

Technical Note

To Wrexham County Borough Council

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From Vic Mohun

Office Wrexham Office

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File

Subject Response to NRW Comments

Introduction

Further to the planning submission of the FCA for the above scheme, NRW provided comments in a formal letter dated 12.09.2019.

WSP have reviewed the individual comments and would provide supporting information as follows:

Response to NRW Comment 1

There were uncertainties in the original NRW model received. As far as practicable, WSP have used a number of conservative assumptions in undertaking the hydraulic model. WSP agreed the modelling methodology with the NRW before the completion of the hydraulic modelling and FCA to NRW's requirements. Therefore the uncertainties in the model have also been clarified and accepted by the NRW before the model was completed.

Response to NRW Comment 2

The original model received from the NRW was too unstable when run with a 67% blockage scenario and above. The model crashed and did not produce any reliable results.

WSP improved the NRW model received and whilst every attempt was made to model the 95% blockage scenario, the model was too unstable to be able to run (it crashed with the 95% blockage) and therefore it was not possible to obtain any results from this particular model run. This is why this particular event has not been reported on.

In the majority of modelling cases, the 95% blockage scenario are known to cause instabilities and the NRW are aware and generally accept this fact as part of their modelling review. In this particular case, WSP were able to improve the NRW for up to the 30% and 67% blockage event and these showed negligible differences in flood levels on site.

On this basis the 95% blockage scenario is unlikely to affect the proposed building significantly given the proposed floor levels are proposed to be raised above the 1in 100year + 45% climate change allowance level by 150mm. Further to consultations with the Architects (WCBC), WSP were advised that this 150mm allowance is the maximum that the building could be raised without having to modify the existing roads and other designs in the vicinity.

Response to NRW Comment 3

A1.14 In addition to the above general conditions there are particular flooding consequences which may not be considered acceptable for particular types of development. For instance in view of the traumatic impact of flooding on people's personal lives it is not sensible to allow residential development in areas which flood frequently. Environment Agency advice to planning authorities suggests that development should be designed to be flood free during the 1% fluvial flood (i.e. that fluvial flood with a 100 to 1 chance of occurring in any year) and the 0.5% tidal/coastal flood (i.e. 200 to 1 chance in any year event). There is therefore a frequency threshold of flooding below which flooding of development should not be allowed. The following table, which should not be regarded as prescriptive, provides indicative guidance as to what that frequency threshold could be for different types of development described in terms of annual probability of occurrence.

Type of Development	Threshold Frequency (Years)	
	Fluvial	Tidal
Residential	1%	0.5%
Commercial/Retail	1%	0.5%
Industrial	1%	0.5%
Emergency Services	0.1%	0.1%
General Infrastructure	1%	0.5%

Technical Advice Note 15: Development and Flood Risk

TAN15 – Section A1.14 clearly states that the designed floor levels for residential properties should be at a minimum of threshold frequency of **1% (no climate change)** above the fluvial flood. For this development, the proposed floor levels of the buildings are set at 150mm above the 1 in 100 year + 45% climate change level. The FCA report states that the proposed floor level is also above the modelled 1 in 1000 year flood level. As far as the building is concerned the proposed development is flood free for the 1% event, as per Section A1.14 of TAN15. The proposed finished floor levels are very conservative as they are well above the 1% threshold frequency required by TAN15.

There is nowhere stated in TAN15 that the finished floor level should be above the 1 in 100+ climate change plus 95% blockage scenario level. Advice and guidance is required from NRW regarding the origin and status of this new guidance.

5 Nature of development or land use

5.1 Particular flooding consequences may not be acceptable for particular types of development. For example, allowing residential development in areas which are subject to high risks of flooding can result in a traumatic impact on people’s lives. The precautionary framework identifies the vulnerability of different land uses to flooding, and for this purpose, development has been sub-divided into three categories in figure 2.

Figure 2

Development category	Types
Emergency services	hospitals, ambulance stations, fire stations, police stations, coastguard stations, command centres, emergency depots and buildings used to provide emergency shelter in time of flood
Highly vulnerable development	all residential premises (including hotels and caravan parks), public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators), and waste disposal sites
Less vulnerable development	General industrial, employment, commercial and retail development, transport and utilities infrastructure, car parks, mineral extraction sites and associated processing facilities, excluding waste disposal sites

Figure 2: TAN15

As per Figure 2 of TAN15, car parks and gardens do not fall under “Highly Vulnerable Development”. NRW should verify and reconsider the statement and correctly regard car parking and gardens as “Less Vulnerable Development” and provide further, clear guidance to developers and consultants, in compliance with TAN15. The habitable rooms in the proposed building are designed to be above the 1 in 100 year +45% climate change plus 150mm freeboard. The habitable rooms are also not at risk of flooding in the 1 in 1000year floods.

