Appendix B

HOTSPOT SELECTION TECHNICAL NOTE

TECHNICAL NOTE
HOTSPOT SELECTION

Project	East Hertfordshire District SWMP
Date	07 September 2016
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Project Reference	70009115 – 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 East Hertfordshire 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.

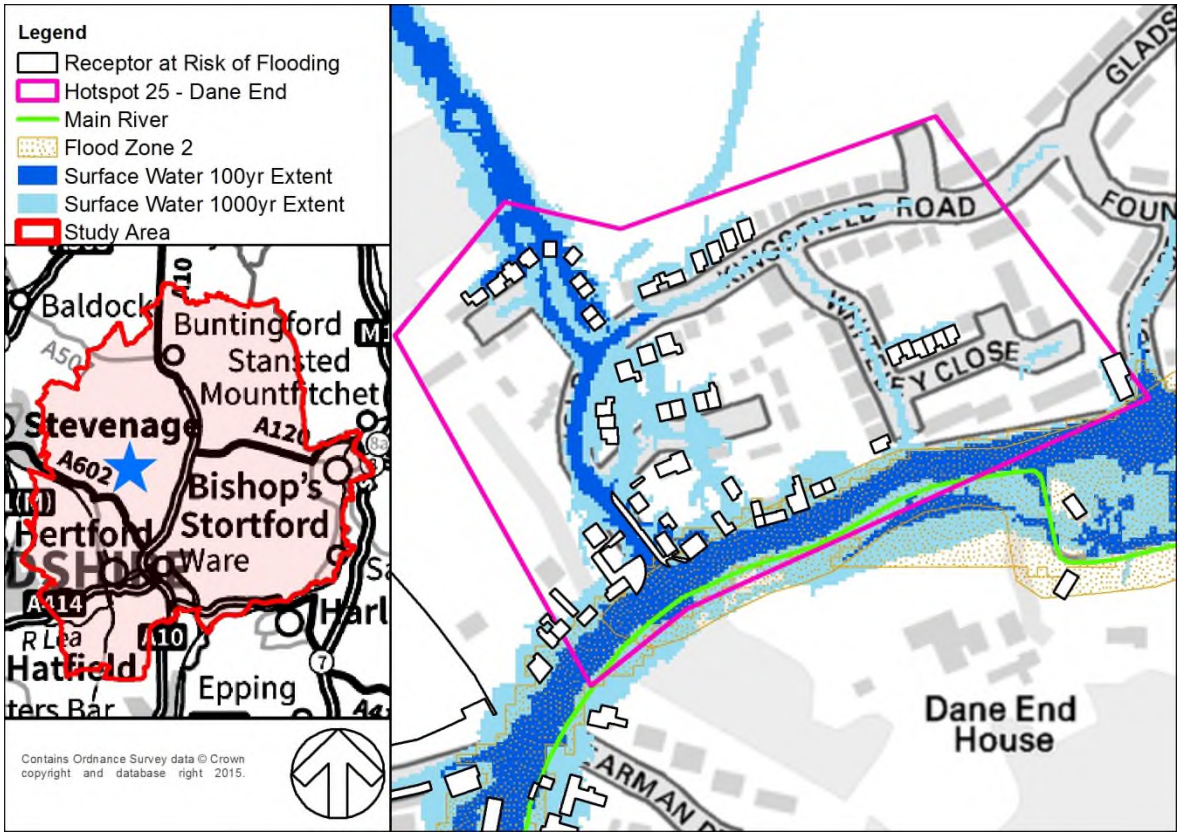

Figure 1: Example Hotspot

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 4. 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 East Hertfordshire District and this updated information was included in the SWMP hotspot assessment.

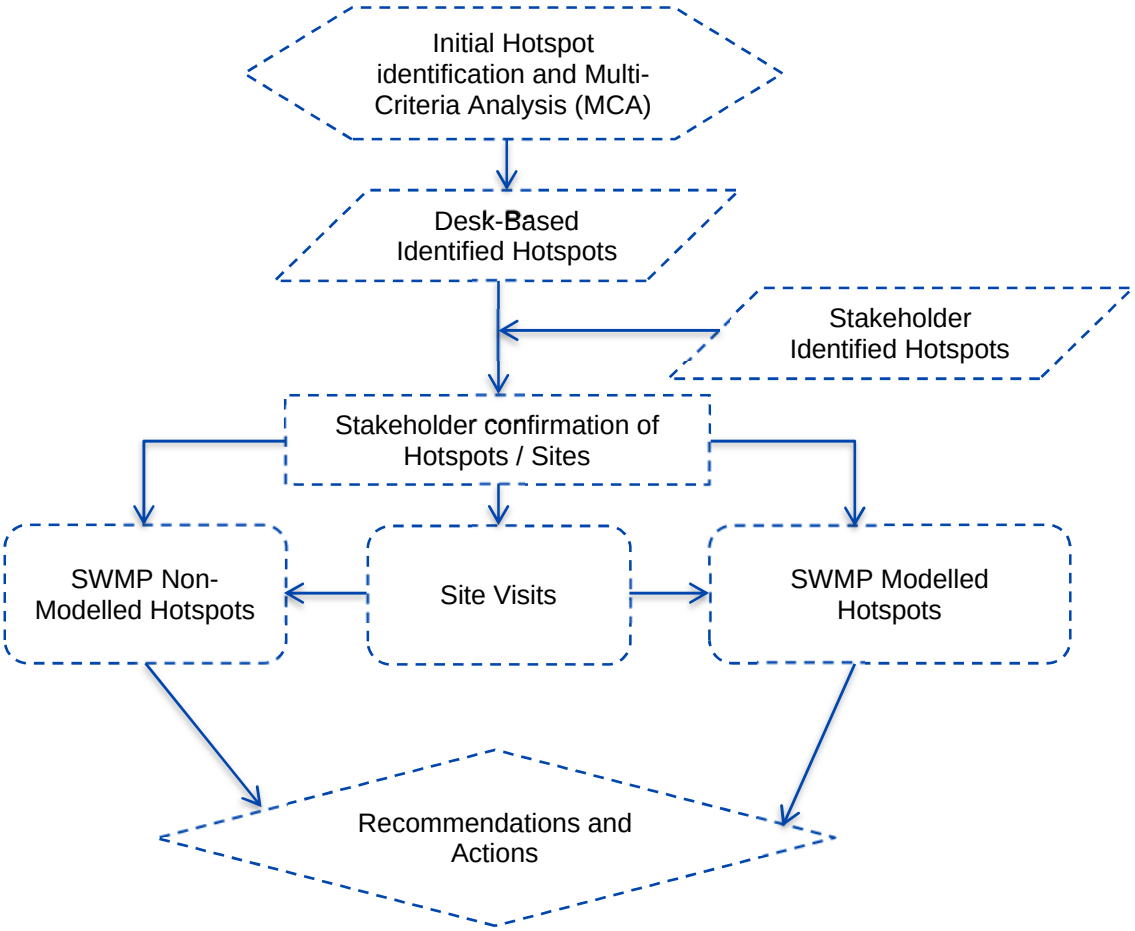

Figure 2: Hotspot Selection Process

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 five modelled hotspots are investigated in detail (detailed hydraulic modelling is undertaken) within the District of East Hertfordshire.

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

[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.

Actions). This will ensure that any recommendations and actions are recorded for future reference and future funding can be focussed accordingly if appropriate.

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 Company (WaSC) servicing the district, which for East Hertfordshire District is Thames Water Utilities Ltd (TWUL).

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:

- East 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
DWELLING	1	1,000		East Hertfordshire 018A	4.76	30,297
DWELLING	1	100		East Hertfordshire 017E	6.79	28,075
GRAVEL EXTRACTION	2	30	YES	East Hertfordshire 010B	8.36	26,147
DWELLING	3	100	YES	East Hertfordshire 010B	8.36	26,147

3.1.7 The OS MasterMap polygons associated with the records shown in Table 1 were converted to points and plotted as density. This allowed clusters of point receptors at risk of flooding to be symbolised and hotspots developed from this.

3.1.8 The analysis was iterative with the first instance producing 31 hotspots within East Hertfordshire District. Through subsequent analysis the hotspot sizes were reduced and the number of hotspots analysed increased. 44 hotspots within East Hertfordshire District were taken forward as part of the Desk-Based Hotspots brought to the stakeholder meeting.

3.1.9 In each iteration of analysis, the selected hotspots were analysed in Excel using the Multi-Criteria Analysis (MCA) methodology detailed in Section 4.

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 the North Hertfordshire and Dacorum SWMPs. 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.

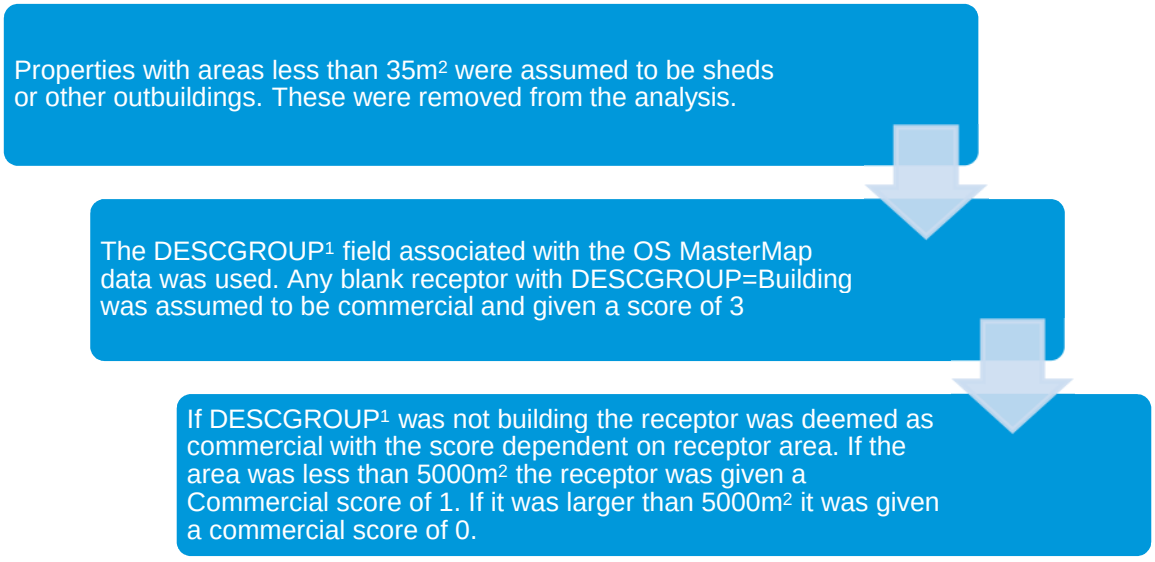

Figure 3: Logic Flow Chart – Assessing Missing Receptor Type[2]

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

4.1.7 During the initial analysis of the data, it was deemed that the large fluvial Flood Zone 2 and 3 extents across East Hertfordshire District were skewing results in favour of hotspots with large numbers of properties located within Flood Zone 2 or 3. Flooding from Main Rivers is

[2] The DESCGROUP (Descriptive Group) is an attribute of the OS MasterMap data. It is used to theme the map data. The 'Building' Descriptive Group describes all buildings excluding glasshouses. More information can be found in the OS MasterMap Topography Layer User Guide Chapter 4 located at https://www.ordnancesurvey.co.uk/docs/user-guides/os-mastermap-topography-layer-user-guide.pdf

outside the scope of the SWMP therefore to compensate for this, Residential and Non-Residential receptors were removed where they were not located within a surface water flood extent. Where a receptor was located within a surface water flood extent, the Flood Zone / Historic flood extent data was analysed.

4.1.8 For the Road areas and Rail lengths located within fluvial Flood Zones or Historic Flood Map extents these were disregarded from the analysis. Only the area/length within Risk of Flooding from Surface Water map extents was analysed.

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

4.1.9 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 peoples' lives. Therefore, they were considered the most important surface water and fluvial flood mechanisms.

4.1.10 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 of the number of properties within each extent and multiplying by that extent's weighting.

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

4.1.11 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.

4.1.12 Data from Hotspot 1 – Buntingford has been included in Table 3 to provide an illustrative example.

Table 3: Flood Extents and Weightings (including example data from Hotspot 1 – Buntingford)

FLOOD EXTENT	FLOOD EXTENT WEIGHTING APPLIED	EXAMPLE RESIDENTIAL COUNT DATA FROM HOTSPOT 1 – BUNTINGFORD	FLOODING INDEX (FLOOD EXTENT WEIGHTING × RESIDENTIAL COUNT)
No. of receptors in Flood Zone 2	0.1	112	11.2
No. of receptors in Flood Zone 3	0.25	2	0.5
No. of receptors in Risk of Flooding from Surface Water (3.33% AEP, 1 in 30 year)	0.25	54	13.5
No. of receptors in Risk of Flooding from Surface Water (1% AEP, 1 in 100 year)	0.15	57	8.55
No. of receptors in Risk of Flooding from Surface Water (0.1% AEP, 1 in 1000 year)	0.05	399	19.95
No. of receptors in Historic Flood Map	0.2	110	22
		Sum of Flooding Index:	75.7
		Sum of Residential Scoring (Priority Scoring):	510
		Hotspot Area (ha):	353.4
		Flood Impact Score:	109.24

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

4.1.14 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.

4.1.15 To calculate the Priority Scoring for each hotspot, the total road area for each class of road was summed and multiplied by the scoring value given in Table 2. This weighted the Road receptor score to hotspots with large areas of main roads flooded. Example Road data is shown in Table 4.

4.1.16 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 rather than hectare flooded basis. As discussed below, the analysis between hotspots is based on it's ranking therefore as long as units are consistent within each receptor type, the ranking will not be affected.

4.1.17 The same methodology, as that for roads, 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).

Table 4: Hotspot 1 – Buntingford Example Roads Data

ROAD CLASS	ROAD AREA FLOODED (m²)					
	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)	TOTAL AREA OF EACH ROAD CLASS IN FLOOD EXTENT (m²)	SCORING VALUE (FROM TABLE 2)	WEIGHTED SCORE
A Road	326.5	1,038.9	6,712.7	8,078.1	9	72,703.3
B Road	4,576.9	1,715.3	2,317.3	8,609.6	3	25,828.8
Local Street	4,037.1	3,690.1	16,933.5	24,660.7	1	24,660.7
Minor Road	7,771.9	7,735.6	10,743.4	26,250.8	1	26,409.8
Private Road – Publicly Accessible	908.2	175.1	818.1	1,901.4	1	1,901.4
Private Road – Restricted Access	30.3	582.9	1,065.1	1,678.3	1	1,678.3
Total Area of road in each flood extent (m²):	17,650.9	14,937.9	38,590.2	**Sum of Road Scoring (Priority Scoring):**		**153,182.3**
Flood Zone Weighting:	0.25	0.15	0.05			
Flooding Index (Weighting × Total Area)	4,412.7	2,240.7	1,929.5	**Sum of Flooding Index:**		**8,583**
				Hotspot Area (m²):		**3,534,000**
				Flood Impact Score:		**372.0**

4.1.18 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 then summed together across Receptor Types for each hotspot to obtain the "Total Risk Ranking." Hotspot 1 is provided as an example below in Table 5.

Table 5: Receptor Type and associated Importance Factor (Example data provided for Hotspot 1 – Buntingford)

RECEPTOR TYPE	FLOOD IMPACT SCORE	RANK	IMPORTANCE FACTOR	WEIGHTED RANK
Residential	109.24	37	10	370
Non-Residential	37.3	42	7	294
Listed Buildings	0.57	42	1	42
Roads	372.0	41	3	123
Rail	0	1	2	2
	Un-weighted Hotspot score:	163	**Total Risk Ranking Weighted Hotspot score:**	831

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
42	Central Hertford	220	1009
8	St Margarets / Stanstead Abbotts	186	933
39	East Ware	131	865
44	Benhooks Avenue, Bishop's Stortford	125	844
1	Buntingford	163	831

* Note: Each hotspot was assigned a number across East Hertfordshire District (and the Borough of Broxbourne 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 East 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 15th May 2015 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 East Hertfordshire District. This included reviewing the hotspots analysed by the MCA within East Hertfordshire 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 on 3rd June 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 East 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 1 – BUNTINGFORD

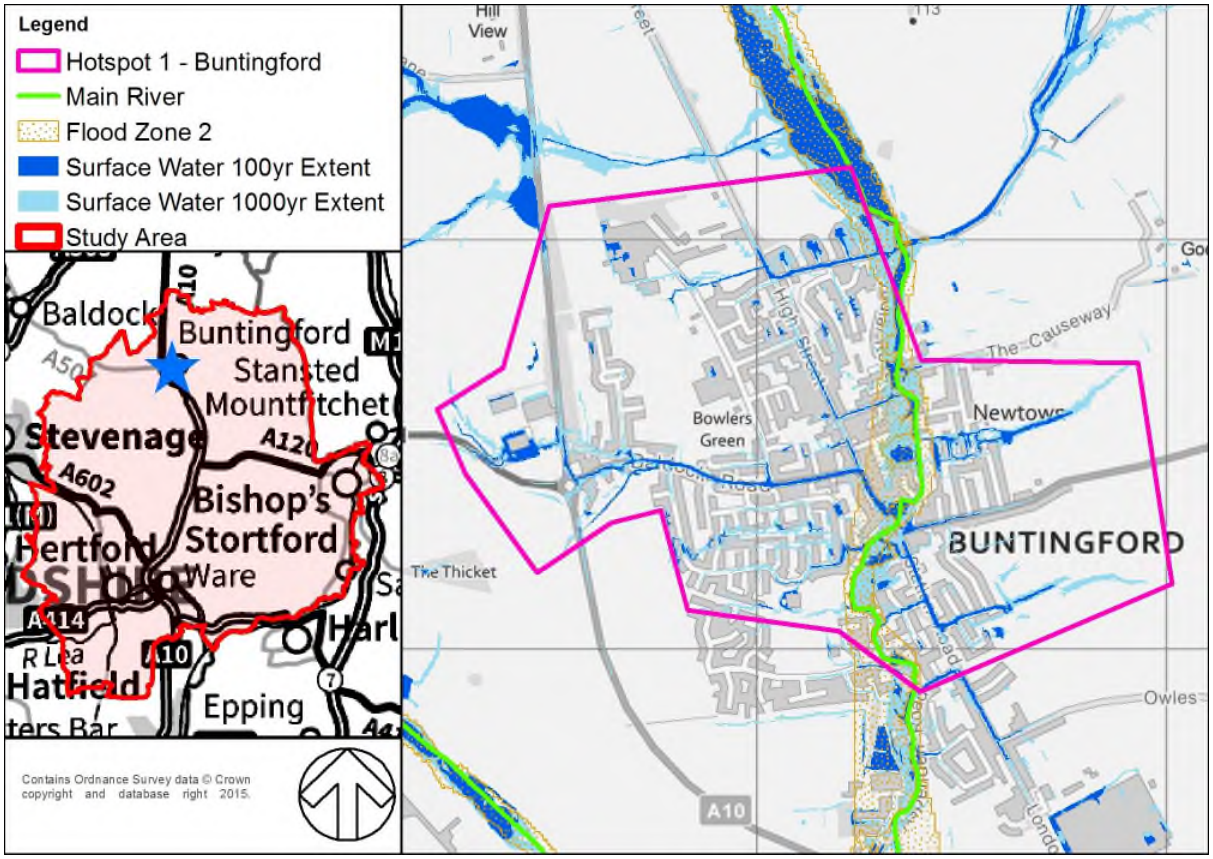

Figure 4: Hotspot 1 – Buntingford

KEY ISSUES

- Surface water flooding at this hotspot is likely to be heavily influenced by the river level and any flooding on the River Rib. Surface water sewers could become flood locked due to levels in the river; high levels in the river could mean surface water sewers cannot drain freely. In addition, surface water flow routes and fluvial flow paths will interact.
- The Risk of Flooding from Surface Water map shows that surface water flows eastwards along Baldock Road (B1038), leading to the flow path on the High Street, the flow path in Monks Walk, which is a residential area, also leads to the High Street. The High Street and Monks Walk are both known to be historic flooding sites.
- Flooding is known to have occurred in Buntingford, with reported flooding on 16th – 17th July 2015.

