



Norfolk County Council

Investigation Report into the flooding within the Norwich Urban Area during the summer of 2014

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Contents

1. Disclaimer	3
2. Executive Summary	4
3. Justification for Flood Investigation	7
4. Findings of the investigation	9
5. Rainfall events and data	17
6. General Location of flooding incident.....	18
A. Central City Catchments	20
B. Dalimond Catchment.....	27
C. Dobb’s Beck Catchment.....	34
D. Hellesdon Catchment	40
E. Riverside Catchments	47
F. Thorpe St Andrew Catchments	59
G. Other Flooding Locations	66
Appendix A - Key definitions and responsibilities.....	70

1. Disclaimer

- 1.1 Although every effort has been taken to ensure the accuracy of the information contained within this report, we cannot guarantee that the contents will always be current, accurate or complete.
- 1.2 This report has been prepared as part of Norfolk County Council's responsibilities under the Flood and Water Management Act 2010. It is intended to provide context and information to support the delivery of the local flood risk management strategy and should not be used for any other purpose.
- 1.3 The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.
- 1.4 The opinions, conclusions and any recommendations in this Report are based on assumptions made by Norfolk County Council when preparing this report, as well as, but not limited to, those key assumptions noted in the Report, including reliance on information provided by third parties.
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2. Executive Summary and Update on actions taken since January 2015

- 2.1 This report has been updated with those properties affected ¹during the rainfall events in 2014 that had not been investigated at the time of the publication of this report in January 2015. This should be read in conjunction with the [Addendum to the Flood Investigation Report 2014](#) (Ref: FIR008/A - Norwich Urban Area 2014) which provides an update on the actions taken by Risk Management Authorities and those affected by the flood events since the publication of the investigation report in January 2015. This report has been produced in consultation with Norwich City Council: Broadland District Council: Anglian Water and the Fire and Rescue Service in response to the flooding events that occurred across the Norwich urban area between May and October 2014.
- 2.2 The aim of the report is to determine the causes of the flooding and identify the roles and responsibilities of organisations to incidents of flooding. The report also recommends actions to reduce the impact or frequency of flooding in the future.
- 2.3 The organisations with responsibilities for managing the flooding incidents in the Norwich Urban Area are all classed as Risk Management Authorities. They are Anglian Water: Norfolk County Council (as Lead Local Flood Authority and Highways Authority): Norwich City Council as Highways Authority: and Broadland District Council.
- 2.4 Between late May and early October 2014 a series of rainfall events caused 80 properties to flood internally within the Norwich urban area. Two of these rainfall events caused the most impact to people, property and infrastructure and they occurred on the 27th of May and the 20th of July 2014.
- 2.5 In response to the flood events the Fire and Rescue Service, Norwich City and Norfolk County Council deployed services to provide assistance to the public. In some locations proactive investigations and remedial work has already been undertaken by Anglian Water and Highways Authorities to identify issues, clear and repair surface water systems to ensure that residents are better protected from flooding.
- 2.6 The key findings and recommendations are summarised below. More detailed or site specific recommendations are included later in the report on a catchment and street level basis.

Key Findings

¹ Marion Road, Pg. 48 (Ref: FWF/14/4/1789) & The Denes Pg. 60 (Ref: FWF/14/5/2044 & FWF/14/5/2043)

- 2.7 The report has highlighted a number of factors that contributed to the flooding;
- a) There are a large number of connected drainage systems which are in multiple ownership. Where maintenance on these systems is undertaken it is not coordinated between Anglian Water and the relevant Highways Authority.
 - b) It is difficult to determine within the Norwich City area when drainage cannot be maintained by contractors due to access constraints.
 - c) A lack of regular maintenance of drainage systems in the Norwich Urban Area. This is in part related to insufficient resources being allocated to regularly maintain drainage systems to their design capacity.
 - d) Highway drainage systems are not fully mapped or digitised. This makes it difficult to schedule appropriate risk based maintenance.
 - e) Private property owners have increased impermeable surfaces such as driveways. This has directed water off high ground to the areas of flooding quickly. In addition, property level drainage has in some cases been unmaintained or is insufficient to cope with the level of rainfall experienced.
 - f) A significant number of properties have flooded as they are located where the rainfall naturally concentrates along flow paths or low points. For example, certain areas of Norwich have been built in close proximity to historic watercourses and other areas have lost historic drainage features such as ponds.
 - g) Some localised areas experienced extreme rainfall. These events could not reasonably be accommodated by the design standard of the drainage system.
 - h) Planning decisions on certain new (post 2012) developments did not fully consider the flood risk to the development or the constraints in the local drainage infrastructure.

Key Recommendations

- 2.8 Maintenance of drainage systems
- a) There is a need for better coordination between Norwich City Council Highways and Anglian Water in relation to routine maintenance/works on the drainage systems in Norwich.
 - b) Norwich City Council Highways, Anglian Water and Norfolk County Council should prioritise the maintenance of drainage systems where there are known flooding issues.
 - c) More detailed record keeping of maintenance activities by Norwich City Council could be undertaken to ensure that any drainage systems not initially cleaned are recorded and revisited or included on the deep cleansing schedule (see section 4.37 for further explanation of the deep cleansing schedule)
- 2.9 Funding
- a) Risk Management Authorities could work together to apply for funding to mitigate flood risk associated with their areas of

responsibility. This could include large or small scale Sustainable Drainage Systems, provision of alternative points of discharge and provision of property level protection.

- b) Additional funding may be required to provide an increase in the level of maintenance of the drainage systems in priority areas as budget constraints currently limit levels of maintenance.

2.10 Improved understanding of drainage capacity and surface water flows

- a) Increase the number of rainfall gauges across Norwich to ensure all areas of high risk have access to rainfall event data.
- b) Share information (including mapping) between Risk Management Authorities to ensure that the responsibilities and capacity of surface water, foul and combined systems are identified.
- c) Utilise evidence from the Anglian Water Sustainable Drainage System pilot project to identify the preferred locations for the infiltration of excess surface water.
- d) Utilise updated surface water and catchment mapping across organisations to inform plans and projects.

2.11 Planning

- a) Local Planning authorities should work closely with the Lead Local Flood Authority and Environment Agency to fully consider and incorporate lessons learnt from flood investigations in relation to proposed development.
- b) Local Planning Authorities should note that there is an automatic right to connect to the public sewer. As such, Anglian Water's ability to reduce the risk of flooding within current systems is limited if new development is approved in a manner which does not provide appropriate mitigation. Despite Anglian Water not being a statutory consultee to the planning process, Local Planning Authorities should include Anglian Water as a consultee for significant developments.

3. Justification for Flood Investigation

- 3.1 It was deemed necessary to complete a formal investigation into the flood incidents that occurred across the Norwich Urban Area from May to October 2014 onwards as:
- a) Multiple residential properties were internally flooded
 - b) Multiple commercial properties were internally flooded
 - c) A number of schools (classed by Defra as critical infrastructure) were internally flooded
- 3.2 This impact met Norfolk County Council's threshold for triggering the undertaking of a formal flood investigation. The criteria below is used by Norfolk County Council as a basis for determining whether the event has, or is likely to, increase flood risk and what the consequences of any increase in risk may be.
- Any risk to loss of life or serious injury
 - One or more residential or business property flooded internally
 - One or more Critical Services/Installations and Vulnerable Persons properties flooded internally; and/or rendered inoperable or their functions severely compromised due to the access to the premises being impassable; and/or resulting in a loss of service impacting on the local community.
 - Any section of a national category 3 road or above made impassable due to flooding; and/or flooding to priority 1 and 2 gritting routes.
 - Flooding adversely impacting a rail link by making it impassable.

The purpose of the report

- 3.3 The purpose of this report relates to Section 19 of the Flood and Water Management Act 2010. This legislation sets out that the County Council, in its role as Lead Local Flood Authority for Norfolk, should investigate the role and response of organisations to significant flooding incidents. Significant flooding is deemed to be those incidents that impact upon people, property and infrastructure.
- 3.4 The flood investigation report aims to:
- provide a transparent and consistent review of recent flooding
 - identify those organisations and individuals who have responsibility to manage the causes of the flooding
 - identify what their response has been or will be to the flooding
 - make recommendations as to how the flood risk could be mitigated or reduced
 - provide new evidence for the level of risk faced by

communities in Norwich, which can be used in current funding bids for flood mitigation schemes

3.5 Mitigation measures include property level protection: reinstating lost drainage features: reviewing or increasing maintenance regimes and increasing the capacity of the drainage network.

3.6 It is the intention of the Lead Local Flood Authority to monitor the progress of Risk Management Authorities in meeting the recommendations of this report. As such, we will publish an addendum, a year after publication of this report, which will outline the actions undertaken by Risk Management Authorities to better protect residents and properties in Norwich.

4. Findings of the investigation

- 4.1 This section sets out the key themes that have been identified during the course of the flood investigation, and that apply across the Norwich urban area. These findings are set against previous studies undertaken in Norwich, and the Government's proposed changes to funding and insurance.

Impacts of the summer rainfall

- 4.2 Between late May and early October 2014, 71 properties flooded internally within the Norwich Urban Area. This number rises to 77 if you take into account properties that were flooded as a result of structural failure. A significant number of these properties have been flooded on more than one occasion over this period. Of the 10 rainfall events that caused internal flooding: the two events of 27 May and 20 July 2014 caused the most disruption to people, property and infrastructure. These two rainfall events were calculated to be 1 in 16 year and 1 in 121 year events respectively.
- 4.3 The possibility of heavy storms had been forecast and warnings had been issued by the Met Office and the national Flood Forecasting Centre in over half of the flood events that affected Norwich and Broadland. However, the precise locations of such storms cannot be predicted by current technology. As a result the warnings can cover the whole of the county, region or most of the country.
- 4.4 Properties suffering from structural issues - At least 6 properties reported flooding² related to structural issues³ caused by heavy rainfall. Three of these incidents occurred on the 27 May rainfall event, one occurred on the 24 June⁴ and two on the 20 July⁵ rainfall events. All the properties impacted were commercial properties. This trend may relate to the type of building construction, as the nature of these structural issues has generally included damage to roofing, allowing ingress of water. In some incidents this was caused or exacerbated by a lack of maintenance of guttering associated with flat roofing. Whilst this type of flooding is not something that is looked into in any further detail as part of this report, it is evidenced by media articles and private communications to the partnership group. The locations of flooding

² EDP24 Article; Video: Heavy rain causes ceiling collapse at McDonald's restaurant (Case 749) near Norwich, Thursday, May 29, 2014. [Link](#); EDP24 Article; Norwich furniture showroom (Case 746) forced to close following flood, Thursday, May 29, 2014. [Link](#); Business Staff 2014 pers. Comm., 4 Nov (Case 1047)

³ Flood Questionnaire received 16 July 2014 (Case 726).

