.1% AEP undefended case present day (output zones 2 and 6)



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Figure 1-1: Model 3 output zones (image reproduced from the Medway Catchment Mapping and Modelling (2015) report)

1.2.2 Tonbridge and Malling Borough Council climate change modelling

Climate change hydrology and modelling prepared by JBA Consulting for Tonbridge and Malling Borough Council, and which Tonbridge and Malling Borough Council gave permission for use in this project, was available for the following events/zones applicable to this project:

- 3.3% AEP defended case +27% flows and +37% flow allowances (output zone 2)
- 1% AEP undefended case +27% flows and +37% flow allowances (output zone 2)
- 0.1% AEP undefended case +27% flows and +37% flow allowances (output zone 2)

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1.2.3 Additional events requiring modelling

Modelling and mapping for the following events/zones was not available from other projects, and needed to be simulated for this project.

- 3.3% AEP defended case +27% flows and +37% flow allowances (output zone 6)
- 1% AEP undefended case +27% flows and +37% flow allowances (output zone 6)
- 0.1% AEP undefended case +27% flows and +37% flow allowances (output zone 6)

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2 Modelling approach

2.1 Hydrology and modelling

Refer to the Medway Catchment Mapping and Modelling (2015) Hydrology Report⁴ for full details of the hydrological assessment, which used continuous simulation⁵ methods for producing flood flow estimates.

From the suite of continuous simulation events available for the River Medway catchment modelling, flood event inputs were selected which have the required magnitude (annual exceedance probability) for output zones 2 and 6.

This necessitated re-simulating the hydrology modelling for the +27% and +37% flow conditions, as the operation of Leigh Flood Storage Area (FSA) is influential to the predicted flows which flow eastwards downstream. This work was completed as part of the Tonbridge and Malling Borough Council project. For output zone 2, the continuous simulation hydrology event varies due to the influence of Leigh FSA, while for output zone 6, the same hydrology event is used, as the flows are informed by the predictions at Stonebridge gauging station, upstream of the influence of Leigh FSA.

Table 2-1: Hydrology event references for Flood Zone 3b model simulations (3.3% AEP defended case) events

Output zone	Present day	+27% flows	+37% flows
2	15Nov1923	26Feb3493	20Dec6392
6	07Dec4998	07Dec4998	07Dec4998

Table 2-2: Hydrology event references for Flood Zone 3b model simulations (1% AEP undefended case) events

Output zone	Present day	+27% flows	+37% flows
2	18Feb5460	02Jan3008	02Jan3008
6	18Feb6196	18Feb6196	18Feb6196

Table 2-3: Hydrology event references for Flood Zone 3b model simulations (0.1% AEP undefended case) events

Output zone	Present day	+27% flows	+37% flows
2	31Jan4016	01Jan3162	02Jan3262
6	16Dec5485	16Dec5485	16Dec5485

⁴ JBA Consulting for the Environment Agency. Medway Catchment Mapping and Modelling Hydrology Report, April 2015, which forms Appendix A to the Final Report, October 2015.

⁵ Continuous simulation is a hydrological estimation method. It is a rainfall-runoff hydrological method that simulates a long time-series of rainfall and flow events, rather than using a single design event of specified probability. From this long time-series of events, individual design events can be selected. The approach is often considered on catchments where there are complex combinations of factors that affect the magnitude of flood flows and flood water levels.

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Model simulations names for the events simulated as part of this commission are as follows:

- 3.3% AEP defended case climate change +27% flows (output zone 6):
Medway_Model3_024_006b_Def_0030plus27pc_07Dec49980200
- 3.3% AEP defended case climate change +37% flows (output zone 6):
Medway_Model3_024_006b_Def_0030plus37pc_07Dec49980200
- 1% AEP undefended case climate change +27% flows (output zone 6):
Medway_Model3_024_006b_Und_0100plus27pc_18Feb61962000
- 1% AEP undefended case climate change +37% flows (output zone 6):
Medway_Model3_024_006b_Und_0100plus37pc_18Feb61962000
- 0.1% AEP undefended case climate change +27% flows (output zone 6):
Medway_Model3_024_406b_Und_1000plus27pc_16Dec54850800
- 0.1% AEP undefended case climate change +37% flows (output zone 6):
Medway_Model3_024_406b_Und_1000plus37pc_16Dec54850800

2.2 Mapping

From the suite of simulations (events and output zones), maximum flood depth predictions were exported as a raster format grid and merged to produce a combined flood depth grid for each AEP event. These depth grids were then converted to flood extents, and clipped to the Tunbridge Wells Borough Council boundary, producing an updated set of Flood Zones from the River Medway and River Teise modelling.