SUGGESTED APPROACH

- Utilise the existing Environment Agency model of the River Rib and extend this to facilitate the application of direct rainfall to the ground surface in the central town and residential areas of Buntingford; between Freman College, Bowling Green Lane and Luynes Rise.

- The greatest magnitude fluvial scenario able to be assessed at this hotspot would be the 100 year + climate change scenario. This is due to concerns the Environment Agency hold over assessing greater return period events on their hydraulic model of the River Rib. Further liaison with the Environment Agency to gain a greater understanding of their exact concerns is ongoing.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- The Environment Agency's Flood Zone 2 extent is based on the historical flood extent. However, the 0.1% AEP (1 in 1,000 year) fluvial flood mapped extent of the River Rib conducted by Mott MacDonald (2009) is more closely aligned to the channel. As a result, in places at the boundary of the Flood Zone 2 extent, the ground level is 2–3m above the river channel.
- Buntingford was not visited on site.

AGREED APPROACH

- Take forward as a SWMP Modelled Hotspot, the modelling methodology will detail the agreed approach to modelling this hotspot.

7.3 HOTSPOT 40 – BENGEO, HERTFORD

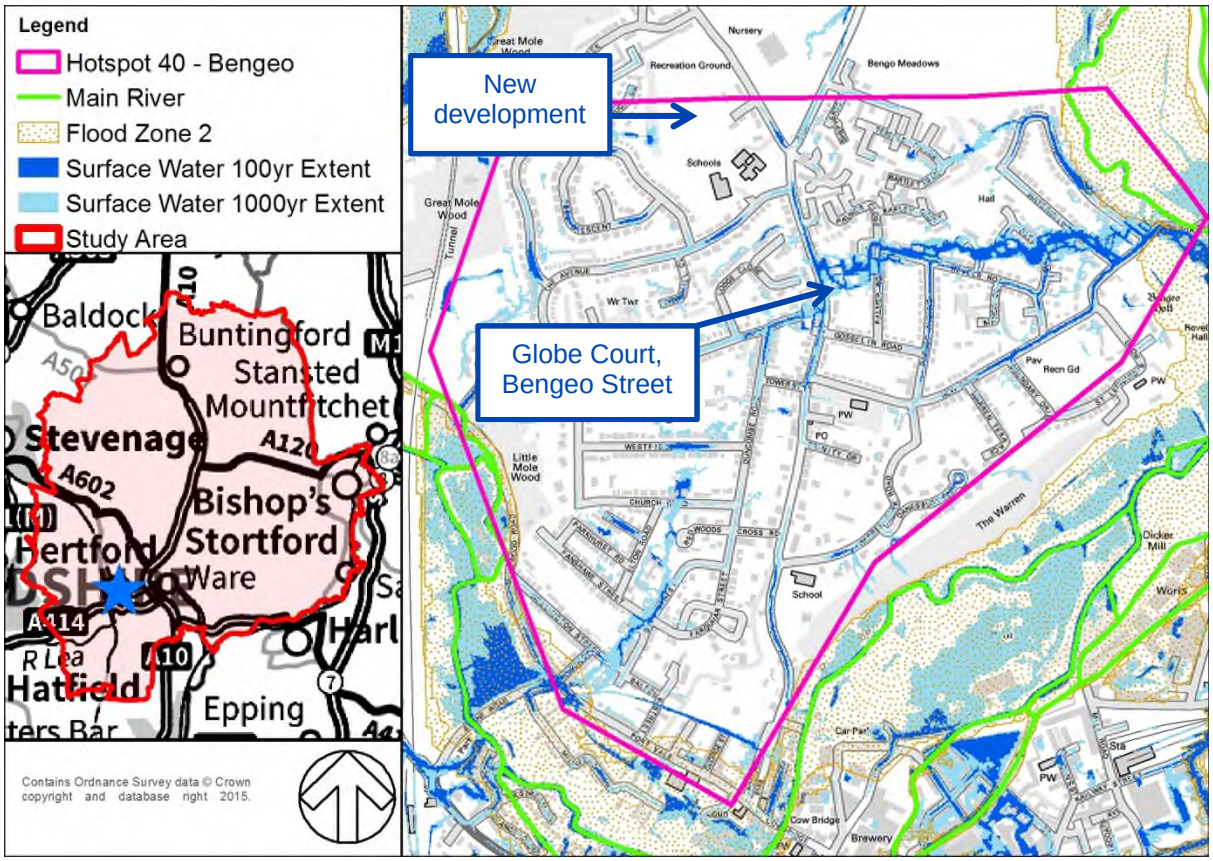

Figure 5: Hotspot 40 – Bengeo, Hertford

KEY ISSUES

- Risk of Flooding from Surface Water map shows two flow paths within this hotspot. One flow path begins in the area surrounding Church Road, where water flows south down Byde Street, towards Port Vale and finally towards the River Beane. The second flow path begins at Bengeo Street, where surface water flows towards Globe Court, Bengeo Street, here, the Risk of Flooding from Surface Water map shows water flowing easterly through residential area towards the River Rib.
- Flooding was reported in this hotspot in August-September 2015, with the flood event occurring on 24th August 2015. Flooding was reported at Globe Court, Bengeo Street. Flooding was also reported in Port Vale, with water flowing down Byde Street towards Port Vale.
- Historical flooding has been reported by residents at Globe Court, Bengeo Street. Some historical flooding can be attributed to tree roots blocking pipes; there has also been foul flooding. Properties have also been affected by surface water ponding in the road, where it flows off into houses.
- Flooding at Port Vale and Byde Street will be included in the Initial Assessment being undertaken by Hertfordshire County Council in conjunction with the Environment Agency.

SUGGESTED APPROACH

- Take forward as a SWMP Modelled Hotspot. The final modelling methodology will be detailed in the modelling methodology technical note along with any topographical survey requirements.

- Change the boundary of the hotspot to focus on the easterly flowing flow path, to account for the southerly flow path being analysed in a separate HCC study. Ensuring that detailed hotspot modelling can be undertaken to analyse the surface water flood flow path at Globe Court, Bengeo Street.
- A new development off Sacombe Road has been built in the north of this hotspot, this development of 97 residential units applied for planning permission in July 2010. A review will be undertaken to obtain an understanding of the impact of this development on surface water downstream, to the south.

LOCAL KNOWLEDGE

- No site visit was undertaken as part of the SWMP, however HCC have visited the site when flooding was reported and spoken to local residents to understand the issues in the area. Residents reported that short duration, high intensity rainfall events were found to cause flooding in the area of Globe Court, Bengeo Street. Residents reported problems with gullies and also previous sewer blockages which have been cleared by Thames Water.
- Residents at Globe Court and the County Councillor reported the potential impact of the new development off Sacombe Road, to the north of Globe Court.

AGREED APPROACH

- Take forward as a SWMP Modelled Hotspot, with a focus on Globe Court, Bengeo Street and the impact of the new development on this area.
- The new development will be assessed by building a hydraulic model of the area and assessing the following scenarios:
  - Pre 2010 (no development);
  - Development in place, with soakaways and all drainage working as planned on the drainage assessment submitted with the planning application;
  - Development in place, with drainage not working effectively.

7.4 HOTSPOT 43 – HADHAM ROAD, BISHOP'S STORTFORD

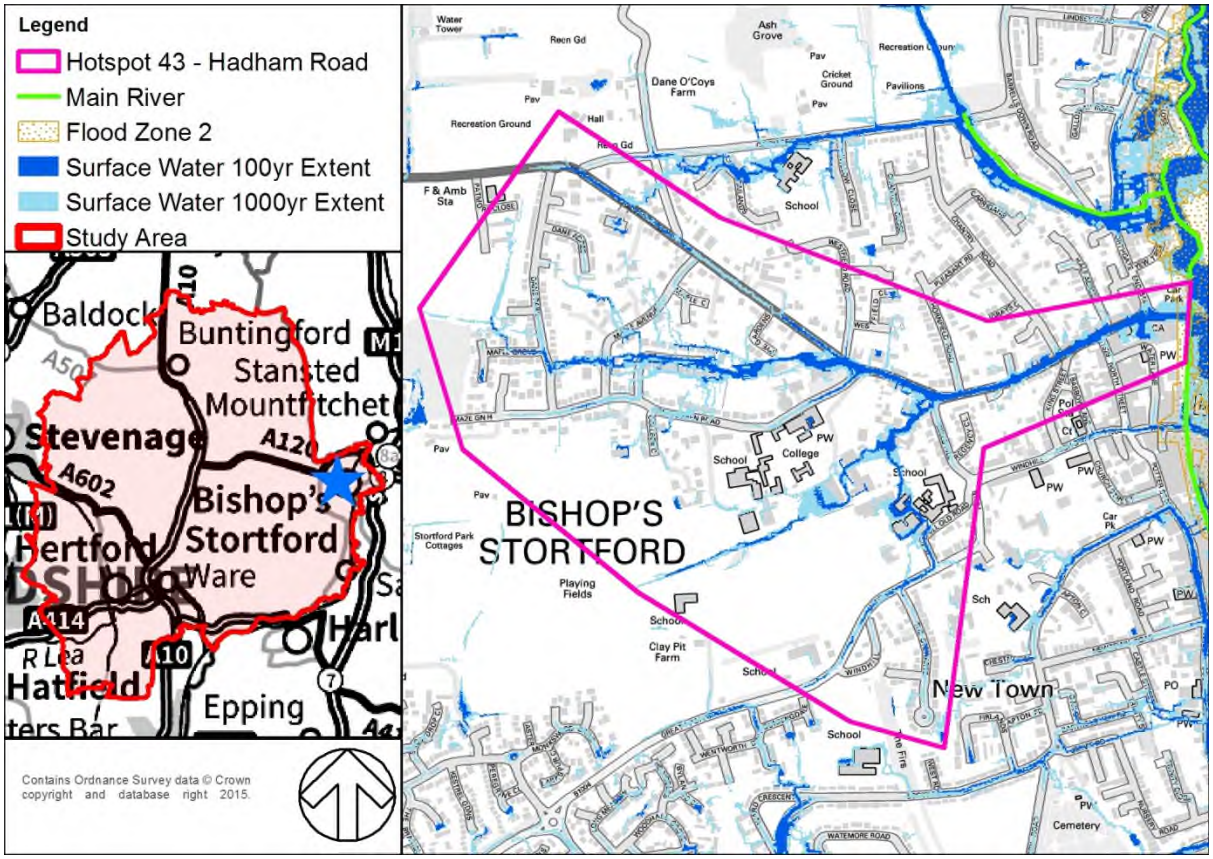

Figure 6: Hotspot 43 – Hadham Road, Bishop's Stortford

KEY ISSUES

- Surface water flow path begins in the residential area to the west, surface water flows through properties before reaching Matching Lane where it flows through further residential areas before reaching Hadham Road (A1250).
- Flow path down Hadham Road (A1250) seems well contained within the highway extent.
- Finished floor levels at the eastern end of Hadham Road near to the River Stort appear to be at or below ground level from desk analysis (using GIS mapping and Google Street View).
- The current mapped surface water flow paths indicate lots of properties and obstructions that surface water passes and flows through. Further modelling would confirm whether the existing flow paths through these residential areas are accurate.

SUGGESTED APPROACH

- Targeted highway survey and a direct rainfall ESTRY-TUFLOW hydraulic model to refine the flow path through the properties and down to the River Stort.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken.

AGREED APPROACH

- Take forward as a SWMP Modelled Hotspot, the modelling methodology will detail the agreed approach to modelling this hotspot.

7.5 HOTSPOT 44 – BENHOOKS AVENUE (INCORPORATING HOTSPOT 60 – POTTER STREET / SOUTH STREET), BISHOP'S STORTFORD

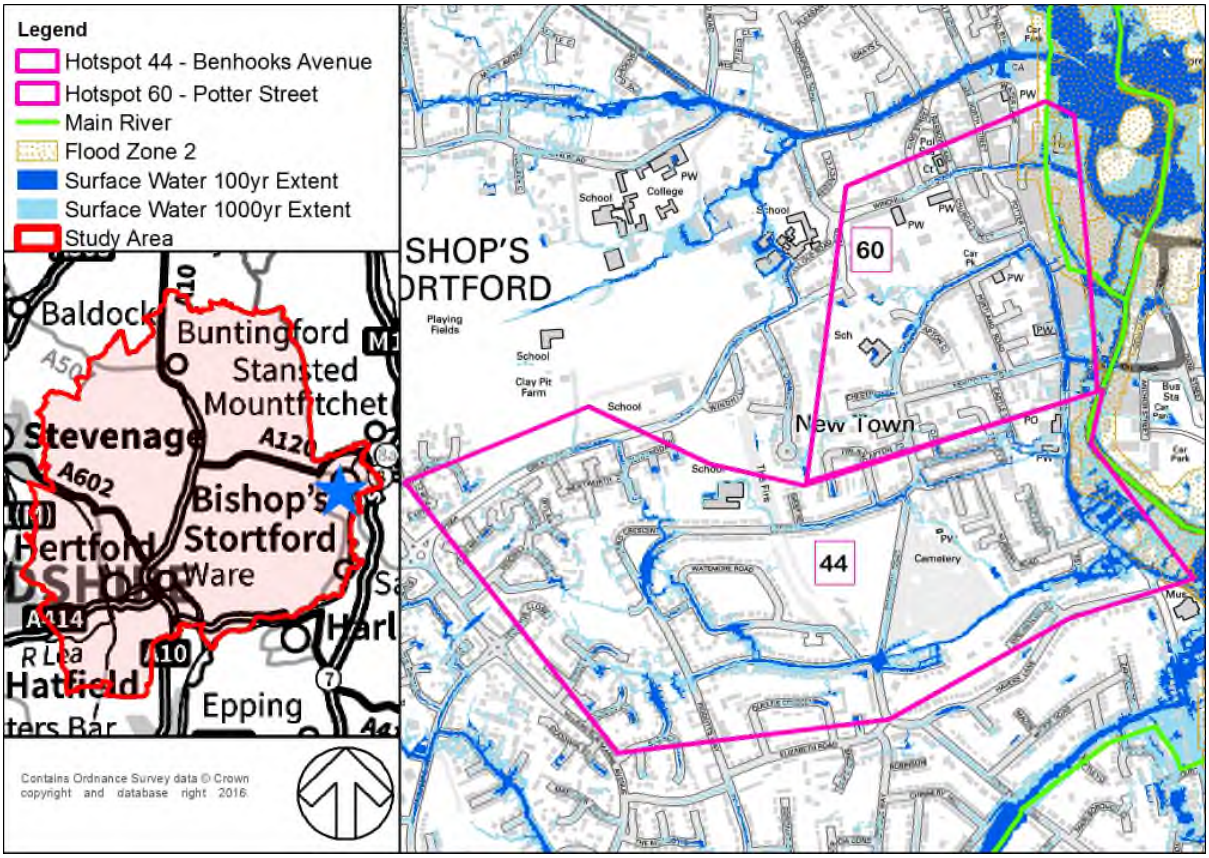

Figure 7: Hotspots 44 and 60 – Benhooks Avenue and Potter Street / South Street, Bishop's Stortford

KEY ISSUES

- Surface water flow path runs eastwards along Benhooks Avenue then along the back of the cemetery. In some locations the flow path is constrained to the highway. However, in other locations the flow path routes through residential areas. Some properties are predicted to flood in the 1% AEP (1 in 100 year) event, shown on the Risk of Flooding from Surface Water map.
- There may be some inflows from the northern Hotspot 60 – Potter Street / South Street.
- Flooding was reported in August 2015 at Wharf Road at the downstream (easterly) extent on Hotspot 44. This follows the Risk of Flooding from Surface Water flow path, as it flows towards Flood Zone 2.