⁴ EDP24 Article: Cavell Primary to close on Wednesday after sudden downpour floods school, Tuesday, June 24, 2014 (Case 1002)

http://www.edp24.co.uk/news/education/cavell_primary_to_close_on_wednesday_after_sudden_downpour_floods_school_1_3655277

⁵ Tesco's Duty Manager 2014 pers. comm., 14 Oct

caused by structural failure are widely distributed across the urban area, and include the city centre both East and West of the River Wensum, as well as locations in the Broadland District area.

- 4.5 Highways flooding – During the rainfall events over the summer, a number of highways were flooded. Whilst these were generally passable with care, a number of reports highlighted that cars driving through flood water caused bow waves which exacerbated flooding for adjacent residents. In some locations, water ran off adjacent land and along the highway, causing problems for users and adjacent residents. In addition, a small number of roads were damaged by manholes lifting in flood conditions. These instances were repaired by Anglian Water but led to road closures, one of which occurred during the Norfolk Show period. Reactive cleansing of systems was also undertaken where there was an identified need and flooding had occurred.
- 4.6 Sewer flooding – During the rainfall events over the summer significant impacts were seen on the sewer network within the Norwich urban area. At times of heavy rainfall, parts of the sewer system became overloaded, and issues became apparent in locations where previously there had been none. The heavy rain led to increased customer demand being placed on operational teams across East Anglia, and in particular in the Norwich area. In order to address this additional work load, Anglian Water drew on support from contractors as well as other operational areas of the business to deal with issues in the sewers and at pumping stations.

Post event, significant work included clearing blockages, clean up at flooded locations and investigations that include jetting and CCTV of the sewer system.

- 4.7 External flooding – Whilst it has been attempted to highlight the spatial distribution of properties affected by external flooding, many more properties are likely to have been affected than those reported to authorities.

Tactical response

- 4.8 Prior to the flooding in the summer, Defra grant-funded training and equipment for emergency flood response for the three fire stations in Norwich. This was part of a wider programme across the County's Fire and Rescue Service.
- 4.9 In response to the flood events, a number of organisations deployed services to provide assistance to the public. During the initial response period this generally tended to be the Fire and Rescue Service (88 responses), Anglian Water Services Ltd and the Highway Departments of Norwich City and Norfolk County Council. The responses of these organisations has involved the pumping out or jetting of water management systems in an attempt to clear flood waters from affected

premises, as well as the provision of face-to-face advice to residents. In addition, the Fire and Rescue Service also provided an update by telephone to local emergency planning officers within district authorities to ensure they were kept informed about the flood events.

- 4.10 The public response to the flooding events has been varied. A number of residents and business owners have proactively protected their properties; others contacted emergency services, council services and water companies to seek support. These services include the deployment of drain clearing and traffic management teams. In many cases it should be noted that in high intensity rainfall events, it is unlikely that all requested resources could be deployed quickly enough to be effective.
- 4.11 Some residents sought access to sandbags from Districts and the County Council. It should be noted that this facility is no longer available as sandbags can be difficult to distribute in time: ineffective against flood water and hard to dispose of.

Partnership working and response

- 4.12 Following the high number of flooding reports in the Norwich Urban Area, Anglian Water: Norwich City Council: Broadland District Council and Norfolk County Council formed a working group to take forward the large number of investigations. As part of the investigation process many flood questionnaires were circulated to residents and companies affected by flooding. These were then collated and shared between authorities to ensure that reports and information was not overlooked.
- 4.13 Officers from all organisations have undertaken site visits to the locations affected by flooding and spoken with many affected residents. Additionally, officers have met with representatives from the affected communities including Parish, District and County Councillors, as well as Members of Parliament. The information received from residents, risk management authorities (see Appendix A for a description of risk management authorities), elected representatives, and through on-site investigations has been collated and summarised in this report.

Work undertaken as of November 2014

- 4.14 During the investigation process, initial remedial work has been carried out on the drainage network. This has included de-silting and cleaning, removing obstructions and repairing damaged structures and surfaces. For details on where this work has been undertaken please see the investigation findings tables for each catchment or area.
- 4.15 Relevant Risk Management Authorities, affected parties and local councillors have been consulted on the Flood Investigation Report to ensure that the final document accurately reflects the flood events, responses and recommendations.

- 4.16 Public events were undertaken in November and December 2014 in Hellesdon, Sprowston and Thorpe Hamlet. These public events provided an opportunity for officers, residents and councillors to discuss the impact of the flooding, remedial work undertaken and ways of reducing the flood risk in the future.

Previous studies into surface water flooding

- 4.17 Prior to the events of 2014 broad-scale national predictive surface water modelling identified Norwich as one of the top 50 areas outside London at significant risk from surface water flooding. This modelling suggested approximately 6,500 properties were at risk within the urban area⁶.
- 4.18 Due to the City's level of risk, Defra funded multi-agency work to deliver a Surface Water Management Plan (SWMP) for the area. This document called the "Norwich Urban Area SWMP" was completed in May 2012, and covered all of the Norwich City Council area and the connected urban areas of South Norfolk and Broadland District Councils⁷. This study produced surface water mapping of extreme rainfall events; identified 3 key areas where the risk of flooding is most concentrated, and an action plan of measures to lessen the impact of this risk. It is of note that 8 properties in 1 of these key areas, Catton Grove and Sewell Critical Drainage Catchment (Dalimond), suffered internal flooding across the summer. Currently the Environment Agency and Anglian Water have allocated funding for Norfolk County Council to develop projects in these areas to reduce flood risk. These projects should commence in 2016.
- 4.19 Following this study and as part of this report, detailed surface water catchments were identified across the urban area. The risk mapping was then redone to provide a risk context for this report. While it is not a direct comparison, this modelling identified over 3,000 properties at risk in the 1 in 30 year rainfall event and over 7,000 properties at risk in the 1 in 100 year rainfall event across the 14 catchments in Norwich and Broadland that suffered flooding during the summer.
- 4.20 This report provides evidence that supports current funding bids for flood mitigation schemes. During the summer flooding further work was undertaken to produce accurate evidence to support these bids. This work remodelled the surface water flooding and assessed the most cost effective mitigation measures to be taken forward.

⁶ Norwich Urban Area Surface Water Management Plan Briefing Note 6 December 2010

⁷ Norwich Urban Area Surface Water Management Plan, Prepared for Norfolk County Council; adopted 14 May 2012; [Link](#)

Types and capacity of piped systems

- 4.21 There are three types of piped system within the Norwich urban area. Those systems that convey surface water only, those that convey foul water only, and those combined systems that convey both surface and foul water. Responsibility for the majority of these systems is split between highway authorities and the water company.
- 4.22 Anglian Water is responsible for the foul sewer network including combined sewers. These take the foul water from residents/businesses and convey them to sewage treatment plants. In a number of urban areas misconnections to the sewer system occur where surface water drainage is connected to foul water sewers, or waste appliances are connected to the surface water systems.
- 4.23 Surface water from impermeable areas such as roofs and roads makes its way into the surface water drainage network. In some instances these connect to an Anglian Water sewer network, and in others they discharge into soakaways or watercourses.
- 4.24 Highways authorities have responsibility for those surface water systems that serve the highway until they discharge into a wider network, which can be in private or public ownership. Property level surface water systems are usually in private ownership. It should be noted that highway surface water systems are not designed to provide protection for third party land or assets even where private connections exist.
- 4.25 The drainage network that serves the Norwich urban area has a finite capacity. The UK industry design standard for new piped systems including sewers (foul and surface water) states that new piped systems should be built to ensure they do not surcharge in the 1 in 1 or 1 in 2 year rainfall event. Higher standards of flood protection can be provided within some networks but generally do not accommodate return periods above the 1:30 year rainfall event. The many rainfall events that occurred between May and October highlighted issues with the maintenance of drainage systems in Norwich. In addition, some localised areas experienced extreme rainfall that could not be accommodated by the design standard of the drainage systems.
- 4.26 Prior to the 1970's, drainage systems were built to variable design standards. In addition historic drainage systems have been subject to increasing pressures as they have been utilised to serve new development. Therefore the level of protection provided to properties is varied and its level of resilience then depends upon regular maintenance.

Norfolk County Council highway drainage maintenance approach

- 4.31 A number of road drainage systems within the affected areas (e.g. Sprowston and Hellesdon), have specific surface water drainage systems that discharge into a watercourse or the ground (via soakaways or boreholes). A highway surface water system will normally comprise of gullies with catchpits (to capture debris/silt), which are then connected to a pipe, which will then outfall into a watercourse (open or culverted) or the ground.
- 4.32 Norfolk County Council Highways undertake routine maintenance to keep drainage assets operational, as set out in the authorities Transport Asset Management Plan (TAMP).
- 4.33 Norfolk County Council clean highways gullies on a cyclic schedule which varies from annual to biannual. The priority network is cleansed on an annual basis. Where there are known flooding issues these will also be cleansed on an annual basis. Where access to gullies has been obstructed (e.g. by parked cars), then the contractor will revisit the site.
- 4.34 The pipe network and the subsequent underground structures e.g. soakways/boreholes that receive the highway water, were annually cleansed up until 2006/7. Thereafter these systems have been reactively maintained e.g. maintenance activities are only undertaken once problems are reported to them. This change has been due to a reduction in the budget for drainage maintenance. The implication of this approach is that systems may operate below their design capacity.
- 4.35 Where highway drainage systems are absent or inadequate, the County Council will consider implementing capital drainage schemes which are prioritised according to a range of factors including impact and frequency of flooding.

Norwich City Council's Highway drainage maintenance approach

- 4.36 Norfolk County Council has an agreement with Norwich City Council to maintain the highway network within the City Council area. A large proportion of the highway drainage network within the city drains into Anglian Water sewers (surface water, foul and combined). The highway drainage maintenance programme requires approx. 21,000 highway and footway gullies and catch pits to be cleansed every 24 months⁸.
- 4.37 Where it is identified that the majority of gullies and catch pits cannot be cleansed, (e.g. due to parked cars), then the contractor will revisit the site again on another day. Where access cannot be secured these roads will then be placed on a separate deep cleansing schedule and cleaned every 36 months. Previous high risk areas have been cleaned

⁸ In the contract the cyclical cleansing programme should be annually

on a more frequent basis. The deep cleansing programme involves a request for the removal of the parked cars, (via letters to residents and signs and cones placed within the street). Once the cars are removed the gullies, catch pits and pipework are cleaned and jetted. The road is cleaned at the same time to ensure detritus that could block gullies is removed.

