Water

Cheshire West and Chester Council

October 2012

Winsford Area Flood Risk Assessment

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Winsford Area Flood Risk Assessment

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1 Introduction

1.1 Reason for the Report

AECOM, formerly Faber Maunsell, was commissioned by Cheshire West and Chester (referred to hereafter as CWAC) to undertake an Area Flood Risk Assessment (referred to hereafter as AFRA) for Winsford. For large scale regeneration schemes or multiple development sites, AFRA's should be carried out as a step between a Strategic Flood Risk Assessment (referred to hereafter as SFRA) and a site specific Flood Risk Assessment (referred to hereafter as FRA). Winsford has been identified specifically through the outcomes of the West Cheshire SFRA as an area that is at risk of flooding and part of a large scale regeneration programme.

A broad regeneration programme (Winning Winsford) has been developed for the town following a number of studies which have identified the need for a physical regeneration programme to tackle areas suffering from decline and to develop assets whose potential have yet to be fully realised. Of particular relevance to this study is the Winsford Regeneration Strategy, undertaken by consultants on behalf of the Council, together with a number of other partner organisations including the former Cheshire County Council (now CWAC), Action Weaver Valley, Winsford Town Council and British Waterways to produce a framework to assess the feasibility of a range of regeneration opportunities in the area of the Winsford waterfront. The Winsford Waterfront Regeneration Strategy aims to link Winsford to its Waterfront, opening up physical and visual connections from the town to the river and wider countryside and to bring about the reuse of under-utilised sites with the overall goal of regenerating and improving the waterfront. The Town Council are now preparing a Neighbourhood Development Plan for Winsford to take these schemes forward in conjunction and consultation with the community of Winsford.

This AFRA will look at the associated flood risk in Winsford's proposed development areas and determine the development vulnerability that should be permitted in accordance with Planning Policy Statement 25 (referred to hereafter as PPS 25) i.e. the sequential test and identify the parameters of the exceptions test. The purpose of the sequential test is to drive development towards lower flood risk areas.

The Sequential Test can be applied at a regional, local and site specific level. The West Cheshire SFRA has applied the Sequential test to all the development allocations and future potential development sites across the local authority. Development allocations and future potential development sites were taken from the Council's Annual Housing Monitor and Strategic Housing Land Availability Study (SHLAA) at the time of writing the SFRA. It should be noted that Council's Annual Housing Monitor and Strategic Housing Land Availability Study have been updated since the SFRA was written. This AFRA seeks to carry out the Sequential test to the development area of Winsford and to individual development sites.

1.2 Requirements for PPS25

PPS 25 defines four zones of flood risk. These zones are based on the quantified degree of flood probability to which an area of land is subject at the time at which a land allocation decision is made or a planning application submitted. The PPS25 flood risk zones and their associated fluvial flood risk characterisations are summarised in Table 1 below:

The PPS25 flood risk zones give a broad indication of flood probability. Flood risk includes both the probability of flooding and the consequences of flooding. However, many areas which fall within the high risk zone (Zone 3) are on flood plains and may already enjoy some degree of protection from established flood defences. The actual degree of flood risk to which these areas are subject may well be significantly less than that implied by their PPS25 classification, provided that those defences are maintained and improved to reflect the impact of climate change.

1.2.1 National Planning Policy Framework

Please note that between the analysis being carried out in line with PPS25 and this report being finalised PPS25 has been replaced by the National Planning Policy Framework, (NPPF). The Sequential and Exception Tests, the flood zones and flood vulnerability as described in PPS25 have all been carried forward into the NPPF and there is no substantive difference, in terms of flood risk analysis, between the two documents. This report will therefore refer to PPS25.

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Table 1: PPS25 Flood Zones

Zone 1 Low Probability
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Zone 2 Medium Probability
This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.
Zone 3a High Probability
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Zone 3b The Functional Floodplain
This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

PPS25 requires LPAs to adopt a risk-based approach to development in areas at risk of flooding, and to apply a "Sequential Test" to such areas. This means that, other factors being equal, the LPA would favour development in areas with a lower flood risk. The Sequential Test aims to steer new development to areas with the lowest probability of flooding (Zone 1).

It is clear that study areas within the PPS25 "high risk" zone may be at very different risks of flooding.

As shown in Table 1, PPS25 Zone 3 is subdivided into two areas, 3a and 3b. Zone 3b is classed as functional floodplain and is defined as being at risk from the 1 in 20 year flood or greater. PPS25 also states that the following types of development should be allowed.

3a: Water-compatible and less vulnerable uses of land in Table D.2 of PPS25 are appropriate in this zone. More vulnerable development is allowed subject to the Exception Test. Table 2 describes the types of development appropriate.

3b: Only water-compatible uses and the essential infrastructure listed in Table 2 that has to be there should be permitted in this zone. Essential infrastructure in this zone should pass the Exception Test.

The Exception Test considers the vulnerability of the new development to flood risk and, to be passed, must demonstrate that:

- There are sustainability benefits that outweigh the flood risk;
- It is on previously developed land or there are no other suitable previously developed sites in lower flood risk zones; and
- The new development is safe and does not increase flood risk elsewhere.

The Sequential Approach is also a risk based approach to development. In a development site located in several Flood Zones or with other flood risks, the Sequential Approach directs the most vulnerable types of development towards the areas of least risk within the site.

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1.3 Scope of Services

In preparing the AFRA we have:

- Obtained data from Environment Agency (referred to hereafter as EA), Cheshire West and Chester Council (CWAC) and United Utilities (UU)
- Reviewed relevant reports (West Cheshire SFRA, Sustainable Management for Winsford Flash, Weaver Gowy Catchment Flood Management Plan etc.)
- Considered the source and pathways of flooding within Winsford
- Assessed flood risk sequentially within Winsford and potential future areas of development
- Advised on mitigation measures to alleviate flooding
- Considered the impact of climate change
- Commented on suitable drainage schemes for the area
- Drafted specific policies for development for each proposed development area

It should be noted that the EA have stated that they have no historical records of flooding for Winsford. This does not imply that flooding has not occurred, just that they have no records.

Table 2: Flood Risk Vulnerability Classification from PPS25

Essential Infrastructure	- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. - Essential utility infrastructure which has to be located in a flood risk area for operational areas, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. - Wind turbines.
Highly Vulnerable	- Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. - Emergency dispersal points. - Basement dwellings. - Caravans, mobile homes and park homes intended for permanent residential use. - Installations requiring hazardous substances consent. (Where there is demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as ‘Essential Infrastructure’).
More Vulnerable	- Hospitals. - Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. - Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. - Non–residential uses for health services, nurseries and educational establishments. - Landfill and sites used for waste management facilities for hazardous waste.20 - Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.

