Appendix B

HOTSPOT SELECTION TECHNICAL NOTE

TECHNICAL NOTE
HOTSPOT SELECTION

Project	North Hertfordshire District SWMP	
Date	18 March 2015	Revision Date – March 2017
Prepared By	C Brammeier	
Checked By	A Smith / C Patmore	
Project Reference	70006808 – TN1	

1 INTRODUCTION

1.1.1 This Technical Note has been prepared to record the approach taken to the hotspot identification and selection process, in order to enable the project stakeholders to make an informed decision as to which hotspots should be taken forward for detailed hydraulic modelling. This Technical Note will be adapted to form part of the Strategic and Intermediate Phase SWMP Report.

1.2 AIMS OF STUDY

- Increase Hertfordshire County Council's (HCC) understanding of the key flooding mechanisms in North Hertfordshire District in their role as Lead Local Flood Authority (LLFA);
- Give HCC a better understanding of how the Environment Agency's Risk of Flooding from Surface Water map corresponds to the flooding mechanisms that occur in this district;
- To identify hotspot sites which have the potential to benefit from scheme investment from funding such as Flood Defence Grant in Aid (FDGiA);
- To identify hotspots which do not need hydraulic modelling (e.g. due to flood mechanisms being well represented in the Risk of Flooding from Surface Water map), but are identified with suggested actions as part of the SWMP;
- Identify potential actions and recommendations to be undertaken by HCC and/or other Risk Management Authorities (RMAs);
- Identify mitigation measures where necessary; and
- Provide the general public with a tool which better represents the surface water flood risk in their area.

2 HOTSPOT DEFINITION

2.1.1 For the purpose of this Surface Water Management Plan (SWMP), a hotspot is defined as a spatially limited area in which there are a number of residential or commercial properties at risk from flooding resulting from surface water; other sources of flooding and their interaction with surface water flooding are also recognised. An example of such a hotspot is shown in Figure 1.

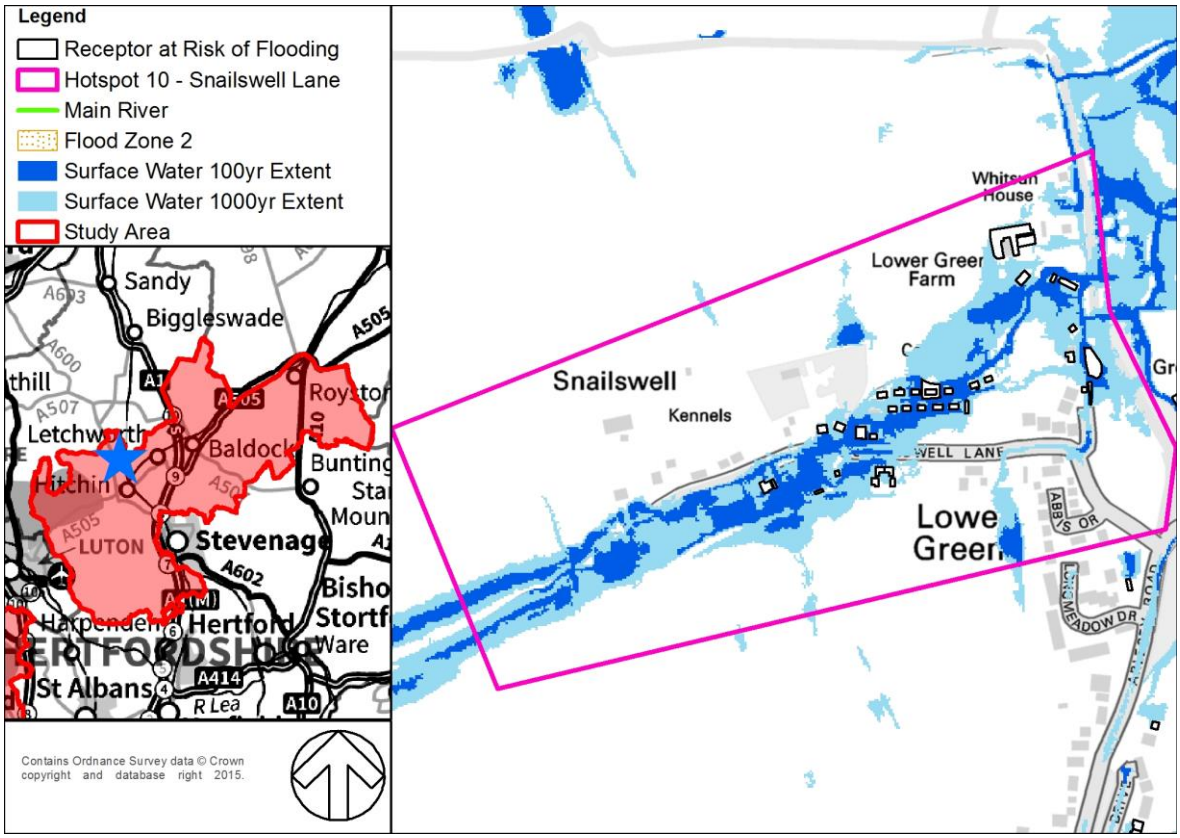

Figure 1: Example Hotspot

2.1.2 A number of different terms are used to describe how the hotspots are identified and how they are selected to be taken forward for detailed hydraulic modelling. The flow chart in Figure 2 illustrates the process for selecting hotspots and the terms used to describe each type of hotspot during the hotspot selection process. The Glossary (Section 10) also provides definitions of all terms used.

2.1.3 The methodology and analysis conducted as part of the early SWMP process is documented in Section 3 and 0. These sections explain the “Initial Hotspot identification and Multi-Criteria Analysis (MCA)” process and how this produced a list of Desk-Based Identified Hotspots which were discussed at the stakeholder meeting. At the meeting, stakeholders brought forward information on other areas within North Hertfordshire District and this updated information was included in the SWMP hotspot assessment.

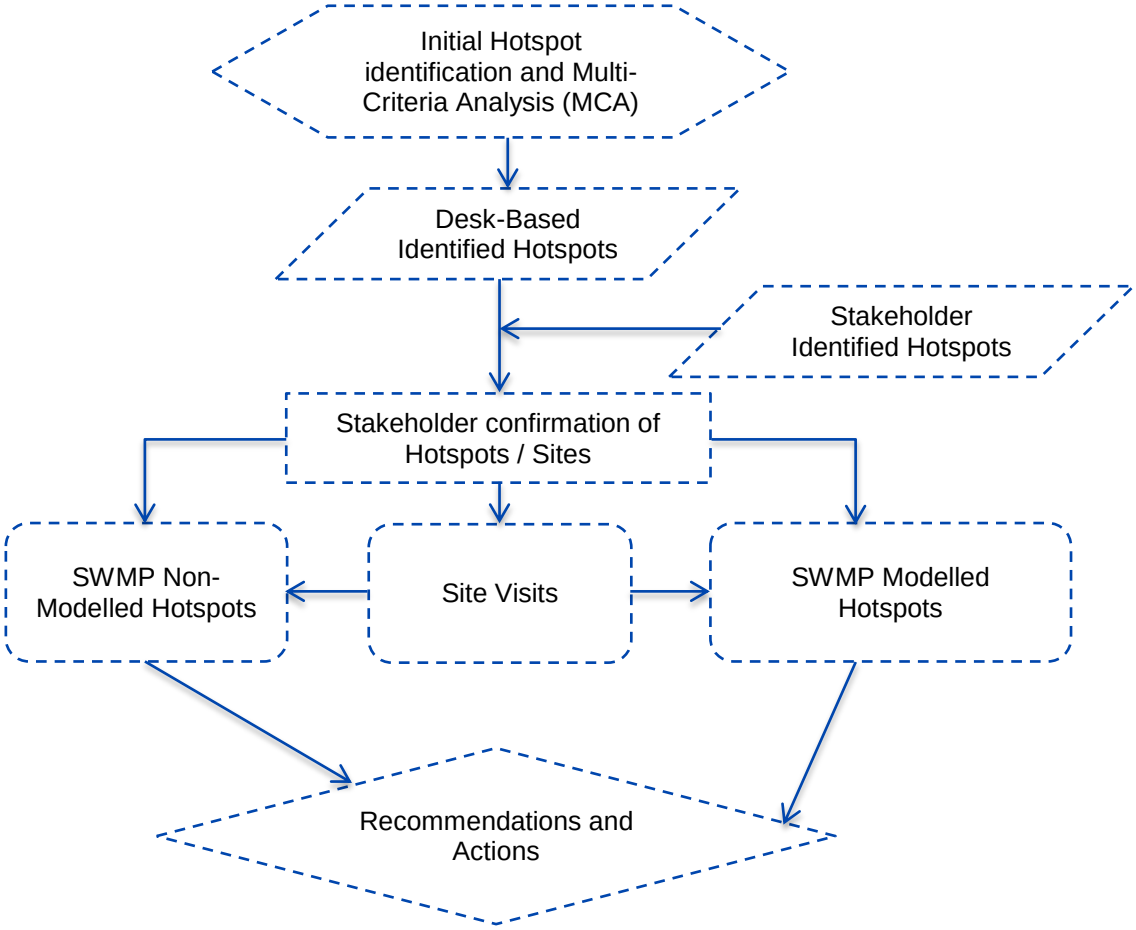

Figure 2: Hotspot Selection Process

2.1.4 Following stakeholder input, the Desk-Based Identified Hotspots and Stakeholder Identified Hotspots were assessed in combination, and the need for on-site assessments was identified; subsequently site visits were undertaken. Following the site visits, hotspots were assessed again and divided into SWMP Modelled and SWMP Non-Modelled Hotspots. SWMP Modelled Hotspots are those to be taken forward for detailed hydraulic modelling. Recommendations and Actions will be identified for all SWMP Modelled Hotspots, it is therefore anticipated that the majority of the Recommendations and Actions will be identified as a result of the detailed hydraulic modelling. However, Recommendations and Actions may also be identified for a number of SWMP Non-Modelled Hotspots.