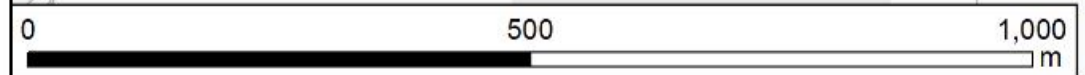
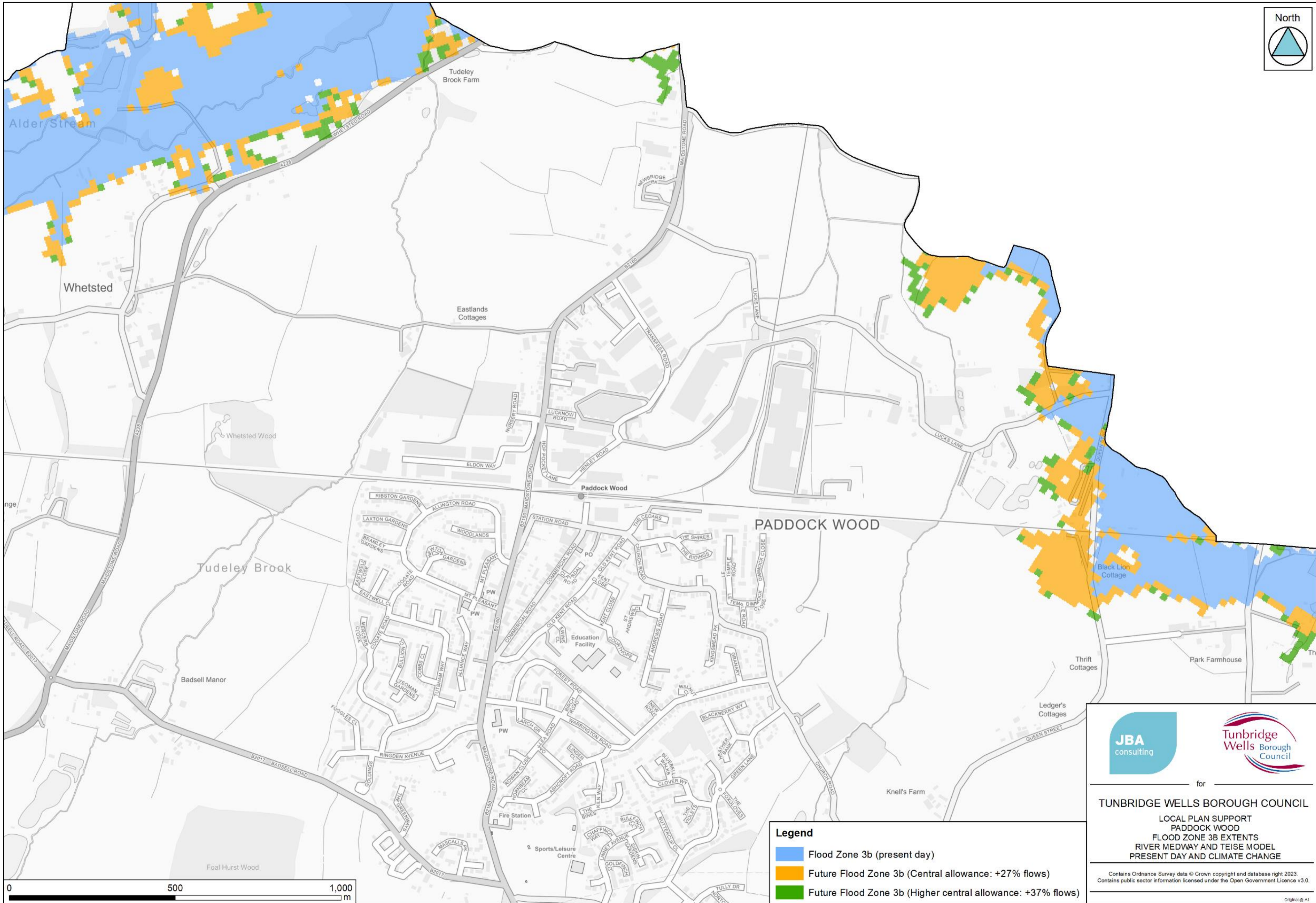
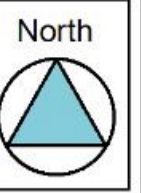
Appendices A, B and C present the flood extent predictions for the Flood Zone 3b (3.3% AEP), Flood Zone 3a (1% AEP) and Flood Zone 2 (0.1% AEP) conditions, respectively for the present day and with climate change allowances.