- 4.38 The wide scale practice of on-street parking within the City Council area restricts access to drainage, and means it can often be inaccessible to contractors for cleansing. In addition, there is no routine logging and reporting of road drainage not cleansed due to access constraints (e.g. parked cars). It should be noted that whilst the highway gullies and catch pits are cleaned, the pipework that directs water to the main sewer network are not routinely cleaned.

Anglian Water drainage maintenance approach

- 4.39 Anglian Water's stated approach to maintenance is that they undertake a planned preventative maintenance (PPM) programme in the Norwich area. This is a proactive programme of work that involves the prioritisation of maintenance based on a number of criteria, which include history of flooding to properties; risk within the Anglian Water catchment; levels of Fats, Oils and Grease (FOG's) identified in the system and pollution incidents. This proactive maintenance programme, for sewer sections identified as being at risk of blockage, runs alongside a reactive programme of works which deals with issues as they arise.
- 4.40 Emergency sewer repairs are addressed within 1 week in order to restore service to customers. If additional work is required to resolve the situation, funding has to be secured via the Anglian Water capital programme. To be successful as part of this programme, a scheme would have to meet wider water company priorities and cost benefit analysis. Where risk has been identified and a bid for capital works has been made, mitigation and on-going planned maintenance continues until such a time as the capital bid is initiated.

Economic impacts

- 4.41 The cost effectiveness of flood alleviation schemes is derived by measuring the cost of the scheme against the reduction in risk to properties. This process enables the estimation of the value of household damages being avoided if the scheme is implemented. For simplicity, the government assumes each flood causes a maximum of £30,000 of damages per household. The Government bases this figure on insurance claim data as well as evidence⁹ from the floods in 2007.

⁹ ref: Flood and Coastal Resilience Partnership Funding - an introductory guide DEFRA, 23 May 2011

- 4.42 Using this calculation, it can be estimated that the cost of damages to the 51 residential buildings that are known to have suffered internal flooding comes to over £1.5 million. The other 29 properties impacted by the flooding were either commercial or public buildings. The economic and service impacts on these properties are more difficult to estimate, however the scope of impacts include damage to property, loss of stock and trade as well as the cost of repair and recovery. One example of these impacts the Council has been made aware of was a business that incurred costs of over £450,000 due to loss of trade and damage to property.
- 4.43 14 buildings owned by Norfolk County Council made claims on their insurance for damages caused by water ingress. These claims came to just over £100,000. This does not cover all the costs that were incurred as these are not all associated with insurance claims.
- 4.44 Less widely recognised are the significant longer term detrimental health and economic effects of flooding. Studies following similar flooding events to those recently suffered in Norwich have shown the incidence of physical and mental health disorders such as depression and post-traumatic stress to be significantly higher in people in the months following flooding incidents. This puts further strain on public health services and a knock-on negative effect on the economy due to higher instances of absence from work¹⁰.
- 4.45 The Norfolk Community Foundation and Eastern Daily Press (EDP) Flood Appeal provided financial support to a small number of residents in need following the flooding incidents. These funds were raised through donations from the public and businesses.

Insurance

- 4.46 People whose homes have been flooded in the past or who live in flood-prone areas can find it more difficult than others to access affordable insurance. This is because it is the responsibility of the house owner to notify their insurer of flooding to the property and because Government has made flood risk mapping publically available and open to use by the insurance industry.
- 4.47 The figures of internal flooding referenced in this report represent a minimum of the total number of affected properties across Norwich. This is due to under-reporting of incidents by those residents and businesses who do not want their experience of flooding to increase their insurance premiums or to affect the sale of their property.

¹⁰ Kenichi Azuma, Koichi Ikeda, Naoki Kagi, U Yanagi, Kenichi Hasegawa & Haruki Osawa (2014) Effects of water-damaged homes after flooding: health status of the residents and the environmental risk factors, International Journal of Environmental Health Research, 24:2,158-175, DOI: 10.1080/09603123.2013.800964

5. Rainfall events and data

- 5.1 A large number of intense rainfall events fell across the County of Norfolk between late May and early October 2014. These include events that led to the internal flooding of properties that occurred on the 27 May, 5 June, 26-27 June, 8-9 July, 13 July, 20 July, 10 August, 13 October. Significant numbers of properties were impacted by the 27 May and 20 July rainfall events with a number of properties being flooded internally by both. These are analysed in more detail in the paragraphs below;
- 5.2 **27 May Rainfall Event** – 39.4mm was recorded as falling in 4hrs 15mins by Heigham rainfall monitoring station. This intensity of rainfall equates to a 1 in 16 year rainfall event¹¹.
- 5.3 **20 July Rainfall Event** – Hourly rainfall totals from the Norwich Airport rainfall monitoring station show 45.8mm fell in 1 hour from 14:00. This intensity of rainfall equates to a 1 in 121 year rainfall event¹².

Rainfall data

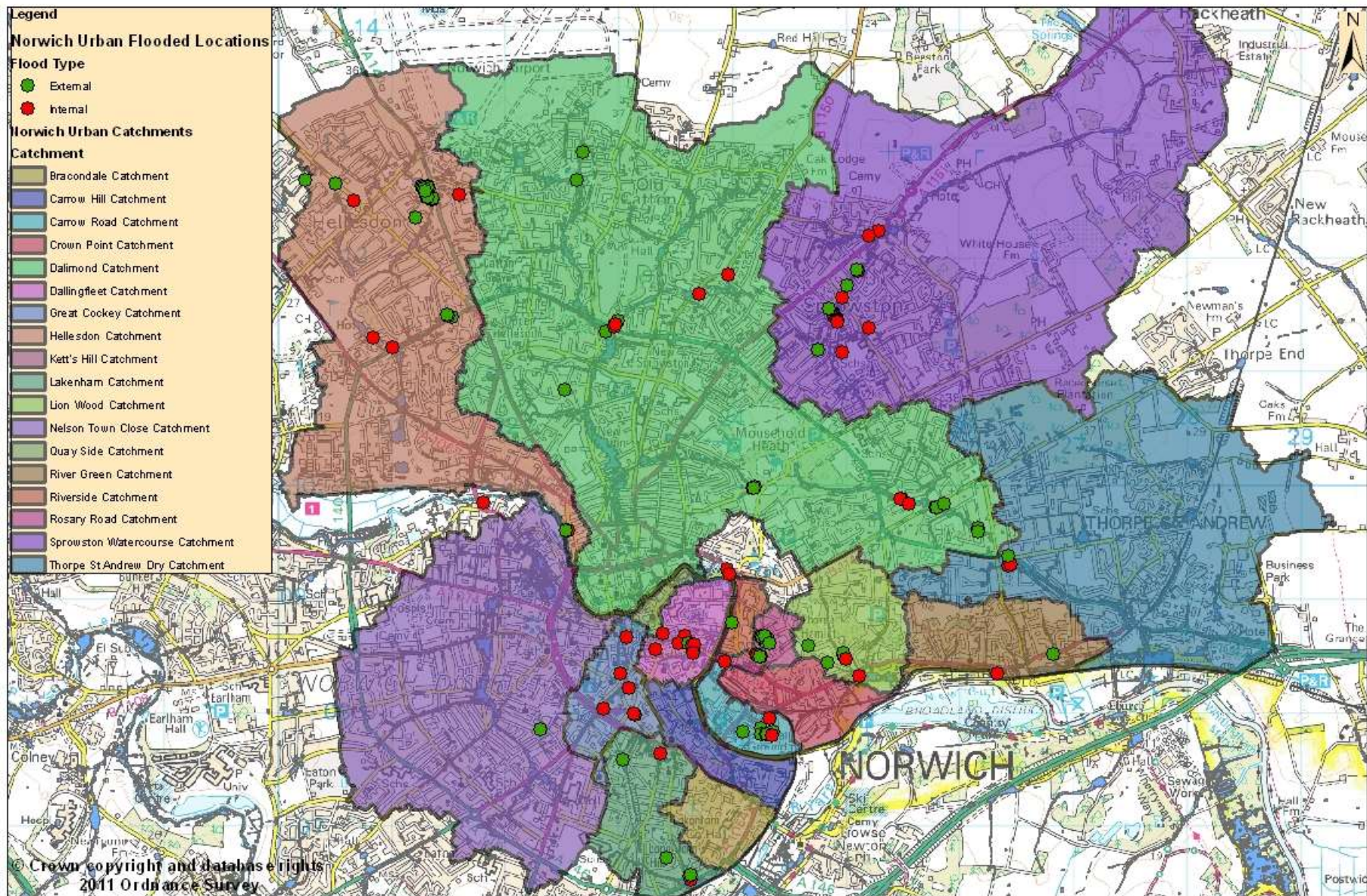
- 5.4 Data from rain gauges in Heigham Street and Norwich Airport has been analysed to determine the intensity of the rainfall events experienced across the city. This analysis is also useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas were exceeded. To ensure that any analysis reflects the localised nature of these events a 2.5km radius from these instruments has been used.
- 5.5 Whilst this process is in line with British Standards, it means that 23 (29%) of the 80 locations of internal flooding are within the operating range of these gauges. This largely covers the catchments of Hellesdon, Dalimond, Dallingfleet and the Great Cockey. For areas of flooding outside this coverage it is difficult to assess the return period of the rainfall event and consequently if the drainage system could have reasonably been able to cope.

¹¹ Calculated using the Flood Estimation Handbook event rarity method.

¹² Met Office rainfall analysis report for Anglian Water (6 June and 29 September 2014)

6. General Location of flooding incident

- 6.1 The flooding that occurred between May and October impacted across a large area of the city of Norwich including its surrounding conurbations. To aid the investigation process and, for ease of presentation, the incidents of flooding have been grouped within this document based on hydrological catchments.
- 6.2 Hydrological catchments catch water (particularly rainfall) and discharge it at locations known as outlets. Individual hydrological catchment boundaries are usually formed by ridges of surrounding higher ground, which separate the lower lying areas at a line known as a watershed.
- 6.3 The purpose of viewing flooding incidents based on hydrological catchments primarily reflects the reality that flooding does not respect administrative boundaries. As catchment areas describe a specific topographic extent it is not unusual that flood management activities connect organisations with different administrative boundaries.
- 6.4 The hydrological divisions presented within this report are;
- A. Central City Catchments
 - B. Dalimond Catchment (Catton Grove & Sewell)
 - C. Dobb's Beck Catchment (Sprowston)
 - D. Hellesdon Catchment
 - E. Riverside Catchments
 - F. Thorpe St Andrew Catchments
 - G. Other flooding locations



Map 1: Catchments that cover the Norwich Urban Area

A. Central City Catchments

7. Location of the flood incidents within the catchment

7.1 This section of the report covers the central city area, (see Map 2) and is bounded by the River Wensum to the North and East and by high ground to the West and South. This topography can be separated into two localised catchments associated with historic watercourses; the Great Cockey watercourse and the Dallingfleet watercourse. These historic watercourses have catchment areas (high ground) which direct water into them and it is these catchment areas that are used within this section of the report.

