Methodology in support of Performing the Sequential Test

Final

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MALDON DISTRICT COUNCIL

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Contract

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This document describes work commissioned by Bloom Procurement Services on behalf of Maldon District Council, by an instruction dated 09 February 2022. The Client's representative for the contract was Louise Staplehurst of Maldon District Council. Sophie Thorpe of JBA Consulting carried out this work.

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Contents

1 Introduction

1.1 Background

JBA Consulting have been commissioned by Bloom Procurement Services on behalf of Maldon District Council to prepare a Level 1 SFRA. As part of the reporting, it was agreed that a sequential test methodology would be outlined for reference and sharing with Essex County Council, the Lead Local Flood Authority.

The need to address this matter arises from changes to the National Planning Policy Framework (NPPF) in July 2021 and the Planning Practice Guidance (PPG) in August 2022.

The changes to the PPG in August state that all sources of flood risk should be considered now and in the future as part of the Sequential Test. This document addresses the use of flood risk information in the performance of the Sequential Test but does not include the consideration of wider planning issues, as set out in the Sustainability Appraisal.

1.2 Summary of changes

Paragraph 168 of the NPPF has been changed such that the recommended approach to the Sequential Test must now *"steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding."*

Prior to the changes to the NPPF the recommendation was set out as follows and only included consideration of river and sea flood risk when applying the Sequential Test:

Previous Policy Wording	New Policy Wording (July 2021)
The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding (the Planning Practice Guidance advised that the exercise should be performed using the flood zones, as describe river and sea flood risk)	The aim of the Sequential Test is to steer new development to areas with the lowest risk of flooding from any source

The August 2022 PPG application of the Sequential Test diagram (Figure 1-1) shows that flood risk should preferably be considered in terms of low, medium and high-risk areas, both now and in the future.