On this basis of the above the proposal more than complies with Section A1.14 of TAN15.

Response to NRW Comment 4

TAN15 Section A1.15

A1.15 Beyond the threshold frequency proposed development would be expected to flood under extreme conditions. However even with adequate mitigation measures in place it may still not be sensible to allow particular development to take place. For instance it would not be sensible for developments to be built in areas where the velocity and depth of floodwaters was such that structural damage was possible or that people could be swept away by the flood. Similarly it would not be sensible for single storey residential development to be sited where the depth of flooding would exceed heights of 0.6metres (ie the height of a bed or a cot). The following table, which should not be regarded as prescriptive provides indicative guidance on what is considered tolerable conditions for different types of developments.

Type of development	Maximum depth of flooding (mm)	Maximum rate of rise of floodwaters (m/hr)	Maximum speed of inundation of flood risk area (hrs)	Maximum velocity of floodwaters (metres/sec)
	Property Access			Property Access
Residential (habitable rooms)	600 600	0.1	4	0.15 0.3
Commercial & Retail	600 600	0.3	2	0.15 0.3
Industrial	1000 1000	0.3	2	0.3 0.45
Emergency Services	450 600	0.1	4	0.15 0.3
General Infrastructure	600 600	0.3	2	0.3 0.3

NOTE. The above figures are indicative and reflect conditions in which, given the presence of adequate warnings and preparation, appropriately equipped personnel could undertake emergency activities. However they are not definitive. Each site must therefore be considered individually and a judgement taken in the context of the particular circumstances which could prevail at that site.

Figure 1 below shows the development plan of the designed properties and the location of extraction points for the flood depth and flood velocity data, such information can be seen in the Tables 1 and 2 below.



1. Figure 1 Proposed Development plan, location of depth and velocity points

Table 1 Maximum flood depth (mm) outside of the proposed development access

				30% blockage	67% Blockage
Location	1% AEP	1% AEP + 45%CC	0.1% AEP	1%AEP +45%CC	1%AEP +45%CC
1	2	26	45	3	26
2	-	8	13	-	8
3	-	2	2	-	2
4	-	88	133	-	88
5	-	-		-	-
6	-	-		-	-
7	-	-		-	-
8	-	-		-	-

2. Table 2 Maximum flood velocities (m/s) outside of the proposed development access

				30% blockage	67% Blockage
Location	1% AEP	1% AEP + 45%CC	0.1% AEP	1%AEP +45%CC	1%AEP +45%CC
1	0.0318	0.2723	0.4135	0.049	0.2724
2	-	0.1195	0.1741	-	0.119
3	-	0.0214	0.0276	-	0.0216
4	-	0.0002	0.0165	-	0.0003
5	-	-		-	-
6	-	-		-	-
7	-	-		-	-
8	-	-		-	-

Figure 2 below shows the 1 in 100 year event for maximum velocity and maximum depth outside of the proposed development area.