2.1.5 Reasons for not modelling a hotspot include:

- The hotspot has already been extensively investigated, or is due to be investigated as part of current or planned works (by one or more of the stakeholders);
- The benefits from any further work would not be proportionate to the scale of the issue;
- The site visit confirmed that the surface water flow paths within the hotspot are well represented by current models and/or the Risk of Flooding from Surface Water map;
- Likely recommendations and actions would not have the potential to secure sufficient capital funding (Flood Defence Grant in Aid (FDGiA), Local Levy or third party contributions) to reduce flood risk;
- During the Initial Hotspot identification and MCA, the Desk-Based Identified Hotspots were ranked. If a hotspot ranked too low, it was not included in this round of assessment;
- The hotspot has already secured capital funding.

2.1.6 It should be noted that **all** hotspots identified through this process will be mapped within the SWMP, with the GIS layer information provided to HCC. This will allow periodic re-assessment and review (e.g. when making decisions regarding funding or post flooding). This re-assessment and review would likely involve looking again at the hotspots to see if there is any potential to reduce flood risk.

2.2 SWMP MODELLED HOTSPOTS

2.2.1 SWMP Modelled Hotspots will require some degree of hydraulic modelling to provide a greater understanding of the current flood mechanisms, pathways and receptors within the hotspot. The aim of this is to develop, where possible, a potential mitigation solution which is community focused and feasible in terms of funding and sustainability.

2.2.2 As part of this SWMP, Hertfordshire County Council (HCC) have requested ten hotspots are investigated in detail (detailed hydraulic modelling is undertaken) across the District of North Hertfordshire and the Borough of Dacorum as these were assessed concurrently.

2.2.3 The SWMP Modelled Hotspots will be selected from the hotspots listed within this Hotspot Selection Technical Note. As part of the hotspot selection process a number of factors influence the decision to progress a hotspot to the detailed modelling stage, these factors can include one or more of the following:

- The accuracy to which the current modelled flood extents (e.g. from the Risk of Flooding from Surface Water map) are represented;
- Site specific risks (e.g. details including surface water infrastructure, threshold levels, on site flow paths) that cannot be assessed as part of a desk based study;
- Potential for economically, sustainable and environmentally beneficial mitigation options to be derived and promoted;
- Potential sites where options identified could meet the criteria for funding from the Flood Defence Grant in Aid1 (FDGiA) programme; and those sites which could be potentially brought forward in the short to medium term by other stakeholders through local funding;
- The level of additional ancillary works needed to facilitate any future hydraulic modelling/assessment;
- Progressing will provide an evidence base for HCC as Lead Local Flood Authority (LLFA) and the Local Planning Authority (LPA) to help inform future development decisions.

2.2.4 This Technical Note is the hotspot selection stage of the SWMP, not all sites explained in this note will be taken forward for further modelling. In addition, this Technical Note does not quantify the hydraulic modelling required, as this is still dependent on the receipt of available data from stakeholders and the extent of topographical surveys required for each location.

2.3 SWMP NON-MODELLED HOTSPOTS

2.3.1 If a Desk-Based Identified Hotspot or a Stakeholder Identified Hotspot does not meet the requirements of a SWMP Modelled Hotspot; it is not suitable to be taken forward for further assessment or it is not possible to undertake detailed hydraulic modelling, then it will be classified as a SWMP Non-Modelled Hotspot. For a SWMP Non-Modelled Hotspot a potential sustainable mitigation solution or further study recommendation, if applicable, will be promoted through the SWMP (and included as part of the Recommendations and Actions). This will ensure that any recommendations and actions are recorded for future reference and future funding can be focussed accordingly if appropriate.

[1] Flood Defence Grant in Aid (FDGiA) funding is the mechanism through which the Environment Agency funds flood defence measures in England and Wales. Funding is based on the how much public benefit a project will have, e.g. economic value, how many households are better protected from flooding and the amount of environmental/habitat improvements are gained. As such, areas of land which do not meet the above criteria and are unable to demonstrate they meet the FDGiA criteria would be unable to secure funding, without substantial third party contributions. These include both undeveloped areas such as farmland and developed areas such as car parks.

2.3.2 A SWMP Non-Modelled Hotspot will also include hotspots where there is potential for works to be undertaken by HCC and/or other Risk Management Authorities (RMAs) to alleviate flooding without the need for detailed hydraulic modelling. This includes using Property Level Protection (PLP) measures, changes to current practices and readily implementable mitigation solutions, such as a change in maintenance regime, new manholes or gully installations, or for example highway flow control and restrictions such as raised kerbs or speed humps. These kinds of recommendations and actions will be things that can be implemented without further study or need to go through large financing or funding arrangements.

2.3.3 SWMP Non-Modelled Hotspots will not be economically assessed as part of the SWMP but will be included in the final SWMP report with associated recommendations and actions.

3 HOTSPOT SELECTION METHODOLOGY

3.1.1 The potential hotspots were selected as part of a phased approach, as follows:

- Phase 1 – Dataset and location review (by an experienced hydrologist);
- Phase 2 – (a) Initial Assessment and (b) Multi-Criteria Analysis (GIS and Excel based);
- Phase 3 – Stakeholder discussions and site visits;
- Phase 4 – Hotspot selection process (by an experienced hydrologist).

3.1.2 The first phase involved reviewing a range of technical datasets (GIS based information) available from Hertfordshire County Council (HCC), the Environment Agency (EA) and the Water and Sewerage Companies (WaSCs) servicing the District which for North Hertfordshire are Thames Water Utilities Ltd (TWUL) and Anglian Water (AW).

Phase 1 – Dataset and location review

3.1.3 The data was reviewed by an experienced hydrologist familiar with the relevant flooding mechanisms and SWMP assessments and mitigation designs. The datasets used from the aforementioned stakeholders were:

- North Hertfordshire District boundary;
- OS MasterMap data and background mapping;
- Environment Agency's National Receptor Database (NRD);
- Environment Agency's Main River network;
- Environment Agency's Risk of Flooding from Surface Water map (High (3.33 % AEP, 1 in 30 year), Medium (1% AEP, 1 in 100 year) and Low (0.1% AEP, 1 in 1,000 year) extents);
- Environment Agency's Flood Map for Planning (Flood Zone 2 & 3);
- Environment Agency's Historic Flood Map;
- Index of Multiple Deprivation (IMD) (2010);
- Lower Super Output Area (LSOA) boundaries.

Phase 2 – (a) Initial Assessment

3.1.4 The Environment Agency's National Receptor Database (NRD) was combined with the underlying OS MasterMap layer. This created a spatial receptor layer with information on each "Receptor Type" such as "DWELLING" or "POST OFFICE" etc.

3.1.5 Each receptor was also combined with deprivation data using the Indices of Multiple Deprivation (IMD) (2010) dataset and the associated Lower Super Output Areas (LSOAs). The LSOAs are areas with a population of 1,000 – 3,000, the boundaries are available online. In the IMD, higher deprivation scores indicate more deprived areas and from this deprivation score the national deprivation rank is determined. Within this initial assessment

process, the deprivation score is applied to each receptor within the score's administrative area, hence all receptor types have deprivation scores associated with them. The deprivation scores were only taken into account when assessing the residential receptors.

3.1.6 Each receptor was updated with its maximum probability flood extent for fluvial, surface water and historic flooding sources. An example slice of data is shown in Table 1.

Table 1: Example Receptor Data

RECEPTOR TYPE	FLOOD ZONE	RISK OF FLOODING FROM SURFACE WATER	HISTORIC FLOOD MAP	LOWER SUPER OUTPUT AREA (LSOA) DESCRIPTION	INDEX OF MULTIPLE DEPRIVATION (IMD) SCORE	RANK
DENTAL SURGERY	1	100		North Hertfordshire 005B	3.67	31,304
ELECTRICITY SUB STATION	3	100		North Hertfordshire 012F	9.82	24,254
GENERAL COMMERCIAL	3	1,000		North Hertfordshire 005F	12.05	21,473
DWELLING	3	100	YES	North Hertfordshire 005F	12.05	21,473

3.1.7 17 Hotspots were developed within North Hertfordshire and analysed in Excel using the below multi-criteria Analysis.

4 HOTSPOT ANALYSIS – MULTI-CRITERIA ANALYSIS (MCA)

Phase 2 – (b) Multi-Criteria Analysis

4.1.1 The Multi-Criteria Analysis (MCA) conducted and described below was developed during the Watford and St Albans SWMP updates and refined during the development of this Surface Water Management Plan. This MCA was undertaken on all Desk-Based Identified Hotspots (where Stakeholder Identified and Desk-Based Identified Hotspots coincided, MCA was also undertaken).

4.1.2 The MCA has been developed based on the principles from the Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal (Multi-Coloured Manual, 2013).