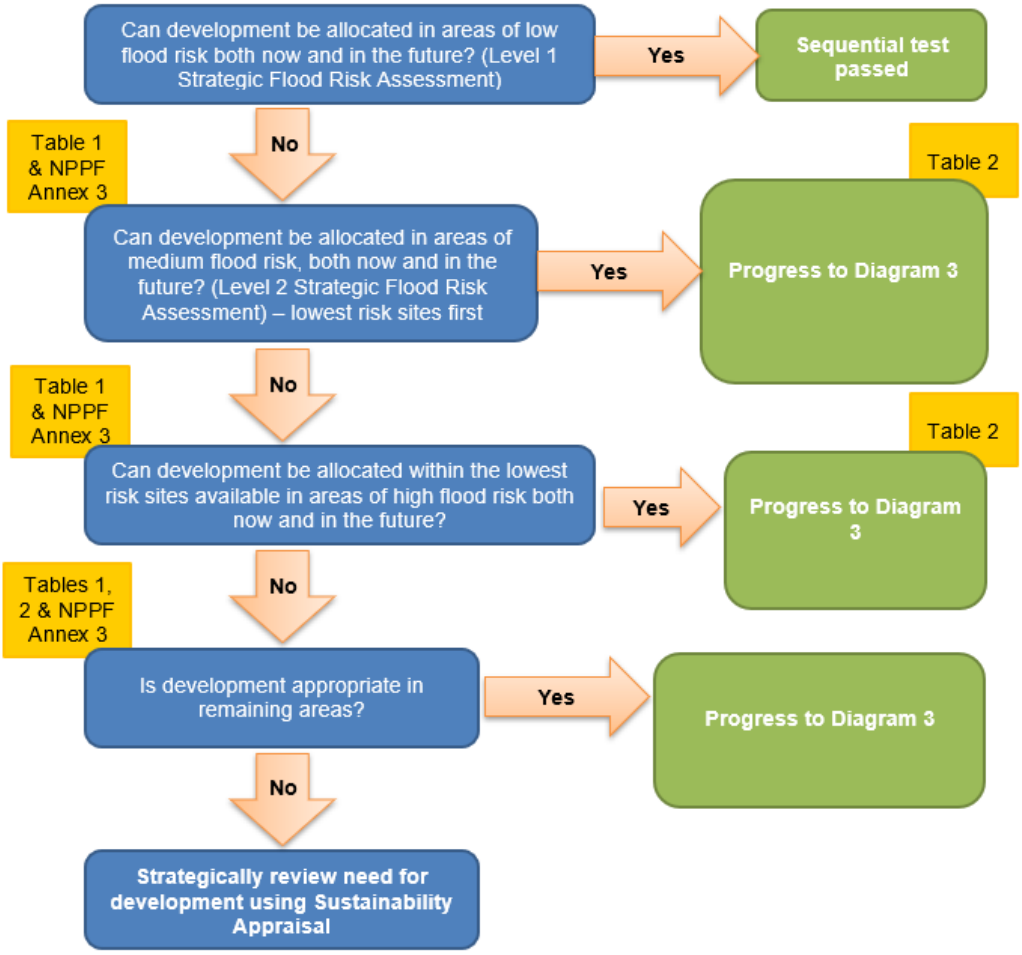


Figure 1-1: Diagram 2 in PPG

In addition, the August 2022 version of the PPG now also notes that where Neighbourhood Plans are considering proposing development they should address how this would be consistent with the local planning authority's application of the Sequential Test and if necessary, the Exception Test for the plan. If not, these tests will need to be re-visited on a local authority-wide basis.

1.3 Considerations for implementation

A meeting was held on 23 August 2022 to discuss how the changes to the sequential test should be implemented in the absence of formal guidance. Representatives from Maldon District Council, Essex County Council, the Environment Agency and JBA Consulting were in attendance. A briefing note was also provided (HBH-JBAU-XX-XX-FN-HM-0012-S3-P01_Sequential_Test_Briefing).

Although the EA and ECC were already consulted and their comments have been incorporated into this Sequential Test Methodology, new Planning Practice Guidance (PPG) was issued to reflect the requirement for the sequential test to now include all forms of flooding since the meeting. It is therefore important that formal confirmation is sought from

the LLFA that the proposed approach outlined in this document to address surface water and groundwater flood risk and the Sequential Test will be supported at examination.

Further consultation will be held with the Environment Agency to confirm that they agree in principle with the proposed approach.

It is important that the LLFA, EA and potentially neighbouring councils support the approach so it can be evidenced in the plan documents submitted for Examination.

2 Summary of implications of NPPF Policy changes

The Sequential Test, based on the sequential approach was originally conceived to direct proposed new development to locations that did not rely on Flood Risk Management features to make them safe, as this is inherently more sustainable and avoids placing a burden on future generations to address flood risk issues that will potentially be exacerbated by climate change effects. The test was previously performed using a set of "Zone" maps that showed the extent of river and sea flooding for circumstances where no defences were present for events with high, medium and low probability. This provided a logical conceptual basis for the placement of proposed new development that would not require investment in flood risk management (and so not place a burden on future generations).

The test process recognised that in some circumstances it would not be possible to locate development in locations outside of medium and high risk Flood Zones, as there are no reasonable alternatives. An obvious circumstance being proposed town centre development in locations of high flood risk, as it is not possible to redevelop town centre sites unless they remain in the town centre. In circumstances where the Sequential Test has been performed but is not satisfied the policy requires that the Exception Test is performed. The Exception Test is a two-part process that requires preparation of evidence to demonstrate that development proposals at risk of flooding deliver wider sustainability benefits and that it is evidenced it can be made safe for the intended lifespan (thus it is a requirement to demonstrate that proposed development will be safe under climate change conditions).

The updated NPPF (July 2021) recommends that application of the Sequential Test to any source of flooding. The general implications of this are summarised as follows:

The Sequential Test should preferably be based on mapping that enables decision making according to a prioritisation based on a risk-based sequence (for river and sea flooding national mapping is available that describes low, medium and high risk flood zones but comparable mapping of this specific type and quality is not available for other sources. For River and Sea flooding based on the assumption that no flood risk management features are present).

The other sources of flood risk that can be included in the Sequential Test are surface water, groundwater, sewer flooding and reservoir flooding (or other water impounding features such as canals).

It follows that proposed new development placed in locations at high or medium risk from flooding from other sources now and in the future should be accompanied by evidence that the Exception Test can be satisfied (in a Level 2 SFRA).

A basic requirement for the Sequential Test to be performed is that appropriate, competent mapping is available to enable logical comparison of the flood risk from different sources at

alternative locations, both now and in the future, as this is fundamental to establishing a logical “risk sequence”. The following summary of the available data and mapping describes the implications of including different sources of flooding both now and in the future in the Sequential Test, highlights matters to be considered and identifies a proposed approach.