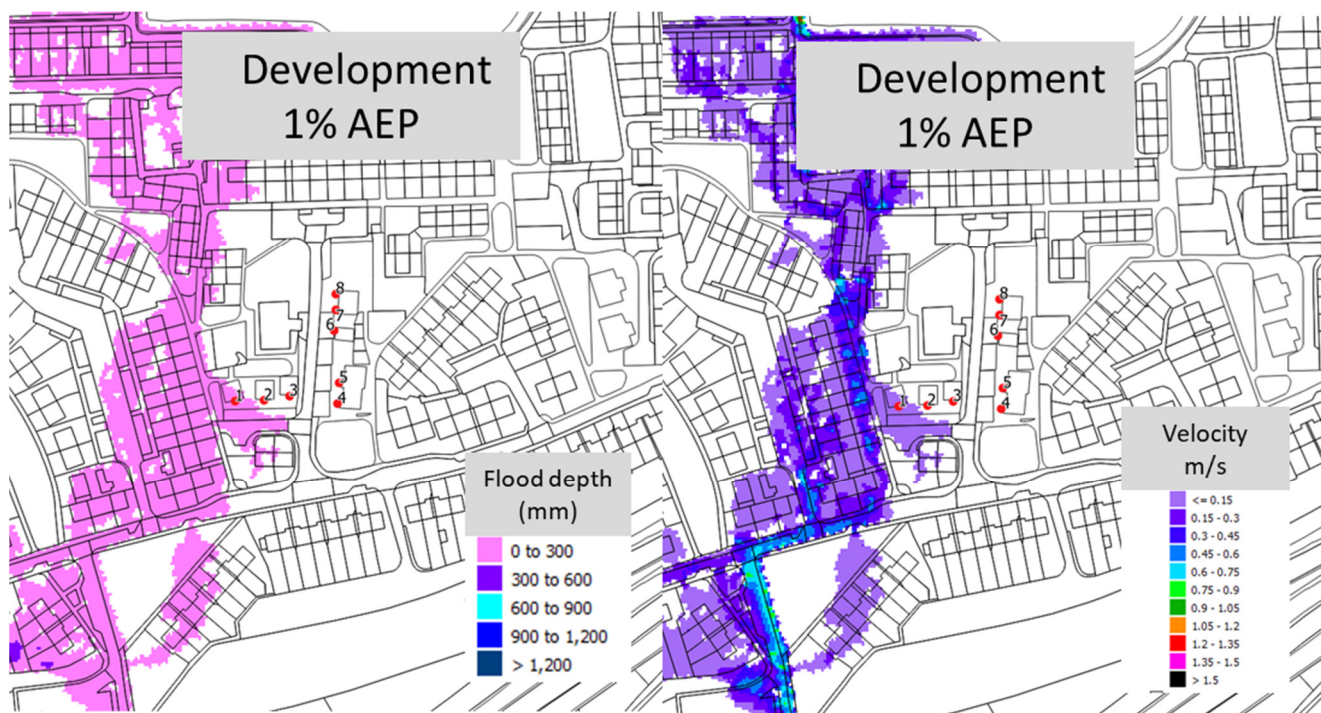


Figure 3 below shows the 1 in 100 year event plus 45% climate Change allowance, for maximum velocity and maximum depth outside of the proposed development area.

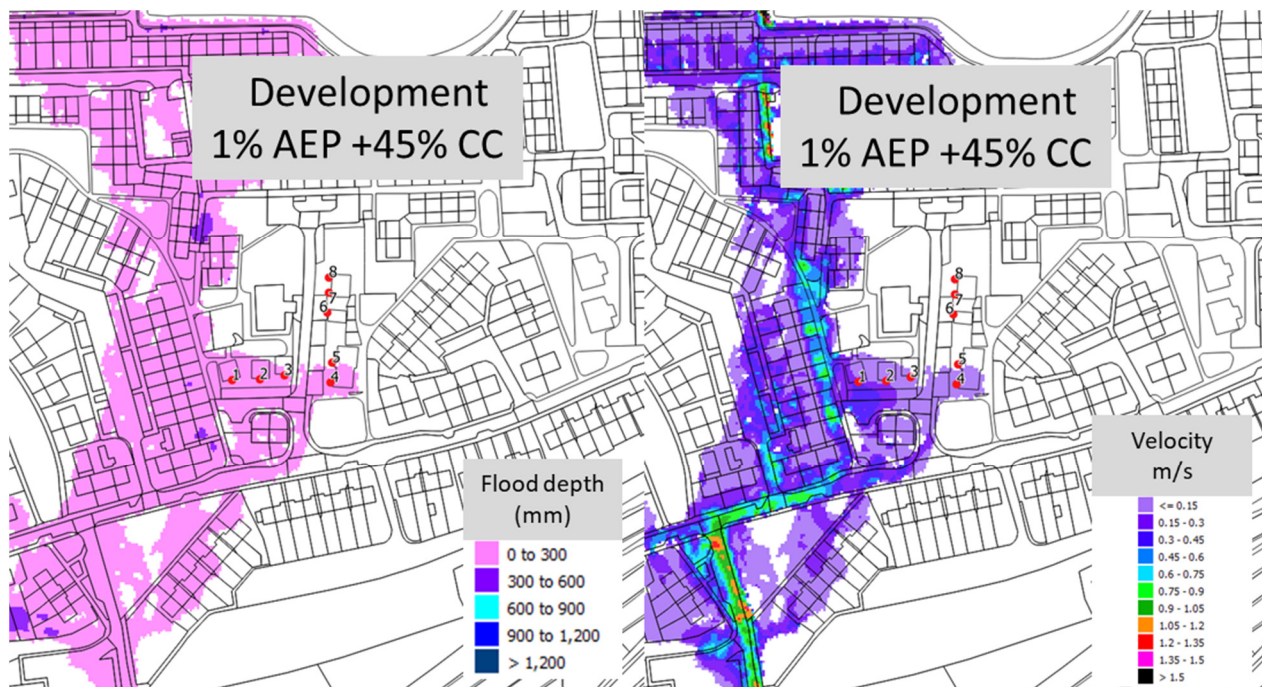
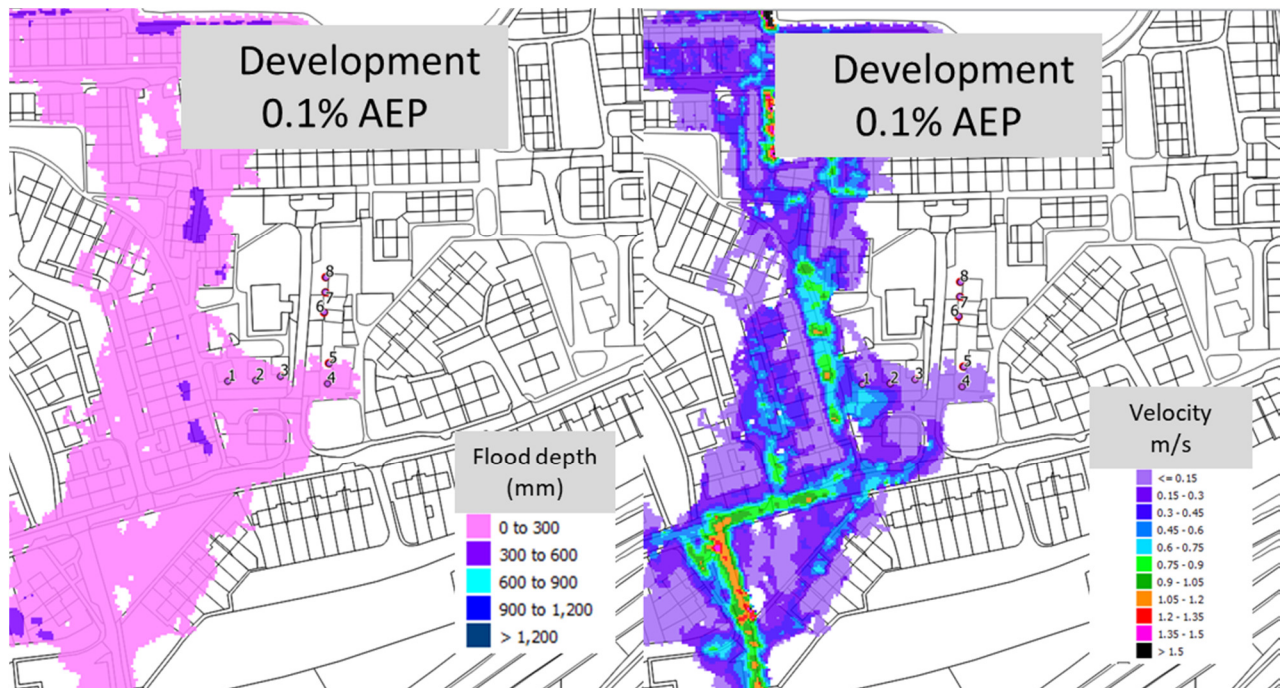