4.1.3 The MCA was used to assess the impacts of flooding on each hotspot and provide measurements to the prioritisation of hotspots.

4.1.4 Using the Receptor Type information from the National Receptor Database (NRD) dataset, buildings were assessed based on Residential or Non-Residential classes. This was further supplemented by Listed Buildings, Roads and Rail networks within each hotspot.

4.1.5 As there were some receptors within the NRD dataset which had no assigned receptor type (these were blank in the original dataset), an assumption was made as to their designation using the logic flow chart shown in Figure 3.

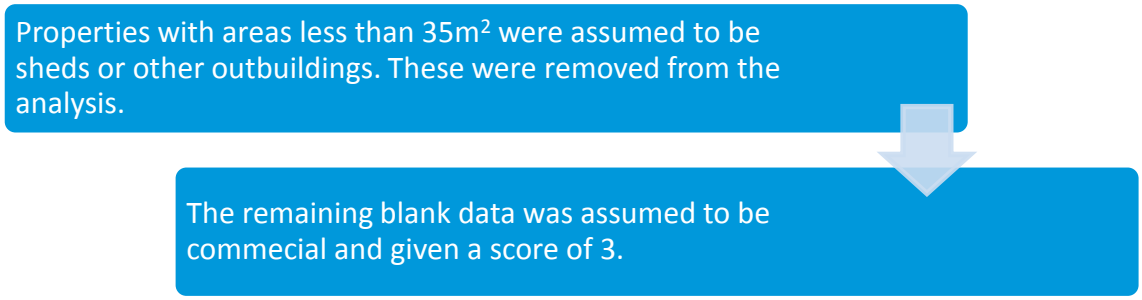

Figure 3: Logic Flow Chart – Assessing Missing Receptor Type

4.1.6 Residential and Non-Residential receptors were separated out and scored based on the criteria outlined below in Table 2. The score was assigned to each individual receptor and summed for Residential and Non-Residential receptors for each hotspot.

Table 2: Receptor Type and Scoring Values

RECEPTOR TYPE		SCORING VALUE		
		1	3	9
Residential		60% Least Deprived	20-40% Most Deprived	20% Most Deprived
Non-Residential	Commercial	Retail Buildings	Warehouses & Offices	Industrial Buildings
	Critical Infrastructure	Hospitals, Hotels, Prisons, Residential homes etc.	Fire/Ambulance/Police Station	Electrical/sewage infrastructure etc.
	Educational, Cultural or Civic Buildings	Schools / Colleges Universities / Nurseries / Museums and Libraries	Churches	Community Centres / Village Halls / Law Courts etc.
Listed Buildings		n/a	n/a	n/a
Road		All Other	B Roads	Motorways / A Road
Rail		All rail tracks	n/a	n/a

4.1.7 The six flood extents used in the analysis are shown in Table 3. Each of the six flood extent types carries an associated weighting value, this was used to ensure priority was given to the highest probability flooding mechanism, these being the Risk of Flooding from Surface Water map 3.33% AEP (1 in 30 year) extent or in Flood Zone 3 (greater than 1% AEP, 1 in 100 year) extent. These extents are associated with the highest probability / highest frequency flooding and therefore relate to the most damage and greatest impact on people's lives. Therefore, they were considered the most important surface water and fluvial flood mechanisms.

4.1.8 Within each hotspot, a total count of the number of receptors affected by each flood extent was made. The total count was multiplied by the flood extent weighting (see Table 3). Flooding Index was calculated by summing the number of properties within each extent and multiplying by that extent's weighting.

$$\text{Flood Impact Score} = \frac{\text{Flooding Index} \times \text{Priority Scoring}}{\text{Hotspot Area}}$$

4.1.9 The Flood Impact Score was calculated using the above formula. The Flooding Index × Priority Scoring was divided by the Hotspot Area to ensure that larger urban areas did not dominate the analysis. Dividing by hotspot area ensured that the Flood Impact Score for each hotspot (no matter the hotspot's size) was comparable.

4.1.10 Data from Hotspot 7 – Oakfield has been included in Table 3 to provide an illustrative example.

Table 3: Flood Extents and Weightings (including example data from Hotspot 7 – Oakfield)

FLOOD EXTENT	FLOOD EXTENT WEIGHTING APPLIED	EXAMPLE RESIDENTIAL COUNT DATA FROM HOTSPOT 7 – OAKFIELD	FLOODING INDEX (FLOOD EXTENT WEIGHTING × RESIDENTIAL COUNT)
No. of receptors in Flood Zone 2	0.1	73	7.3
No. of receptors in Flood Zone 3	0.25	38	9.5
No. of receptors in Risk of Flooding from Surface Water (3.33% AEP, 1 in 30 year)	0.25	84	21
No. of receptors in Risk of Flooding from Surface Water (1% AEP, 1 in 100 year)	0.15	105	15.75
No. of receptors in Risk of Flooding from Surface Water (0.1% AEP, 1 in 1000 year)	0.05	171	8.55
No. of receptors in Historic Flood Map	0.2	3	0.6
		Sum of Flooding Index:	62.7
		Sum of Residential Scoring (Priority Scoring):	365
		Hotspot Area (Ha):	147.5
		Flood Impact Score:	155.2

4.1.11 The Road and Rail receptors were analysed on the area of road or length of rail track within the flood extent.

4.1.12 For the Road receptors, the Flooding Index was obtained in a similar way to that of the Residential and Non-Residential receptors. For each hotspot, the total area of road within each flood extent was multiplied by the same weightings (for the flood extents) shown in Table 3.

4.1.13 To calculate the Priority Scoring for each hotspot, the priority score of each road type flooded within each hotspot was summed. Example Road data is shown below in Table 4.

4.1.14 The same methodology was used for the Rail receptors, calculating the length of rail (as opposed to area of road) within each flood extent within each hotspot (and weighted for each flood extent accordingly, as it was for buildings and roads). The Scoring Value used for Rail receptors was 1 (see Table 2).

4.1.15 As can be seen in Table 4, there was typically less than 1ha of road area within each road class and flood extent. Therefore, flooding was assessed on a m^2 basis and this was used to calculate the Flooding Index. The hotspot area in hectare was used to calculate the Flood Impact Score. As discussed below, the analysis between hotspots is based on its ranking therefore as long as units are consistent within each receptor type, the ranking will not be affected.

Table 4: Hotspot 7 – Oakfield Example Roads Data

ROAD CLASS	ROAD AREA FLOODED (m^2)						SCORING VALUE (FROM TABLE 2)
	FLOOD ZONE 2	FLOOD ZONE 3	RISK OF FLOODING FROM SURFACE WATER (3.33% AEP, 1 IN 30 YEAR)	RISK OF FLOODING FROM SURFACE WATER (1% AEP, 1 IN 100 YEAR)	RISK OF FLOODING FROM SURFACE WATER (0.1% AEP, 1 IN 1,000 YEAR)	HISTORICAL	
A Road	118.0	956.3	788.5	1,056.9	4,150.2	65.4	9
Local Street	573.3	829.1	3,148.2	3,214.0	9,442.8	425.1	1
Minor Road	898.0	1,298.5	2,022.5	2,842.6	5,121.4	0.0	1
Private Road – Restricted Access	0.0	0.0	159.5	148.4	950.0	0.0	1
Total Area of road in each flood extent (m^2):	1,589.3	3,083.9	6,118.8	7,261.9	19,664.3	490.4	
Flood Zone Weighting:	0.1	0.25	0.25	0.15	0.05	0.2	
Flooding Index (Weighting × Total Area)	158.9	771.0	1,529.7	1,089.3	983.2	98.1	
						Sum of Flooding Index:	**4,630.2**
						Sum of Scoring Values (Priority Scoring):	**12**
						Hotspot Area (Ha):	**147.5**
						Flood Impact Score:	**376.7**

4.1.16 When all Flood Impact Scores had been calculated, the Flood Impact Score for each receptor type was ranked from low to high with high ranking hotspots having the greatest scores. The ranks were then multiplied by an Importance Factor to gain a weighted rank. The weighted ranks were summed together across Receptor Types for each hotspot to obtain the "Total Risk Ranking." Hotspot 7 is provided as an example below in Table 5.

Table 5: Receptor Type and associated Importance Factor (Example data provided for Hotspot 7 – Oakfield)

RECEPTOR TYPE	FLOOD IMPACT SCORE	RANK	IMPORTANCE FACTOR	WEIGHTED RANK
Residential	155.1	12	10	120
Non-Residential	0.895	1	7	7
Listed Buildings	0	1	1	1
Roads	376.6	8	3	24
Rail	0.070	8	2	16
	Un-weighted Hotspot score:	30	**Total Risk Ranking Weighted Hotspot score:**	168

5 MULTI-CRITERIA ANALYSIS (MCA) RESULTS

5.1.1 The top five hotspots from the Multi-Criteria Analysis (MCA) are shown in Table 6.

Table 6: Total Risk Ranking – Top Ranked Hotspots

HOTSPOT NUMBER*	HOTSPOT NAME	UN-WEIGHTED HOTSPOT SCORE**	TOTAL RISK RANKING WEIGHTED HOTSPOT SCORE
11	Letchworth Garden City	67	344
12	Baldock Centre	66	316
6	Hitchin	66	314
14	Royston	61	308
17	Knebworth	51	251

* Note: Each hotspot was assigned a number across North Hertfordshire District (and the Borough of Dacorum as these were assessed concurrently). The Hotspot Number just corresponds to the assigned hotspot, GIS polygon number/ID, and does not have any reference to the hotspot ranking.