Less Vulnerable	- Police, ambulance and fire stations which are **not** required to be operational during flooding. - Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. - Land and buildings used for agriculture and forestry. - Waste treatment (except landfill and hazardous waste facilities). - Minerals working and processing (except for sand and gravel working). - Water treatment works which do **not** need to remain operational during times of flood. - Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water Compatible Development	- Flood control infrastructure. - Water transmission infrastructure and pumping stations. - Sewage transmission infrastructure and pumping stations. - Sand and gravel workings. - Docks, marinas and wharves. - Navigation facilities. - MOD defence installations. - Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. - Water-based recreation (excluding sleeping accommodation). - Lifeguard and coastguard stations. - Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. - Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

1.4 Sources of Information

Table 3: Data received

Description	Provider	Action
Sustainable Management for Winsford Flash	VRBC (now CWAC)	Reviewed
West Cheshire SFRA	AECOM	Reviewed
LIDAR data	Environment Agency	Reviewed

Description	Provider	Action
Cheshire and Wirral Flood Risk Mapping Project: Supplementary Northwich Modelling Study Associated ISIS River Model data for the River Weaver	Environment Agency	Reviewed
Winsford Waterfront Development Brief – Summary Baseline Report	Scott Wilson	Reviewed
Winsford Waterfront Development Brief, Consultation Draft	Scott Wilson	Reviewed
DG5 Register for Winsford – past sewer flooding incidents	United Utilities	Assessed for content
Weaver Gowy CFMP	Environment Agency/ AECOM	Reviewed

2 Background Information

2.1 Catchment Description

Winsford is located in the centre of Cheshire on the River Weaver. The population of Winsford is approximately 33, 000 (Census 2001). The town is within a rural catchment with the River Weaver flowing south to north through the borough. The River Weaver has been canalised between Winsford and Northwich, into the Weaver Navigation. Upstream of Winsford town centre, the original River Weaver channel flows into Bottom Flash before becoming the Weaver Navigation.

For the purposes of this report and figures, the River Weaver has been split into three specific areas as shown in Figure 1 and detailed in the referenced figures in Appendix A:

- Southern: Area encompassing Bottom Flash to the beginning of residential properties (Figure A4)
- Central: Reach of the River Weaver where each bank is bounded by existing residential and commercial properties (Figure A3)
- Northern: Extending north from the central catchment where industrial complexes bound the banks (Figure A2).

2.2 Potential Development Areas

CWAC is currently working to bring about regeneration of Winsford and is looking in particular at potential redevelopment opportunities along the waterfront including those sites identified in the Winsford Waterfront Regeneration Strategy. The Waterfront Strategy forms part of the wider Winning Winsford regeneration proposals and the emerging Neighbourhood Development Plan with the aims being:

- The provision of new homes within Winsford and encouraging sustainable growth
- Provision of new commercial property.
- Support and strengthen the local employment base and attract a wide variety of businesses to Winsford
- The utilisation of the River Weaver by creating a mixed-use waterfront.
- Promote and diversify the use of the Flashes and the Weaver Valley

Table 4 below lists those key sites identified and the potential development types which are within the river flood boundary or likely to suffer fluvial flooding and which will require a more detailed fluvial study when site specific FRAs are required. It should be noted that these sites are only potential development sites and are not currently allocated for development in any adopted plan.

Other proposed development areas outside of the flood plain are included in the sequential test matrix contained in Appendix B. Sites greater than 1 hectare will still require a FRA despite being in Flood Zone 1. Figures in Appendix A showing the more detailed 1 in 100 year flood extents (with and without climate change) prepared using the CFMP modelling (and subsequently confirmed using data from the EA Supplementary Northwich Modelling Study) show only six of the 48 sites are potentially affected by fluvial flooding (Table 4).

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Figure 1: River Delineation Map

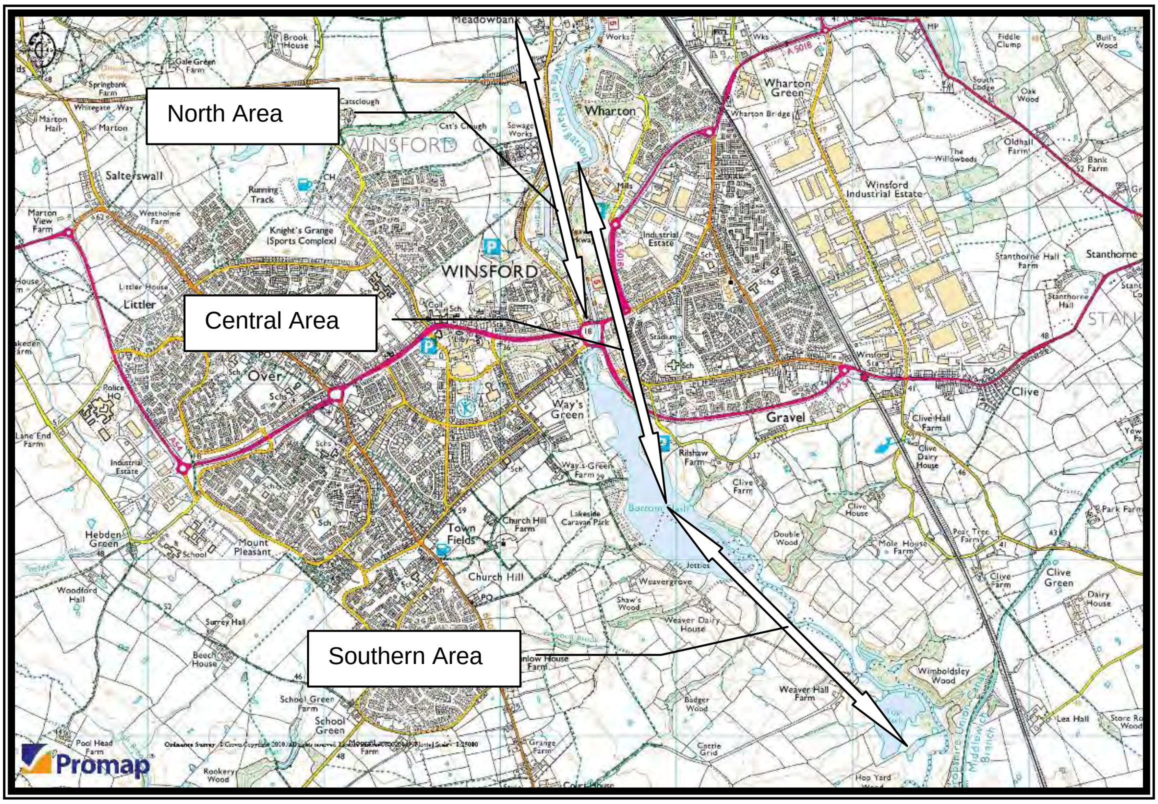

Table 4: Winsford Potential Development Areas at Risk of Fluvial Flood

Area	Allocation name	Description
VLH112	Red Lion Pub (land to rear), High Street	Residential – Western boundary of site at risk
VLH136	Cheshire Warehousing New Road	Residential – Eastern boundary of site at risk
VLH151	Meadow Island Bradford Road	Residential – Eastern boundary of site at risk
VLH152	Over Works Stocking Area Bradford Road	Residential – Western boundary of site at risk
VLH153	West Works Bradford Road	Residential – Western edge of site at risk
VLH109	Greedy Pig Site, New Road	Residential - Location not known

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2.3 Sources and Causes of Flooding

Table 5 indicates the sources of flooding within Winsford. Adoption of the Sequential Approach within these sites (i.e. no development along the site boundaries at risk of flooding) would result in no loss of flood plain storage. As previously explained, the Sequential Approach directs the most vulnerable types of development towards the areas of least risk within the site.