2.1 River and sea risk - now and in the future

2.1.1 Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Rivers and sea	Flood Map for Planning and detailed models	• The Sequential Test can be carried out using the Flood Map for Planning for present day low (Flood Zone 1), medium (Flood Zone 2) and high risk (Flood Zone 3) as previously was the case. • Where detailed models are available, Future Flood Zones 2 (0.1% AEP event), 3a (1% AEP event) and 3b (now the 3.3% AEP) will be assessed with climate change allowances. It should be noted that there may be instability issues running the 0.1% AEP event with climate change allowances. • The fluvial models may experience instabilities during 0.1% AEP plus climate change runs which may mean that results cannot be prepared. • Generalised modelling (JFlow) is used to delineate present day Flood Zones where there is no detailed mapping.

2.1.2 Recommendations for using river and sea flood risk in the Sequential Test

- For present river flood risk, the EA's Flood Zones 1, 2 and 3 should be used. For future fluvial flood risk, where detailed models are available, the following climate change runs should be assessed as part of the sequential test:
  - Fluvial defended 3.3% AEP plus climate change allowances.
  - Fluvial undefended 1% AEP plus climate change allowances.
  - Fluvial undefended 0.1% AEP plus climate change allowances.
- Where detailed modelling is not available, present day Flood Zone 3a has been used as a proxy for present day Flood Zone 3b.
- For present coastal flood risk EA's Flood Zones 1, 2 and 3 should be used. For future coastal flood risk, where detailed models are available, the following climate change runs should be assessed as part of the sequential test:
  - Coastal defended 3.3% plus climate change allowances.
  - Coastal undefended 0.5% AEP plus climate change allowances.
  - Coastal undefended 0.1% AEP plus climate change allowances.

2.2 Surface water flood risk now and in the future

2.2.1 Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Surface Water	Risk of Flooding from Surface Water (RoFSW)	• Mapping based on a generalised modelling methodology. • Generally suitable for showing surface water flow routes at different probability flood events (1 in 30, 1 in 100 and 1 in 1000), although the uncertainty associated with the predicted outlines for the respective probabilities is high. JBA Consulting also hold the required 3.3% and 1% AEP plus climate change allowances. • Doesn't always include allowance for drainage features such as culverts and can over or underestimate flooding where there are linear features such as embankments. • Unlike the Zone maps for river and sea flooding the surface water mapping makes an allowance for the assumed performance of a local drainage system.

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		• Normal profile of extent and shape of surface water flooding is a “dendritic” pattern that follows low lying topography and is not an extensive blanket, as is most often the case for river and sea flooding. • The flood risk is normally more likely to be relatively short lived and much more localised than would be the case for river and sea flooding (most likely being caused by local high intensity short duration rainfall events). • It is likely that in many circumstances surface water flood risk zones based on the surface water mapping could affect a relatively small proportion of a proposed allocation site, but in practical terms this might not in itself be a factor that demonstrated that the principle of development could not be supported.

2.2.2 Recommendations for using zone maps for surface water flooding

Use the 1 in 1000 surface water flood extent mapping to define a simple zoning scheme that identifies a high risk and low risk zone:

Surface Water mapping does not strictly describe the same conceptual risk zone as is defined for river and sea flooding (even though it is notionally associated with the same probability) as the mapping is based on different assumptions. However, it does create a product that can accommodate an appropriate level of sequential testing, as it can facilitate strategic decisions that direct development to land in a “low risk surface water flood zone” and identifies locations where it is appropriate to consider the application of the Exception Test. Using such mapping it is not anticipated that the Sequential Test for surface water would normally require the consideration of alternative sites at lower risk, as the widespread and dendritic nature of surface water flood risk is conceptually very different to river and sea flood risk, but in some circumstances for relatively small sites that are potentially substantially affected it is possible that alternatives should be considered (as these could potentially not satisfy the flood risk requirements when assessed under the Exception Test).