SUGGESTED APPROACH

- Direct rainfall ESTRY-TUFLOW hydraulic model.
- Targeted survey may be required to provide information on possible ditches to the south of the cemetery.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken.

AGREED APPROACH

- Take forward combined with Hotspot 60 as a SWMP Modelled Hotspot with consideration as to how to limit the channel survey requirements along the open section of watercourse behind the properties fronting Havers Lane.

7.6 HOTSPOT 47 – RAYNHAM ROAD, BISHOP'S STORTFORD

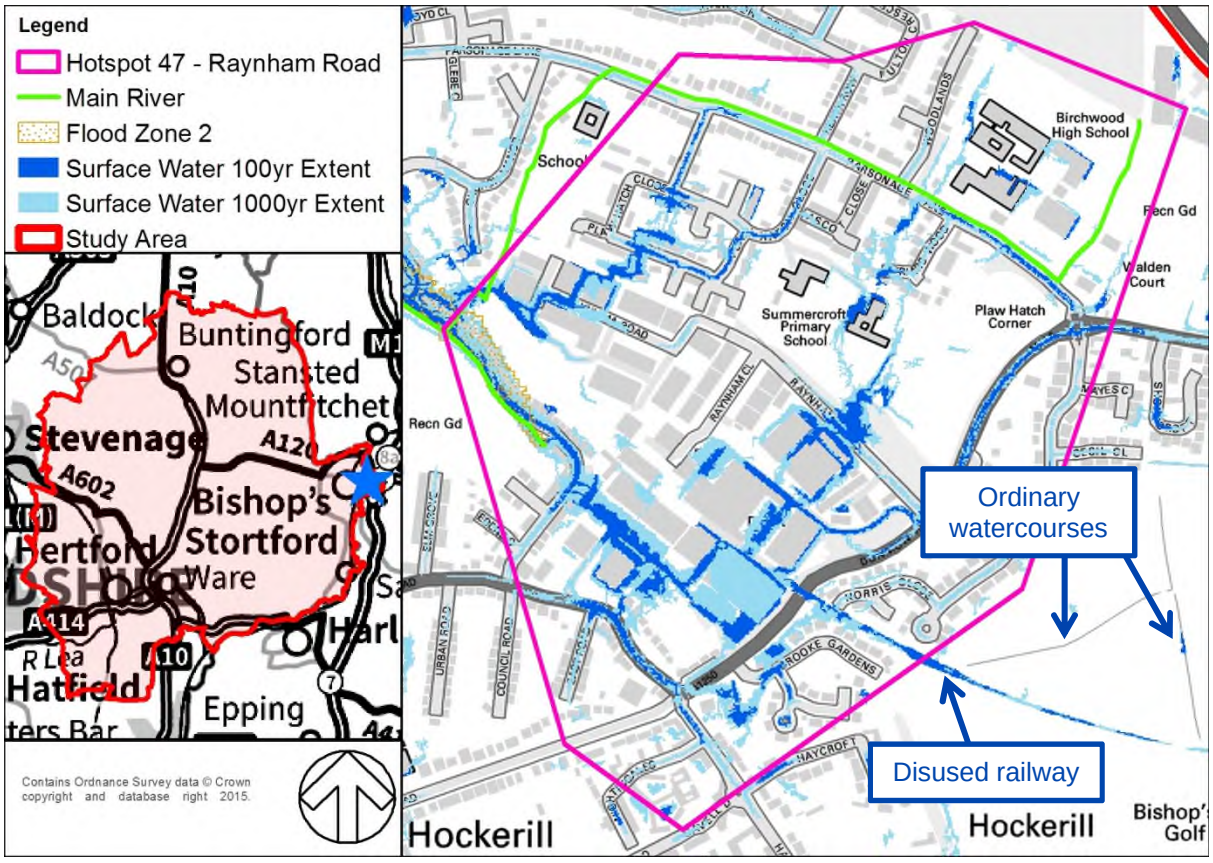

Figure 8: Hotspot 47 – Raynham Road, Bishop's Stortford

KEY ISSUES

- During the Stakeholder meeting, discussions were had on the culverted watercourse that flows through this hotspot. The watercourse is marked as Main River; however it does not appear on OS mapping due to being in culvert, it is also unnamed. This culvert appears on the Thames Water sewer asset data.
- The industrial estate is shown on the Risk of Flooding from Surface Water map as at Medium to High risk. EHDC reported historical occurrences of flooding in this area.
- There is an ordinary watercourse to the east of Dunmow Road (A1250); the watercourses are shown by the grey lines on the OS background mapping. At the point where the grey lines meet the disused railway, the ordinary watercourse flows towards the west and runs parallel to the disused railway, until it meets Dunmow Road (A1250).

SUGGESTED APPROACH

- Create a hydraulic model to assess the risk of surface water flooding within the catchment and include the area upstream of the disused railway. Much of the upper catchment is drained through culverted watercourses and surface water sewers.
- The upstream catchment from the disused railway and ordinary watercourses will be assessed as part of the modelling process.

- The model will also need to include cross sections of areas of open channel; this will be represented at a suitable resolution for the purpose of the modelling. The conveyance associated with the channel is likely to be restricted by flood levels within the River Stort, which the Main River shown in this hotspot drains into in the west.
- Targeted topographic and sewer survey will likely be required to confirm flow paths and levels in this hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit undertaken.

AGREED APPROACH

- Take forward as SWMP Modelled Hotspot, the final modelling methodology will be detailed in the modelling methodology technical note and follow the suggested approach detailed above.

8 SWMP NON-MODELLED HOTSPOTS

8.1 HOTSPOT 3 – PUCKERIDGE / STANDON

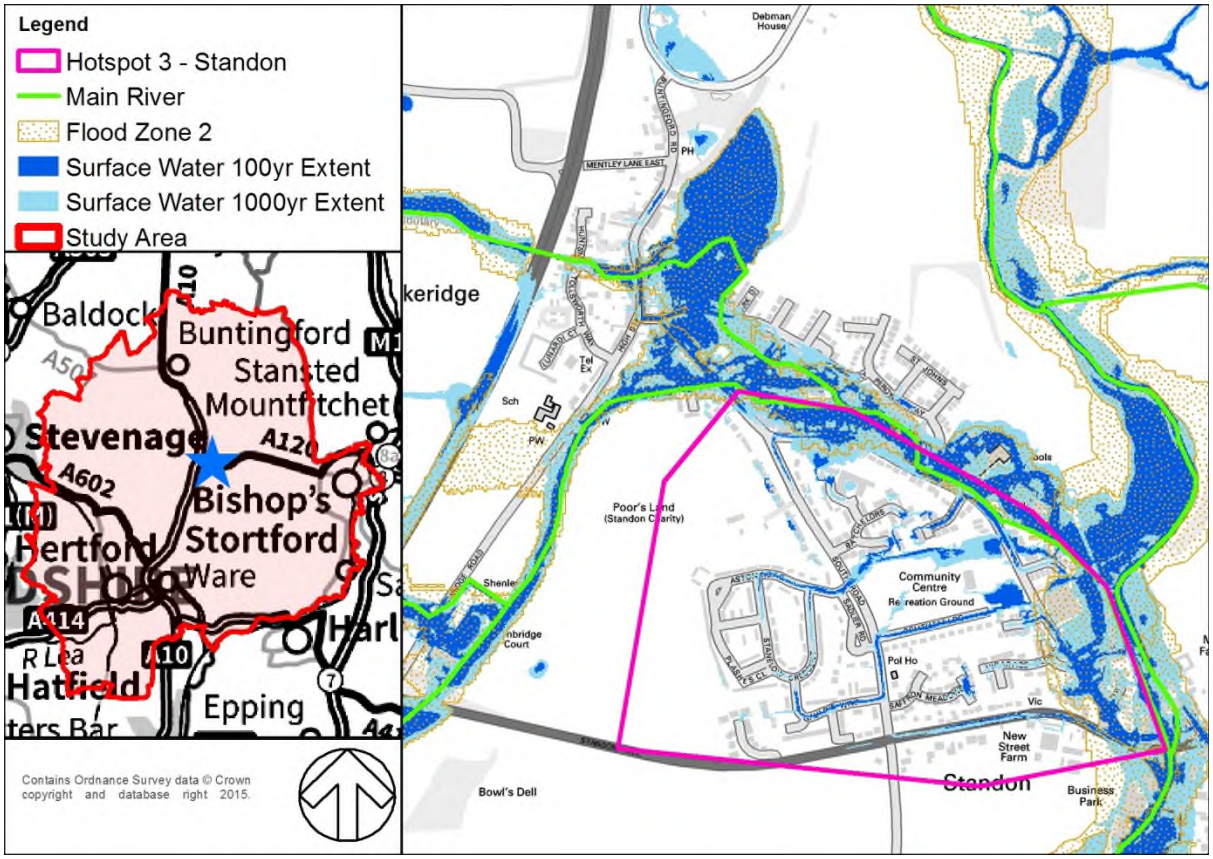

Figure 9: Hotspot 3 – Puckeridge / Standon

KEY ISSUES

- The areas surrounding Puckeridge and Standon are the confluence of a number of Main Rivers including the River Rib and the Puckeridge Tributary.
- Flooding was reported by the Parish Council during February 2014. East Herts District Council have also raised a number of historical flood instances, in particular the areas around Roman Way and The Moat. The areas raised by EHDC are within Flood Zone 2 and 3 extents.
- The Environment Agency has been conducting updated modelling within the area of the Puckeridge Tributaries following the flooding which occurred in February 2014. The modelling has produced updated Flood Zone extents which were incorporated into the Flood Map for Planning in the October 2015 update.
- The influence of blockages was also assessed and found that when there are blockages, the channels are susceptible to flooding during small events. The Environment Agency is investigating whether there are any potential options to reduce flood risk in the village such as upstream flood storage and property level protection.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot.
- No further assessment is proposed following the work conducted by the Environment Agency following previous flooding in this area.

- Should further modelling be required then a surface water model could be developed linked with the existing fluvial model (held by the Environment Agency). However, it is likely that extensive topographical survey would be required to ensure any improvement in flood risk is gained over the existing mapping.

LOCAL KNOWLEDGE

- No site visit was undertaken.

AGREED APPROACH

- Recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.
- This decision was based on the work recently undertaken by the Environment Agency stakeholders following historical flooding.
- In addition, extensive topographical survey would likely be required to enhance the flood map in order to provide an enhanced resolution over and above the existing mapping.

8.2 HOTSPOT 5 – WATTON AT STONE

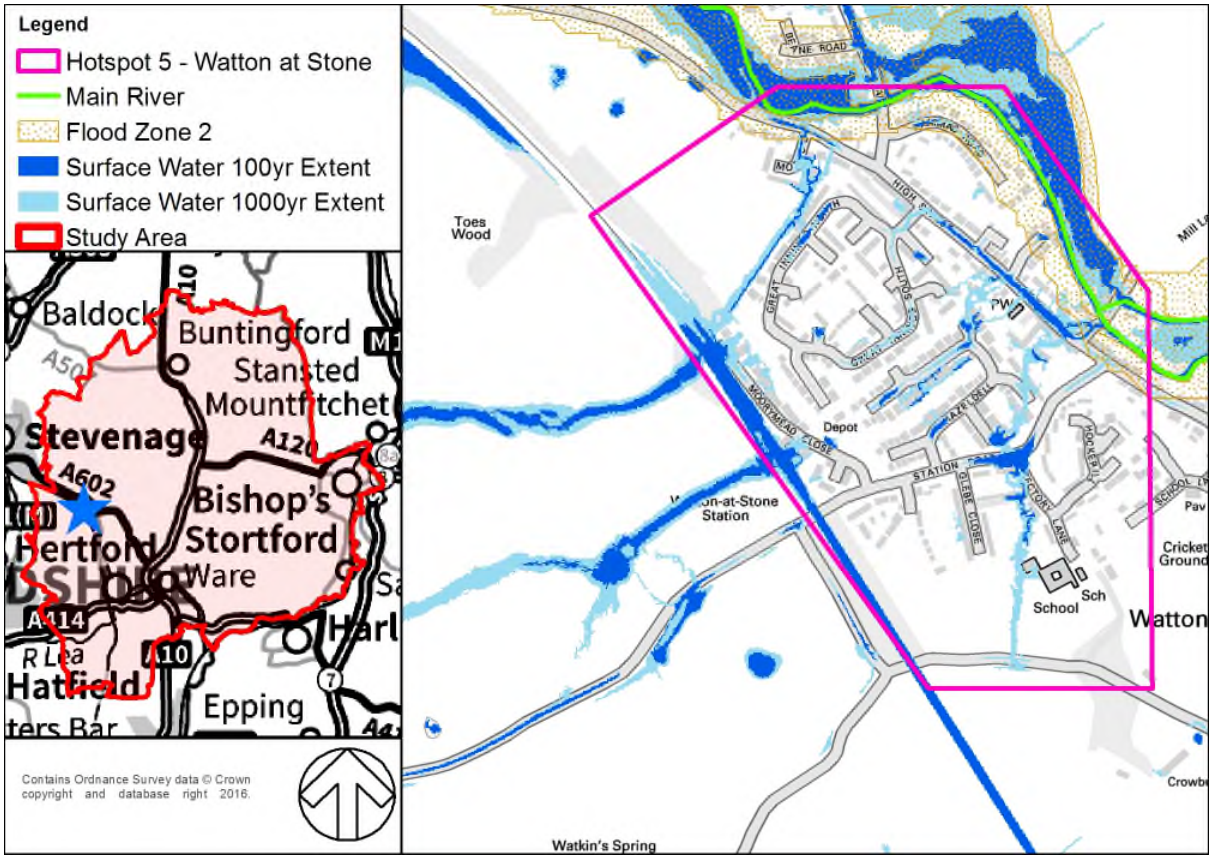

Figure 10: Hotspot 5 – Watton at Stone

KEY ISSUES

- There are well defined flow paths running southwest to north east, these are obstructed by the railway line which forms the southwestern boundary of the hotspot.
- The Risk of Flooding from Surface Water map also shows a flow path to the northwest of Great Innings North. This flow path is well confined suggesting it is within a ditch; this was subsequently confirmed on site. In addition, subsequent GIS analysis showed that this is an ordinary watercourse.

SUGGESTED APPROACH

- If this hotspot were to be taken forward as a SWMP Modelled Hotspot, a coarse model to the south west of the hotspot would be constructed and used to assess the surface water flow paths limited by the railway. The effect of the railway would then be assessed to determine how much water it is impeding.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- EHDC have raised flooding incidents to properties located on Great Innings North.
- A site visit was undertaken to assess the lie of the land to the southwest of the hotspot and seek any culverts underneath the railway. One culvert was observed with an approximate diameter of 225mm to 300mm.
- Great Innings North was also visited to assess any ditch to the rear of the properties. This was found to be overgrown and contain litter.

AGREED APPROACH

- This hotspot is not to be taken forward as a SWMP Modelled Hotspot. However, increased maintenance of the ditch to the rear of Great Innings North may alleviate some flood risk to nearby properties.
- Therefore, this hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

SITE VISIT PHOTOS

Figure 11: Headwall and culvert under railway

Figure 12: Headwall and culvert under railway

Figure 13: Ditch behind Great Innings North

Ditch behind Great Innings North looking northeast with the railway culvert behind.

Figure 14: Ditch behind Great Innings North

Ditch behind Great Innings North, looking southwest towards the railway culvert

8.3 HOTSPOT 8 – ST MARGARETS / STANSTEAD ABBOTTS

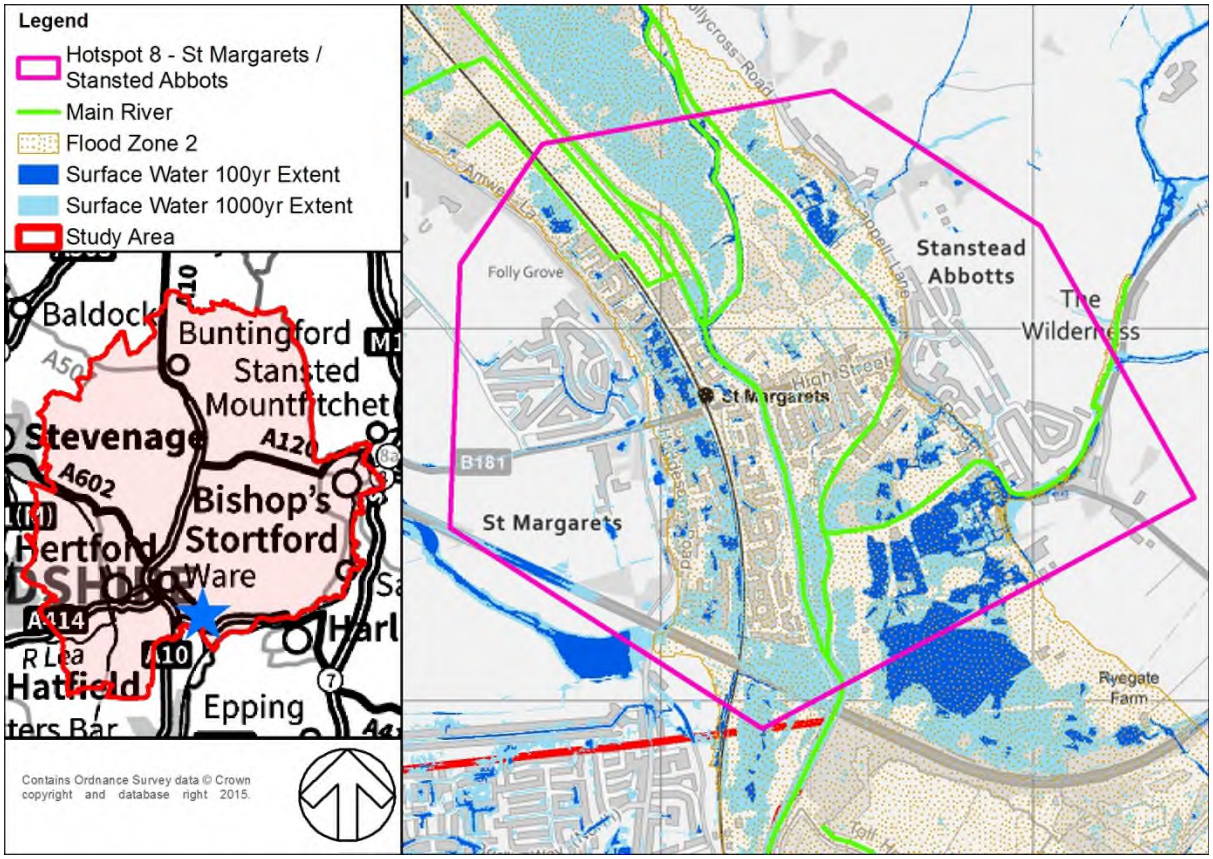

Figure 15: Hotspot 8 – St Margarets / Stanstead Abbotts

KEY ISSUES

- The Environment Agency is conducting a fluvial study in the area. This study is on Stanstead Drain, which enters the hotspot from the east.
- The Environment Agency gave an update on the progress of their study in Stanstead Abbotts in November 2015. This said how they have updated the baseline model to include a better representation of the culvert and the blockage scenarios; they are now using this to investigate options.
- East Hertfordshire District Council (EHDC) raised a number of locations where flooding has been reported in Stanstead Abbotts. These include areas with a variety of different problems, such as maintenance issues, including clearing out drains and maintaining retaining walls.
- The Parish Council also reported flooding in locations along Cappell Lane, High Street and Marsh Lane.
- The flood locations identified by EHDC and the Parish Council are located within the Flood Zone 2 extent.