Information from the drainage service provider only lists 3 incidents of sewer flooding in Winsford. However, it should be assumed that during extreme rainfall and flood events the drainage system cannot cope with the additional surface water and therefore drains and culverts back up and/or become blocked. It should also be noted that it is unknown how long the drainage service provider has been recording sewer flooding incidents, so the number of incidents could be higher than the 3 recorded. The length of record is not known.

Table 5: Sources of Flooding

Source of flooding	Level of risk	Development allocations impacted
Fluvial	There is minimal risk to proposed development areas within the bounds of Winsford due to the topographic nature of the town. Those listed here are directly affected.	VLH112 – Red Lion Pub (land to rear), High Street, VLH136 – Cheshire Warehousing, New Road, VLH151 – Meadow Island, Bradford Road, VLH152 – Overworks Stocking Area, Bradford Road, VLH153 – West Works, Bradford Road, VLH109 – Greedy Pig Site, New Road
Sewer/Drainage/surface water	All areas have some level of flood risk but this is difficult to quantify without modelling the systems involved. DG5 Register (external incidents) shows 3 properties have had past sewer flooding incidents. CW7 2 (1 number) and CW7 3 (2 number) There is no plan of these available.	All
Infrastructure failure	Risk from industrial processes, burst water mains, blocked sewers or failed pumping stations.	All
Groundwater	Not applicable	None
Reservoir	Not applicable	None
Tidal	Not applicable	None

2.4 Flood History

It is known that an extreme flood event occurred in February 1946 across Cheshire, when a combination of excessive rainfall and snowmelt across the catchment resulted in flood flows on the River Weaver and Weaver Navigation. Data for this flood or any others within the Winsford area are not held by the EA or by CWAC. Normally finished floor levels for proposed development would be set either 0.60 or 0.30 metres above the calculated flood levels for the 100 year and 100 year plus climate change flood events respectively. Flood levels are usually calculated using data collected during flood events (i.e. measured flood levels), which are integrated into computer models for verification. Currently no data is held with either CWaC or the EA on recorded flood levels, so figures used for this report are extracted purely from the computer flood models.

2.5 Existing Flood Risk Management

The River Weaver from Winsford to Northwich has been canalised into the Weaver Navigation. Upstream of Winsford is the original channel leading from Bottom Flash. As the channel narrows after the Flash and before entering the town some natural attenuation will occur. As the surface area of the flash is in the order of 34 hectares, there is a large storage volume within the basin. The canalised section begins south of the Gyratory and has been considerably widened from the natural river with the banks being constructed from vertical masonry. Due to the engineering works the storage volume has been increased and therefore would provide a greater level of protection than a natural river. If flood levels where to top the masonry banks the topography of the river basin would suggest that water would be kept within a narrow band following the river.

There are currently no flood risk management plans for Winsford.

2.5.1 Flood Warning Areas

There are currently no flood warning areas within Winsford.

2.6 Flood Risk Assessment

The original approach used for the catchment wide study (West Cheshire SFRA) illustrated several sites would be affected by fluvial flooding. This was due to the level of flood extent information available at the time of preparing the SFRA and the scale of the mapping/modelling used – this was of necessity large scale due to the requirements of the SFRA. For an AFRA, more detailed mapping and flood modelling was made available from the CFMP and the Supplementary Northwich Modelling Study. In consequence the more detailed information used to prepare this report has removed many potential development areas from risk of flooding. The Winsford Exception Test matrix, Appendix B, lists those potential redevelopment areas that will require a formal site specific FRA for sites greater than 1 hectare. This is provided for the convenience of both planning officers and developers in providing simplified guidance in relation to the flood risk requirements for a specific development site.

2.7 West Cheshire Strategic Flood Risk Assessment

SFRAs provide an evidence base to inform the production of Local Development Documents (LDDs) the allocation of land and in the consideration of planning applications with respect to all forms of flooding, including flooding from rivers and the sea, flooding from groundwater, land drainage, sewerage and other artificial forms of flooding (i.e. reservoirs and canals etc.). An SFRA for West Cheshire including the former Vale Royal Borough Council area was completed in August 2008 and was reviewed for this study.

The initial outcomes and recommendations of the SFRA relevant to Winsford include:

- A more detailed assessment of the levels of flood risk within the Flood Zones should be undertaken within Winsford. This should be used to identify the areas least at risk and in turn inform the major developments that are planned in Winsford.
- The guidance and flood risk matrix in the SFRA report should be used for all developments in order to find the correct consultation process and requirements for a FRA.

In general flood hazard through Winsford to the north is classed as high; the flood extent is at its greatest towards Bradford Road. In Winsford the lower flood risk areas (in hazard rating and frequency of flooding) are to the east and west of the town centre. The potential development sites with the greatest level of risk associated with them are as follows:

- VLH112 - Red Lion Pub, High Street
- VLH136 - Cheshire Warehousing, New Road
- VLH151 - Meadow Island Bradford Road
- VLH152 - Over Works Stocking Area Bradford Road
- VLH153 - West Works Bradford Road
- VLH109 – Greedy Pig Site, New Road

3 Assessment of Flood Risk

3.1 Site Visit

A site visit was conducted on 3rd October 2007 in order to visually assess the potential regeneration areas, flood routes and current defences.

3.2 Fluvial Flooding

The River Weaver flows approximately south to north through the town of Winsford. To the south of Winsford is Bottom Flash, a large lake formed in a depression caused by subsidence after salt mining and/or brine extraction. The lake covers some 34 hectares and is fed by the Weaver River which extends across the bottom of a relatively low lying, steep sided but narrow valley. The landscape is characterised by fields and agricultural grassland, wooded valley sides and urban development.

Towards the northern tip of Bottom Flash the valley floor narrows just before the Gyratory. At this point the River Weaver becomes the Weaver Navigation and banks change from earth to sheet pile and masonry block. As the Weaver Navigation passes under the Gyratory the width of the channel reduces to some 20 meters expanding to approximately 40 meters downstream. The breadth remains relatively constant to Meadow Bank which is the northern most scope of this report.

The Weaver Navigation is set at the base of a valley, the town of Winsford being set on the steeply rising banks. The left (west) bank rises steeply to a plateau some 4.00 to 5.00 metres above top of bank level within 5.00 meters of the masonry river boundary. This plateau reduces to approximately 3.00 meters at Verdin's Cut, but rises to 4.00 metres when approaching the Salt Union Sites and Meadowbank.

On the right (east) bank Weaver Parkway has been created. This area of parkland has been rehabilitated from the quays and industrial areas which once lined the navigable river reach. Once again the topography consists of steep banks but set back at a distance varying from 20 to 50 meters. At the northern end of the right (east) bank is an industrial complex of where there has been an artificial raising of the steep bank.

Refer to Figure A1: Location Map – Winsford in Appendix A for locations.