6 STAKEHOLDER MEETING AND SITE VISITS

Phase 3 – Stakeholder discussions and site visits

6.1.1 In addition to the GIS and Excel review detailed in the previous sections, parish councils and North Hertfordshire District Council were contacted to put forward their knowledge of surface water historical flooding, in order to inform the process of selecting SWMP Modelled Hotspots. Any hotspots stakeholders put forward were termed "Stakeholder Identified Hotspots." The information provided by stakeholders was cross referenced with the emerging hotspots selected as part of the Phase 1 and Phase 2 works and discussed further at the stakeholder meeting.

6.1.2 A stakeholder meeting was undertaken on 3rd February to discuss the outcome of the Desk-Based hotspot analysis (GIS and MCA), with the additional aims to share information and flooding knowledge on issues within North Hertfordshire District. This included reviewing the hotspots analysed by the MCA within North Hertfordshire District, discussing where they ranked and their potential as SWMP Modelled Hotspots, in addition to identifying any high level recommendations and actions at this initial stage.

6.1.3 The suggested approach determined by WSP | Parsons Brinckerhoff was also discussed along with any existing and previous studies conducted by stakeholders.

6.1.4 Following a review of the Stakeholder Identified Hotspot sites raised during the meeting, site visits were subsequently conducted at a number of locations in February 2015. The primary aims of the site visits were to:

- Assess on site the land elevation and topographical changes;
- Understand if the site met the criteria detailed in Section 2 for a SWMP Modelled or SWMP Non-Modelled Hotspot;
- If the hotspot visited was considered to meet the criteria for a SWMP Modelled Hotspot, then to gain an understanding of the most appropriate modelling approach;
- Understand if there were any immediate recommendations and actions identified for the site.

6.1.5 This all led onto Phase 4 – Hotspot selection process, which is detailed in Section 7 and 8.

7 SWMP MODELLED HOTSPOTS

7.1.1 This section (Section 7) identifies the proposed SWMP Modelled Hotspots for North Hertfordshire District. These have been put forward for modelling as they meet the criteria for a SWMP Modelled Hotspot as detailed in Section 2.

7.2 HOTSPOT 6 – HITCHIN

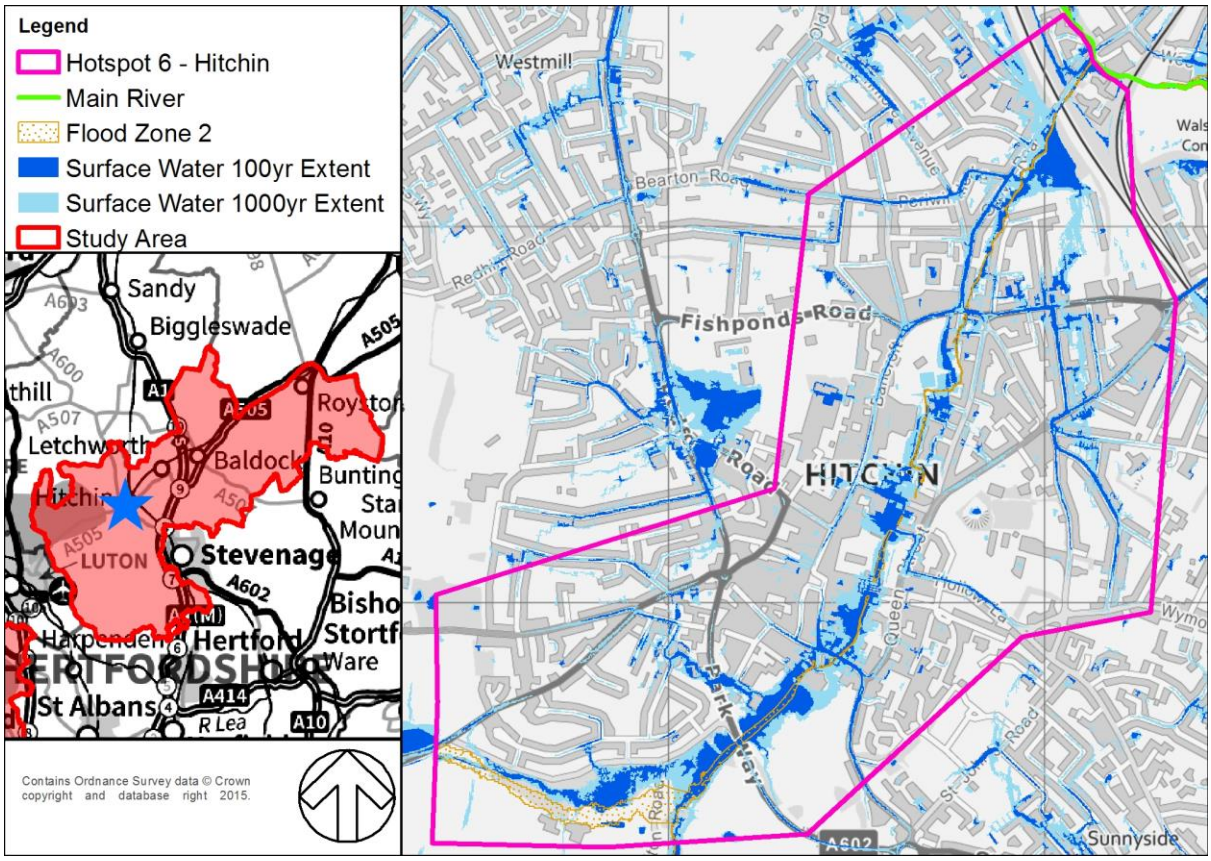

Figure 4: Hotspot 6 – Hitchin

KEY ISSUES

- Surface water / fluvial flooding;
- Environment Agency flood map;
- Topographical / channel survey requirements.

SUGGESTED APPROACH

- Adopt Environment Agency model and convert to direct rainfall model;
- Equates to several hotspots.

LOCAL KNOWLEDGE/SITE VISIT OBSERVATIONS

- The Environment Agency hold a 1D ICM model from the North Herts SFRA 2008 which could be converted and extended to assess the risks of surface water flooding by applying the rainfall direct to the terrain;
- The main risks were identified as flooding as a result of blockage under the A505 and the areas of car parking to the west of the identified hotspot area.

AGREED APPROACH

- Bring forward as SWMP Modelled Hotspot providing modelling is cost effective;
- WSP | Parsons Brinckerhoff are assessing the potential for utilising the Environment Agency 1D ICM model to facilitate a direct rainfall model without the need for extensive topographical survey.

7.3 HOTSPOT 7 – OAKFIELD

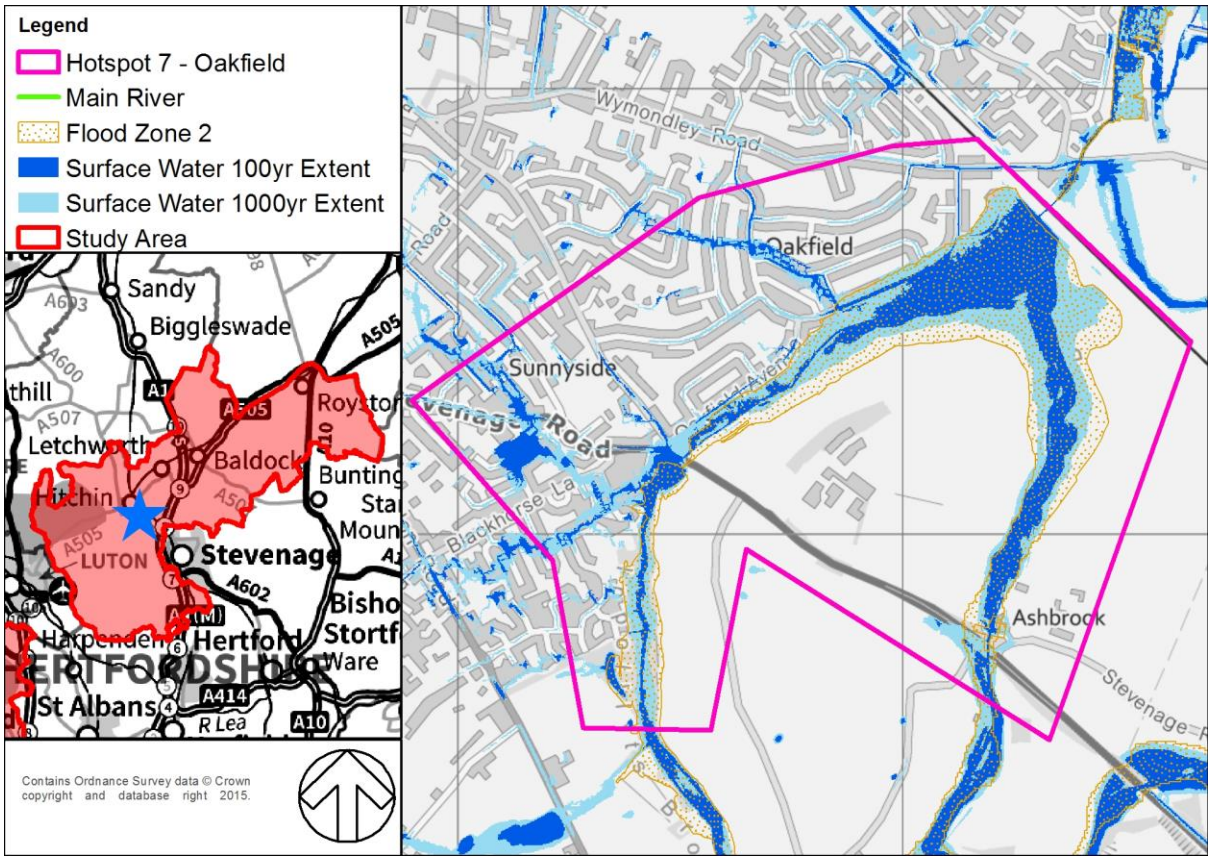

Figure 5: Hotspot 7 – Oakfield

KEY ISSUES

- Surface / Fluvial Flooding;
- Highway Drainage;
- EA Map.