SUGGESTED APPROACH

- Mitigation could be determined based on the results of the Environment Agency study when the results are available.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was not undertaken for this hotspot.

AGREED APPROACH

- At this stage no hydraulic modelling is to be undertaken as part of the SWMP. It is expected that the SWMP, as part of a future update (as a living document), will review the implications of the Environment Agency study and focus on identifying options for flood risk in Stanstead Abbotts.
- This hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.4 HOTSPOT 18 – HORMEAD

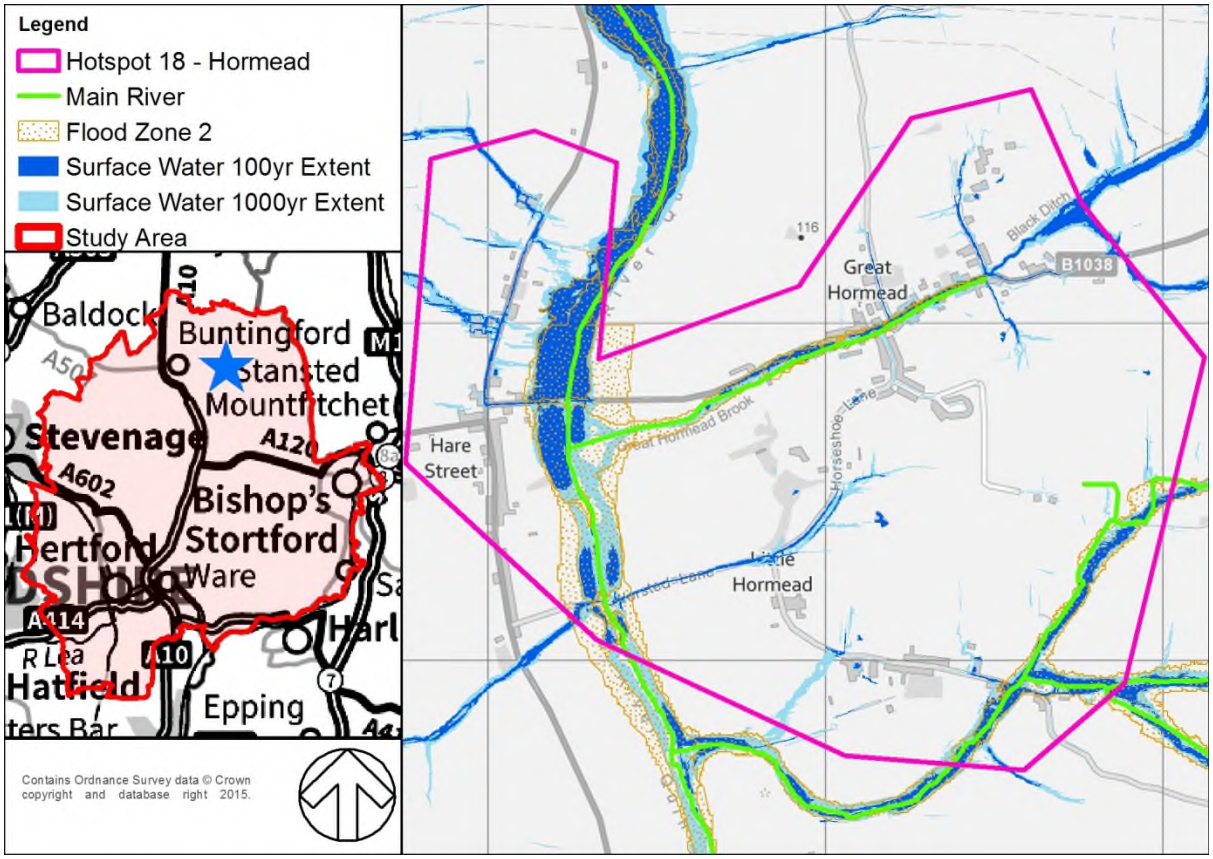

Figure 16: Hotspot 18 – Hormead

KEY ISSUES

- The parish council have raised a number of locations that have experienced flooding in the past including the village pavilion and bandstand. The locations raised by the parish council are located within fluvial Flood Zone 2.

SUGGESTED APPROACH

- Localised hydraulic models of the key culverts could be undertaken to assess the risk, however, these would need downstream boundary estimates of the implications associated with locking due to fluvial flooding.

LOCAL KNOWLEDGE/SITE VISIT OBSERVATIONS

- A site visit was not undertaken for this hotspot.

AGREED APPROACH

- This hotspot will not be taken forward as a SWMP Modelled Hotspot, however Property Level Protection (PLP) surveys could be conducted to make recommendations for home improvements, protecting against the surface water flood risk.
- This hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.5 HOTSPOT 25 – DANE END

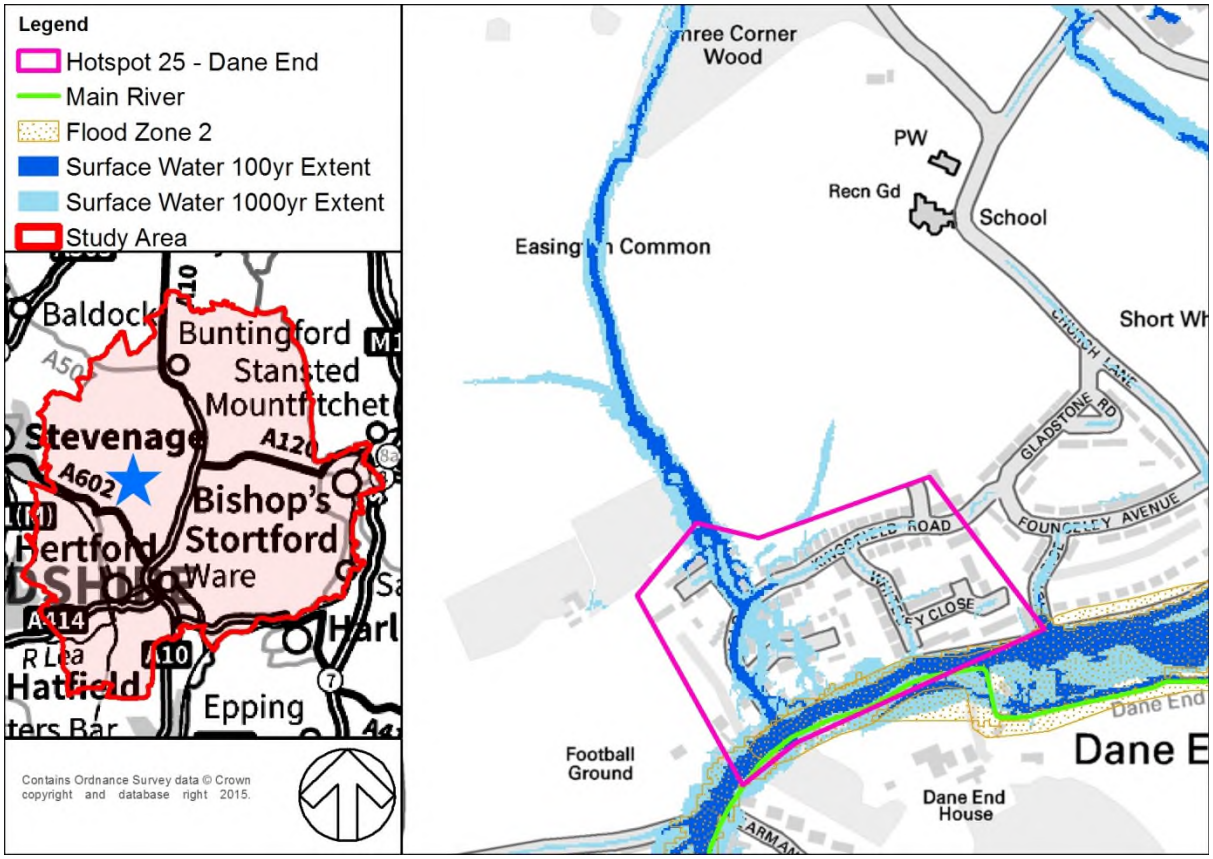

Figure 17: Hotspot 25 – Dane End

KEY ISSUES

- The Risk of Flooding from Surface Water map shows a well-defined surface water flow path running south across Easington Common before passing through properties in Kingsfield Road / Easington Road, the flow path then joins the large flow path on Munden Road.

SUGGESTED APPROACH

- Provide cut-off drain and channel diverting incoming flows around residential properties.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was not undertaken for this hotspot.

AGREED APPROACH

- HCC to explore the potential for the provision of a cut-off drain and channel diverting incoming flows around residential properties.
- To include Dane End within the SWMP as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.6 HOTSPOT 27 – THUNDRIDGE / HIGH CROSS

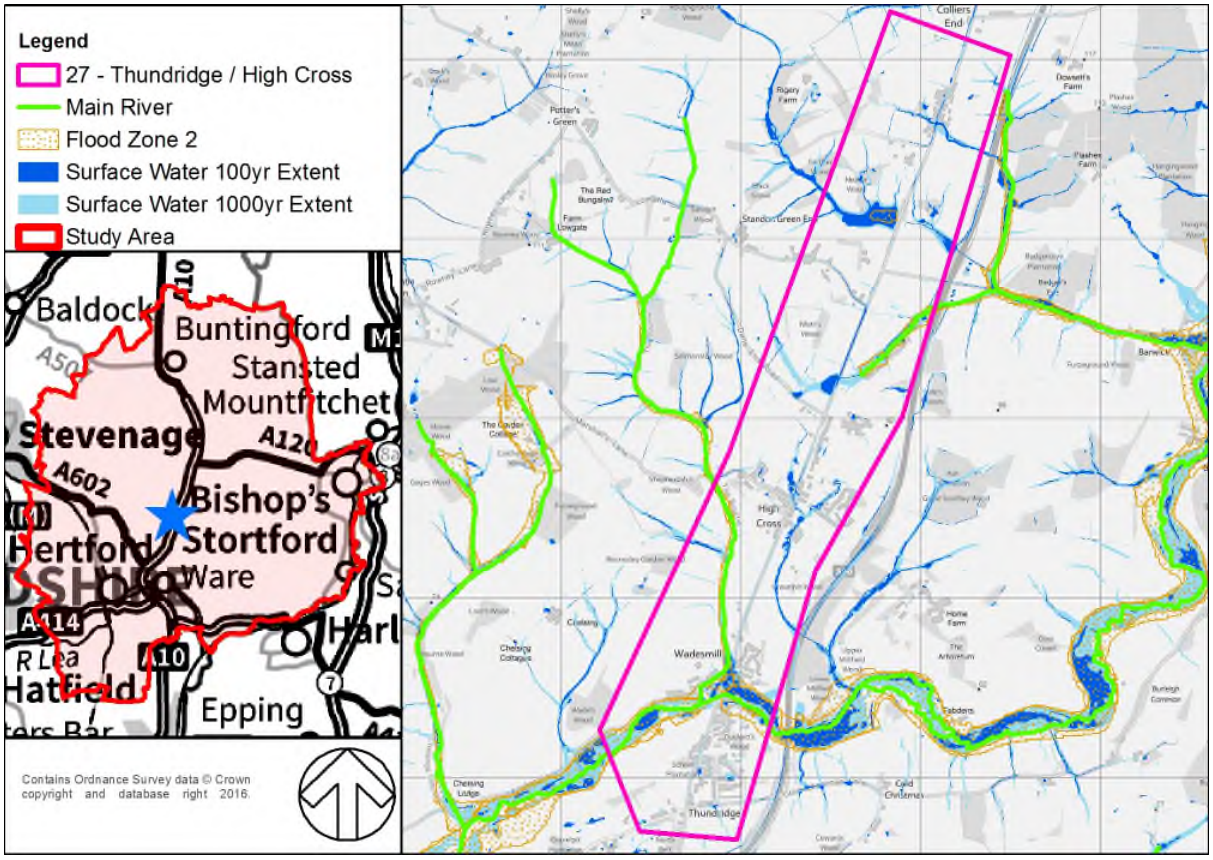

Figure 18: Hotspot 27 – Thundridge / High Cross

KEY ISSUES

- This hotspot includes a number of villages that are shown as at risk of flooding from surface water.
- EHDC have raised a number of properties within High Cross that have experienced surface water flooding.
- A proposed development within High Cross may also be at risk of surface water flooding.

SUGGESTED APPROACH

- A simple excel based assessment could be undertaken to assess the capacity of the culverts/ highway drainage infrastructure and compare that to the estimate flows to determine the volume of water that may run across the highway/inundate properties.

LOCAL KNOWLEDGE

- No site visit was undertaken.

AGREED APPROACH

- This hotspot won't be taken forward as a SWMP Modelled Hotspot. The SWMP could recommend that any proposed development should provide mitigation for the flow path through High Cross.

8.7 HOTSPOT 28 – HADHAM CROSS / MUCH HADHAM

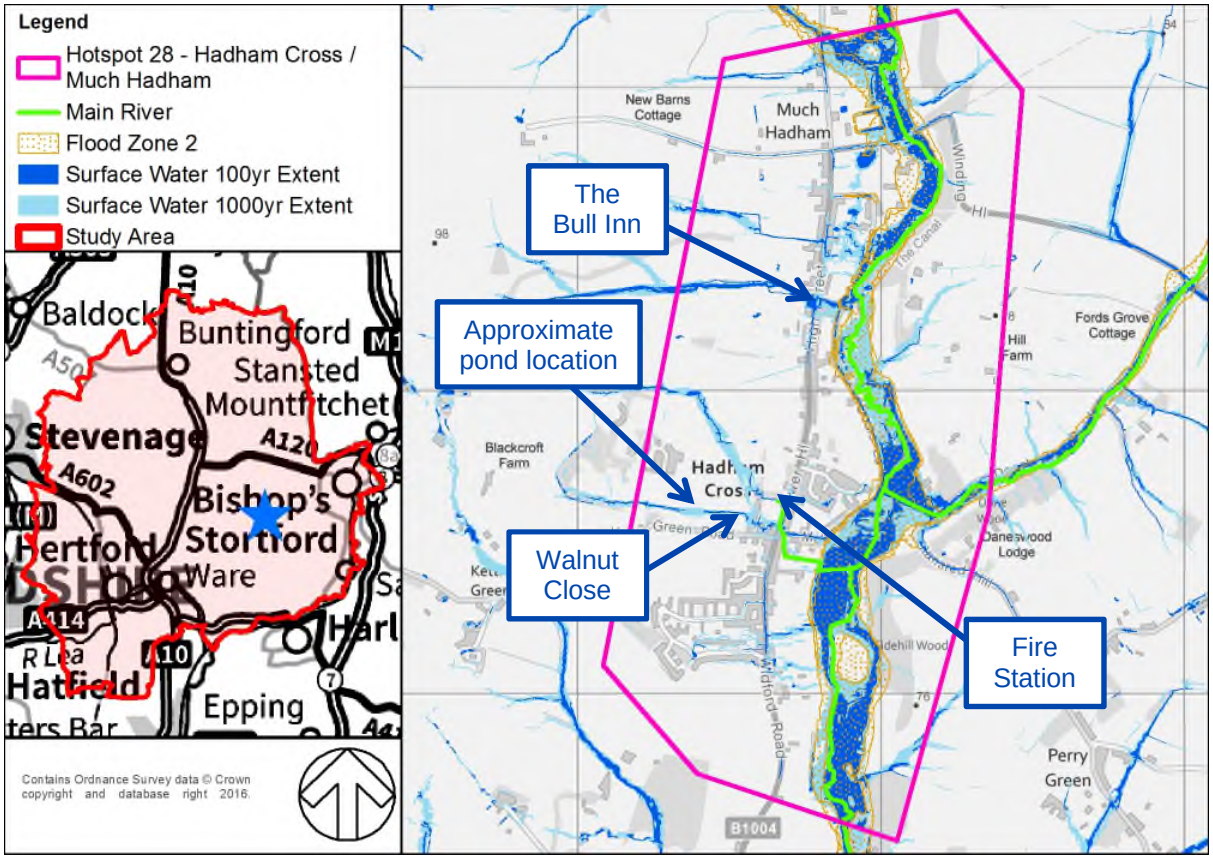

Figure 19: Hotspot 28 – Hadham Cross / Much Hadham

KEY ISSUES

- In Hadham Cross, Fire Station Ditch, which is a tributary of the River Ash (both Main River) begins outside the Fire Station and runs south underneath Tower Hill (B1004) before turning eastwards and running down Maltings Lane towards the River Ash.
- The Risk of Flooding from Surface Water map shows two surface water flow paths that pass through Walnut Close.
- There are also a number of other flow paths shown on the Risk of Flooding from Surface Water map crossing Tower Hill/High Street (B1004) running in an easterly direction towards the River Ash.