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Photograph 1: Bottom Flash

Photograph 2: Original channel of River Weaver, looking upstream of A54

Photograph 3: Canalised Weaver Navigation, view from A54 looking downstream

Photograph 4: Canalised Weaver Navigation, view from A54 looking downstream

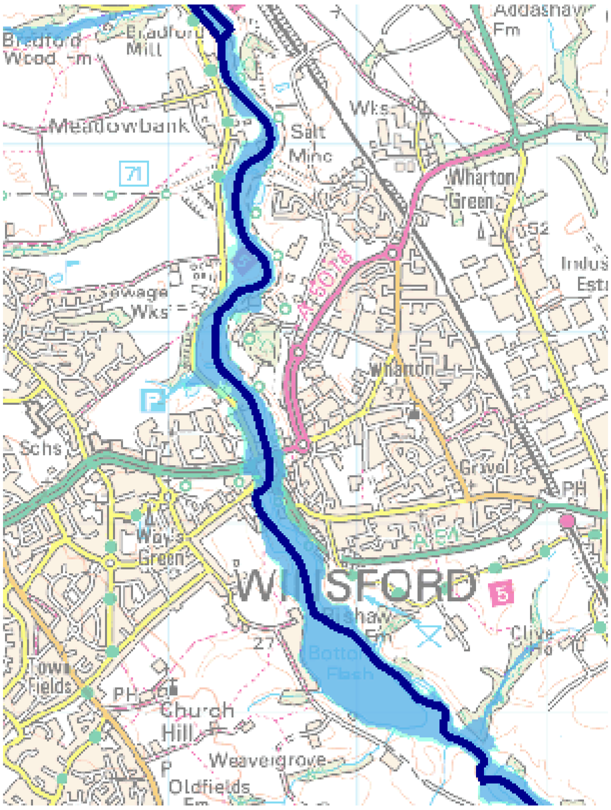
Photograph 5: Salt storage at site VLH153

Photograph 6: Weaver Navigation looking north

3.3 Probability

The EA's flood map (Figure 2) shows the estimated flood extent across Winsford. The flood maps show the Flood Zones and the level of risk (low, medium and high) associated with them. The level of risk within each flood zone takes account of the existing development. Figure 2 indicates that the banks adjacent to Weaver Navigation are within Flood Zone 3 and 2. Some zones would therefore be considered at low to medium risk of fluvial flooding while others would be at high risk. This suggests that the annual probability of flooding adjacent to the Weaver Navigation within Winsford is largely between 1% and 0.1% with some areas at higher risk (greater than 1%). However, the more detailed mapping prepared for the 1 in 100 plus climate change prepared for the Weaver Gowy CFMP maps shows that the assessed flood water is more confined than on the current EA flood maps. More detailed information has been provided by the EA (see below), which confirms that the flood extents along the banks of the river Weaver north of Winsford Bridge are more confined.

Figure 2: Environment Agency Flood Map 2011



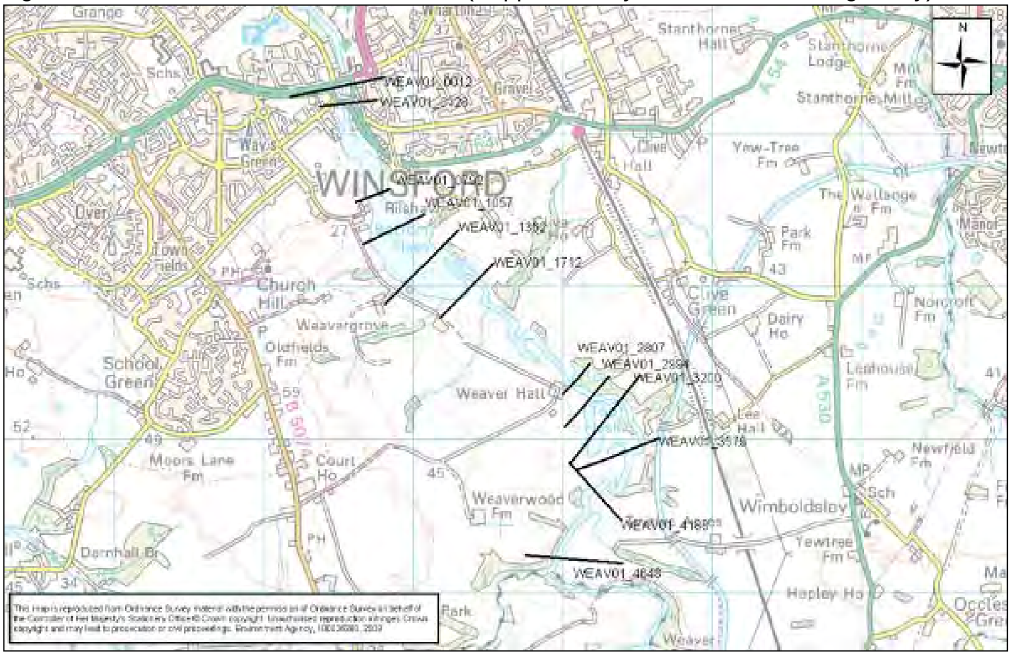
Key to Flood Map	
	Flood Zone 1
	Flood Zone 2
	Flood Zone 3
	Main River

3.4 Additional Flood Zone Analysis

The current EA flood zone maps at Winsford are based on JFLOW modelling and identify significant flooding on the west bank of the Weaver north of Winsford Bridge. This affects a number of industrial units and New Road / Bradford Road, which runs alongside the Weaver. The flooding also causes an issue for future retail / commercial development at the site.

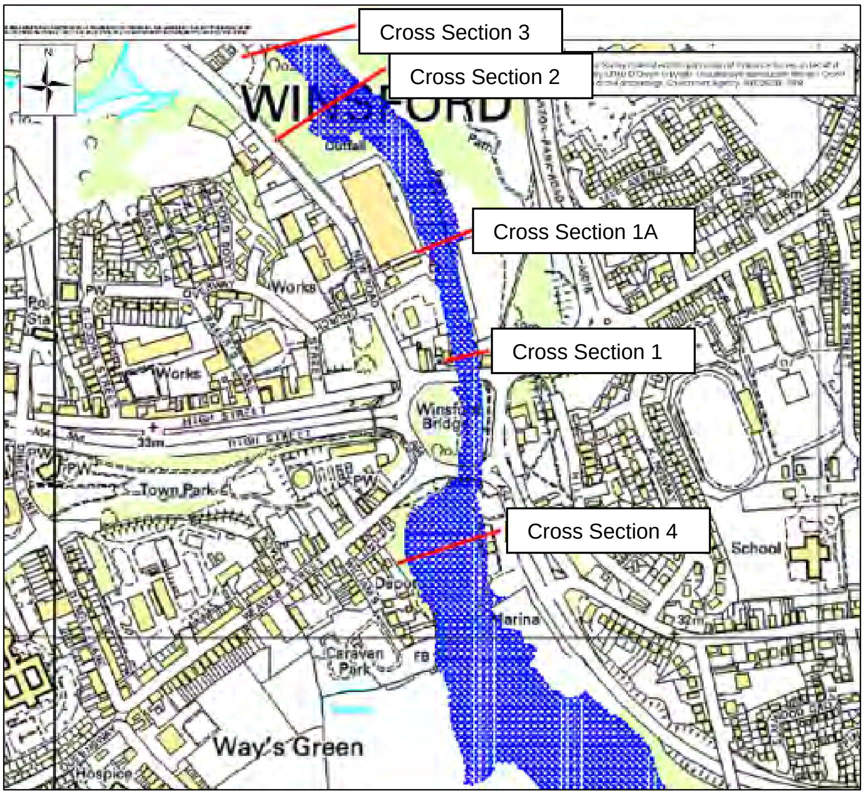
The ISIS hydraulic model used in the Supplementary Northwich Modelling Study contains cross sections of the Weaver through Winsford at approximately 100-700m spacing, which have been derived from Digital Terrain Model (DTM) data. The location of these sections (WEAV01_3575 to WEAV01_0012) is shown in Figure 3 below:

Figure 3: Cross Sections of EA ISIS Model (Supplementary Northwich Modelling Study)



It has often been found that JFLOW derived modelling over-estimates the extent of flooding and river structures are not taken into account. The results from the EA ISIS hydraulic model may therefore be more appropriate in determining flood extents at (and downstream of) Winsford Bridge. The ISIS model has been supplemented by a number of LiDAR derived cross sections prepared by AECOM (see Figure 4 below). This has allowed for an assessment and comparison between the JFLOW results and ISIS model results to be undertaken.

Figure 4: Location of LiDAR Derived Sections



3.4.1 Analysis

No hydraulic model for the 1 in 100 year storm event has been provided by the EA for this assessment (as displayed on the EA flood zone maps). However, the 1 in 200 year water level, which has been provided, is likely to be of similar magnitude to the 1 in 100 year water level with an allowance for climate change (+20% flow). Peak water levels from the 1 in 200 year ISIS hydraulic model in the vicinity of Winsford Bridge are as follows, with interpolation used to calculate levels at LiDAR derived sections as required:

Table 6: Peak 1 in 200 year Water Levels through Winsford

ISIS Section	LiDAR Section	Peak Water Level (m AOD)
WEAV01_0792		19.42
	XS4	19.10
WEAV01_0128		19.04
WEAV01_0012		18.95
WEAN03_8856	XS1	18.71
	XS1A	18.69
	XS2	18.67
	XS3	18.65
WEAN03_7374		18.53

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Comparison of the peak water levels from the ISIS hydraulic model against the sections derived from LiDAR results in the following observations:

XS4	**Main channel and 'inlet channel' (to the east) remain in bank.**
WEAV01_0128 (ISIS section south of A54 Road Bridge)	Approx. 13m of flooding to west bank; approx. 24m flooding to east bank.
WEAV01_0012 (ISIS section south of Winsford Bridge)	Contained by west and east banks.
WEAN03_8856 (ISIS section 20m north of Winsford Bridge)	Contained by west and east banks.
XS1	Contained by west and east banks.
XS1A	Contained by left bank; approximately 65m flooding to right bank.
XS2	Contained by west and east banks.
XS3	Contained by west and east banks.

Based on available LiDAR and ISIS hydraulic model data the 1 in 200 year peak water level is likely to be contained by the west bank of the River Weaver north of Winsford Bridge. It can therefore be determined that the 1 in 100 year and 1 in 100 year plus climate change peak water levels will remain in-bank. This statement is in agreement with the Weaver Gowy Catchment Flood Management Plan (July 2008) but is contrary to the current flood extents as displayed on the current EA flood zone maps. It is understood that the EA are currently undertaking further modelling for the Weaver Navigation. Photographs illustrating these findings are shown below.

Photograph 7: Approximate position of cross scetion1 looking from east bank to west.

Photograph 8: Looking from west bank to east from Winsford Bridge.

Photograph 9: High level of west bank at approximate line of cross section 1A.

Photograph 10: Verdins Cut at approximate line of cross section 2

Photograph 11: Low west bank (Bradford Road area). Approximate line of XS3

Photograph 12: Bradford Road Area

Photograph 13: Artificially raised land at salt storage areas

Therefore, for the purposes of this AFRA, the existing EA flood zone maps should be superseded by the 100 year plus climate change maps presented in Appendix A. This has the effect of placing the proposed development sites along the left (west) bank of the River Weaver outside of the 100 year plus climate change flood extent which in turn changes the types of development that would be suitable in these areas.

Conclusion: The 1 in 100 year and 1 in 100 year plus climate change peak water levels will remain in-bank along the left (west) bank of the River Weaver to the north of Winsford Bridge. The proposed development sites along the left (west) bank of the River Weaver, to the north of Winsford Bridge, are therefore located outside of the 100 year plus climate change flood extent.

3.5 Climate Change

The EA flood maps (Figure 2) do not currently illustrate climate change allowances; however PPS 25 requires that the spatial planning process (i.e. SFRAs and LDF /LDD's) should. In the SFRA an upper limit of 20% increase in river flows (over the next 100 years) in accordance with Defra and PPS25 guidance was used.

When designing surface water drainage for a new development, the impact of climate change should also be taken into account. It is predicted that climate change will increase the intensity of storms and the volume of rainwater. The existing guidance for assessing the impact of climate change on peak rainfall is summarised in Table 8 below.

Table 7: Recommended increases in peak rainfall intensities (from Table B.2 PPS25)

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	+ 5%	+ 10%	+ 20%	+ 30%
River flows	+10%	+20%		

3.6 Finished Floor Levels

The EA currently holds no calculated Finished Floor Level (FFL) for the potential development sites along the Weaver Navigation. Using the flood levels calculated from the current model and taking climate change into consideration it could be assumed that the FFL would be defined as:

- Upstream (VLH 136)
  - 1 in 100 year flood = 18.71m AOD
  - Climate change allowance (over 100 years) - included
  - Design freeboard = 0.6m

More vulnerable development FFL = **19.31m AOD**

- Downstream (VLH 109)
  - 1 in 100 year flood = 18.53m AOD
  - Climate change allowance (over 100 years) - included
  - Design freeboard = 0.6m

More vulnerable development FFL = **19.13m AOD**

These figures would require confirming with the EA during the site specific FRA discussions. For less vulnerable developments the freeboard elements could be reduced to 0.3m giving 10.01mAOD upstream and 18.83m downstream. These figures would require confirming with the EA.

Run-off rates will also be affected by climate change and are expected to increase in line with the increase in peak rainfall depending on the type and level of development. In line with current EA guidance and best practice a 20% increase should be applied to commercial and retail development over the next 60 years. For residential development an increase of 30% should be considered over the next 100 years. A site specific FRA should consider this when assessing the changes in existing and proposed run-off for each development site.

3.7 Flood Risk to People

Part of the West Cheshire SFRA assessed flood risk to people in order to inform the Sequential Test by recommending where certain types of development should be located, depending on the hazard rating attributed. This has been used to assess the different levels of risk for individual future potential development sites. The assessment method is based on the DEFRA/EA Flood & Coastal Defence R&D Programme, R&D Outputs: Flood Risk to People, Phase 2, Guidance Document.

The flood risk profile (flood risk to people) was calculated as a function of flood velocity and flood depth using the following equation:

HR = d x (v + 0.5)

HR = flood hazard rating

d = depth of flooding (m)

v = velocity of floodwaters (m/sec)

LiDAR data was used to obtain the elevation and therefore potential flood depth for the different development areas. River stage levels were taken from the EA's ISIS model for the River Weaver for the 1 in 100 year flood event. To gain a more accurate understanding of flood hazard, additional nodes were plotted on the rivers adjacent to the development areas and hazard rating values were obtained adjacent to these node points.