SUGGESTED APPROACH

- Direct Rainfall Model with highway drainage.

LOCAL KNOWLEDGE/SITE VISIT OBSERVATIONS

- This hotspot was recommended to be taken forward by the stakeholders.

AGREED APPROACH

- Agree with approach to focus on an initial assessment of risks associated with the two western culverts and then consider potential impacts and proposed development in the area;
- Modelling to be undertaken consisting of spreadsheet based calculations for the watercourses. However, the EA have a 1D Infoworks model associated with the Ash Brook. Therefore we require the report from the EA to determine if spreadsheet analysis is the best option.

SITE VISIT PHOTOS

Figure 6: Culvert under the A602, looking south

Figure 7: Field adjacent to A602

Looking northwest towards neighbouring properties along Ippollitts Brook.

Figure 8: Culvert under railway track

Figure 9: Crossing point from playground to field

Situated north of the confluence of Ash Brook and Ippollitts Brook.

7.4 HOTSPOT 12 – BALDOCK

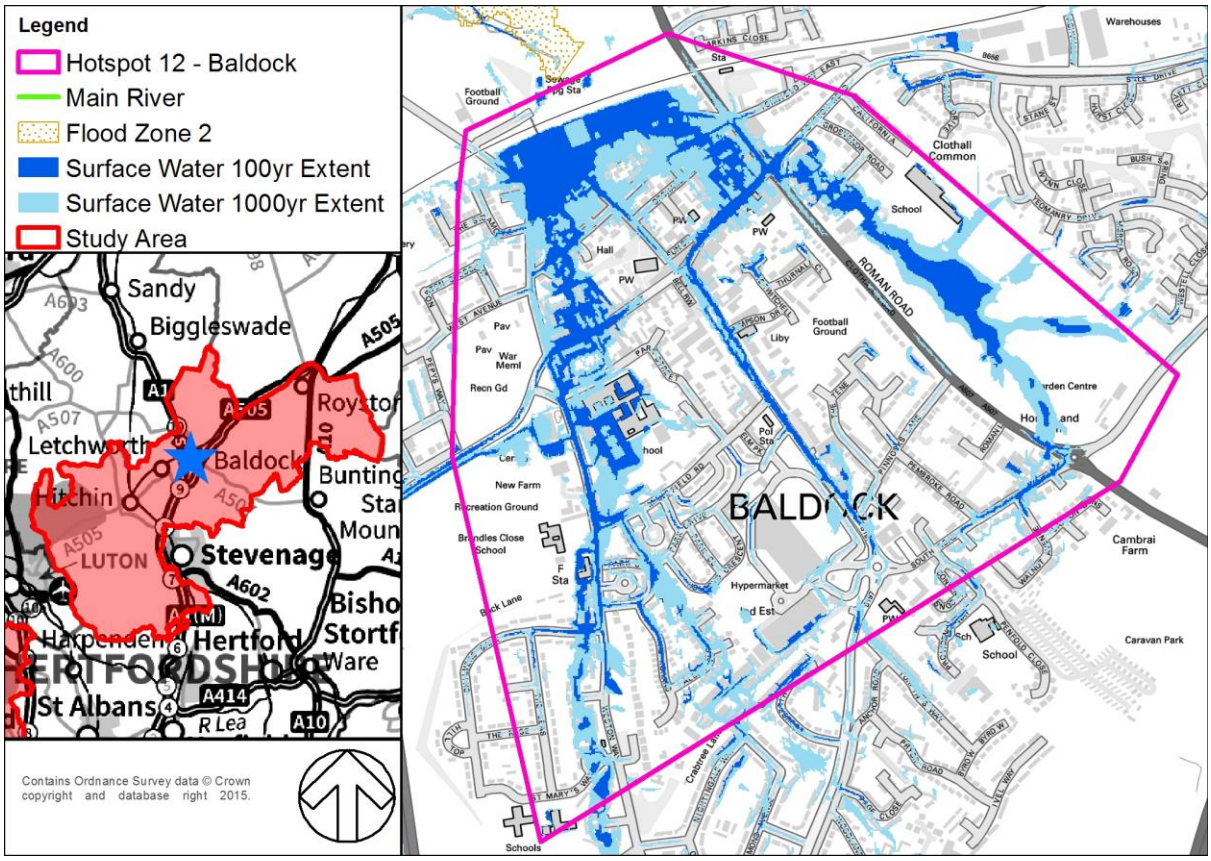

Figure 10: Hotspot 12 – Baldock

KEY ISSUES

- Surface Water Flooding;
- Railway Culvert constraints.

SUGGESTED APPROACH

- Site Visit to be undertaken;
- HCC would like to consider this site as a basis to getting a better understanding of how the EA's Surface water flood map corresponds to the flooding mechanisms that occur in this area;
- Scope of Hydraulic Modelling to be assessed upon completion of site visit.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No documented references of flooding;
- Proposed allocated development to the north of the hotspot adjacent to the rail track, within existing commercial development area;
- The EA has J-Flow Modelling for this area;
- Public underpass located under the existing rail track;
- Levels from the south fall towards the underpass.

AGREED APPROACH

- Hydraulic modelling to be undertaken.

7.5 HOTSPOT 13 – CLOTHALL COMMON

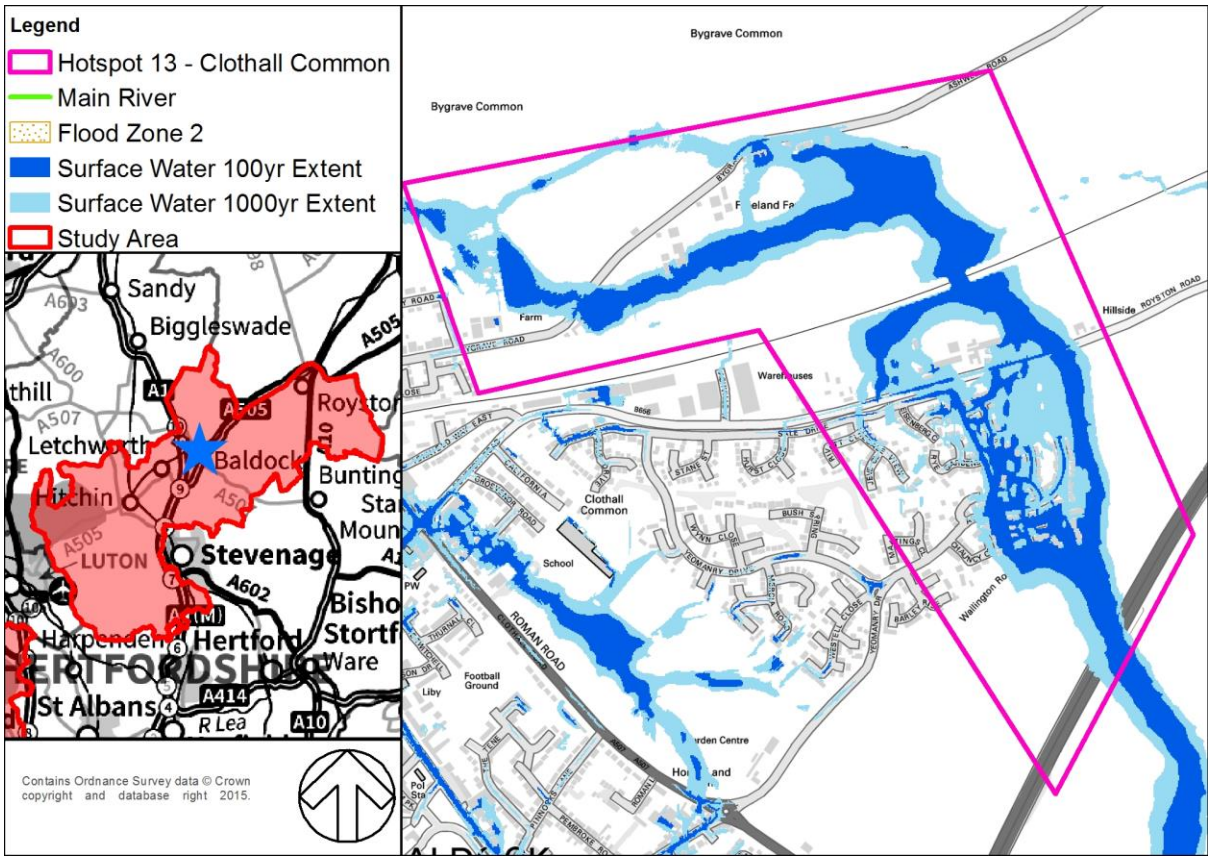

Figure 11: Hotspot 13 – Clothall Common

KEY ISSUES

- Overland flows.