SUGGESTED APPROACH

- A hydraulic model could be developed to assess the implications of the surface water system including the culverted extents, given the age of the network substantial CCTV survey would be required.
- An Excel based assessment could be undertaken to assess the capacity of the culvert that is thought to run underneath The Bull Inn at Hadham Cross.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was undertaken to Hadham Cross to assess the short length of Main River and check the topography to the west of the Hotspot.
- During the site visit, information was gleaned from one of the residents at Walnut Close, who said that water didn't run off the fields to the back of his property, due to it

now being a piped network. The resident informed us that a field drain pipe has been put in from the pond, which drains down the field, along the back of the properties and then into Fire Station Ditch. Therefore, the residents have not witnessed the surface water flow path shown on the Risk of Flooding from Surface Water map.

- The Bull Inn was also visited to assess the flow path from the rear of the Inn. A headwall and screen was observed with a brick culvert running underneath the property. No easily available further land was identified for flood mitigation areas and recent improvement works to the hydraulic system appeared to have been undertaken.

AGREED APPROACH

- No further assessment is to be undertaken at this time, as the hotspot does not meet the criteria for a SWMP Modelled Hotspot. This is due to the potential costs for CCTV survey and the potential for cost effective mitigation works to be undertaken.

SITE VISIT PHOTOS

Figure 20: Rear of properties on Walnut Close

Figure 21: Headwall and screen

Ditch enters culvert under Tower Hill (B1004) and becomes listed as Main River.

Figure 22: Ditch to the side of Hadham Cross Fire Station

Figure 23: Culvert/ditch contains lots of detritus

Vegetation and detritus has fallen/passed through the screen.

Figure 24: Brick culvert and screen

Culvert is to the rear of The Bull Inn.

Figure 25: Brick culvert and screen

Brick culvert has been mended with PVC inserted inside. Culvert runs in a southerly direction adjacent to the High Street (B1004) southbound carriageway opposite The Bull Inn.

8.8 HOTSPOT 30 – HUNSDON

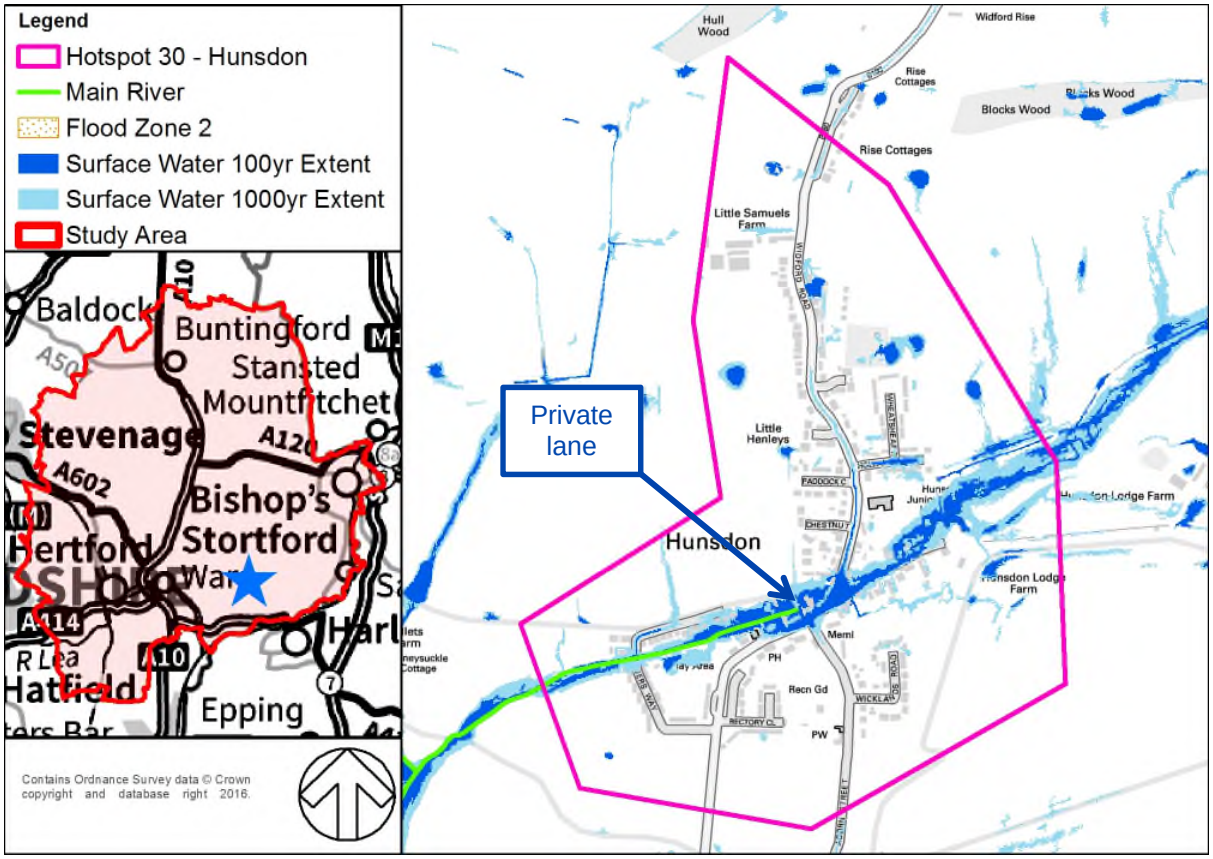

Figure 26: Hotspot 30 – Hunsdon

KEY ISSUES

- The Risk of Flooding from Surface Water map shows a significant flow path that is generated from runoff from the land to the east of the hotspot. This flows westwards along Drury Lane and then onwards towards the High Street (B180) and further, towards the Hunsdon Brook, which is Main River.

SUGGESTED APPROACH

- A hydraulic model could be developed to provide a better representation of the flow paths and flooding mechanisms, this would require topographical and channel survey to ensure improvements in the current surface water model representation.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- EHDC and Hunsdon Parish Council have raised issues of flooding in Drury Lane, including a culvert underneath the northern footway that is prone to collapse. The Parish Council reported that the gardens to the rear of the village hall and the two adjacent cottages to the south were flooded during 2014; the ditch and culvert to the rear of the hall were completely blocked. The farmer, Mr E Bone, cleared this however, it is unknown if this will stop further flooding.
- The culvert appears to run under the Village Hall Car Park to the rear of the hall then under the garden of Rose Cottage, under a private lane (opposite Acorn Street) and feeds into Hunsdon Brook in the garden of the cottage adjacent to the private lane.
- A site visit was conducted to assess the topography to the west of the Hotspot and assess the flow paths from the east through the hotspot. A pond / basin was found

towards the eastern end of Drury Lane (shown in Figure 27 and Figure 28) and during the site visit this appeared almost stagnant with little flow in or out. An outfall was sought but could not be observed due to vegetation in the area.

- During the site visit, WSP and HCC together with EHDC and a representative from Draincare (who have worked with EHDC on local projects in this area) walked along the private lane leading to the fields off the High Street (B180), opposite Acorn Street. From this private lane, the Main River was located within residential rear gardens.

AGREED APPROACH

- Recommend as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

SITE VISIT PHOTOS

Figure 27: Pond at eastern end of Drury Lane

Figure 28: Pond at eastern end of Drury Lane

8.9 HOTSPOT 39 – EAST WARE

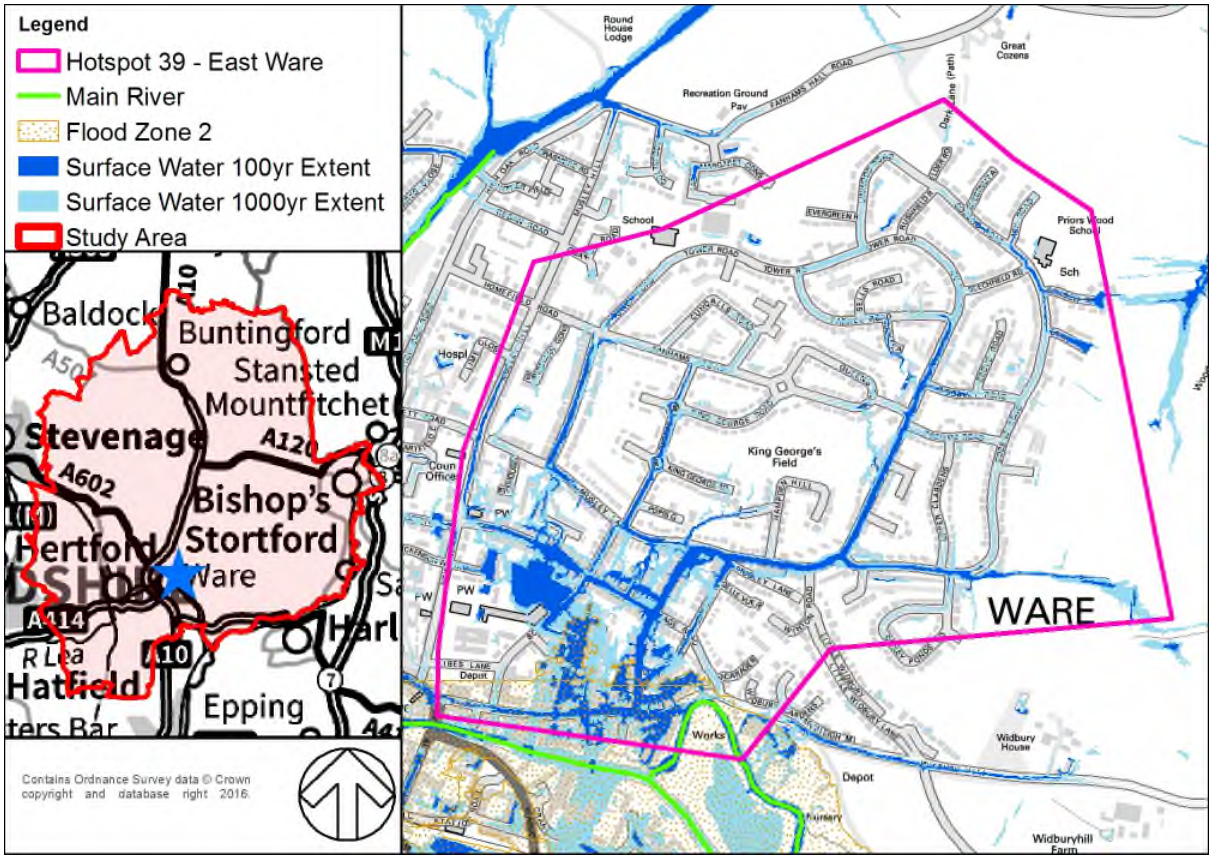

Figure 29: Hotspot 39 – East Ware

KEY ISSUES

- A number of surface water flow paths flow southerly towards the River Lea and the River Lee Navigation.

SUGGESTED APPROACH

- The benefits of progressing this hotspot within the SWMP are limited given that the current Risk of Flooding from Surface Water flood map is thought to be an accurate representation. Further additional modelling is unlikely to improve the current map, given the confirmed flow paths from the local topography and highway networks observed on site. In addition, no historical flooding has been reported by stakeholders.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was conducted to assess the local features. The site visit confirmed the Risk of Flooding from Surface Water Map; the local topography coincided well with the predicted surface water flow paths.
- During the site visit, it was concluded that any surface water flooding would most likely be limited to the highway extents, particularly in the upstream parts of the hotspot (in the north); therefore additional hydraulic modelling would not be cost beneficial.
- Property threshold levels to the south of the hotspot e.g. Garland Road and Jeffries Road are below the road level in places. Some have small garden walls that may provide some protection from overland flows.
- Information provided by stakeholders suggested that there have been no reports of historic flooding in this area of Ware.

AGREED APPROACH

- Hotspot will not be taken forward as a SWMP Modelled Hotspot, however Property Level Protection (PLP) surveys could be conducted to make recommendations for home improvements, protecting against the surface water flood risk.
- Therefore, this hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.10 HOTSPOT 41 – SELE, HERTFORD

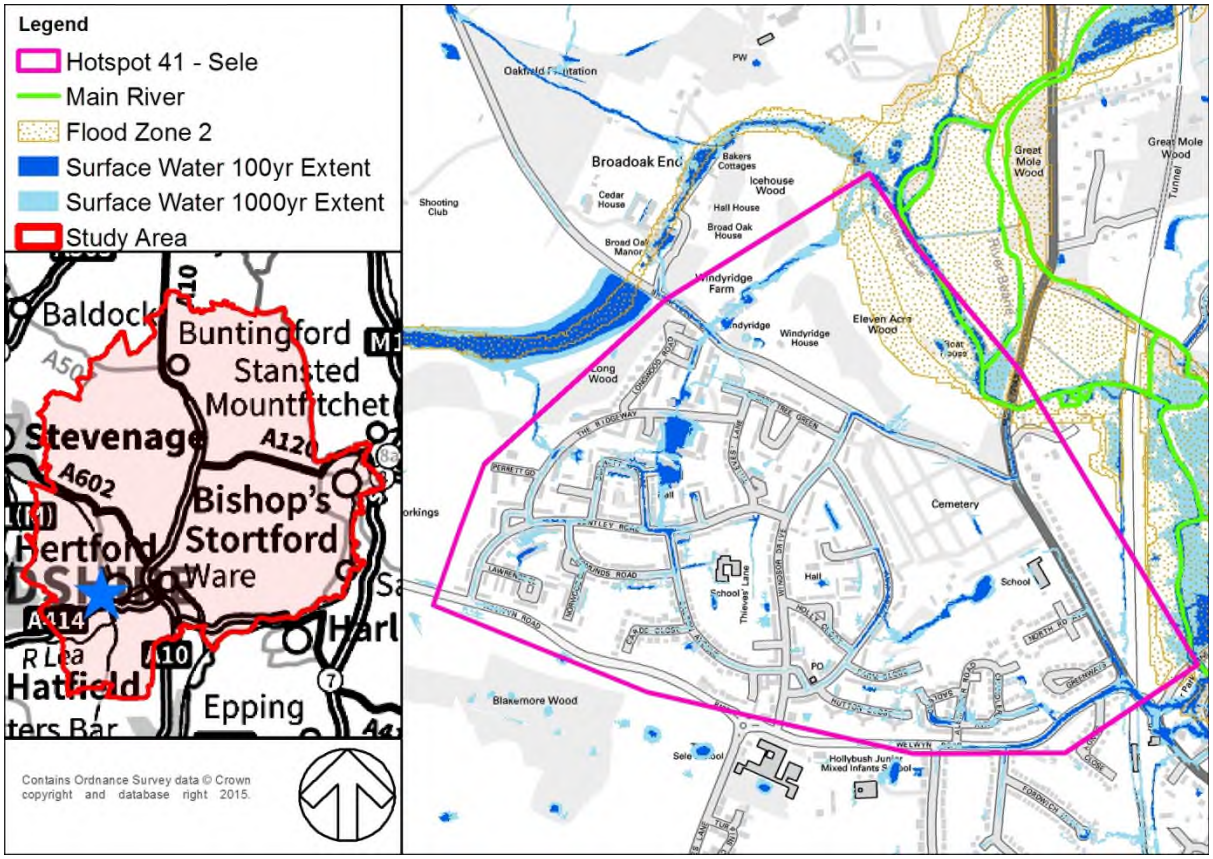

Figure 30: Hotspot 41 – Sele, Hertford

KEY ISSUES

- The Risk of Flooding from Surface Water map suggests there are a number of locations within the Sele Farm Estate where surface water runoff accumulates.
- Hotspot ranking is affected due to the relatively high levels of residential deprivation in this area.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot due to the localised nature of the predicted flooding. HCC should undertake a site visit to better understand the potential and implications of any surface water ponding in this area.

LOCAL KNOWLEDGE

- No site visit was undertaken.

AGREED APPROACH

- Recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report. It is unlikely that the results of the modelling and any mitigation measures would be cost effective.