The degree of hazard (low, moderate, significant and extreme) was then attributed to the hazard rating values. The rating was taken from a table in the EA/Defra guidance and can be seen below.

Table 8: Hazard to People as a Function of Velocity & Depth (DEFRA/EA Flood & Coastal Defence R&D Programme, R&D Outputs: Flood Risk to People, Phase 2, Guidance Document)

D x (v + 0.5)	Degree of Flood Hazard	Description
< 0.75	Low	Caution *“Flood zone with shallow flowing water or deep standing water”*
0.75 – 1.25	Moderate	Dangerous for some (i.e. children) *“Danger: Flood zone with deep or fast flowing water”*
1.25 – 2.5	Significant	Dangerous for most people *“Danger: flood zone with deep fast flowing water”*
> 2.5	Extreme	Dangerous for all *“Danger: Extreme flood zone with deep fast flowing water”*

Due to the topography of the Winsford Area the flood waters are kept generally within bank when detailed flood maps are assessed. The locations where flood waters overtop the bank are shown in Appendix A. Development is not proposed in these areas. Where development is shown to be adjacent to the river, the Sequential Approach should be followed with the result that development will not be located in areas of hazard. Therefore flood hazard is not considered to be a problem.

Conclusion: Development is not proposed in the locations where flood waters could overtop the bank. Based on adopting the sequential approach where development is proposed adjacent to the river, development will not be located in areas of hazard. Flood hazard is therefore not considered a problem.

3.8 Displacement of Floodwater

PPS 25 states that FRAs should consider the risk of displaced floodwater caused by additional new buildings. Any net gain in buildings within the floodplain will cause a loss in floodplain volume and result in the displacement of flood waters. If existing buildings where to be demolished and replacement buildings did not exceed the original building footprint no loss of flood plain would occur. Loss of volume would occur if new buildings or any associated land raising exceeded the original buildings footprint.

The impact of any reduction of flood plains within the Winsford area would be minimal when considering the characteristics of the more detailed flood mapping. However site specific FRAs should assess the effect at a more detailed level.

Calculations were performed to gauge the loss of flood plain if protection was afforded to potential development sites along the Weaver Navigation. Examination of the more detailed flood level mapping shows six sites potentially affected by flooding. However these are only on their boundaries and the adoption of the Sequential Approach would ensure that there is no land raising and therefore no loss of flood plain storage. Loss of flood plain storage is therefore not an issue.

Conclusion: Based on adopting the sequential approach where development is proposed adjacent to the river, there will be no loss of flood plain storage. Loss of flood plain storage is therefore not considered a problem.

However, site specific FRAs would still have to confirm that compensatory flood storage is not required, and will also have to consider any revised flood levels determined by the EA as part of the current flood modelling exercise.

3.9 Run-off

PPS25 states that FRAs should consider the risk to others caused by new developments. New developments can lead to increased run-off of surface water which increases the risk of flooding elsewhere.

Developers should consider the existing run-off rates across the development sites and whether the proposed development is likely to increase or reduce run-off. As Winsford Waterfront regeneration proposals are based on the redevelopment of brownfield sites, it is expected that there will not be a significant increase in surface run-off. Future developments should be designed in a way that maximises soft landscaping which could reduce rather than increase run-off rates. The run-off for a specific development site should be considered as a whole for the individual site so that any landscaping and open spaces would reduce total run-off rates benefiting the entire site. It should be noted that United Utilities may require significant reductions in the rate of surface water from the sites, if surface water is discharged to public sewer.

The developers will also have to consider the impact of climate change on run-off. With foresight and implementation of good practice within their designs the predicted climate problems may be diminished.

An outline drainage strategy for each site should be prepared to justify the way development has dealt with these issues. This would inform the site specific FRA when it assesses the impact of run-off to other areas.

4 Sequential Testing

4.1 Introduction

PPS25 states that development should be directed to Flood Zone 1 wherever possible, and then sequentially to Flood Zones 2 and 3, as identified by the SFRA. The EA Flood Zone maps show current best estimates of the risk of flooding from rivers and the sea and does not consider other sources. Therefore this principle of locating development in lower risk areas should also be applied to other forms of flooding.

As previously explained, the Sequential Approach is also a risk based approach to development. In a development site located in several Flood Zones or with other flood risks. The Sequential Approach directs the most vulnerable types of development towards the areas of least risk within the site.

In adopting the Sequential Approach, the following should be considered:

- Development in Flood Zone 3 should be seen as a last resort and that certain uses (as identified in PPS25 Table D1) are inappropriate in high risk areas and should not be permitted at all.
- Development in Flood Zone 2 should not be seen as without risk of flooding.
- Appropriate measures to manage residual risk must be applied to any developments which are exceptionally constructed in flood risk areas. These measures must take into account the effects of climate change.

In exceptional circumstances there may be valid reasons for a development type to be considered even if it is not compatible with the level of flood risk. In this case, the site must pass all elements of the Exception Test (see below).

The Sequential Test has been applied to each of the potential development sites. This was carried out by updating the flood risk matrix from the SFRA with additional information gathered in the AFRA. The flood risk matrix can be found in Appendix A

4.2 Sequential Test

The first step of the Sequential Test is to verify whether there are any suitable and readily available locations with potential for development that are in areas of lower flood risk. CWAC has confirmed that while there may be other locations capable of future development within the town, they would not offer the same benefits in terms of both the physical regeneration and associated socio-economic benefits for the area. The next step in the Sequential Test is to determine whether the development types conflict with the Flood Zone in which it resides. If there is a conflict it must be resolved by either moving the development to a safer zone or carrying out the Exception Test.

4.3 Exception Test

The Exception Test should be applied only after the Sequential Test has been applied and in circumstances shown in Table D1 of PPS25 when ‘more vulnerable’ development and ‘essential infrastructure” cannot be located in Flood Zone 1 or 2 and ‘highly vulnerable‘ development cannot be located in Flood Zone 1. For the Exception Test to be passed:

- it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and

- a site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Both elements of the test will have to be passed for development to be allocated or permitted.

As shown in Section 3 Assessment of Flood Risk there are no currently identified potential development sites that are wholly in Flood Zone 2 or 3. For those that have an element (or boundary) within either Flood Zone 2 or 3 the Exception Test should be applied. However this should be a relatively straight forward exercise if the Sequential Approach is applied within the development site: i.e. the vulnerability of the development is matched to the specific Flood Zone within a particular area of a site.

5 Flood Mitigation Measures

5.1 Fluvial Measures

Fluvial flood risk can be managed by a number of mitigation measures. This section outlines possible approaches which would either reduce flood levels or prevent the flood waters reaching and adversely affecting the development sites.

5.2 Land Raising

Any land raising should be based on the threshold levels agreed with the EA for development in Winsford town centre. These Finished Floor Levels (FFLs) could be achieved by raising the ground level or by alternative engineering practices. Based on the latest flood mapping it is unlikely that land raising would be required for any of the development sites along the Weaver Navigation provided the Sequential Approach is applied within the development boundaries. Any land raising would lead to loss of flood plain storage and as such compensatory storage would have to be arranged.