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Appendices

A River Medway and River Teise Flood Zone 3b mapping: present day and climate change allowances



- Legend**
- Flood Zone 3b (present day)
 - Future Flood Zone 3b (Central allowance: +27% flows)
 - Future Flood Zone 3b (Higher central allowance: +37% flows)



for

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LOCAL PLAN SUPPORT
 PADDOCK WOOD
 FLOOD ZONE 3B EXTENTS
 RIVER MEDWAY AND TEISE MODEL
 PRESENT DAY AND CLIMATE CHANGE

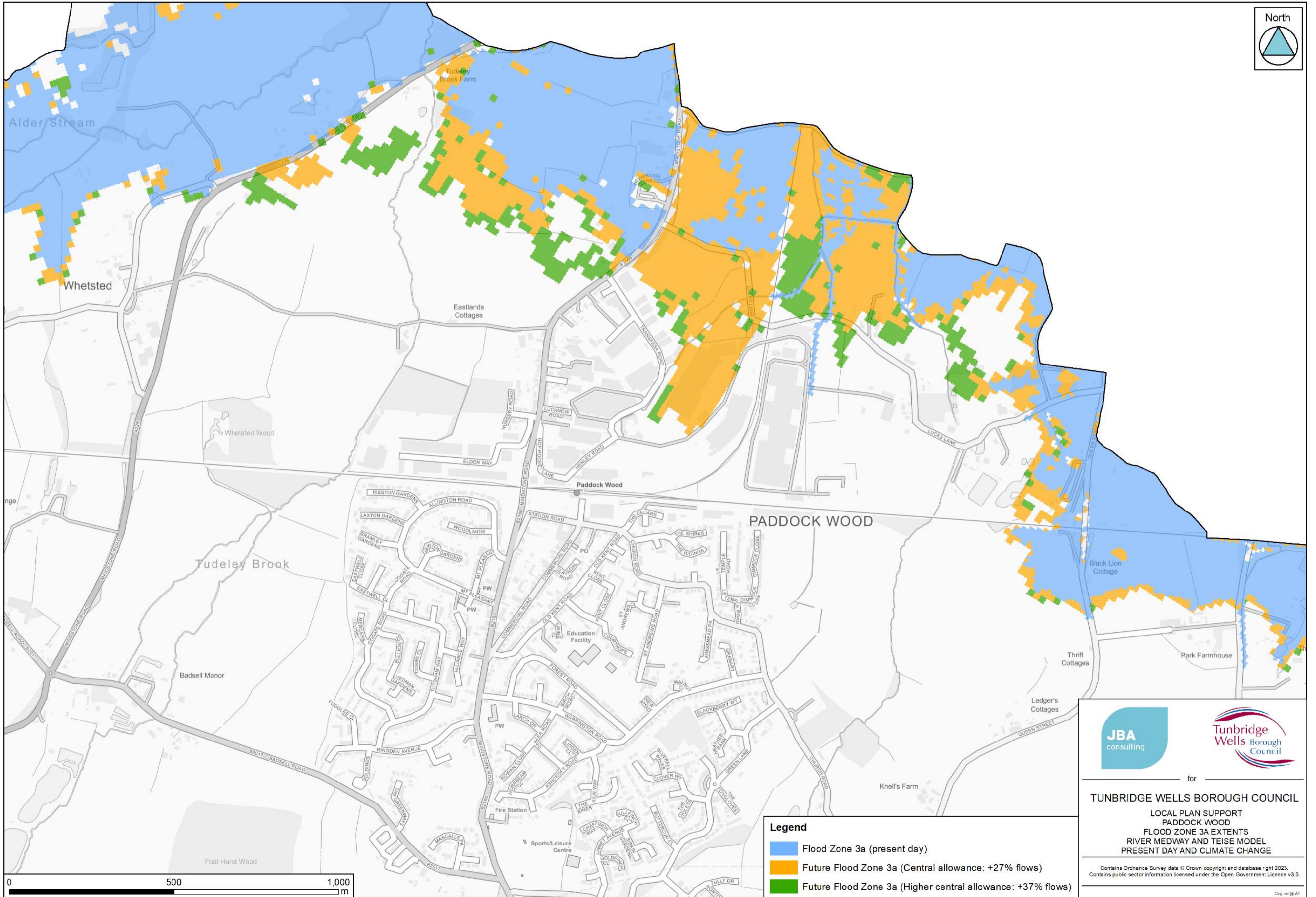
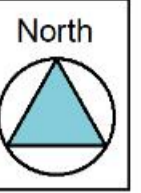
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B River Medway and River Teise Flood Zone 3a mapping: present day and climate change allowances