8.11 HOTSPOT 42 – CENTRAL HERTFORD

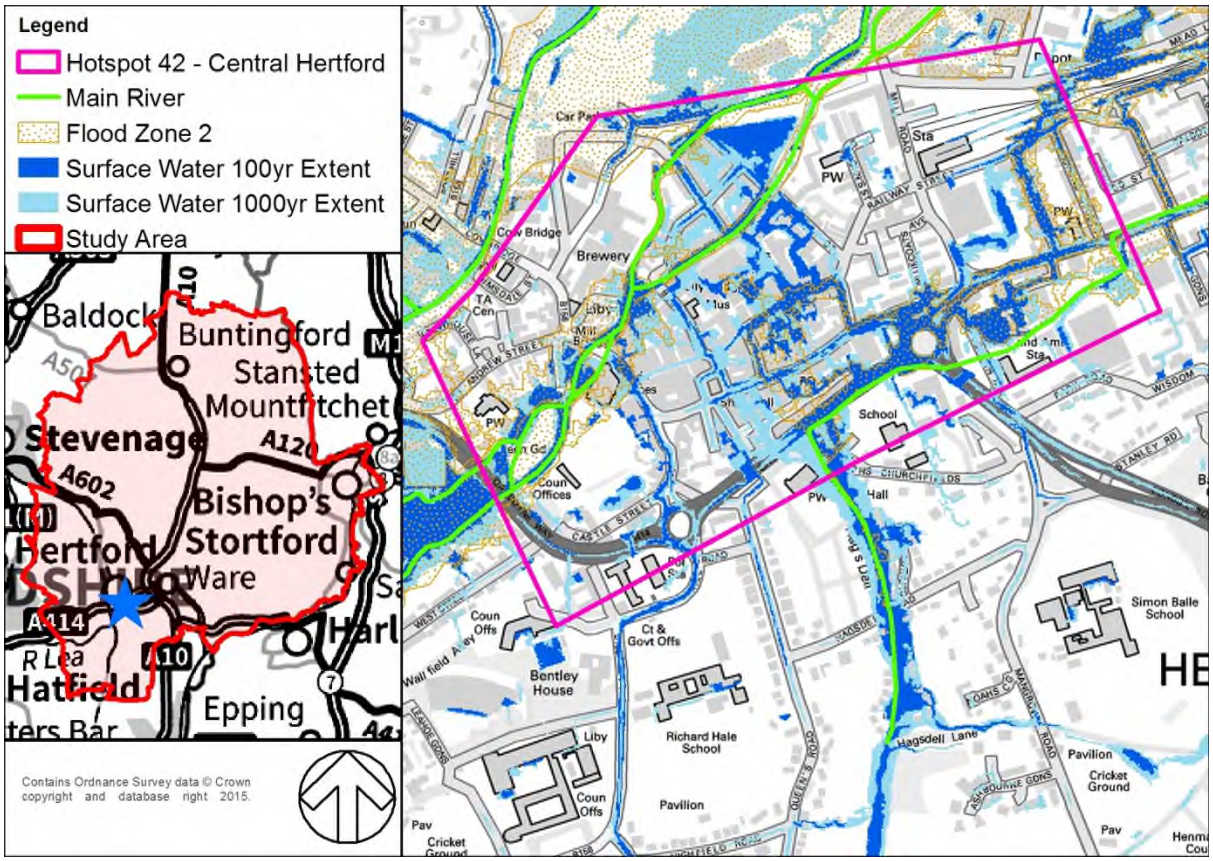

Figure 31: Hotspot 42 – Central Hertford

KEY ISSUES

- The River Lea flows through the centre of Hertford, in addition to a number of other rivers, which also flow through Hertford, including the River Beane and River Mimram.
- The culverted Hag's Dell Main River runs northerly across Hagsdell Road before entering the hotspot through from the hotspot's southern boundary. The culvert reaches a 90° bend and continuing eastwards.
- Fluvial flooding covers a significant proportion of the hotspot. Interaction occurs between surface water (pluvial) and fluvial flooding.

SUGGESTED APPROACH

- Do not take forward for further assessment as the Environment Agency is currently conducting a fluvial modelling study, assessing flooding in the town.
- HCC will also be undertaking an Initial Assessment, in conjunction with the Environment Agency, into the effects of combined fluvial-pluvial flooding in Hertford.

LOCAL KNOWLEDGE

- This location was not visited on site.

AGREED APPROACH

- This hotspot will not be taken forward for further assessment and is therefore a SWMP Non-Modelled Hotspot.

- Recommendations and actions for this hotspot could consist of suggested future mitigation options by Hertfordshire County Council (HCC) in their role as LLFA following publication of the results from the Environment Agency (EA) study. However, it is anticipated that the Environment Agency study will provide mitigation options.
- The aim of the joint HCC-EA fluvial-pluvial Initial Assessment study is to understand the interactions between the river and surface water flow paths across Hertford. On completion of this study, the potential for mitigation options will be able to be better focussed on the surface water / river interactions and the flooding that occurs as a result of these combined flood mechanisms.

8.12 HOTSPOT 46 – STANSTED ROAD, BISHOP'S STORTFORD

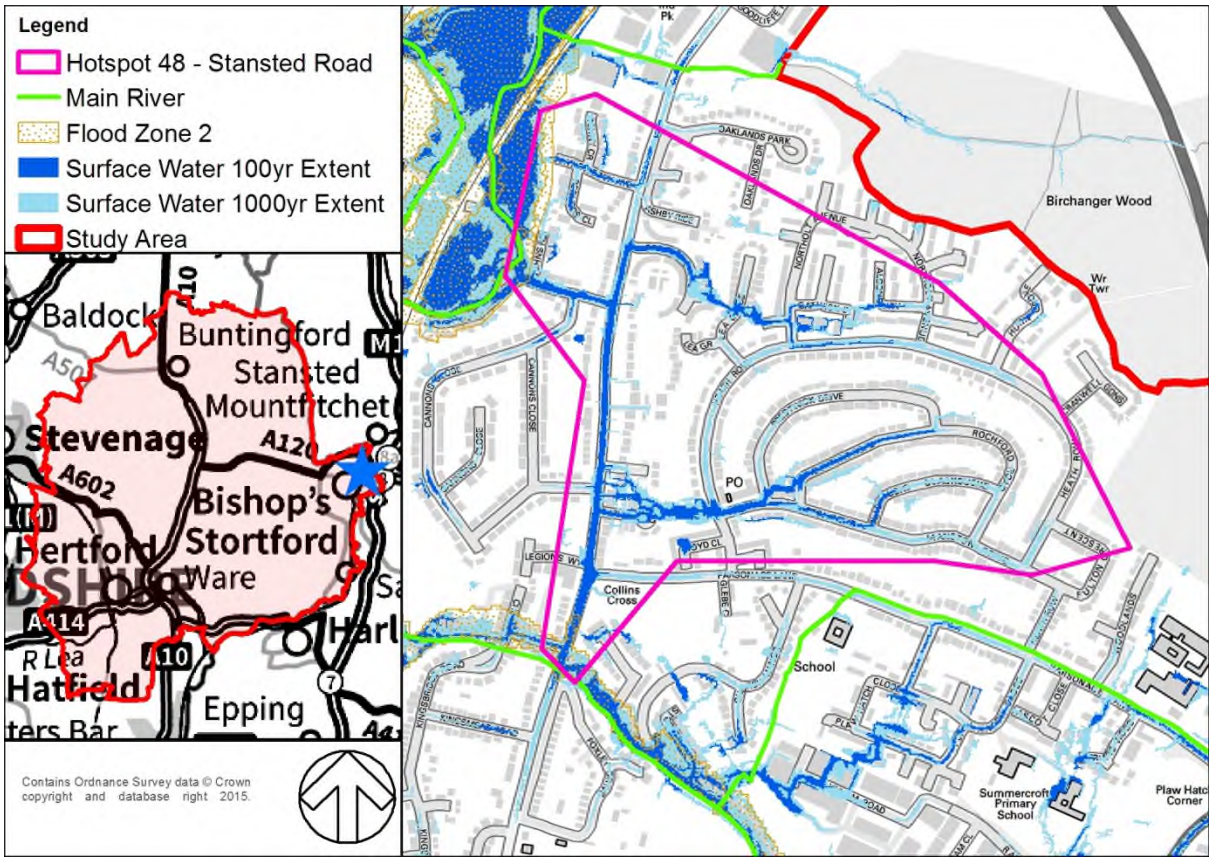

Figure 32: Hotspot 46 – Stansted Road, Bishop's Stortford

KEY ISSUES

- EHDC have noted existing flooding incidents along Stansted Road.
- Flooding was reported in August 2015 in the highway, on the junction of Stansted Road with Parsonage Lane.

SUGGESTED APPROACH

- The southern part of this hotspot will be modelled as part of the modelling being undertaken for Raynham Road.
- Additional survey work will be undertaken around the junction of Parsonage Lane and Stansted Road, to gain an improved understanding of the highway and levels in this area.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was not conducted for this hotspot.

AGREED APPROACH

- The part of this hotspot which flooded in August 2015 will be included in the modelling work being undertaken for Raynham Road, Bishop's Stortford. The volume of water reaching this junction will be assessed, together with an indication of the likely flood mechanisms affecting the area.

8.13 HOTSPOT 58 – GREEN STREET (NEAR LITTLE HADHAM)

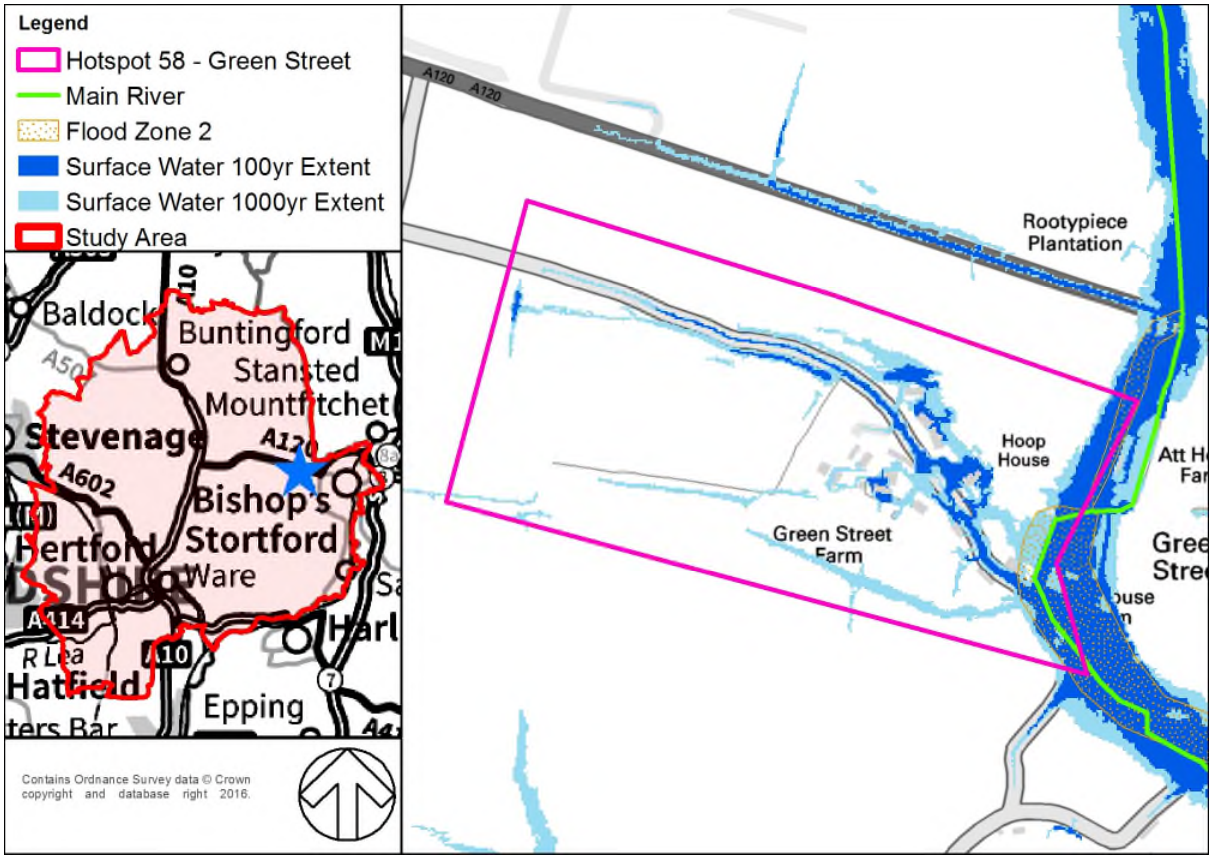

Figure 33: Hotspot 58 – Green Street (near Little Hadham)

KEY ISSUES

- Hotspot has been raised by EHDC due to historical instances of flooding.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot as it does not meet the criteria of a SWMP Modelled Hotspot.
- The limited number of properties affected, and the localised nature of the historical flooding also support the way forward for this hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was not conducted for this hotspot.
- Stakeholders reported historical flooding in this hotspot. Flooding has been reported in the road where the surface water flow path comes in from the west. Stakeholders also reported flooding on the eastern boundary of the hotspot, near to the Main River.

AGREED APPROACH

- Recommend as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.14 HOTSPOT 61 – RHODES AVENUE, BISHOP'S STORTFORD

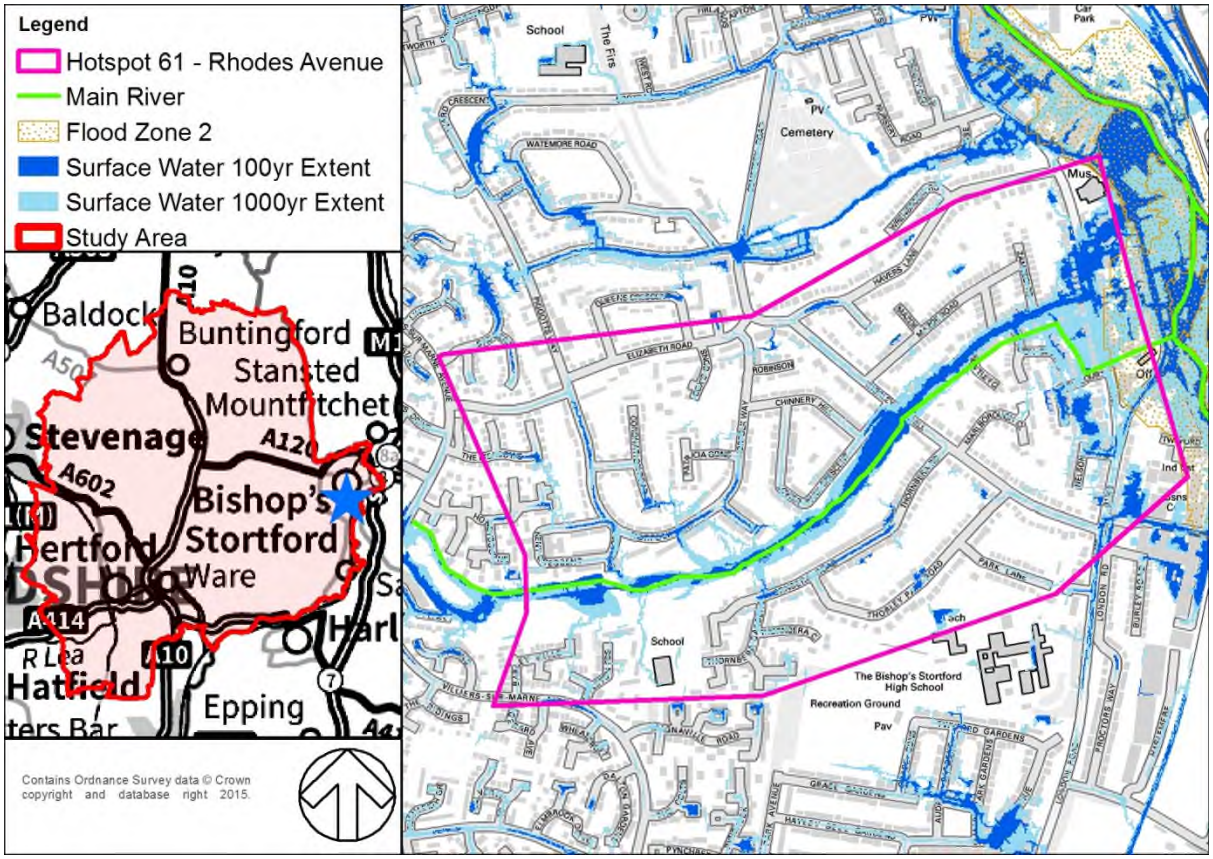

Figure 34: Hotspot 61 – Rhodes Avenue, Bishop's Stortford

KEY ISSUES

- Hotspot has a Main River running through the centre of the hotspot (named on the Main River layer as Thorley Tributaries (West Arm)). There are no Flood Zones associated with this Main River however it is shown on OS mapping suggesting it is not culverted.
- The Risk of Flooding from Surface Water map shows a surface water flow path follows the course of this Main River before running westerly along Rhodes Avenue towards the River Stort.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot as it does not meet the criteria of a SWMP Modelled Hotspot. Consultation with EHDC revealed that other areas of Bishop's Stortford have historical surface water flooding problems, so focus should be maintained on those areas.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was not conducted.
- No flooding was reported at this hotspot by stakeholders.