5.3 Foul and Surface Water Arrangements

Through consultation with United Utilities (UU) it was confirmed that UU will not allow building over public sewers or rising mains. On request from the developer, UU will consider diversion of these existing assets at the expense of the developer. The design of the proposed adoptable sewers should be in accordance with the current Sewers for Adoption. Existing runoff rates would need to be proven and allowances for climate change taken in to consideration dependant on the life of the proposed development.

Consultation with the EA has indentified that they would offer similar advice to United Utilities, with regards to building over existing culverts and culverting watercourses.

5.4 Sustainable Drainage Systems

Sustainable Drainage Systems (SuDs) is the collective term for a number of drainage methods which can be used in various combinations to provide an effective but sustainable drainage system in place of, or in conjunction with, a traditional drainage system.

SuDs schemes aim to improve on traditional drainage methods by attempting to replicate natural land drainage systems and processes. These schemes reduce the risk of flooding, by more effectively managing the flow rates of surface water to watercourses.

Through natural processes, they also reduce the amount of pollution transmitted to watercourses, stabilising or improving water quality. In addition to this, Suds schemes can actively enhance the developed environment by improving landscaping, wildlife habitats, and community facilities.

Table 10 shows some typical SuDs mechanisms available. Some of these are more suitable than others and more specific ground investigation will be needed to establish the effectiveness of these measures on specific sites.

Table 9: SUDS Options

Category	Techniques	Purpose
Preventive Measures	Rain-water recycling, good-practice design and maintenance	Reduces the amount of rainfall leaving a site.
Filter strips and swales	Vegetated landscape features (smooth surfaces, gentle downhill gradient).	Drains water evenly off impermeable surfaces, mimicking natural drainage patterns.
Filter drains and permeable and porous pavements	Permeable surfaces	Allow rainwater and run-off to infiltrate into permeable material placed below ground to store water prior to discharge.
Infiltration devices	Soakaways, infiltration trenches, swales with infiltration and infiltration basins	Below-ground or surface structures that drain water directly into the ground can be installed at source or the run-off may be conveyed to the infiltration area in a pipe or swale.
Basins and ponds	Detention basin Balancing/attenuation ponds Flood storage reservoirs Lagoons Retention ponds Wetlands/reed beds	Structures designed to hold water when it rains. Basins are empty in dry weather. Ponds contain water at all times and are designed to hold more when it rains.
Manufactured Retention Systems	Pre-designed systems by manufacturers such as Stormcell, Atlantis and Hoofmark	Manage the heavy rainfall events as they are set for design storm events.
Engineered Solutions	Tank Sewers, Detention Tanks	Provides solution if the above ones are not feasible, and where adoption is required under the Water Industry Act.

5.5 Flood Proofing

There may be circumstances for less vulnerable development where temporary disruption is acceptable as long as flood warning is provided. Flood proofing are suitable measures which can provide either flood resistance or flood resilience. Flood resistance (dry proofing) prevents flood water entering a property, whereas, flood resilience (wet proofing) accepts entry of flood water and allows for the situation through careful internal design. Tables 11 – 13 outline a variety of flood resilience, resistance and avoidance measures, which should be considered by developers when proposing their final master-plans.

For more information on Flood Resistance and Flood Resilience Techniques refer to the EA/DEFRA Document 'Improving the Flood Performance of New Buildings'.

Table 10: Flood resilience measures

Resilience measures
• Building materials - Denser materials such as concrete and engineering bricks have good resilience characteristics • Foundations ➢ for flood depths less than 0.3m (water exclusion strategy): - Minimise the entry of water through permeable elements of the foundation. Concrete blocks used in foundation should be sealed with an impermeable material or encased in concrete to prevent water movement from the ground to the wall construction. ➢ for flood depths more than 0.3m (water entry strategy): - Provide durable materials that will not be affected by water and use construction methods and materials easy draining and drying. ➢ Basement can provide an effective barrier to flood water (not preferred for living accommodations) • Floors ➢ for flood depths more than 0.3m (water exclusion strategy): - Ground supported floors and concrete slabs of at least 150mm thickness are the preferred option for non-reinforced construction. - Suspended floors may be necessary where ground supported floors are not suitable, namely in shrinkable/expanding solid or where depth of fill is greater than 600mm. - Suspended timber floors are not a preferred option. - Hardcore and blinding is necessary to reduce the risk of settlement and consequential cracking - Damp proof membranes should be included to minimise the passage of water through ground floors. - Floor insulation should be of the closed-cell type to minimise the impact of flood water. - Suitable floor finishes include ceramic tiles or stone floor finishes and skirting board. - When the expected probability of flooding in any year is 20%, the provision of a sump and small capacity automatic pump at a low point of the ground floor is recommended. - Under floor services using ferrous materials should be avoided. ➢ for flood depths more than 0.6m (water entry strategy): - Materials that retain their integrity and properties when subjected to flood water (such as concrete) or those that can be easily replaced (sacrificial materials), should be specified. - Construction should allow easy access for cleaning, (e.g. below suspended floors), and drainage - the applications of water exclusion strategy and water entry strategy are quite similar • Walls ➢ for flood depths up to 0.3m or up to 0.6m (water exclusion strategy): o Masonry walls: - Engineering bricks up to predicted flood level plus one course of bricks to provide freeboard; this will increase resistance to water penetration. - Aircrete blocks allow less leakage than typical concrete blocks but concrete blocks dry more quickly. - Do not use highly porous bricks such as hand made clay bricks. - Clear cavity walls, i.e. with no insulation in the cavity, have better flood resilience characteristics than filled or part filled cavity walls as they dry more quickly. o Framed walls: - Avoid timber framed walls should be avoided (poor performance in floods) o Reinforced concrete wall/floor - should be considered for flood-prone areas o External renders - effective barriers to water penetration o Insulation: - External insulation is better than cavity insulation because it is easily replaced if necessary. o Internal linings: - Internal cement renders (with good bond) are effective at reducing flood water leakage into a building and assist rapid drying of the internal surface of the wall. - Avoid standard gypsum plasterboard as it tends to disintegrate when immersed in water. ➢ for flood depths above 0.3m or above 0.6m (water entry strategy):

- Masonry walls:
  - Use good quality facing bricks for the external face of cavity walls.
  - Do not use soft bricks which can easily crumble when subjected to water.
  - Concrete blocks dry more quickly than Aircrete blocks. However, Aircrete blocks allow less leakage.
  - Clear cavity walls, i.e. with no insulation, have better resilience characteristics than filled or part filled cavity walls as they dry more quickly
- Framed walls:
  - Avoid timber framed walls should be avoided (poor performance in floods)
- External renders
  - Should not be used as they provide a barrier to water penetration and may induce excessive differences in depth between outside and inside of the property resulting in possible structural problems.
- Insulation:
  - External insulation is better than cavity insulation because it is easily replaced if necessary; however it is generally protected by rigid lining which may create a barrier to water.
- Internal linings:
  - Avoid internal cement renders as these can prevent effective drying.
  - Use standard gypsum plasterboard up to the predicted flood level (plus freeboard of 50mm) as a sacrificial material.
  - Above predicted flood level (plus freeboard) the use of plasterboard or internal cement renders is appropriate.