SUGGESTED APPROACH

- Bunding/watercourse improvements upstream of the urban area;
- Storage upstream of the A505.

LOCAL KNOWLEDGE

- The A505 is in cutting at this location, therefore without connectivity/bypass routes, overland flows are likely to pond on the highway potentially leading to a significant risk to vehicular drivers;
- There has been flooding in 2009 and 2014;
- Residential properties in the south have very little freeboard and would be at risk of flooding;
- Surface water drainage network discharges via a swale network into a small open soakaway to the south of the residential development;
- Future development is being considered as part of the local plan for the area to the south of the residential area and the A505.

AGREED APPROACH

- HCC to investigate how the A505 drainage/design addresses the overland flow path before further consideration is given;

- Potential liaison with the Highway Agency to put in place mitigation measures (e.g. automated warning signs);
- Future developer to consider surface water flood risk and how this should be mitigated as part of a site specific FRA.

Figure 12: Existing Residential Properties

Properties in the south of Clothall Common have very little freeboard and are at potential risk of flooding.

Figure 13: Field to the south of Clothall Common

Looking west towards the A505.

Figure 14: Field to the south of Clothall Common

Surface water flow routes are anticipated to be directed through this field. Looking south towards A505.

Figure 15: Swale to east of Clothall Common

Observations on site show it falling towards a lows spot which connects to the field.

7.6 HOTSPOT 17 – KNEBWORTH

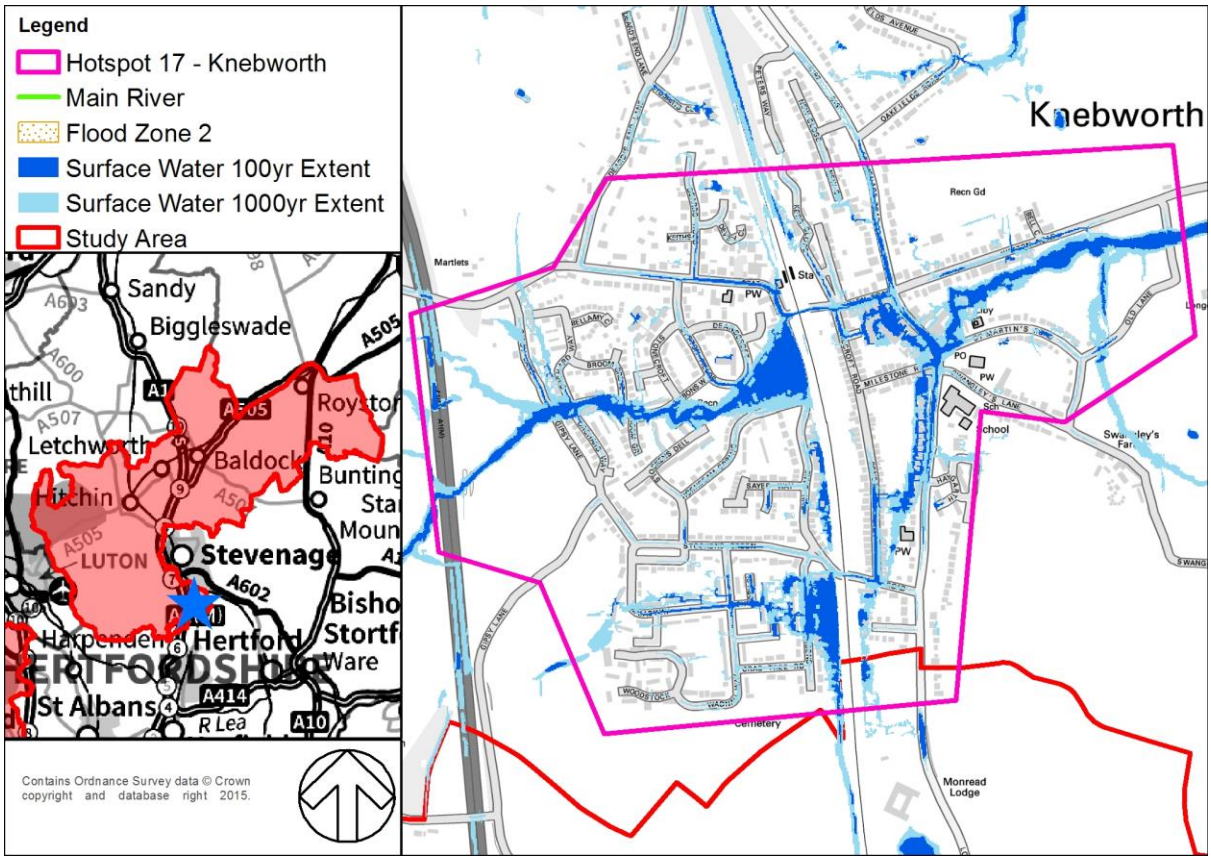

Figure 16: Hotspot 17 – Knebworth

KEY ISSUES:

- Surface Water Flooding;
- Railway culvert constraints;
- Open Channel Extents.

SUGGESTED APPROACH

- Direct rainfall model construction.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- Section 19 flood investigation is being carried out as a result of the February 2014 flooding, which was considered typical for this catchment;
- Flooding was a result of several storms in short succession resulting in a runoff coefficient considered to be around 85% for the chalk agricultural land in the latter events which caused the flooding;
- There is a large undeveloped catchment area to the west of the hotspot which resulted in flooding of the highway and housing estate;
- The A1M drains into this area and discharges in to a large detention/ infiltration pond.

AGREED APPROACH

- Take forward for hydraulic modelling and detailed assessment.

SITE VISIT PHOTOS

Figure 17: A1(M) Retention feature to the west of the hotspot

Figure 18: Natural valley looking east towards existing residential area

Figure 19: Outfall into A1(M) retention feature

Figure 20: Recent flood mitigation works

7.7 HOTSPOT 30 – CAMBRIDGE ROAD (A505), PURWELL AND WALSWORTH AREAS OF HITCHIN

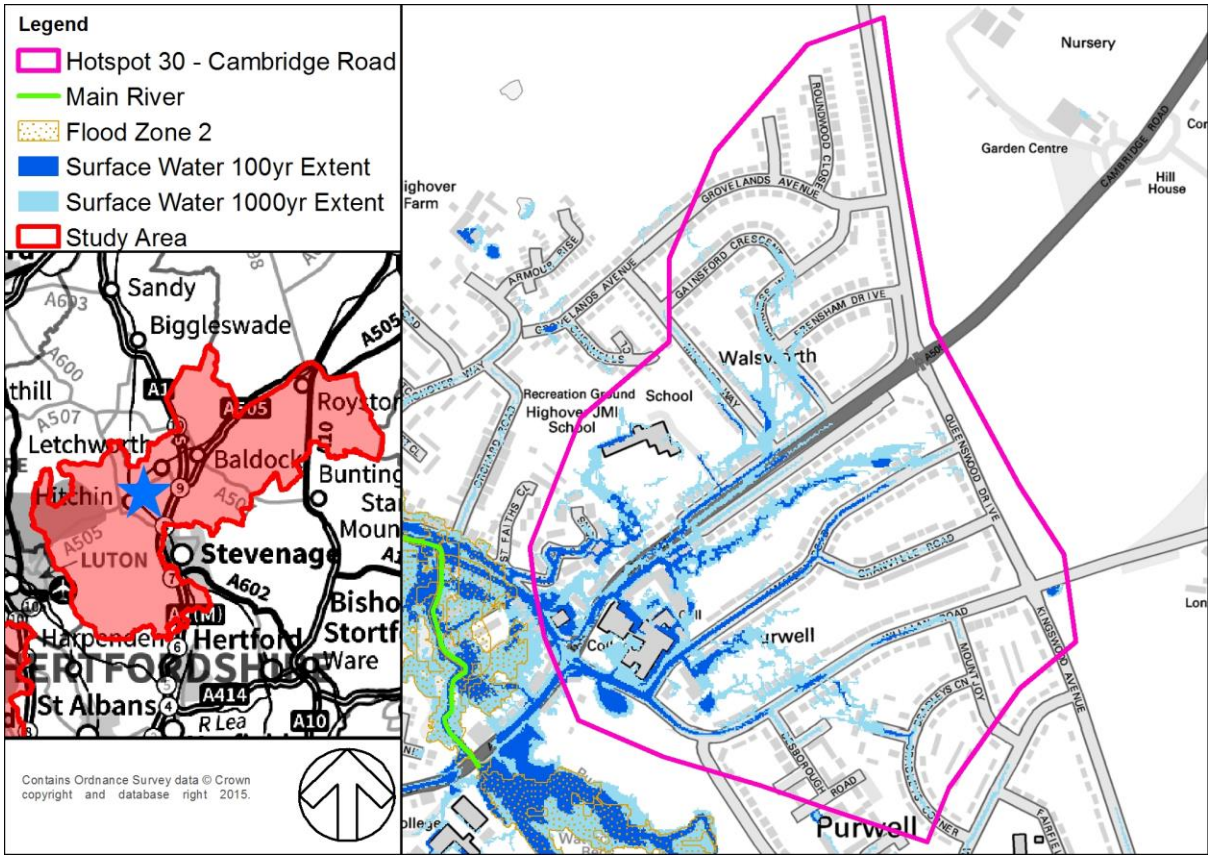

Figure 21: Hotspot 30 – Cambridge Road, Hitchin

KEY ISSUES

- The hotspot has been put forward for consideration based upon several flooding incidents;
- A key property has flooded on several occasions including the 1958 floods;
- The key flooding mechanisms are likely to be from surface water flows along a side road of the A505 as well as main road;
- The property appears to have a side wall and temporary barrier to reduce flood risk;
- The gullies and surface water sewer arrangement likely to surcharge and the pathway acts as a flow splitter on to the property.