AGREED APPROACH

- Recommend as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.15 HOTSPOT 75 – LITTLE HADHAM

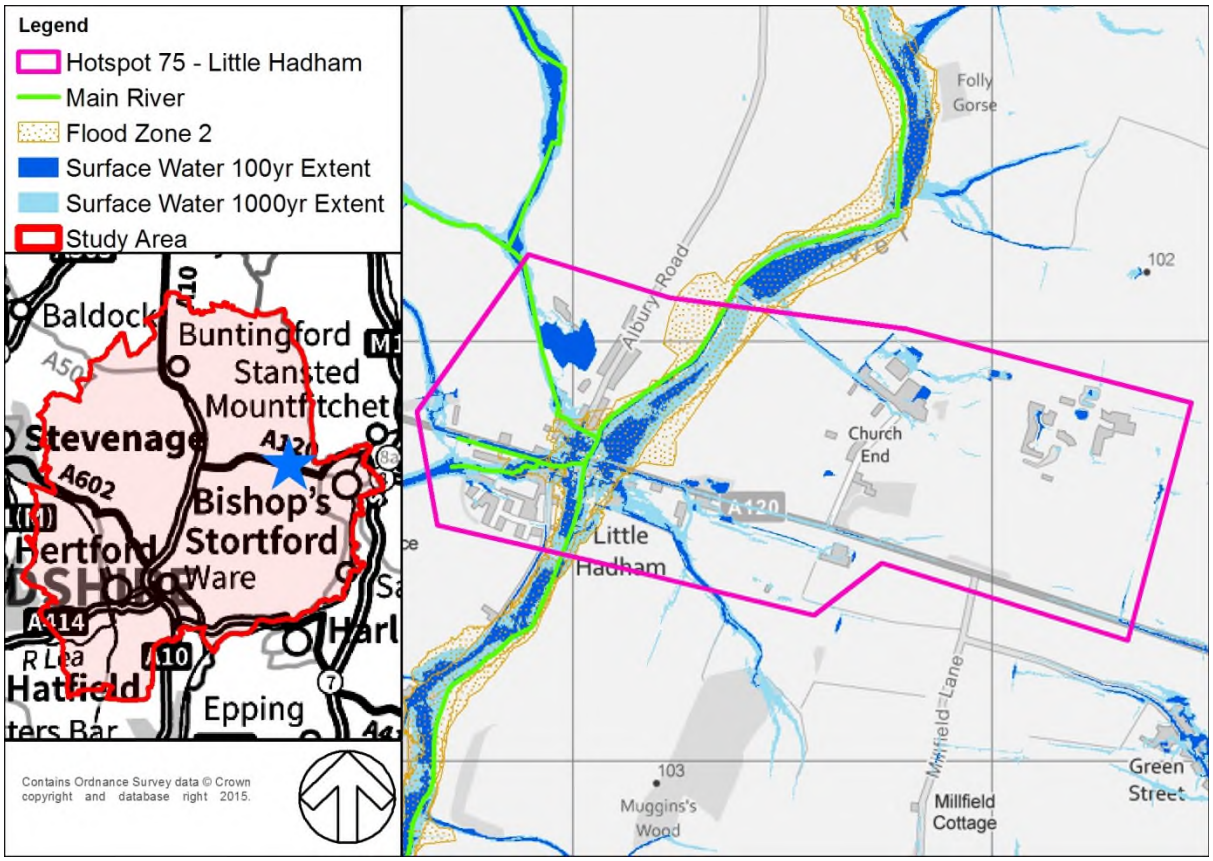

Figure 35: Hotspot 75 – Little Hadham

KEY ISSUES

- The village of Little Hadham is at the confluence of a number of Main Rivers; the River Ash runs through the centre of Little Hadham, and its tributaries: Lloyd Taylor Drain, Spindle Hill Drain and Albury Tributary joining the River Ash in the village centre.
- Little Hadham sits at a crossroads between Albury Road and the A120. The village floods frequently including on 24th July 2015 and February 2014.
- Little Hadham was also put forward by stakeholders due to the historical flooding that has occurred in the village.

SUGGESTED APPROACH

- This hotspot will not be taken forward as a SWMP Modelled Hotspot due to the planned flood alleviation scheme which is due to be undertaken as part of the A120 bypass.

LOCAL KNOWLEDGE

- There is a joint bypass/flood alleviation scheme proposed to the north of Little Hadham which will impound flood water upstream of Little Hadham for events up to and including the critical 1 in 100 year event.
- Information available on Hertfordshire County Council's website states now:

> ***The bypass route crosses the River Ash and Albury Tributary north of Little Hadham. There is therefore potential to create a flood alleviation scheme in conjunction with the bypass. The embankments would act as dams and temporarily store storm water behind them. This storage will help to reduce the risk of flooding***

downstream in Little Hadham by collecting floodwaters and releasing them when a storm has passed."

- No site visit was undertaken at this hotspot.

AGREED APPROACH

- Funding for the proposed bypass has been identified and the bypass will reduce the flood risk to properties within Little Hadham. This hotspot will be progressed as a SWMP Non-Modelled Hotspot.

8.16 HOTSPOT EH01 – GRANGE PADDOCKS / STANE CLOSE, BISHOP'S STORTFORD

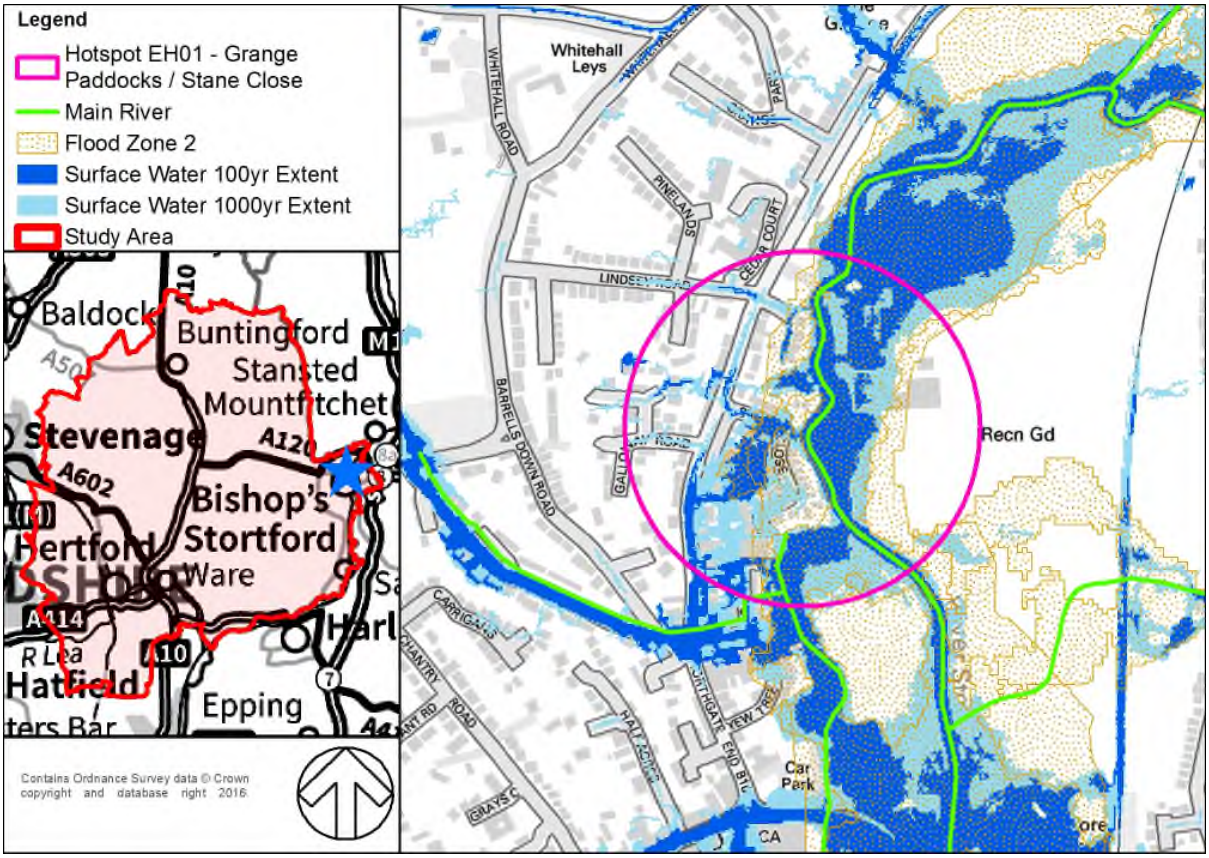

Figure 36: Hotspot EH01 – Grange Paddocks / Stane Close, Bishop's Stortford

KEY ISSUES

- EHDC have raised existing flooding instances in the area surrounding Grange Paddocks Leisure Centre and Stane Close, Bishop's Stortford.
- This area is within the Flood Zone 2 extent of the River Stort.
- There is also a surface water flow path into this area from Elm Road. The Risk of Flooding from Surface Water map, shows a flowpath down Elm Road, when it meets the junction at the end of Elm Road, water splits and flows down into Bryan Road (and towards the River Stort) or Rye Street, at Rye Street surface water flows towards Stane Close and finally to the River Stort.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot as it does not meet the criteria of a SWMP Modelled Hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken for this hotspot.

AGREED APPROACH

- The areas raised by EHDC are within fluvial Flood Zone extent and are therefore outside the scope of SWMP. A Strategic Flood Risk Assessment (SFRA) is a more suitable vehicle for assessing fluvial flood risk in this area.
- Recommend as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.17 HOTSPOT EH02 – JACKSON SQUARE / THE CAUSEWAY, BISHOP'S STORTFORD

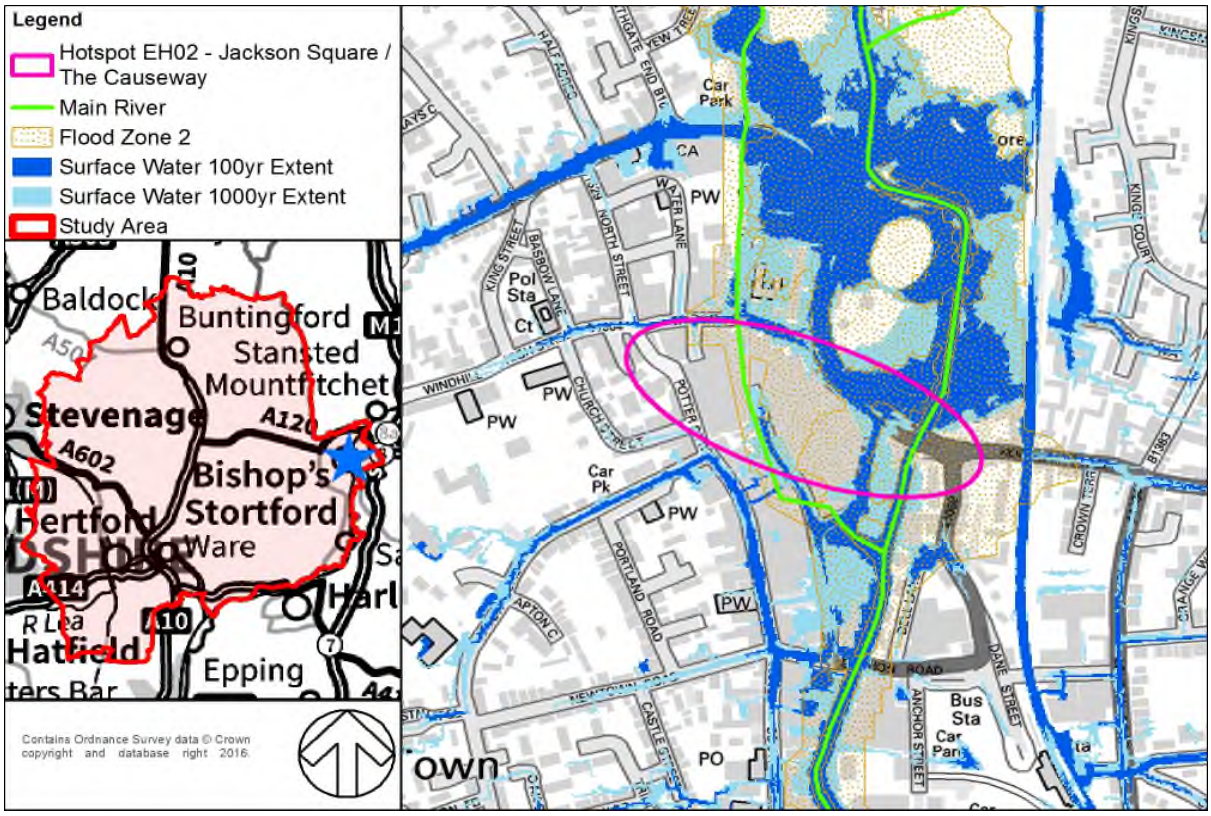

Figure 37: Hotspot EH02 – Jackson Square / The Causeway, Bishop's Stortford

KEY ISSUES

- EHDC have raised flooding incidents along The Causeway and Jackson Square shopping centre. This is adjacent to the proposed SWMP Modelled Hotspots of Hadham Road (43), Potter Street / South Street (60) and Benhooks Avenue (44) (the eastern boundary of this model will be the River Stort (Main River)).
- This area, raised by EHDC, is within fluvial Flood Zone 2 extent.

SUGGESTED APPROACH

- Liaise with the Environment Agency as the main risks here are fluvial driven and work with the landowners to ensure that the risks are understood, and suitable mitigation measures are implemented.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken for this hotspot.

AGREED APPROACH

- The areas raised by EHDC are within fluvial Flood Zone 2 extent and are therefore outside the scope of SWMP. A Strategic Flood Risk Assessment is a more suitable vehicle for assessing fluvial flood risk in this area.
- This hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.18 HOTSPOT EH03 – THORN GROVE, HOCKERILL, BISHOP'S STORTFORD

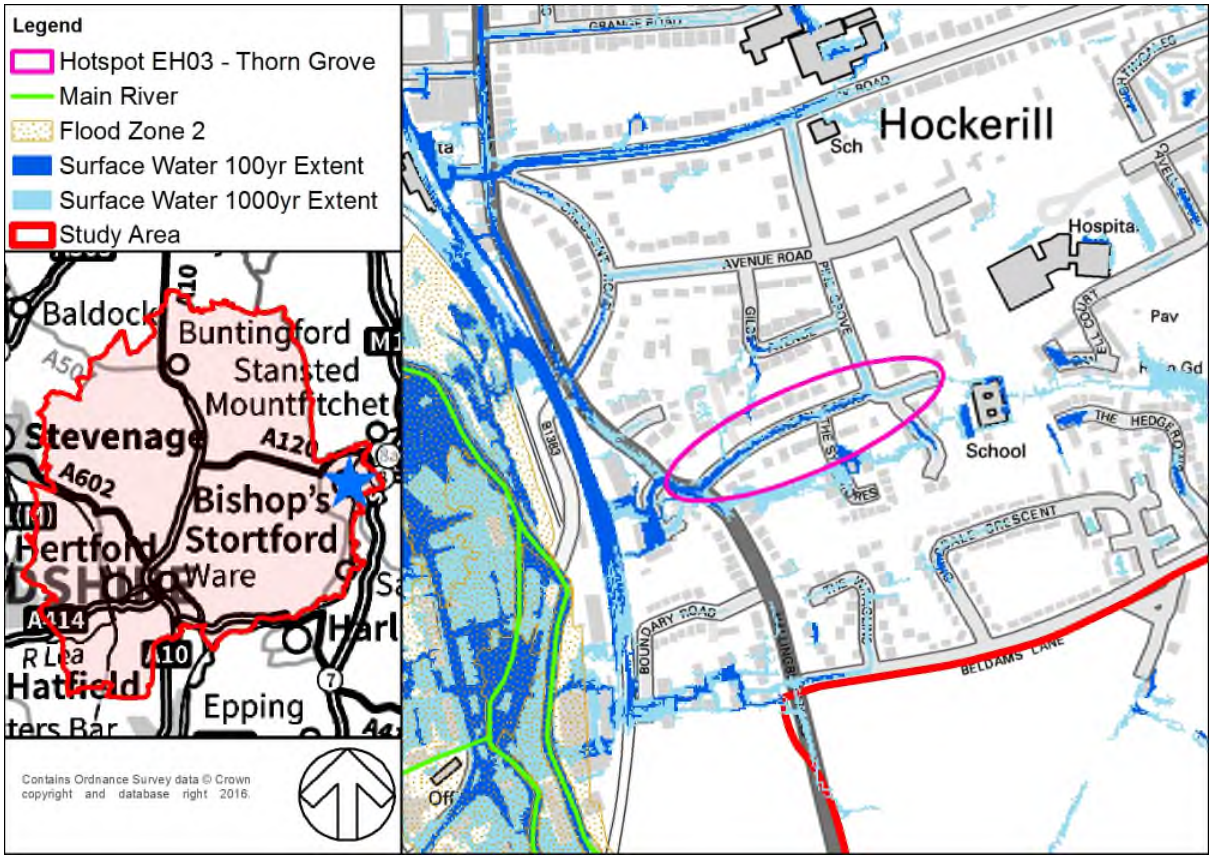

Figure 38: Hotspot EH03 – Thorn Grove, Hockerill, Bishop's Stortford

KEY ISSUES

- This area was raised by EHDC during the stakeholder meeting. It is thought that the area around the school has flooded previously due to a blocked drain. In addition, ditch maintenance in the area was also reported.

SUGGESTED APPROACH

- Document this hotspot as being discussed as part of the SWMP process in the SWMP report. The hotspot doesn't meet the criteria for a SWMP Modelled Hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken for this hotspot.

AGREED APPROACH

- Recommend as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

8.19 HOTSPOT EH04 – FORD END, HADHAM FORD (NEAR LITTLE HADHAM)

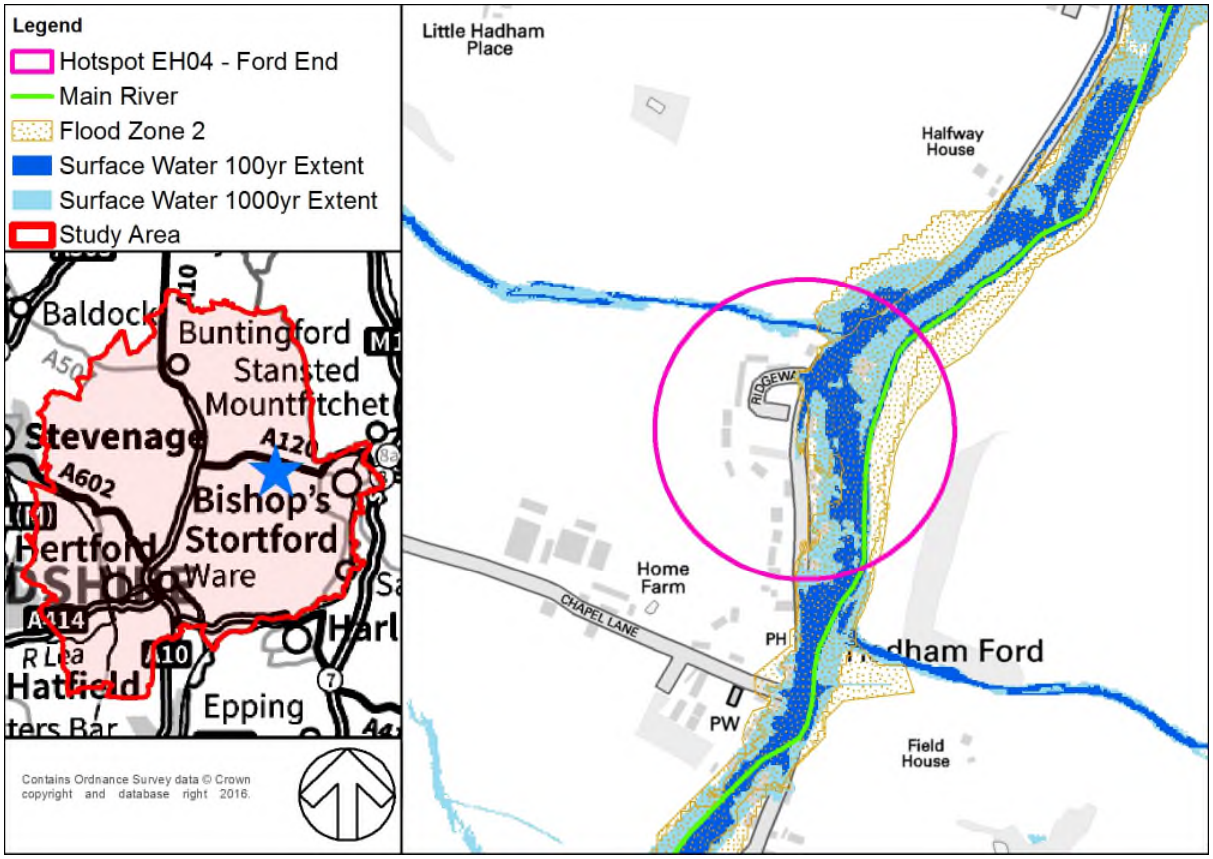

Figure 39: Hotspot EH04 – Ford End, Hadham Ford (near Little Hadham)

KEY ISSUES

- Hotspot was raised by EHDC due to historical flooding; the area was affected in February 2014.
- Fluvial Flood Zone 2 extent covers a large proportion of this area.
- The River Ash runs through the centre of Hadham Ford. Hadham Ford is just south of Little Hadham, so is the next area to be hit by flooding from the River Ash after Little Hadham.