Figure 4 below shows the 1 in 1000 year event for maximum velocity and maximum depth outside of the proposed development area.



The hydraulic modelling methodology agreed with the NRW did not required WSP to provide the 0.1% blockage event and this has therefore not been provided in the FCA report. NRW need to advise if this is an error in their review of WSP report or clarify if they meant a 1% blockage event instead of 0.1% blockage event.

Tables 1 and 2 presented above show a summary of the flood depths and flood velocities for the North Wales Council's Regional Emergency Planning Service to refer to regarding safe access and egress.

The WSP FCA and hydraulic modelling has undertaken the "before" and "after" development comparisons of the flood velocity and hazard ratings for the site. These are included in the Appendices of the FCA and is as summarised above. WSP recommend reference should be made by the NRW to the FULL FCA report and all of its appendices. The comparisons found that the difference between the before and after development comparisons of flood velocity and hazard ratings was negligible and there was no increase in risk.

Raising the access roads and plot levels would increase flood risk elsewhere and is something that WSP will not recommend under any circumstance unless there is a flood compensatory area that can be provided. The NRW need to reconsider their recommendation regarding raising the raising of ground levels on the site as a mitigation measure without considering the impacts of increasing flood risk elsewhere.

Summary

The WSP FCA, the hydraulic modelling (which was undertaken in accordance with the methodology agreed with the NRW) and the additional clarifications presented within this Technical Note, are fit for purpose and accurately assess the risks and consequences of fluvial flooding at this site, in accordance with the relevant requirements of TAN15, given the limits of the base hydraulic model received from the NRW.

On this basis, it is considered that there is no further work required in either the hydraulic modelling or the updating the FCA report.

General

As demonstrated by the hydraulic modelling, the actual problem in this area (to all the other existing properties, not the proposed development) is the lack of capacity and risk of blockages of the culvert inlet structure of the Rhosymedre Brook.

The main mitigation measure that needs to be considered by WCBC and NRW is to improve this culvert inlet and its available capacity so there are less risks of blockages at the Rhosymedre Brook culvert inlet. In addition to the properties as part of this development, many other properties in Plas Madoc will see

beneficial reduction in flood risk. The most appropriate and most cost beneficial flood mitigation measure for the majority of this village is to improve the actual culvert inlet (and sizing where possible) to prevent blockages rather than raising the proposed development site levels.