SUGGESTED APPROACH

- Direct Rainfall Model utilising the EA Flood Zone level (derived from OS contours) as a downstream boundary condition.

LOCAL KNOWLEDGE/SITE VISIT OBSERVATIONS

- This hotspot was recommended to be taken forward by the stakeholders.

AGREED APPROACH

- Take forward for modelling.

SITE VISIT PHOTOS

Figure 22: Property located along the A505 with protection measures

Figure 23: River Purwell looking north along the watercourse

8 SWMP NON-MODELLED HOTSPOTS

8.1 HOTSPOT 5 – KIMPTON

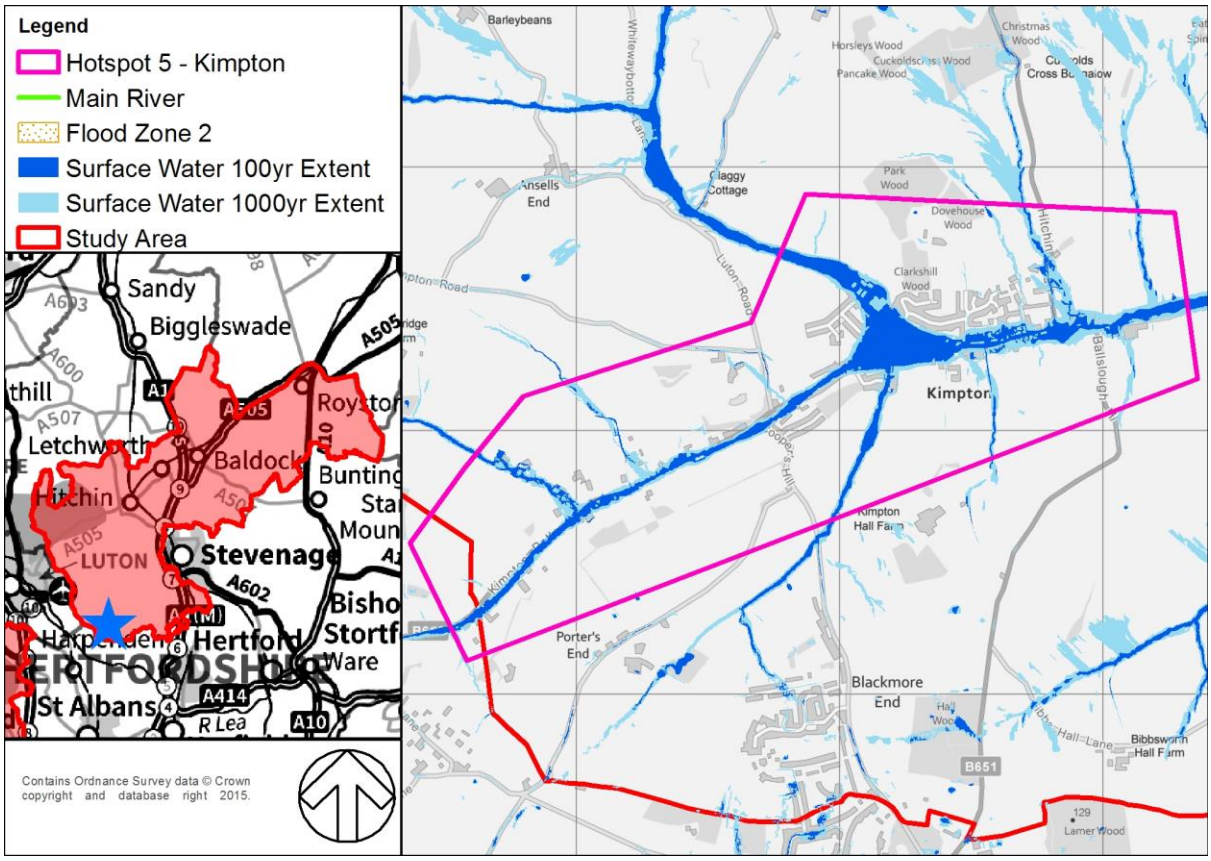

Figure 24: Hotspot 5 – Kimpton

KEY ISSUES

- Highway drainage gullies;
- Culverts.

SUGGESTED APPROACH

- Regular maintenance;
- Consideration of small areas of upstream storage on the tributaries.

LOCAL KNOWLEDGE

- Flooding experienced in 1947 as a result of snow melt.

AGREED APPROACH

- Awaiting results from a separate commission looking at the groundwater flood risks.

8.2 HOTSPOT 11 – LETCHWORTH GARDEN CITY

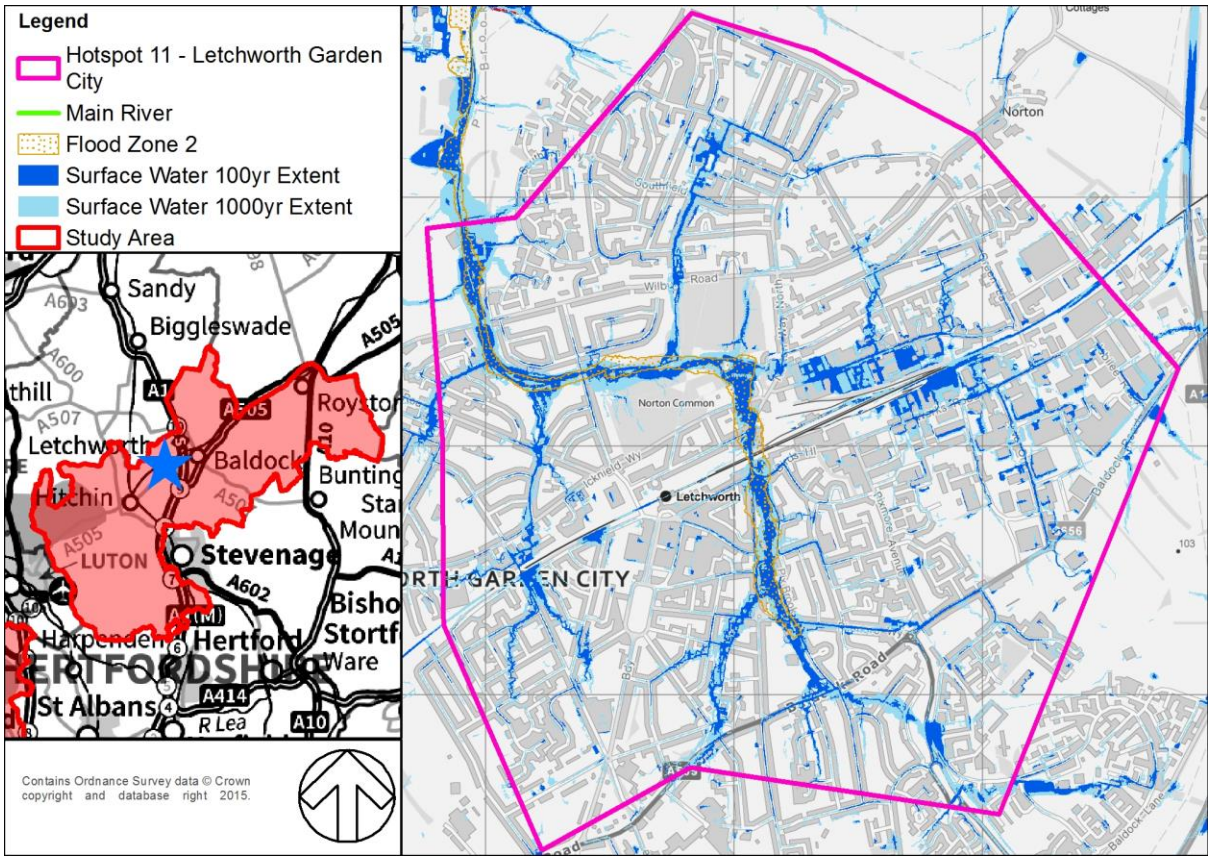

Figure 25: Hotspot 11 – Letchworth Garden City

KEY ISSUES

- Surface Water / Fluvial Flooding;
- EA Flood Map;
- Open Channel Extents.

SUGGESTED APPROACH

- Possible three hotspots within the area;
- Adopt EA model and convert to direct Rainfall.

LOCAL KNOWLEDGE

- Anglian Water has undertaken a significant scheme on the western tributary which incorporates underground tanks. It is unlikely that costs could be secured to do further work;
- The EA mapping for the area is J-Flow hydraulic model.

AGREED APPROACH

- No further modelling to be undertaken.