SUGGESTED APPROACH

- The A120 bypass and associated flood alleviation scheme proposed to protect Little Hadham from flooding will also protect the downstream Hadham Ford.
- This hotspot will not be taken forward as a SWMP Modelled Hotspot due to the planned flood alleviation scheme which is due to be undertaken as part of the A120 bypass.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken for this hotspot.
- As stated in Hotspot 75 – Little Hadham, there is a joint bypass/flood alleviation scheme proposed to the north of Little Hadham which will impound flood water upstream of Little Hadham by embanking the rivers and restricting river flow downstream.

AGREED APPROACH

- Funding for the proposed bypass has been identified and the bypass will reduce the flood risk to properties within Hadham Ford. This hotspot will be progressed as a SWMP Non-Modelled Hotspot.

8.20 HOTSPOT EH05 – MARSH LANE INDUSTRIAL ESTATE, WARE

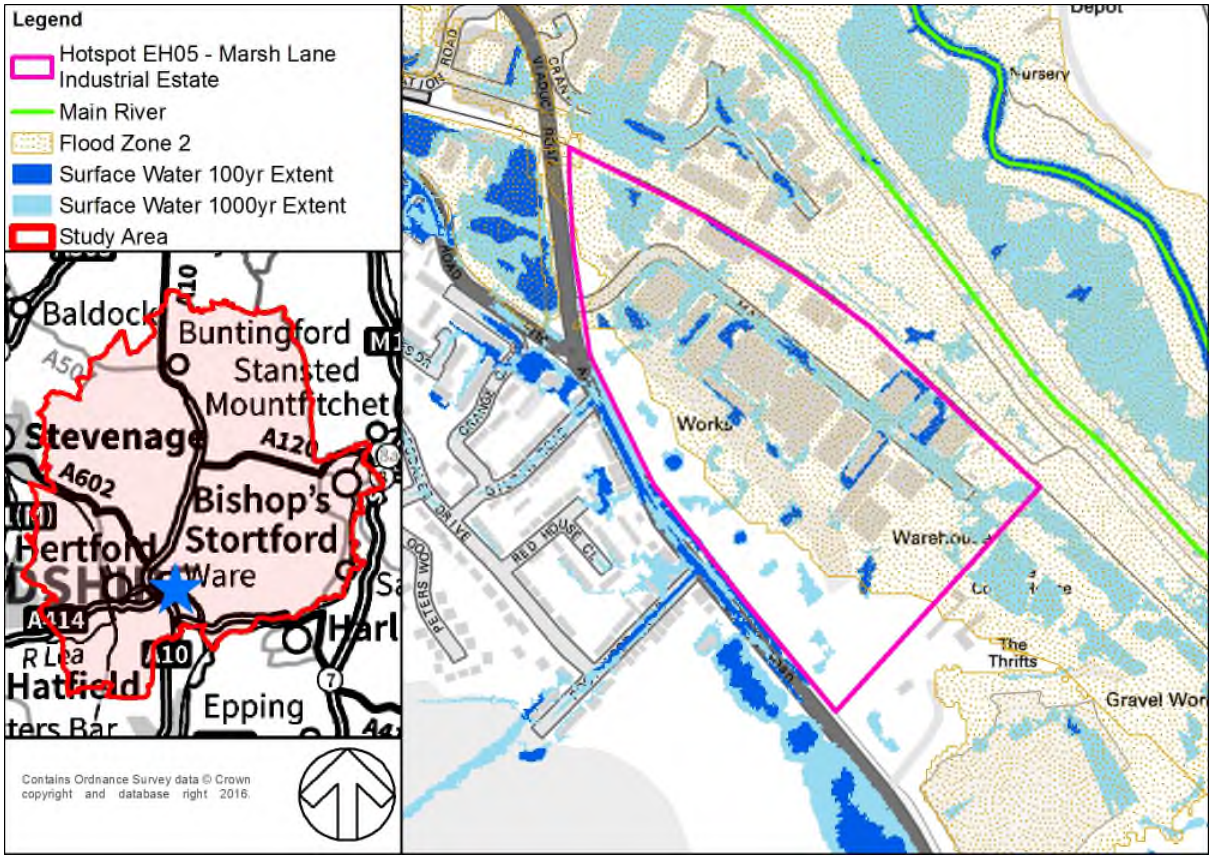

Figure 40: Hotspot EH05 – Marsh Lane Industrial Estate, Ware

KEY ISSUES

- Hotspot was raised by EHDC due to previous instances of flooding. The Marsh Lane Industrial Estate lies within Flood Zone 2, shown in Figure 40.

SUGGESTED APPROACH

- Take forward as a SWMP Non-Modelled Hotspot as it does not meet the criteria of a SWMP Modelled Hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- A site visit was conducted with representatives from WSP, HCC, EHDC and Draincare to assess the topography and suggested mechanisms for historical flooding that has occurred on site.
- During the site visit, an ordinary watercourse was observed running in a north-easterly direction at the south eastern end of Marsh Lane. This ditch was found to contain a lot of litter and detritus.
- At the southern end of Marsh Lane, in the eastern corner of the hotspot, existing drainage was found on a site under private ownership.

AGREED APPROACH

- Following discussions with a WSP, HCC, EHDC and Draincare representative's onsite, it was agreed to not progress the site for further hydraulic modelling as part of the SWMP study. The site is in private ownership and any studies on potential mitigation

solutions and funding of works is to be undertaken by the owners of the properties affected.

SITE VISIT PHOTOS

Figure 41: Ditch at southern end of Marsh Lane

Ditch contains a lot of detritus including bricks and bin bags.

Figure 42: Ditch continues into private land

Private land is owned by Cemex cement plant and is fenced off.

8.21 HOTSPOT EH06 – SOUTH WARE

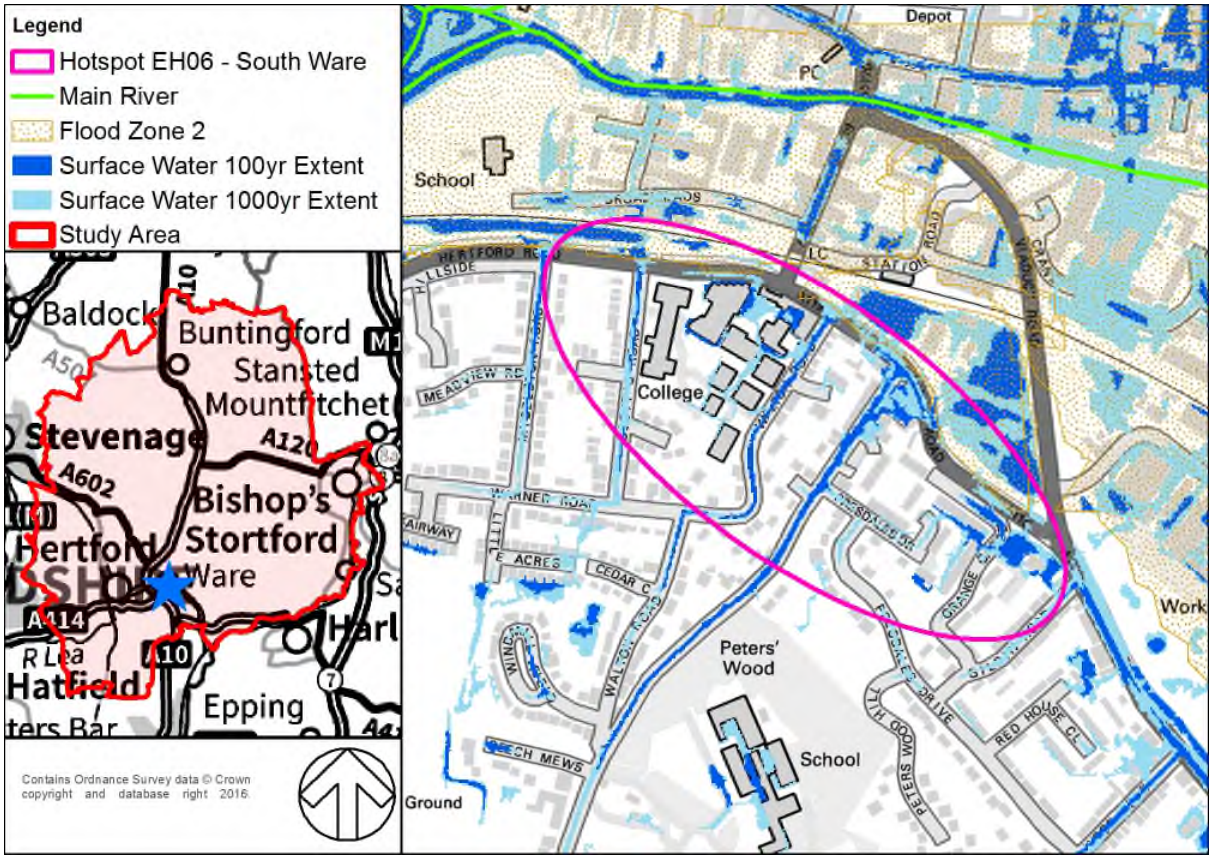

Figure 43: Hotspot EH06 – South Ware

KEY ISSUES

- Area raised by EHDC due to previous reported instances of flooding in the area.
- One reported flood incident in the area is thought to potentially be from the New River and a blocked grill. The New River runs parallel to Hertford Road / London Road (A119).

SUGGESTED APPROACH

- Document this hotspot as being discussed as part of the SWMP process in the SWMP report. The hotspot doesn't meet the criteria for a SWMP Modelled Hotspot.

LOCAL KNOWLEDGE / SITE VISIT OBSERVATIONS

- No site visit was undertaken for this hotspot.

AGREED APPROACH

- This hotspot is recommended as a SWMP Non-Modelled Hotspot, no further modelling required, recommendations and actions will be detailed in the final SWMP report.

9 SUMMARY

9.1.1 A Desk-Based analysis was conducted to assess the flood risk to receptors within the East Hertfordshire District. From this, 44 hotspots were analysed using a GIS Multi-Criteria Analysis (MCA) to prioritise the hotspots most at risk of flooding within East Hertfordshire.

9.1.2 A stakeholder meeting was held on 15th May 2015 to discuss the results of the analysis with relevant stakeholders and allow the 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 on 3rd June 2015, East Hertfordshire District Council also attended a number of sites visited. 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 42 Central Hertford;
2. Hotspot 8 St Margarets, / Stanstead Abbotts;
3. Hotspot 39 East Ware;
4. Hotspot 44 Benhooks Avenue, Bishop's Stortford;
5. Hotspot 1 Buntingford.

9.1.5 Following stakeholder engagement and site visits, two of the Desk-Based Identified Hotspots have been chosen to be progressed as SWMP Modelled Hotspots. It was decided that Hotspot 8 – St Margarets / Stanstead Abbots, Hotspot 39 – East Ware and Hotspot 42 – Central Hertford would not be taken forward for detail modelling and are therefore SWMP Non-Modelled Hotspots. Three other hotspots as a result of site visits, further analysis and stakeholder input have been chosen to be included as SWMP Modelled Hotspots. The final SWMP Modelled Hotspots to be taken forward for further assessment and detailed hydraulic modelling are:

1. Hotspot 1 Buntingford;
2. Hotspot 43 Hadham Road, Bishop's Stortford;
3. Hotspot 44 Benhooks Avenue, Bishop's Stortford;
4. Hotspot 47 Raynham Road, Bishop's Stortford;
5. Hotspot 40 Bengeo, Hertford.

9.1.6 The following hotspots are not being progressed further as SWMP Modelled Hotspots, however, they will be included in the SWMP as SWMP Non-Modelled Hotspots. Possible recommendations and actions are provided where appropriate in the following table (Table 7):

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

HOTSPOT NUMBER	LOCATION	RECOMMENDATIONS AND ACTIONS
à Hotspot 3	Puckeridge / Standon	Partner with the Environment Agency to work with them as they assess potential options.
à Hotspot 5	Watton at Stone	Increased maintenance of the ditch to the rear of properties on Great Innings North may alleviate some flood risk to nearby properties.

à	Hotspot 8	St Margarets / Stanstead Abbotts	Partner with the Environment Agency to work with them as they finalise their hydraulic model and potentially develop options.
à	Hotspot 18	Hormead	Property Level Protection (PLP) surveys could be conducted to make recommendations for home improvements to reduce flood risk.
à	Hotspot 25	Dane End	HCC to explore the possibility of a cut-off drain and channel diverting flows around residential properties.
à	Hotspot 27	Thundridge / High Cross	Work with EHDC and HCC Highways to gain a better understanding of the causes of historical flooding and if there are any small improvements that could reduce risk before considering recommending PLP measures.
à	Hotspot 28	Hadham Cross / Much Hadham	An Excel based analysis of the culvert underneath The Bull Inn could determine if there is adequate capacity in the culvert.
à	Hotspot 30	Hunsdon	Work with landowners to ensure maintenance is undertaken, consider enlarging the pond and/or improving outfall connectivity. Assess options for utilising the highway as a preferential flow path prior to considering PLP measures.
à	Hotspot 39	East Ware	Property Level Protection (PLP) surveys are to be considered for houses in the southern part of the hotspot in the areas surrounding Garlands Road.
à	Hotspot 41	Sele, Hertford	Ensure maintenance is prioritised to the highest risk areas to facilitate rapid drainage.
à	Hotspot 42	Central Hertford	No recommendations and actions for this hotspot at this stage. Recommendations and actions for mitigation could be developed from the results of the Environment Agency Hertford Fluvial Study. HCC, in conjunction with the Environment Agency, will be undertaking an Initial Assessment into the combined fluvial/pluvial flooding in Hertford. This study is due to encompass this central Hertford area.
à	Hotspot 46	Stansted Road, Bishop's Stortford	No recommendations and actions for this hotspot at this stage. Part of this hotspot will be included as part of the Raynham Road, Bishop's Stortford model, as part of the downstream flow path flows through Parsonage Lane and Stansted Road as it flows towards the River Stort.
à	Hotspot 58	Green Street, near Little Hadham	Assess options for utilising the highway as a preferential flow path prior to considering PLP measures.
à	Hotspot 61	Rhodes Avenue, Bishop's Stortford	Partner with the Environment Agency to ensure that this section of main river is considered for hydraulic modelling, potentially with a view for developing attenuation options on public open space between Lower Park Crescent, Thorley Hill and Thornbera Road.

à	Hotspot 75	Little Hadham	No recommendations and actions for this hotspot at this stage. This is due to the proposed A120 bypass and associated flood alleviation scheme, which is due to reduce flood risk at Little Hadham.
à	Hotspot EH01	Grange Paddocks / Stane Close	Consider the preferential flow paths and work with residents to ensure that these are not obstructed, ensure flap valve is present on surface water drainage network if deemed appropriate.
à	Hotspot EH02	Jackson Square / The Causeway, Bishop's Stortford	Consider the preferential flow paths, gully maintenance regimes and work with property owners to consider PLP as appropriate, ensure flap valve is present on surface water drainage network if deemed appropriate.
à	Hotspot EH03	Thorn Grove, Hockerill, Bishop's Stortford	Work with landowners to ensure maintenance is undertaken and the gully maintenance regime is appropriate.
à	Hotspot EH04	Ford End, Hadham Ford (near Little Hadham)	No recommendations and actions for this hotspot at this stage. This is due to the proposed A120 bypass and associated flood alleviation scheme, which is due to reduce flood risk at Ford End, Hadham Ford (downstream of Little Hadham).
à	Hotspot EH05	Marsh Lane Industrial Estate, Ware	Work with landowners to consider PLP as appropriate, riparian maintenance is undertaken and the gully maintenance regime is appropriate.
à	Hotspot EH06	South Ware	Consider the preferential flow paths, gully maintenance regimes and work with property owners to consider PLP, if required.

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.

DESCGROUP – The Descriptive Group is an attribute of the OS MasterMap data. It is used to theme the map data. The 'Building' Descriptive Group describes all buildings excluding glasshouses. More information can be found in the OS MasterMap Topography Layer User Guide Chapter 4 located at https://www.ordnancesurvey.co.uk/docs/user-guides/os-mastermap-topography-layer-user-guide.pdf

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 elevation schemes. They could be identified for both SWMP Modelled and SWMP Non-Modelled Hotspots.