7.2 In broad terms;

- The Great Cockey catchment reflects the path of a historic watercourse within Mancroft Ward and flows south to north towards the River Wensum, broadly between Duke's Bridge and St George's Bridge.
- The Dallingfleet catchment reflects in part the path of a historic watercourse within Thorpe Hamlet Ward and flows west to east towards the River Wensum.

7.3 Both catchments direct water into the River Wensum, a tributary of the River Yare, via numerous outfalls from the local surface water management systems.

7.4 The number of properties at flood risk within these catchments is set out below for 2 different rainfall events;

	1 in 30	1 in 100
Great Cockey Catchment	271 properties	405 properties
Dallingfleet Catchment	95 properties	214 properties

8. Flood Incidents as reported

8.1 The number of properties flooded internally within this area is 13. The majority of these properties were flooded in the 27 May 2014 rainfall event with a number of properties affected by the 20 July 2014 rainfall event. A number of properties have been affected more than twice.

8.2 The breakdown of flooding incidents by event is listed below; (please see Map 2 for approximate locations of incidents within the catchment).

Dallingfleet catchment

- 8.3 **Prince of Wales Road** - 5 properties reported internal flooding on Prince of Wales Road¹³. The majority of these properties were flooded on the 27 May and the 20 July 2014 rainfall events. These incidents were reported by the Fire & Rescue Service, Norwich City Council and the media¹⁴.
- 8.4 **St Faiths Lane** – 1 property was internally flooded on 27 May 2014. This incident was reported by the Fire & Rescue Service¹⁵.
- 8.5 **Eastbourne Place** – 1 property was internally flooded on Eastbourne Place. This property was flooded on the 27 May, 20 July and 13 October 2014 rainfall events¹⁶. This incident was reported by the Fire & Rescue Service and Norwich City Council.
- 8.6 **Upper King Street** – 1 property was internally flooded on Upper King Street¹⁷. This property was flooded on the 27 May 2014 rainfall event. This incident was reported by the Fire & Rescue Service.

Great Cockey catchment

- 8.7 **Bedford Street** – 1 property was internally flooded¹⁸ on Bedford Street. This property was flooded by early April and 27 May 2014 rainfall events. These incidents were reported by the resident directly to the LLFA.
- 8.8 **Westlegate** – 1 property was internally flooded on Westlegate. This property was flooded on the 20 July 2014 rainfall event¹⁹. This incident was reported by the Fire & Rescue Service and Norwich City Council.
- 8.9 **Surrey Street** – 2 properties were internally flooded on Surrey Street²⁰. These properties were flooded on 20 July 2014 rainfall event. This incident was report by the property owners to the LLFA.
- 8.10 **Orford Place** – 1 property was internally flooded on Orford Place²¹. This property was flooded on the 27 May and July 2014 rainfall events. These incidents were reported by Anglian Water Services Ltd.

¹³ Report by Norwich City Council detailing visit to Prince of Wales Road on Monday 21 July 2014 following flooding on Sunday 20 July 2014, (991, 992, 993, 996); Email correspondence from Norwich City Council 2 June 2014 & Business staff 2014 pers. comm., 31 Oct (996 & 997).

¹⁴ EDP24 Article May 27, 2014 Fire service issues flooding advice after 25 call outs in central Norwich, (991)

¹⁵ Fire Service Report June 2014 (Case 1011)

¹⁶ Flood questionnaire for case 990;

¹⁷ Flood questionnaire for case 989

¹⁸ Flood questionnaire for case file 988

¹⁹ Email correspondence from Norwich City Council to LLFA received 24 September 2014 (954)

²⁰ Email correspondence from property owners (728 & 950)

²¹ Business staff 2014 pers. comm., 31 Oct (987)

9. Desk Study

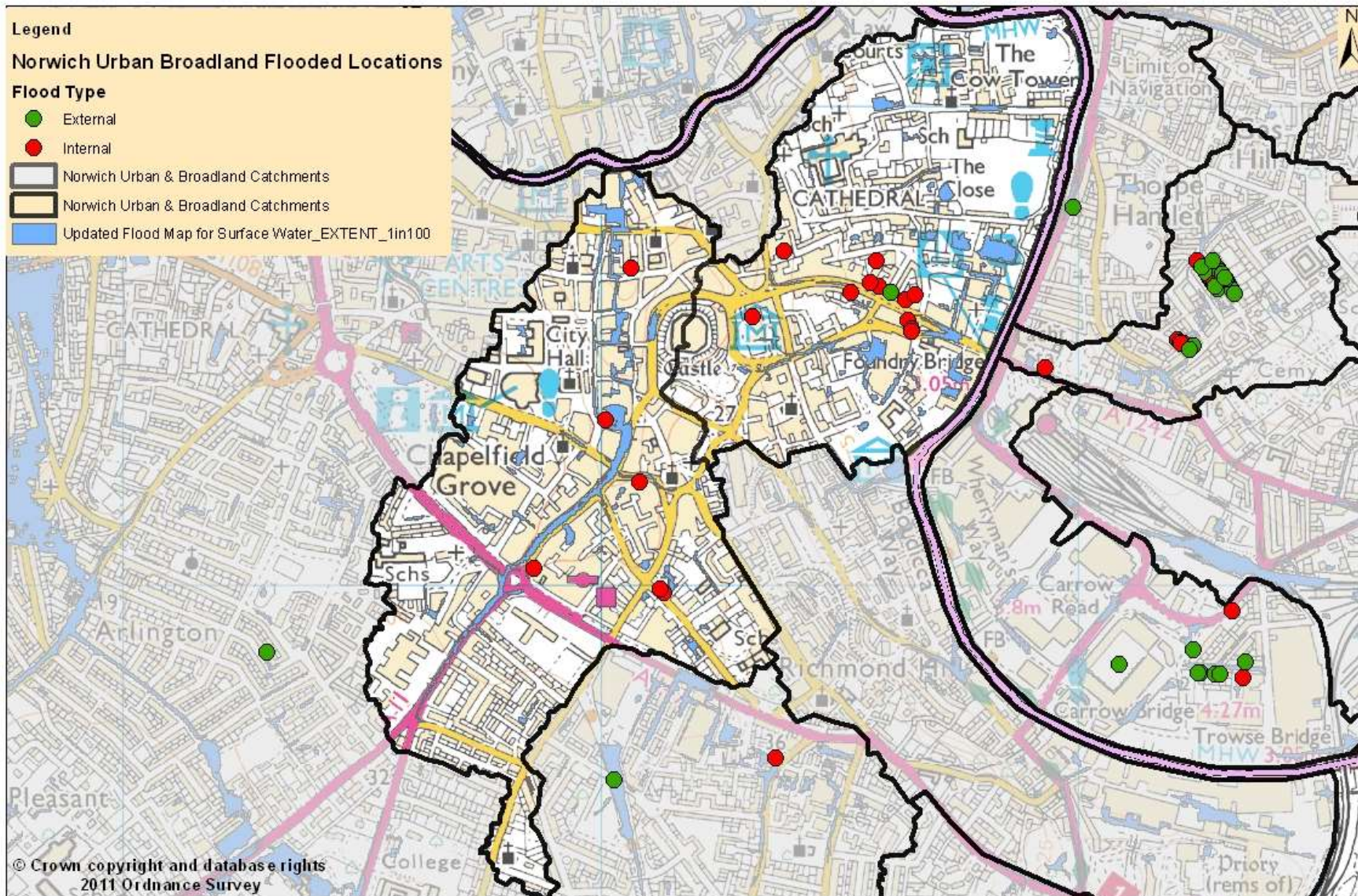
- 9.1 The flooding incidents within the Central City area are:
- Situated within an area of geology likely to have good rates of infiltration.
 - Located within Norwich City Council's administrative boundary
 - Located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
 - Associated with surface water overland flow paths mentioned above in section 8.
 - Likely to be served by historic drainage systems which have been developed and redeveloped over many years.
 - Outside elements of the catchments that are within Flood Zones 2 & 3. The events being investigated are surface water events and as such proximity to Flood Zones may indicate river levels have an influence on surface water drainage particularly where outfalls are subjected to tidal effect
 - Less than 2.5 km from an Environment Agency rain gauge
 - Covered by the flood risk modelling in the Norwich Urban Area Surface Water Management Plan. The area was not taken forward for detailed assessment and no location specific actions exist in the plan to mitigate surface water flood risk.
 - Near to highway that is publically maintainable and that is drained by highway systems within the carriageway.
 - Shown by Anglian Water records to be served by combined and foul water sewers.
- 9.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Anglian Water, Norwich City Council Highways and riparian owners.

10. Summary of impacts

- 10.1 Information relating to the impacts²² experienced at the flood location are detailed below;

Risk to life: No
Internal Flooding: Yes
External Flooding: Yes
Critical services: No
Priority Routes: Yes
Obstruction of Access: No

²² These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.



Map 2: City Centre Catchments-Showing key flow paths and approximate locations of flooding

11. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ²³
<p>Dallingfleet Catchment</p> <p>Prince of Wales Road</p> <p>St Faiths Lane</p> <p>Eastbourne Place</p> <p>Upper King Street</p>	<p>[7] Run-off from significant rainfall was directed into the combined foul and surface water drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties.</p> <p>[10] Due to development of impermeable surfaces localised ground conditions caused water run-off to be directed quickly from where it falls as rain to the areas of flooding in Prince of Wales Road, Eastbourne Place, St Faiths Lane</p> <p>The above causes were exacerbated by the factors below:</p> <p>[A] Water is directed from properties surface water connections (rain water downpipes) in Cathedral St. into the foul water drainage network exceeding its design capacity. This is due to connections from properties into the existing drainage network.</p>	<p>Anglian Water Services (AWS) Ltd for cause 7 and A.</p> <p>Property owners for causes B.</p>	<p>The Fire & Rescue service pumped out a number of properties on the 27 May.</p> <p>Norwich City Council visited a number of properties on the 21 July to assess the impacts of the 20 July flood event.</p> <p>Anglian Water cleaned and surveyed the combined and separate surface water sewers that serve the properties within Prince of Wales Road. This included the removal of fats,</p>	<p>(R4) Anglian Water Services Ltd could determine the wider systems integrity and/or capacity and identify where the drainage network conveys flows to.</p> <p>(R8) Based on investigations into the capacity of the drainage system, Anglian Water could consider the feasibility for a capital drainage scheme in the medium to long term to improve the capacity. This would be dependant on available funding and based on a cost benefit basis.</p> <p>(R7) Where the rainfall event exceeded the design capacity of the drainage system Anglian Water could communicate to affected residents to explain how they would support on-going partnership projects e.g. Surface Water Management Plans.</p> <p>(R12) The property owners could protect their buildings through flood</p>