8.3 HOTSPOT 14 – ROYSTON

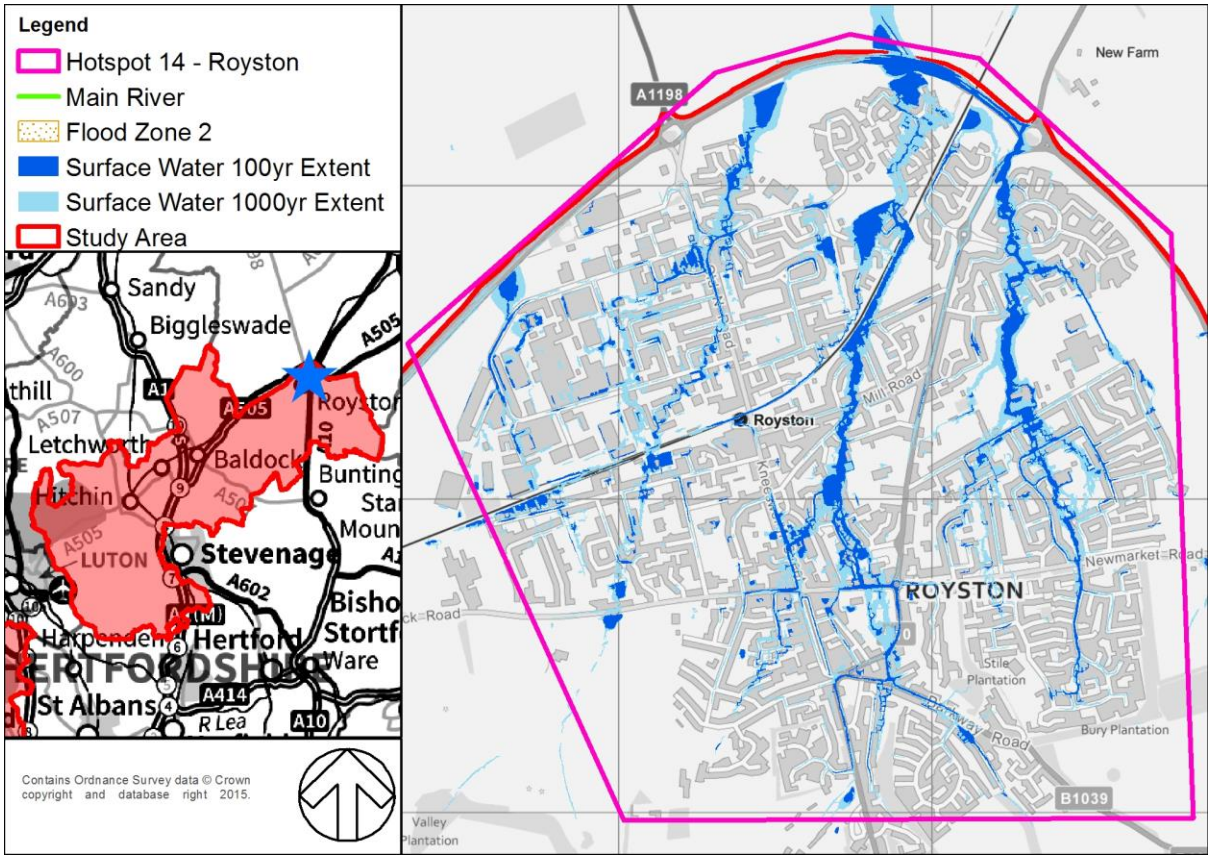

Figure 26: Hotspot 14 – Royston

KEY ISSUES

- Surface Water Flooding;
- Railway / highway Culvert Constraints.

SUGGESTED APPROACH

- Three hotspot locations within the Town;
- Direct Rainfall Model to assess railway and highway constrictions.

LOCAL KNOWLEDGE

- High Chalk area;
- Major flooding experienced recently east of the A10;
- Lots of the town served by soakaways but no information on assets or maintenance;
- There was previously an open sewer/watercourse through the town but this has been culverted but status is currently unconfirmed;
- Flooding along Church Lane, Melbourn Street and Garden Walk have been reported by the Town Council.

AGREED APPROACH

→ As the study would require significant investigation into the current status and performance of the many soakaways and their associated infrastructure, this would not meet the timescales or budget constraints associated with the SWMP. This is not to be progressed for further assessment at this stage, but to be considered further for an individual study.

9 SUMMARY

9.1.1 A Desk-Based analysis was conducted to assess the flood risk to receptors within North Hertfordshire District. From this, 17 hotspots were analysed using a GIS Multi-Criteria Analysis (MCA) to prioritise the hotspots most at risk of flooding within North Hertfordshire District.

9.1.2 A stakeholder meeting was held on 3rd February 2015 to discuss the results of the analysis with relevant stakeholders and allow stakeholders to share information and recommend further sites that should be analysed.

9.1.3 Site visits were conducted with Hertfordshire County Council in attendance in February 2015. The aim of the site visits was to assess hotspots on the ground and determine if the proposed solutions would be appropriate and cost-beneficial.

9.1.4 The initial top five Desk-Based Identified Hotspots, produced as a result of the Multi-Criteria Analysis (MCA) were:

1. Hotspot 11 Letchworth Garden City
2. Hotspot 12 Baldock Centre
3. Hotspot 6 Hitchin
4. Hotspot 14 Royston
5. Hotspot 17 Knebworth

9.1.5 Following stakeholder engagement and site visits, three of the Desk-Based Identified Hotspots and three Stakeholder Identified Hotspots have been chosen to be considered for hydraulic modelling, and be analysed further in the Modelling Methodology Technical Note. The six hotspots to be taken forward for further assessment are:

- → Hotspot 6 Hitchin
- → Hotspot 7 Oakfield
- → Hotspot 12 Baldock
- → Hotspot 13 Clothall Common
- → Hotspot 17 Knebworth
- → Hotspot 30 Cambridge Road, Hitchin

9.1.6 These six hotspots will be assessed as to the suitability of modelling and those to be taken forward as SWMP Modelled Hotspots will be determined from the list of hotspots analysed for both the District of North Hertfordshire and the Borough of Dacorum (as these were assessed in tandem). SWMP Modelled Hotspots will then be modelled and then mitigation and economic assessment will be undertaken. Further information on the hotspots taken forward as SWMP Modelled Hotspots can be found in the Modelling Methodology Technical Note.

9.1.7 The hotspots detailed in Table 7 are not being progressed further as SWMP Modelled Hotspots; however, they will be included in the SWMP as SWMP Non-Modelled Hotspots. Possible actions and mitigations are provided where appropriate.

Table 7: Initial Recommendations and Actions for the District of North Hertfordshire SWMP Non-Modelled Hotspots

	HOTSPOT NUMBER	LOCATION	RECOMMENDATIONS AND ACTIONS
→	Hotspot 5	Kimpton	We are awaiting results from a separate commission looking at the groundwater flood risks.
→	Hotspot 11	Letchworth Garden City	North Hertfordshire District Council have recently completed a scheme within the hotspot. It was therefore felt that further funding would be unlikely, hence this hotspot has not been progressed further.
→	Hotspot 14	Royston	Significant investigation into the status and performance of the many soakaways and their associated infrastructure would be required. This would not meet the timescales or budget constraints associated with the SWMP. This is not to be progressed for further assessment at this stage, but to be considered for an individual study at a later date.

10 GLOSSARY

Hotspot – a spatially limited area in which there are a number of residential or commercial properties at risk from flooding resulting from one or more sources/mechanisms.

Desk-Based Identified hotspots – ranked hotspots identified by GIS/mapping analysis of density of receptors at risk from flooding.

Flood Defence Grant in Aid (FDGiA) – Flood Defence Grant in Aid funding is the mechanism through which the Environment Agency funds flood defence measures in England and Wales. Funding is based on the how much public benefit a project will have, e.g. economic value, how many households are better protected from flooding and the amount of environmental/habitat improvements are gained. As such, areas of land which do not meet the above criteria and are unable to demonstrate they meet the FDGiA criteria would be unable to secure funding, without substantial third party contributions. These include both undeveloped areas such as farmland and developed areas such as car parks.

Stakeholder Identified hotspots – hotspots identified by key stakeholders (districts, boroughs, parishes, Environment Agency, relevant water company/ies) based upon local knowledge and evidence.

SWMP Modelled Hotspots – five hotpots within the administrative boundary to have detailed assessment and hydraulic modelling undertaken to better understand the risks from surface water flooding as part of this iteration of the SWMP. These were identified from a review of both Desk-Based and Stakeholder Identified Hotspots.

SWMP Non-Modelled Hotspots – hotspots within the administrative boundary not put forward for detailed hydraulic modelling; these hotspots may not be modelled for a number of reasons including:

- The hotspot has already been extensively investigated, or is due to be investigated as part of current planned works (by one or more of the stakeholders);
- The benefits from any further work would not be proportionate to the scale of the issue;
- The site visit confirmed that the surface water flow paths within the hotspot are well represented by current models and the Risk of Flooding from Surface Water Map;
- The hotspot is deemed not to have the potential to secure sufficient capital funding (Flood Defence Grant in Aid (FDGiA), Local Levy or third party contributions) to reduce flood risk;
- During the Desk-Based analysis, the hotspot ranked too low, and it was therefore not one of the higher priority sites in this round of assessment;
- The hotspot has already secured capital funding.

It should be noted that all hotspots identified are recorded within the SWMP and will go forward to be periodically assessed for the potential to reduce flood risk. Recommendations and actions (see definition) could be identified for these hotspots.

Recommendations and actions – actions which could be undertaken to reduce the risk of surface water flooding. These actions could range from enhanced maintenance regimes through to capital funded flood alleviation schemes. They could be identified for both SWMP Modelled and SWMP Non-Modelled Hotspots.