The application of the test would logically be accompanied by a commitment to be made in the Plan Policy that all proposed development on sites identified for allocation would be placed in the “low risk surface water flood zone”. In circumstances where it is not possible to place all proposed development in the “low risk surface water flood zone” or

circumstances arose where encroachment on land affected by surface water flood risk could not be avoided then it would be necessary to provide supplementary evidence that the Exception Test could be satisfied. For the purpose of the Plan this supplementary exercise should be set out in the Level 2 SFRA. The proposed approach is relatively simple, enables an appropriate level of sequential selection to be made, is not totally aligned with the river and sea zones (but this is appropriate as the mapping is not based on the same parameters), but from a practical perspective is strongly aligned with the sequential approach defined in para 168 of the NPPF. For these reasons it is recommended.

2.3 Groundwater flood risk

2.3.1 Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Groundwater	BGS Groundwater flood susceptibility maps JBA Groundwater Emergence Map JBA Groundwater Flood Zone Map ECC historic flood events	• BGS mapping does not show the likelihood or risk of groundwater flooding occurring, i.e. it is a hazard and consequence based product and does not enable application of risk based approach. • The JBA groundwater emergence map does potentially enable a risk-based approach to be taken as it depicts different levels of risk. The analyses performed to prepare the mapping are all for a 1 in 100-year event and so provide a risk of groundwater emergence to the surface as they are based on predicted difference between groundwater level and the ground surface. Five zones are defined to describe the risk of groundwater being: at or very near ground surface; between 0.025m and 0.5m below the ground surface; between 0.5m and 5m below the ground surface; at least 5m below the ground surface; and negligible risk of groundwater flooding. However, the mapping does not depict the risk of flooding of the land from groundwater and it should be noted that the location of highest risk of emergence might not be coincident with the location at highest risk of flooding. • Due to the assumptions built into the JBA Groundwater Emergence Map, it does not

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		explicitly make any allowance for sea or tide levels that will affect groundwater levels in coastal superficial deposits. The JBA Groundwater Flood Zone map attempts to identify areas of high groundwater emergence risk resultant from sea or tide levels that will affect groundwater levels. Similarly, this mapping does not depict the risk of flooding of the land from groundwater. With respect to the Sequential Test it is not considered that the data available is competent to be used as the basis for a comparative assessment of risk across the Council area. • The underlying challenge with these datasets is that the data is very uncertain and could not be used with confidence unless supported by more detailed local studies. The mapping provides an indication of where risk of elevated groundwater levels might be higher, but it would not be easy to defend. • The mapping and methods generally do not make provision for the effect of changing seal levels in low lowing areas.

2.3.2 Recommendations for using zone maps for groundwater flooding

The JBA groundwater flood map and ECC's historical known events dataset potentially do not provide the confidence or certainty required to undertake the Sequential Test. The available mapping does not provide competent evidence on the relative risk of flooding across the study area (particularly at the coast) and thus could potentially result in inappropriate allocations if used without understanding the limitations of the data.

JBA Groundwater mapping should therefore be used in conjunction with other relevant sources of flooding such as historical records and the Maldon SWMP so that areas can be identified that are unlikely to be affected by groundwater flooding (low risk) and also areas where groundwater flooding is potentially a material consideration can be identified (high or medium risk) and create a product that can accommodate an appropriate level of sequential testing. At the Level 2 SFRA stage a more detailed assessment should be performed of the proposed development sites where the potential for groundwater flooding is medium or high both now and in the future. The assessment method will draw on the previous SFRA

analyses performed for tidal drainage and groundwater risk zones will be used to understand how rises in tidal levels may impact groundwater risk. Areas which are within permeable geological units connected to the coast will be considered to understand risk of tidally influenced groundwater flooding. This will address the potential effects of climate change on groundwater flood risk to the extent permissible by the available data.

2.4 Sewer flood risk

2.4.1 Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
Sewer flooding risk	Water Company DG5 records Anglian Water DWMP	• Only available at postcode level and thus mapping does not define spatial extent or location of sewer flooding. • Mapping does not enable execution of risk based sequence.

2.4.2 Recommendations for using zone maps for sewer flooding

It is recommended that the sewer flood risk is not considered in the Sequential Test alongside river, sea and surface water flooding on the basis that the available information is not of appropriate resolution or format. This will be clearly stated in the Level 1 SFRA and where possible the DG5 and DWMP information will be used to inform the scope of site specific FRAs.