- Doors and Windows
  - Doors:
    - Raising the threshold as high as possible, while complying with level access requirements, should be considered as the primary measure
    - Hollow core timber internal doors should not be used where the predicted frequency of flooding is high.

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  - Windows/patio doors:
    - Windows and patio doors are vulnerable to flood water and similar measures to those used for doors should be taken.
  - Air vents:
    - special designs of air vent are available in the market to prevent water ingress in circumstances where the predicted flood depth is low
- Fittings

➢ water exclusion strategy
  - use durable fittings that are not significantly affected by water and can be easily cleaned
  - Place fittings (e.g. electrical appliances, gas oven) on plinths as high as practicable above floor so that they are out of reach of flood water.
  - Ensure adequate sealing of joints between kitchen units and surfaces to prevent any penetration of water behind fittings.

➢ water entry strategy
  - Specify durable fittings that are not appreciably affected by water and can be easily cleaned.
  - Place fittings (e.g. electrical appliances, gas oven) as high as practical above floor to minimise the risk of being affected by flood water.
  - Providing gaps behind kitchen units will facilitate drainage and will allow access for forced drying, if proved to be necessary.

- Services
  - Pipework:
    - Closed cell insulation should be used for pipes which are below the predicted flood level.
  - Drainage services:
    - Non-return valves are recommended in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging.
  - Water, electricity and gas meters:
    - Should be located above predicted flood level.
  - Electrical services:
    - electrical sockets should be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation
  - Heating systems:

- Boiler units and ancillary devices should be installed above predicted flood level and preferably on the first floor of two-storey properties. • Communications wiring: - Wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage.

Table 11: Flood Resistance Measures

Resistance measures
- Aiming to prevent floodwater ingress into building - Designed to minimise the impact of floodwaters directly affecting buildings and to give occupants more time to relocate ground floor contents - Use of low permeability materials that reduce the rate of water ingress into a property. • Effective for short duration, low depth flooding

Table 12: Flood Avoidance Measures

Avoidance measures
- Not building in flood risk areas wherever possible - Raising ground or floor level or re-designing to a location outside the flood area, and provision of replacement storage. - Local bunds can be designed to protect individual or groups of buildings from flooding. It is unlikely that these can be made fully watertight and pumps may be necessary to remove or re-direct any seepage water within the protected area. Bunds may be effective where the predicted duration and depth of flooding is low. Advice should be sought from a Qualified Engineer/Professional to ensure the bunds can withstand predicted water pressures. - Landscaping of a development site or building curtilage to direct or divert floodwater away from buildings can be effective particularly where the predicted duration of flooding is short i.e. hours rather than days. Landscaping is an integral component of sustainable drainage systems (SUDS). They can be designed to manage flood risk and water quality, and also environmentally acceptable to communities. - Boundary walls and fencing could be designed with high water resistance materials and/or effective seals to minimise water penetration for low depth, short duration floods (but not for groundwater flooding).

5.6 Access and Egress

PPS25 requires that safe access and egress is available to and from new developments in flood risk areas. This includes access by roads, pedestrian and parking areas. Emergency services should be able to reach developments in flood conditions. Access routes should be above the minimum upstream and downstream levels, 18.71m and 18.53mAOD respectively. Undercroft or external car parking and access at appropriate levels may also be considered acceptable providing the development was protected from flooding through emergency planning (removing cars in advance, lift operation procedures etc.) and with safe dry access.

Landscaping of public areas that are at risk of flooding should allow easy access to higher ground as flood waters rise, avoiding local features that could become isolated and which could cause obstructions to escape routes.

A site specific FRA should be carried out to assess the velocity of floodwaters and flood pathways in relation to the layout of roads and pedestrian routes to maintain safe access and egress.

5.7 Residual Risks

Residual risks are those that remain after applying the Sequential Test and mitigation measures. Flood risk to people and property can be minimised but never completely removed.

A site specific FRA would look at these residual risks in more detail once the development plans and the appropriate mitigation measures are confirmed. For the proposed development sites the likely residual risks include:

- An extreme flood event (such as the 0.1% annual probability flood). Emergency planning by responsible authorities should identify measures to tackle this risk.
- Uncertainty regarding exact flood routes and speeds.
- Failure of surface water conveyance systems.
- Failure of any upstream flood management measure (upstream attenuation site).

5.8 Emergency Access

It is likely that some of the access roads will be under water during an overtopping event. The equivalent of “snow poles” (as used at high elevations during heavy snow to delineate the edges of roads, driveways etc) should be available to ensure that the emergency services are able to enter the site safely. If street furniture were to be appropriately positioned this could act as guidance for access roads. The primary accesses should be set at a level higher than the threshold flood levels plus climate change. In areas where surface flooding is likely, manhole covers should be bolted down to protect against trips and falls. This should be considered in more detail in the site specific FRA and the detailed design stage.

6 Summary

6.1 Overview of Flood Risk

Winsford is located around the Weaver Navigation. The topographic nature of the town means that most potential development areas within Winsford are removed from the risk of fluvial flood. Of the potential sites considered only six are at risk from fluvial flooding. Each is situated adjacent to the Weaver Navigation and may be susceptible to overtopping from the banks. The sites are:

- VLH112 Rear of Red Lion Pub
- VLH136 Cheshire Warehousing New Road
- VLH151 Meadow Island Bradford Road
- VLH152 Over Works Stocking Area Bradford Road
- VLH153 West Works Bradford Road
- VLH109 Greedy Pig Site, New Road

Even for these sites it is only the boundary adjacent to the River Weaver that is at risk from the 100year plus climate change event.

Site VLH109 – Greedy Pig Site, New Road, is not at risk from fluvial flood due to the topographic nature of Winsford. The original broad brush view of flooding in the West Cheshire SFRA would not have investigated the topography to such detail.

SiteVLH122 at Donefields Industrial Estate, appears to be vulnerable from flooding from local land drains. As such there is a potential for surface water runoff during a high level event to increase the flood risk elsewhere. Therefore a site specific FRA should include details of these effects, mitigation and define a threshold level during such events.

Other locations should consider flooding from rainfall, drainage and the effect of ground water when risk assessments are produced.

6.2 Overview of Development Proposals

Regeneration proposals for Winsford are focussed on the waterfront area adjacent to areas at risk of flooding. This does not conflict with flood risk and development guidelines.

This study therefore concludes that it may be appropriate to develop the sites providing site specific FRAs are completed to determine the most appropriate flood risk management responses.

In summary, we propose the following general recommendations:

- Suggested threshold flood levels for development are of 18.71 and 18.53mAOD (plus freeboard and or climate change) for upstream and downstream respectively. The freeboard for the above figures will differ dependant on the proposed site specific use. Site specific levels should be attained during the formal FRA.
- As shown in this report no loss of flood plain will occur provided the Sequential Approach is adopted within development sites adjacent to the river Weaver.
- Site specific FRAs should consider the impact of the Winsford regeneration schemes and development sites on other locations.

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