²³ The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ²³
	<p>[B] The structures of the affected properties within the catchment were not able to withstand the impacts of flood water. As such flood water entered the property through a variety of mechanisms e.g. low thresholds on entrances and unsealed cellar doors.</p>		<p>oils, greases which were restricting the flow within a section of the sewer.</p> <p>It was confirmed that there were surface water connections being redirected to the foul sewer. Advice was provided to property owners that if the surface water down pipes were removed from the foul sewer and connected to the correct system, it would reduce the risk of flooding in future.</p>	<p>protection measures where appropriate.</p>
<p>Great Cockey Catchment</p> <p>Bedford Street</p> <p>Westlegate</p>	<p>[1] On Surrey Street run-off from significant rainfall was concentrated at a low point within the catchment in which the affected properties are positioned.</p> <p>[4] On Bedford Street and Westlegate water is directed off the highway by dropped kerbs and/or the camber of the road on to the properties.</p>	<p>Norwich City Council Highways for causes 4 and 7.</p> <p>Property owners for cause B.</p> <p>Anglian Water Services (AWS) Ltd for causes 7.</p>	<p>Norwich City Council Highways have carried out maintenance on the gullies within the highway on Bedford Street and Surrey Street.</p>	<p>(R3) Anglian Water could work with the LLFA to help identify where the drainage network conveys flows to.</p> <p>(R4) Anglian Water and Norwich City Highways could determine the capacity of the drainage system to understand the systems' role in accommodating normal rainfall</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ²³
Surrey Street Orford Place	<p>[7] Run-off from significant rainfall was directed into the combined foul and surface water drainage network. On Bedford Street, Surrey Street and Orford Place this exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties.</p> <p>[10] Due to development of impermeable surfaces localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding in Surrey Street.</p> <p>The above causes were exacerbated by the factors below:</p> <p>[B] On Bedford Street and Westlegate the structures of the affected properties were not able to withstand the impacts of flood water. As such flood water entered the property through low thresholds at entrances.</p>			<p>events, as well as mitigating flooding.</p> <p>(R8) Based on investigations into the drainage system, Anglian Water and/or Norwich City Council could consider the feasibility for a capital drainage scheme and/or property level protection in the medium to long term to improve the surface water drainage system .This recommendation will be subject to priorities and availability of resources.</p> <p>(R9) Norwich City Highways could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of Norwich City Council's maintenance programme.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p>

B. Dalimond Catchment

12. Location of the flood incidents within the catchment

- 12.1 This catchment covers the North of the city as well as its outlying urban settlements within the Broadland District Council area (see map 3). It is bounded by high ground within the urban environment to the East and West. It extends outside the urban area from the high ground in the North and falls towards the River Wensum to the South. As such there are a number of overland flow paths associated with the topography which aggregate as they fall towards the river. In addition there are numerous outfalls of surface water management systems into the river.
- 12.2 The flooding incidents reported within this catchment included a number of incidents of external flooding to gardens outbuildings and highways. There was one report of internal flooding and this was associated with an overland flow path emanating in the East of the catchment from where it flows in a South-West direction before it aggregates with other flow paths.
- 12.3 The flood risk within this catchment is approximately 1,048 properties (non-residential and residential) in the 1 in 30 year predicted rainfall event. There are approximately 2,478 properties (non-residential and residential) in the 1 in 100 year rainfall event.

13. Flood Incident as reported

- 13.1 There were 8 properties that internally flooded within this area, 5 of these properties were flooded in the 27 May rainfall event with 3 more being affected by the 20 July rainfall event. No properties have experienced repeat internal flooding although they have been affected by external flooding on a number of the summer rainfall events.
- 13.2 The breakdown of flooding incidents by event is listed below; (please see Map 3 for the approximate locations of incidents within the catchment).
- 13.3 **North Walsham Road** - 1 property was internally flooded on North Walsham Road²⁴. This property was flooded on the 27 May 2014 rainfall event. This incident was reported by Norfolk County Council Highways.
- 13.4 **Orchard Close** - 3 properties have internally flooded on Orchard

²⁴ Flood questionnaire for case 713.

Close. One of these properties flooded on the 27 May 2014 and the other two flooded on the 20 July 2014 rainfall events²⁵. These incidents were reported by Anglian Water .

- 13.5 **Allen's Lane** - 1 property was internally flooded on Allen's Lane²⁶. This property was flooded on the 20 July 2014 rainfall event. This incident was reported by the residents to the LLFA.
- 13.6 **Oak Lane** - 3 properties were internally flooded on Oak Lane. These properties were flooded in the late May 2014 rainfall event²⁷. A further 2 properties reported external flooding of sewage on Oak Lane on the 27 May, 13 July and 10 August²⁸. These incidents were reported to Anglian Water.
- 13.7 External flooding was experienced on Furze Road, Plumstead Road East, George Pope Road, Heartsease Lane, Mousehold Avenue²⁹. These incidents were reported by Norwich City Council and Anglian Water.

14. Desk Study

- 14.1 The flooding incidents within the catchment are:
- Situated within an area of geology likely to have good rates of infiltration.
 - Located to the north of Norwich City, and within the boundary of both Norwich City and Broadland District Council's administrative boundaries
 - Located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
 - Associated with a surface water overland flow path mentioned in section 13.
 - Outside elements of the catchments that are within Flood Zones 2 & 3.
 - Elements of this catchment are less than 2.5 km from an Environment Agency rain gauge. The flood incidents on Oak Lane are covered, the other incidents within the catchment are not.
 - Covered by detailed flood risk modelling in the Norwich Urban Area Surface Water Management Plan and further studies. The area is identified as a Critical Drainage Catchment due to the high number of properties at risk from extreme rainfall events. Specific actions to reduce

²⁵ Anglian Water Staff 2014 pers. comm., 31 Oct (1027, 1020, 1021)

²⁶ Flood questionnaire for case 707

²⁷ Email correspondence with Anglian Water 31 Oct 2014 (1009, 1010 & 1036).

²⁸ Anglian Water Staff 2014 pers. comm., 31 Oct (1028, 1029)

²⁹ Email correspondence from Norwich City Council 3 June 2014 (1023 & 1024); Flood questionnaires for cases 1004, 1005, 1006, & 1007. Email correspondence from Anglian Water x (1025 & 1026)

flood risk across the catchment are described in the plan and further studies.

- Near to highway that is publically maintainable and that is drained by highway systems within the carriageway.
- Shown by Anglian Water records to only be served by separate foul and surface water sewers.

14.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Anglian Water, Highways and riparian owners.

15. Summary of impacts

15.1 Information relating to the impacts³⁰ experienced at the flood location are detailed below;

Risk to life: No

Internal Flooding: Yes

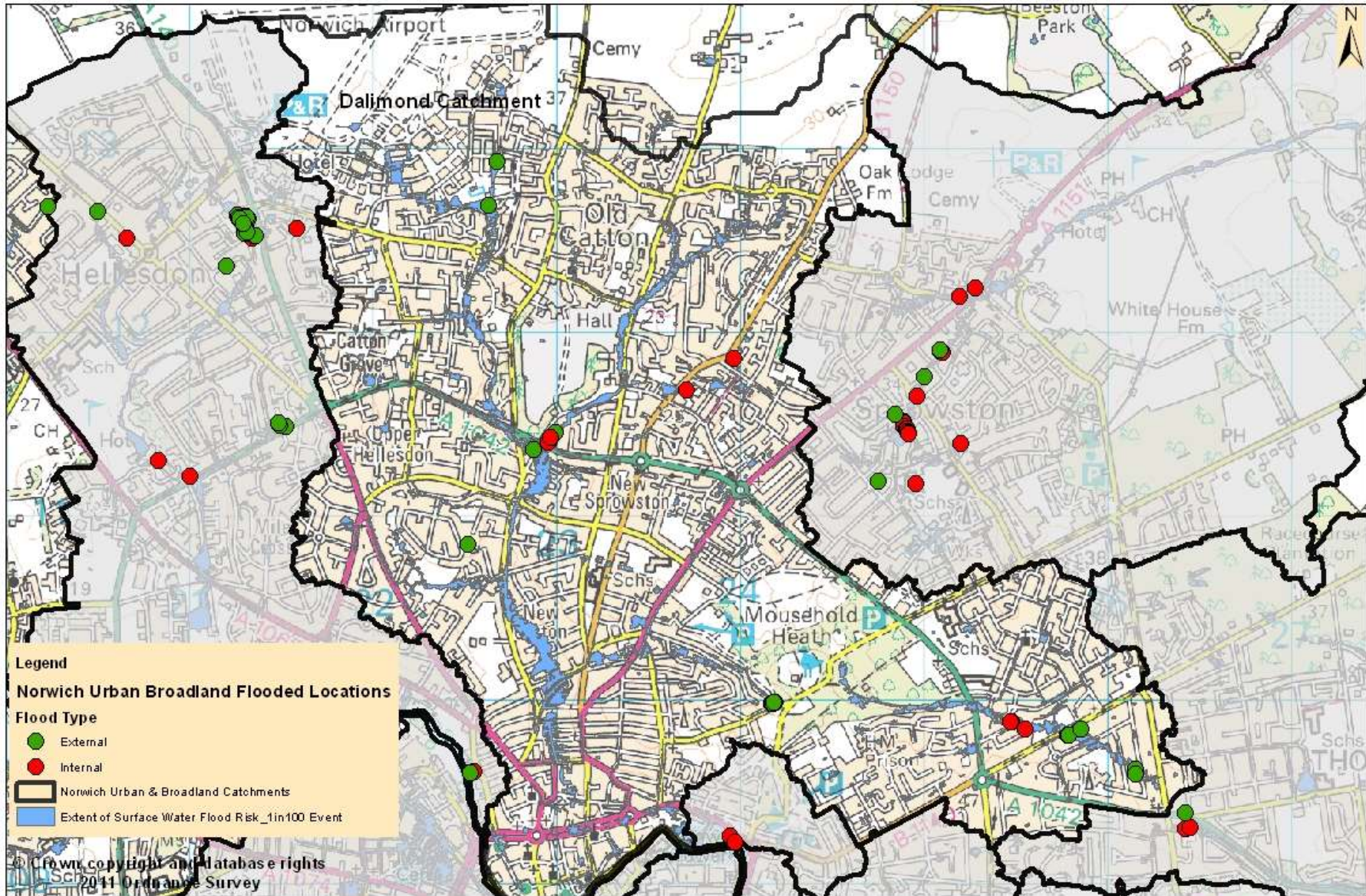
External Flooding: Yes

Critical services: No

Priority Routes: Yes (North Walsham Road only)

Obstruction of Access: No

³⁰ These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.