Water companies were required to publish Drainage Wastewater Management Plans (DWMPs) for river basin catchments across England as part of the Environment Act 2021. The plans describe the basis for long term investment proposals by Water Companies that span for more than 25 years and set out the commitment needed to make wastewater systems safe and secure. The plans contain substantive volumes of mapping, information and data that has not previously been made available by water companies. As part of the DWMPs a risk based catchment screening (RBCS) process has been completed, where existing, readily available data is used to identify where there is a current and/or potential risk or vulnerability in the sewer catchment to future changes, such as new residential development or changes in climate. This feeds into a baseline risk and vulnerability assessment (BRAVA) enabling comparison across locations based on different levels of risk. The resolution of data used as part of the DWMPs is not considered to be comparable to the river and sea flooding information, although Anglian Water will be consulted to confirm the application of this data.

If specific spatial information becomes available on sewer flood risk that provides competent data on the spatial relative risk of flooding this should be evaluated in the Level 2 SFRA and as appropriate inform the Sequential Test process.

2.5 Reservoir flood risk

2.5.1 Implications

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test

Reservoir flooding risk	Reservoir Flood Mapping (RFM)	• The latest available mapping now shows "wet day" and "dry day" reservoir inundation extents. The "wet day" being a reservoir breach at the same time as a 1 in 1000 river flood (as this is a likely time when a reservoir might fail) and the dry day shows the failure just from the water retained by the dam.
		• Neither set of mapping describes a risk-based scenario as they do not indicate the relative risk of land to the probability of dam failure but are intended to describe a "worst credible case". Accordingly, care must be taken in using the information in a comparative assessment alongside other sources of flood risk.
		• More detailed information on flood velocities and depths has been prepared as part of the modelling and mapping study, but this is not publicly available and can only be viewed by those with appropriate security classifications. The flood extents are publicly available.
		• A dataset exists which shows where the impact of reservoir flooding no longer affects the fluvial flood extent. This is known as a Wet Day Termination Extent. This dataset can be used to provide two zones:
		  ○ Where reservoir flooding is predicted to make fluvial flooding worse.
		  ○ Where reservoir flooding is not predicted to make fluvial flooding worse.
		• The mapping could be used to direct proposed new development away from locations that could potentially be affected

Source of Flooding	Available Mapping	Implications of making use of mapping in the Sequential Test
		by reservoir flood risk. However, it would not be conceptually similar to the risks pertaining to river and sea flooding and further assessment would be required to understand the magnitude of the potential hazard. • A consideration with respect to the reservoir maps is that placing new development in locations potentially affected by reservoir inundation could potentially change the “risk category” of the reservoir and this could result in the reservoir owner “undertaker” having to invest in substantive remedial works to demonstrate that the reservoir had the appropriate level of safety. This is not strictly related to the Sequential Test with respect to high or low risk of flooding, but should be a consideration that should be appropriately managed when planning new development.

2.5.2 Recommendations for using zone maps for reservoir flooding

It is recommended that the available reservoir flooding makes it inappropriate to be used alongside risk mapping from other sources when performing the Sequential Test and a more detailed assessment should be included in the Level 2 SFRA. However, it will be made clear in the SFRA that the available information is not conceptually similar to the risks pertaining to river and sea flooding as it shows the worst credible case and not the risk of flooding and so does not support a logical spatial comparison of risk that can be substantiated by appropriate evidence.

The RFM Wet Day Termination Extent will be used to define two zones:

1. Where reservoir flooding is predicted to make fluvial flooding worse.
2. Where reservoir flooding is not predicted to make fluvial flooding worse.