Legend

- Flood Zone 3a (present day)
- Future Flood Zone 3a (Central allowance: +27% flows)
- Future Flood Zone 3a (Higher central allowance: +37% flows)



for

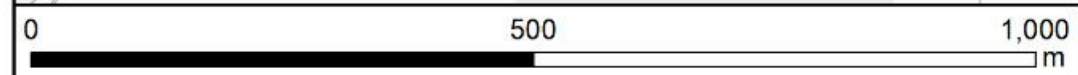
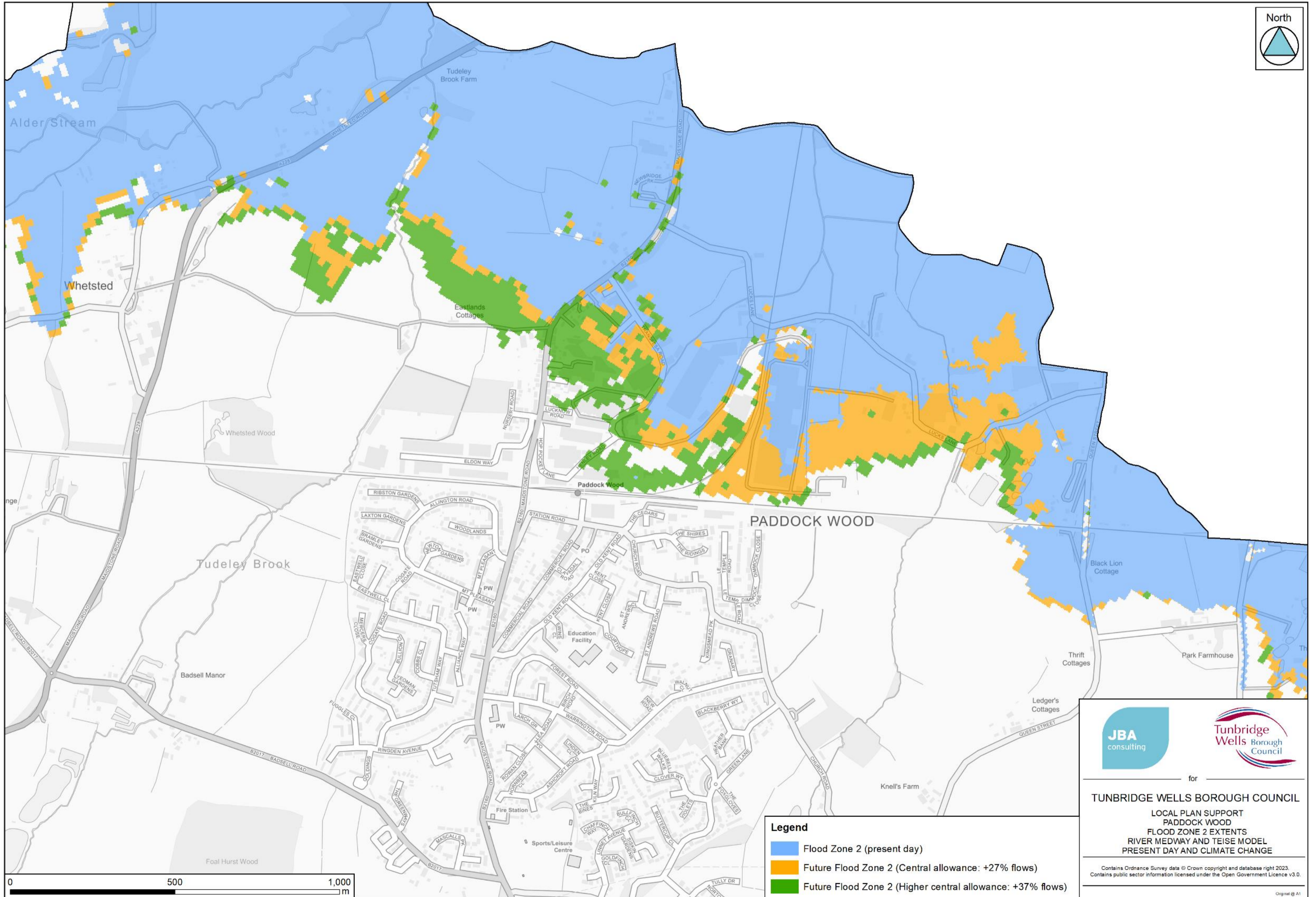
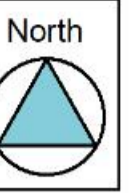
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C River Medway and River Teise Flood Zone 2 mapping: present day and climate change allowances



- Legend**
- Flood Zone 2 (present day)
 - Future Flood Zone 2 (Central allowance: +27% flows)
 - Future Flood Zone 2 (Higher central allowance: +37% flows)



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