Map 3: Dalimond Catchments-Showing key flow paths and approximate locations of flooding

16. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ³¹
North Walsham Road	<p>[C4] Water is directed off the highway by dropped kerb and the camber of the road and footway on to the property access which concentrates flood water towards the affected property.</p> <p>[C7] Run-off from significant rainfall was directed into the surface water drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties.</p> <p>[C10] Due to development of impermeable surfaces localised ground conditions caused water run-off to be directed quickly from where it fell as rain to the areas of flooding.</p>	<p>Norfolk County Council Highways for causes C4 and C7.</p> <p>Property owners</p>	<p>Norfolk County Council has carried out works to the footway and kerbing to reduce the surface water run-off on to the property and has undertaken maintenance to the highway drainage.</p> <p>The property owners have carried out works to attenuate surface water within their property.</p>	<p>(R9) Norfolk County Council Highways could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of Norfolk County Council Highways maintenance programme.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p>

³¹ The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ³¹
Oak Lane Orchard Close	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties on Oak Lane and Orchard Close are positioned.</p> <p>[C4] On Oak Lane water is directed off the highway by dropped kerbs and the camber of the road on to footway access which concentrates flood water towards the affected properties.</p> <p>[C7] Run-off from significant rainfall was directed into the foul and surface water drainage network. This exceeded the design capacity of the systems in both Oak Lane and Orchard Close. This contributed to the accumulation of flood water at the affected properties.</p> <p>The above causes were exacerbated by the factors below:</p> <p>[A] On Oak Lane additional water has been directed to the foul sewer network exceeding its design capacity. This is due to surface water accessing the foul network through domestic manhole chambers.</p>	<p>Anglian Water Services (AWS) Ltd for cause 7</p> <p>Norfolk County Council and Norwich City Highways for cause 4</p> <p>Property owners for cause A</p>	<p>Anglian Water have previously carried out camera survey and modelling of the foul drainage system serving Oak Lane to inform the new scheme, which will include a new sewer with Non Return Valves/flow control system.</p> <p>The properties affected internally by foul sewer flooding on Oak Lane are on Anglian Water's DG5 register, which recognises the need for Anglian Water to resolve the cause.</p> <p>On Orchard Close, Anglian Water have previously</p>	<p>(R7) Where it is determined that there is surface water infiltrating into the public sewer and entering properties, Anglian Water and the Highways authorities could work together to mitigate this pressure. This work could include feasibility studies that identify possible improvements into existing systems and identify the removal of surface water to alternative points of discharge. This could include a range of mechanisms both within the private property and externally.</p> <p>(R8) Based on investigations into the capacity of the drainage system, Anglian Water could consider the feasibility for a capital drainage scheme in the medium to long term to improve and/or link 'the road' surface water drainage system into an alternative positive drainage system.</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ³¹
			<p>carried out camera surveys, modelling of the drainage system along with property level protection at high risk properties.</p> <p>The property owners have carried out works to reduce the impact of surface water to their properties.</p>	
Allen's Lane	<p>(C11) Water is directed from the neighbouring property by their roof drainage and impermeable surfaces which concentrates flood water towards the affected property.</p>	<p>Property owners (those affected as well as neighbouring properties).</p>	<p>The neighbouring property owner has undertaken works to direct water away from their neighbour's property.</p>	<p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R5) The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.</p>

C. Dobb's Beck Catchment

17. Location of the flood incidents within the catchment

- 17.1 The topography within this catchment directs water to the North of the city along flow paths that enter local watercourses. These flow paths emanate from the urban conurbation of Sprowston, a parish in North East Norwich, (see map 4). These flow paths flow south to north east and west to north-east respectively and converge by Blue Boar Lane near the 24 hour supermarket.
- 17.2 The urban area is served by a number of water management systems that outfall into the local watercourse network at approximately the same location as the overland flow paths. The flows in this watercourse network are directed to an infiltration pond in the parish of Rackheath. This infiltration pond directs flows through the soils to 'The Springs' that becomes Dobb's Beck, a tributary of the River Bure.
- 17.3 The flood risk within this catchment is approximately 125 properties (non-residential and residential) in the 1 in 30 year predicted rainfall event. There are approximately 441 properties (non-residential and residential) in the 1 in 100 year rainfall event.
- 17.4 The internal flooding incidents reported within this catchment relate to the southern overland flow path that starts in close proximity to Sprowston High School. This broadly flows north east in the direction of the Golf Course which is part of Sprowston Manor.

18. Flood Incident as reported

- 18.1 The number of properties flooded internally within this catchment were 18. The majority of these properties were flooded in the 27 May 2014 event with further flooding experienced on the 20th July 2014 event. The majority of these properties have experienced repeat flooding.
- 18.2 The breakdown of flooding incidents by event is listed below; (please see Map 4 for approximate locations of incidents within the catchment).
- 18.3 **Cannerby Lane** – 10 properties have confirmed to the LLFA they were internally flooded on Cannerby Lane³². 1 further property is likely to have been flooded but the owners of this property have not

³² Flood Questionnaires (930, 931 & 933); Property owner 2014 pers. Comm., 13 Oct (934, 935 & 937); Property owner 2014 pers. Comm., 14 Oct (762 & 936).

confirmed this to the LLFA. The majority of these properties were flooded on the 27 May and the 20 July 2014 rainfall events. Sprowston High School has been flooded on 4 occasions³³ including 27 May, 5 & 27 June and 8 July 2014. Another property in close proximity to the High School but on Russell Avenue reported significant external flooding on the above dates and also on the 13 and 20 July,³⁴ as did a property on Rosemary Road³⁵. All of these properties experienced a series of external flooding during May, June, July and August. These incidents were reported by the Police, residents, Norfolk County Council Highways and in the media.

- 18.4 **Merlin Mews** – 2 properties were internally flooded³⁶ on Merlin Mews. Both of these properties were flooded twice, first on the 27 May and then again on the 20 July 2014. Other householders on Merlin Mews experienced “near misses” on these events but did not flood internally. These incidents were reported by both Broadland District Council and Norfolk County Council Highways.
- 18.5 **Martin Close** – 2 properties were internally flooded on Martin Close. These were flooded on various rainfall events including 27 May, 20 July and 10 August 2014³⁷. There was significant external flooding of property with some residents gardens entirely under water. These properties reported flooding via Norfolk County Council Highways Department and their local MP.
- 18.6 **Wroxham Road** – 1 property on Wroxham Road was internally flooded³⁸ on 27 May and 10 August 2014. This property reported flooding direct to the Lead Local Flood Authority.
- 18.7 **Varvel Avenue** - 1 property on Varvel Avenue was internally flooded³⁹ on 20 July 2014. This property reported flooding to the Fire and Rescue Service.
- 18.8 **Church Lane** - 1 property on Church Lane was internally flooded⁴⁰ on 20 July 2014. This property reported flooding to the Fire and Rescue Service.
- 18.9 **Falcon Road West** - 1 property on Falcon Road West was internally flooded⁴¹ on 20 July 2014. This property reported flooding to the Fire and Rescue Service.

³³ Flood Questionnaire (928) received 16 July 2014.

³⁴ Correspondence and evidence received regarding case file (689)

³⁵ Email correspondence from Broadland District Council regarding case file (720)

³⁶ Flood Questionnaires (686 & 723) received 16 July 2014 and 24 July 2014.

³⁷ Property owner 2014 pers. comm., 14 Oct & 24 Oct (842); Flood questionnaire (926) received 27 Oct 2014.

³⁸ Flood questionnaire (929) received 15 Oct 2014

³⁹ Fire service report (Case 1123)

⁴⁰ Fire service report (Case 1071)

⁴¹ Fire service report (Case 2176)

19. Desk Study

- 19.1 The flooding incidents within the catchment are:
- Situated within an area of geology likely to have good rates of infiltration.
 - Located within Broadland District Council's administrative boundary.
 - Located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
 - Associated with surface water overland flow paths mentioned above in section 18. In addition there are a number of pre-existing drainage systems associated with this flow path apparent on historic 1905 map.
 - Outside elements of the catchments that are within Flood Zones 2 & 3.
 - Not within 2.5km of an Environment Agency rain gauge
 - Covered by the flood risk modelling in the Norwich Urban Area Surface Water Management Plan. The area was not taken forward for detailed assessment and no location specific actions exist in the plan to mitigate surface water flood risk.
 - Near to highway that is publically maintainable and that is drained by highway systems within the carriageway.
 - Shown by Anglian Water records to only be served by foul water sewers.
- 19.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Anglian Water, Norfolk County Council Highways and riparian owners.

20. Summary of impacts

- 20.1 Information relating to the impacts⁴² experienced at the flood location are detailed below;

Risk to life: Yes (some of the flood events put vulnerable residents at risk of injury e.g where householders were isolated by deep flood water or manholes were lifted by pipes surcharging).