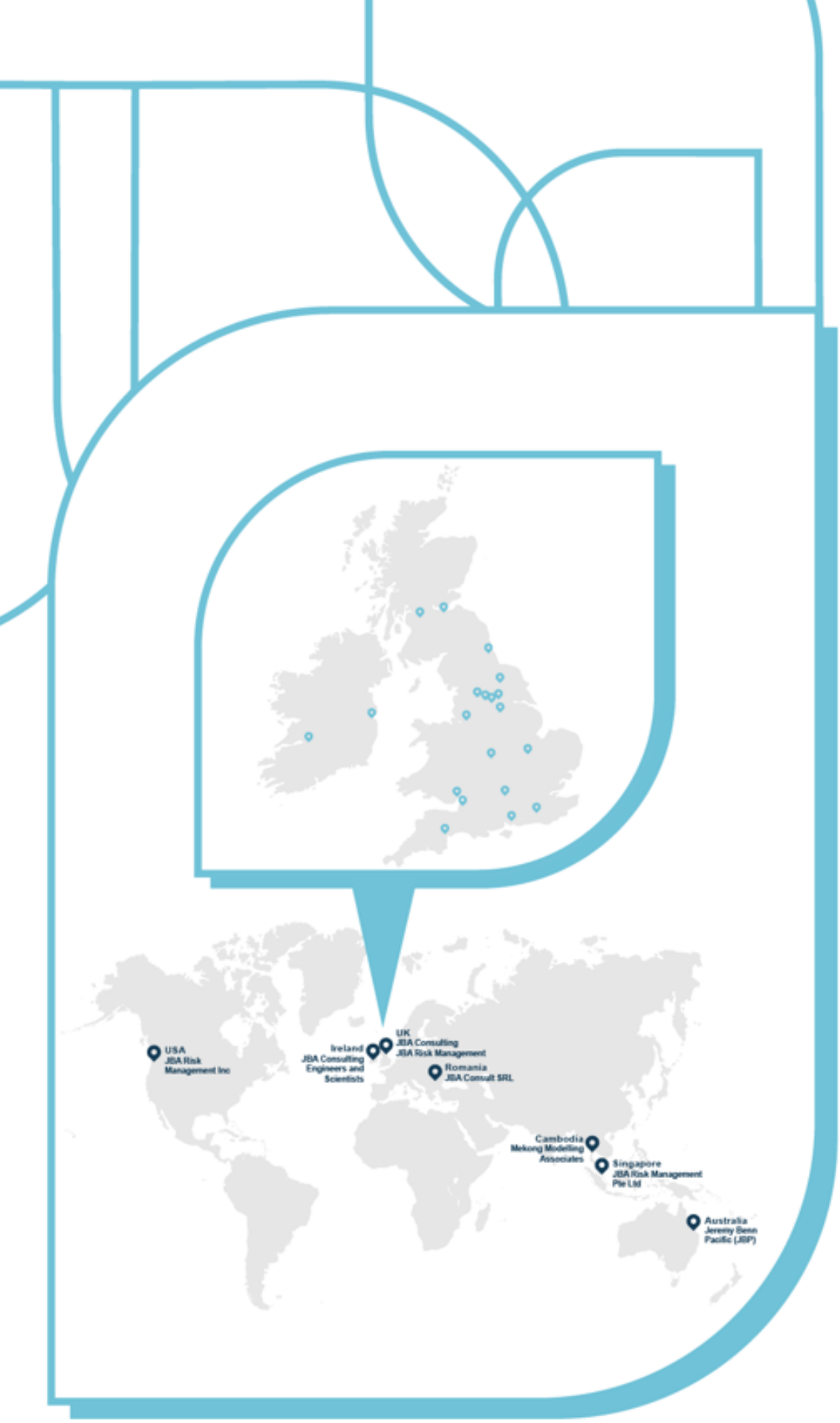
A more detailed assessment should be included within the Level 2 SFRA to identify locations where proposed development could result in a change to the risk designation of a reservoir. If proposed sites are located in a zone at reservoir risk it will be necessary to understand the extent to which the flooding could be made worse and to report on the implications with respect to allocating the land for development. On that basis such an approach is recommended. If proposed development is located in a high hazard zone in the vicinity of an existing dam structure the implications should be considered in the Level 2

SFRA and where appropriate an assessment made of whether alternative sites should be considered in accordance with the Sequential Test.

3 Sequential approach at a site level

In cases where the proportion of the site at flood risk is small, a sequential approach at the site level would be appropriate and enable development to be placed in locations at low risk of flooding (by avoiding high risk areas that might exist at a particular site). This involves incorporating the less vulnerable aspects of the development (according to the Environment Agency's flood risk vulnerability classification) in the areas at risk of flooding. The more vulnerable aspects would be incorporated within areas at lower risk.

It should be noted that in most circumstances the flooding from different sources is likely to affect the same "low lying" location within a proposed site, and thus it is normally logical not to base the preference as being affected by the number of different sources of flooding that could affect a site. Also, it is not strictly appropriate to seek to suggest that flood risks from different sources can be simply combined to derive a combined risk or ranking, as the logic and likelihood of such conclusions cannot easily be evidenced by the supporting data.



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