Internal Flooding: Yes

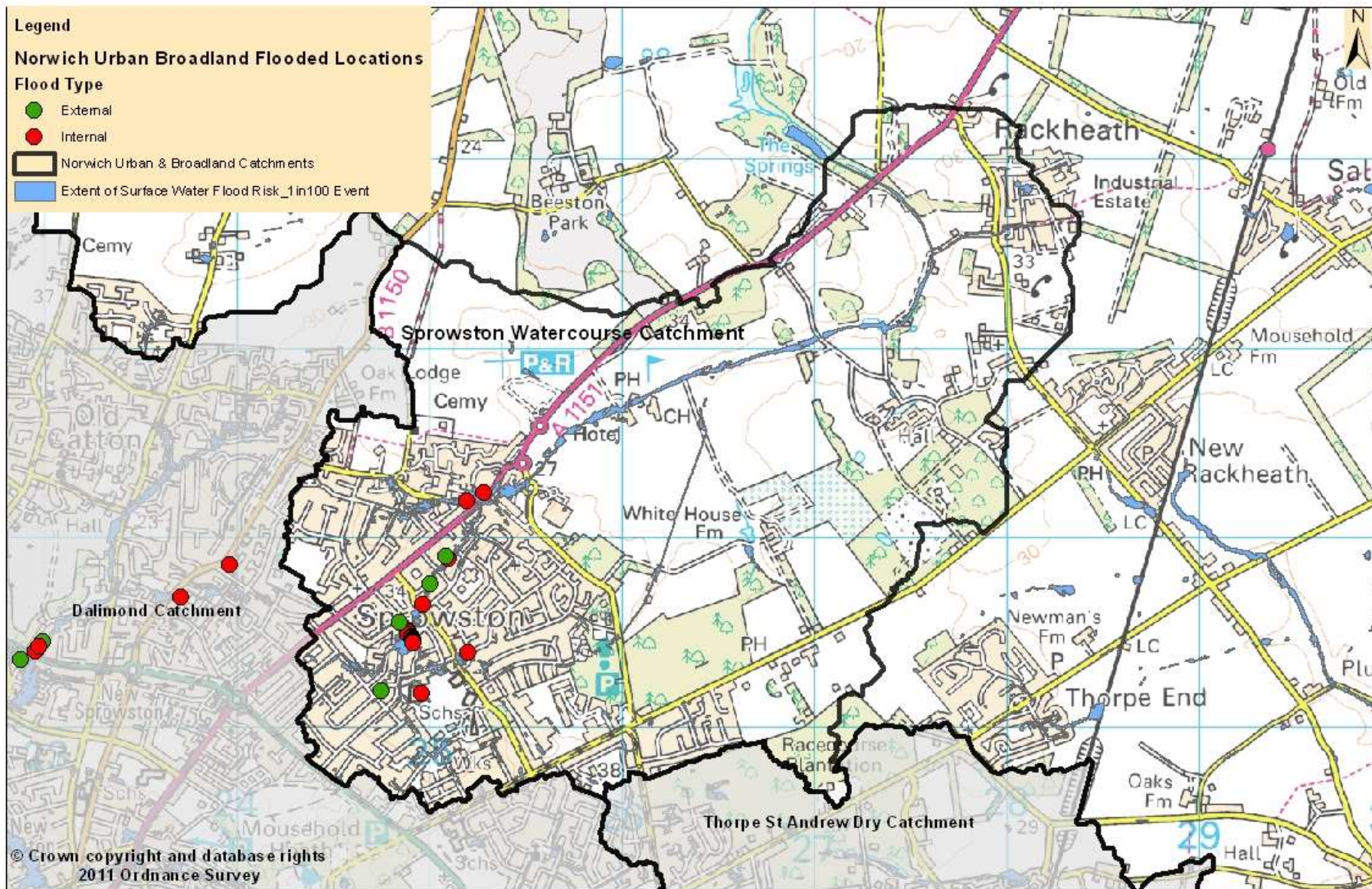
External Flooding: Yes

Critical services: Yes

Priority Routes: No (priority routes were affected but not closed)

Obstruction of Access: Yes (numerous property accesses obstructed, particularly on non-priority routes)

⁴² These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.



Map 4: Sprowston Watercourse Catchment-Showing key flow paths and approximate locations of flooding

21. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁴³
<p>Dobb's Beck Catchment</p> <p>Cannerby Lane (including Russell Avenue)</p> <p>Merlin Mews</p> <p>Martin Close</p> <p>Wroxham Road</p>	<p>[C2] Across the catchment run-off from significant rainfall was concentrated along overland flow paths on which the affected properties are positioned.</p> <p>[C3] On Merlin Mews run-off from rainfall was obstructed by man-made constructions (e.g. walls and fencing) which concentrated flood water in the vicinity of the affected properties</p> <p>[C7] Run-off from significant rainfall was directed into the highway surface water drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties on Cannerby Lane, Merlin Mews, Martin Close and Wroxham Road.</p> <p>[C10] Due to development of impermeable surfaces localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p>	<p>Norfolk County Council Highways for cause C2 and C7</p> <p>Adjacent landowners for cause C.</p> <p>Property owners for causes C3 and E.</p>	<p>Fire Service responded and pumped out a number of properties on the 27 May.</p> <p>Norfolk County Council's Highway repaired drainage cover on the junction of Cannerby Lane and Allerton Road due to pressure from the water forcing the drainage cover open in July 2014.</p> <p>In August 2014 Norfolk County Council Highways carried out a survey through contractors and</p>	<p>(R4) The Lead Local Flood Authority in conjunction with Norfolk County Council Highways could determine the wider systems integrity and/or capacity to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.</p> <p>(R9) Norfolk County Council Highways could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of Norfolk County Council Highways maintenance programme.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R14) The Lead Local Flood</p>

⁴³ The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

	<p>The above causes were exacerbated by the factors below:</p> <p>[C] The loss of historic drainage features within the catchment. Specifically this relates to the loss of a pond within the green in Cannerby Lane.</p> <p>[E] Across the catchment individual property drainage has insufficient capacity to cope with heavy rainfall. Some properties within the catchment are likely to have unmaintained drainage that therefore would not cope with heavy rainfall.</p>		<p>cleansed part of the system but no damage was detected.</p> <p>NCC Flood and Water Management Team visited and spoke to a number of those affected.</p> <p>Property owners on Merlin Mews, Martin Close and Wroxham Road protected their properties at the time of the events e.g. sand bags</p> <p>The property owners (Sprowston High School, Cannerby Lane) have carried out extensive works to increase the capacity and attenuation of surface water flows</p>	<p>Authority and Norfolk County Council Highway's could work with the Environment Agency and Regional Flood and Coastal Committee to determine the possibility of securing funding to mitigate flood risk in this community. This recommendation will be subject to priorities and availability of resources.</p> <p>(R5) Property owners should determine the adequacy of their on-site drainage and where appropriate increase on-site storage capacity and system efficiency.</p>
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D. Hellesdon Catchment

22. Location of the flood incidents within the catchment

- 22.1 This catchment covers the North West of the city and its outlying urban settlements within the Broadland District Council area (see map 5). It is bounded by high ground within the urban environment to the East. It extends outside the urban area from the high ground in the North and West and falls towards the River Wensum to the South. As such there are a number of overland flow paths associated with the topography which aggregate as they fall towards the river and its associated watercourses. In addition there are numerous outfalls of surface water management systems into this network.
- 22.2 The flooding incidents reported within this catchment relate to overland flow paths emanating in North Hellesdon that converge to flow South in the direction of Drayton Road. These are ultimately directed into local ditches that drain into the River Wensum.
- 22.3 The flood risk within this catchment is approximately 217 properties (non-residential and residential) in the 1 in 30 year predicted rainfall event. There are approximately 504 properties (non-residential and residential) in the 1 in 100 year rainfall event.

23. Flood Incident as reported

- 23.1 The number of properties flooded internally within this catchment were 6. All of these properties were flooded on the 27 May 2014 rainfall event with two of these properties experiencing repeat internal flooding on later rainfall events.
- 23.2 The breakdown of flooding incidents by event is listed below; (please see Map 5 for approximate locations of incidents within the catchment).
- 23.3 **Reepham Road** - 2 properties were internally flooded on Reepham Road. 1 of these properties is located near Heather Avenue⁴⁴, the other property is located near Wood View Road⁴⁵. The property near Heather Avenue was flooded on numerous occasions including the 27 May rainfall event and other incidents in June and July. These incidents were reported by Norfolk County Council Highways. The property near Wood View Road has been flooded on numerous occasions since the May rainfall events. These incidents were reported to Norfolk County Council Highways.

⁴⁴ Public Enquiry Manager Record 471250 (729).

⁴⁵ Public Enquiry Manager Record 478703 (739)

- 23.4 **Woods Close** - 1 property was internally flooded on Woods Close⁴⁶. This property was flooded on numerous times including the 27 May, 26 June and the 12 August 2014 rainfall events. These incidents were reported by Norwich City Council.
- 23.5 **Drayton High Road** - 1 property was internally flooded on Drayton High Road⁴⁷. This property was flooded on the 27 May 2014 rainfall event. This incident was reported by the Fire Service.
- 23.6 **Heath Crescent** - 1 property was internally flooded on Heath Crescent⁴⁸. This property was flooded on the 26 June and the 10 August 2014 rainfall events. These incidents were reported to Norfolk County Council Highways.
- 23.7 **St Martins Close** – 1 property was internally flooded on St Martins Close. This incident was reported by Anglian Water⁴⁹.
- 23.9 External flooding was experienced on Meadow Way, Bernham Road, Hawthorne Avenue⁵⁰. These incidents were report by Norfolk County Council Highways.

24. Desk Study

- 24.1 The flooding incidents within the catchment are:
- Situated within an area of geology likely to have good rates of infiltration.
 - Mainly located within Broadland District Council's administrative boundary except Woods Close which is within Norwich City Council's highway maintenance boundary and St Martins Close which is within Norwich City Council's administrative boundary
 - Located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
 - Associated with surface water overland flow paths mentioned above in section 23.
 - Outside elements of the catchments that are within Flood Zones 2 & 3.
 - Within 2.5km of an Environment Agency rain gauge.
 - Covered by the flood risk modelling in the Norwich Urban Area Surface Water Management Plan. The area was not taken forward for detailed assessment and no location specific actions exist in the plan to mitigate surface water flood risk.

⁴⁶ Flood questionnaire for case 684

⁴⁷ Duty manager 2014 pers. comm., 19 August (854)

⁴⁸ Public Enquiry Manager Record 476705 (Case 738 & 880)

⁴⁹ Via Anglian Water (1003)

⁵⁰ Public Enquiry Manager Records for case (814)

- Near to highway that is publically maintainable and that is drained by highway systems within the carriageway.
- Shown by Anglian Water records to only be served by foul water sewers.

24.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Norfolk County Council Highways, Norwich City Council Highways (Woods Close only) and riparian owners.

25. Summary of impacts

25.1 Information relating to the impacts⁵¹ experienced at the flood location are detailed below;

Risk to life: Yes (Woods Close only - vulnerable resident, extreme depth of water and loss of access due to extent of flood waters).

Internal Flooding: Yes

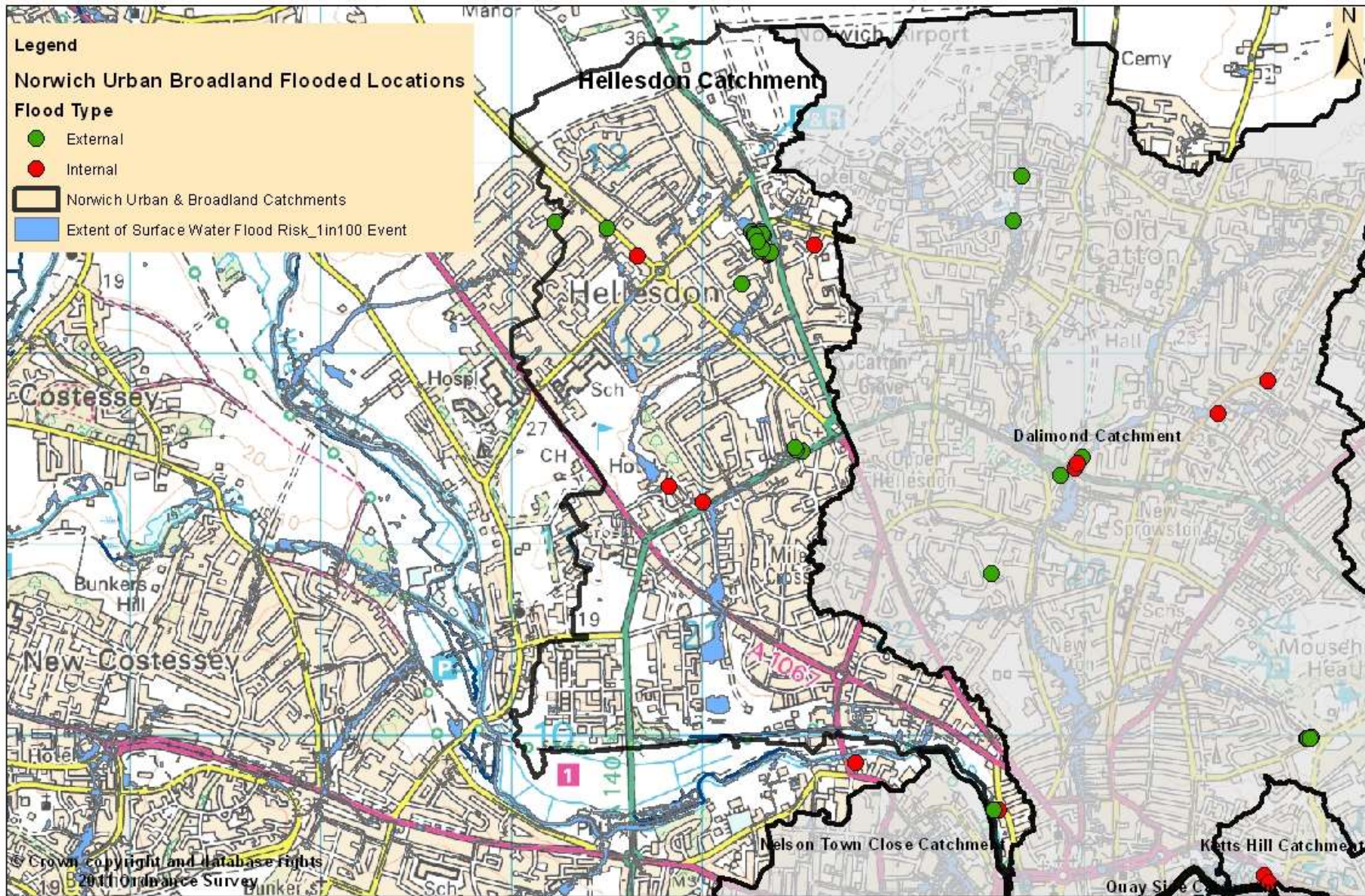
External Flooding: Yes

Critical services: No

Priority Routes: No

Obstruction of Access: Yes (Woods Close and Heather Avenue).

⁵¹ These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.



Map 5: Hellesdon Catchment-Showing key flow paths and approximate locations of flooding

26. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁵²
<p>Reepham Road</p> <p>Heath Crescent</p> <p>Drayton High Road</p>	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties on Reepham Road, Heath Crescent and Drayton High Road are positioned.</p> <p>[C4] Water is directed off the highway by the camber of the road on to the property access, which concentrates flood water towards the affected properties on Reepham Road and Heath Crescent.</p> <p>[C7] Run-off from significant rainfall was directed into the highway surface water drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties on Reepham Road and Heath Crescent.</p> <p>[C10] Due to development of impermeable surfaces localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p>	<p>Norfolk County Council Highways for causes C4 and C7.</p> <p>Property owners</p>	<p>NCC Highways carried out works to the access of one of the properties on Reepham Road as the kerbing was deemed too low. NCC Highways also raised the back edgings of the footway so that the “slope” falls towards the road.</p> <p>The property owners on Drayton High Road have undertaken some remedial work to reduce the volume of surface run-off entering onto their property.</p>	<p>(R9) Norfolk County Council Highways could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of Norfolk County Council Highways maintenance programme.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R5) The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.</p>

⁵² The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁵²
Woods Close	<p>[2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected property was positioned.</p> <p>[C7] Run-off from significant rainfall was directed into the Norwich City Council Highway surface water drainage network via third party land. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties.</p> <p>[C10] Due to development of impermeable surfaces, localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p> <p>The above causes were exacerbated by the factors below:</p> <p>[E] Individual property drainage (soakaway) has insufficient capacity to cope with the heavy rainfall and surface run-off directed to it.</p>	<p>Norwich City Council Highways for cause C7</p> <p>Property owner for cause E.</p>	<p>Fire and Rescue service responded to Woods Close flooding and pumped out the property.</p>	<p>(R4) Norwich City highways could determine the wider systems integrity and/or capacity to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.</p> <p>(R8) Based on investigations into the capacity of the drainage system, the Lead Local Flood Authority and other relevant RMAs could consider the feasibility for a capital drainage scheme in the medium to long term.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R26) The Lead Local Flood Authority could investigate with third parties the potential for retro-fitting of sustainable drainage systems</p> <p>(R17) Where planning applications are made within the local catchment, potential drainage improvements (to be facilitated by the new development and/or redevelopment) should be sought. The evidence and lessons learnt from past flooding and</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁵²
				drainage surveys need to be incorporated into any possible drainage strategy identified for any proposed development.
St Martins Close	(C8) The foul sewer network was obstructed by Fats, Oils and Greases. This reduced the efficiency of the drainage system contributing to the accumulation of foul flood water at the affected property.	Anglian Water Services (AWS) Ltd for cause C8	AWS camera surveyed the system and cleared the blockage of Fats, Oils and Greases.	(R9) Anglian Water could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of Anglian Water's maintenance programme.

E. Riverside Catchments

27. Location of the flood incidents within the catchment

27.1 This section covers those parts of the city centre that lie to the East of the River Wensum, (see Map 6). The topography within the urban environment is bounded by high ground to the North East that falls West and South West towards the River Wensum. This area comprises of short steep isolated sub-catchments that fall down to the river. This area also has numerous outfalls of surface water management systems into the river.

27.2 Three of the principle catchments within this area are;

- A steep catchment (Kett's Hill Catchment) and flow path that falls from East to West and is located to the East of the ring road near the Kett's Hill roundabout.
- A steep catchment (Rosary Road Catchment) and flow path that falls from North East to South West and is located North of the station.
- A shallow catchment (Carrow Road Catchment) that falls North to South and is located near to the football stadium.

27.3 The flood risk to properties within these catchments is set out below for 2 different rainfall events;

	1 in 30	1 in 100
Kett's Hill Catchment	80 properties	101 properties
Rosary Road Catchment	48 properties	128 properties
Carrow Road Catchment	15 properties	30 properties

28. Flood Incident as reported

28.1 The number of properties that flooded internally within this area is 18, although 1 of these properties was converted to flats so flood damage has impacted 24 flats. The majority of these properties were flooded either on the 27 May 2014 event or the 20 July 2014 event. A minority of properties have experienced repeat flooding.

28.2 The breakdown of flooding incidents by event is listed below; (please see Map 6 for approximent locations of incidents within the catchment).

Kett's Hill Catchment

28.3 **Barrack Street** – 1 property was internally flooded on Barrack Street. This property has flooded numerous times including on the

27 May and 20 July rainfall events⁵³. This incident was reported by the property owner to the LLFA.

- 28.4 **St James Meadow** – 1 property was internally flooded on St James Meadow. This property flooded on 20 July 2014 rainfall event⁵⁴. This incident was reported by the Fire Service.

Rosary Road Catchment

- 28.5 **Telegraph Lane East** - 1 property was internally flooded on Telegraph Lane East. This property was flooded in late May and July rainfall events. This incident was reported in the media⁵⁵ on the 21 July 2014 and confirmed by Norfolk County Council⁵⁶.
- 28.6 **Beatrice Road** - 6 properties were internally flooded on Beatrice Road⁵⁷. These properties were internally flooded on numerous occasions but principally on the 27 May, 13 July and 20 July rainfall events. Another 13 properties on Beatrice Road reported significant external flooding⁵⁸ to the road and gardens on both the above dates and 3 further times in June and 1 other time in July. These incidents were reported by Norwich City Council, the residents and the media.
- 28.7 **Ella Road** - 5 properties were internally flooded on Ella Road⁵⁹. These properties were flooded on the 20 July 2014 rainfall event. 1 property on Ella Road reported significant external flooding⁶⁰. These incidents were reported by residents direct to the LLFA.
- 28.8 **Thorpe Road** - 1 property was internally flooded on Thorpe Road⁶¹. This property was flooded on the 20 July 2014 and August 2014 rainfall events. This incident was reported by the affected party.
- 28.9 **Marion Road** – 1 property was internally flooded on Marion Road⁶². This property was flooded on the 20 July 2014.

Carrow Road Catchment

- 28.9 **Carrow Road** - 2 properties were internally flooded on Carrow Road⁶³. These properties were flooded on the 20 July 2014 rainfall event. One of these properties was also flooded previously on the 27

⁵³NCC Officer 2014 pers. comm., 4 Nov (1046).

⁵⁴ Fire Service Flood Report (1045)

⁵⁵ EDP24 Article July 21, 2014; Norwich Evening News 24 Article July 22, 2014 (703).

⁵⁶ NCC Officer 2014 pers. comm., 30 Oct (703).

⁵⁷ Flood questionnaires for cases 972, 973, 698, 977, 978 & 687

⁵⁸ Flood questionnaires for cases 968, 969, 971, 975, 976, 979, 980, 981, 982, 983, 984 & 985

⁵⁹ Flood questionnaires for cases 692, 963, 964, 965 and pers comms from 966

⁶⁰ Flood questionnaire for case 967

⁶¹ Flood questionnaire for case 898

⁶² Flood questionnaire for case 1789.

⁶³ Flood questionnaire for case 844; EDP24 Article July 22, 2014 (949)

May 2014 rainfall event. 1 other property on Carrow Road reported significant external flooding on 20 July impacting the highway and their garden⁶⁴. These incidents were reported by the residents, Norwich City Council and the media.

28.10 **Kerrison Road** - 1 property was internally flooded on Kerrison Road. This property is a multi-occupancy building and was flooded on the 20 July 2014 rainfall event⁶⁵. 6 other properties reported significant external flooding to the highway and gardens⁶⁶. These incidents were reported by a resident to Norwich City Council Highways.

29. Desk Study

29.1 The location of the flooding:

- Is situated within an area of geology likely to have good rates of infiltration.
- Is within Norwich City Council's administrative boundary
- Is located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
- Is associated with surface water overland flow paths mentioned above in section 28.
- There are a number of significant pre-existing drainage systems associated with the catchment near the football stadium apparent on the 1905 map.
- Large elements of the football stadium catchment are within Flood Zones 2 & 3 due to its proximity to the River Wensum. This may also indicate that river levels have an influence on surface water drainage particularly where outfalls are subjected to tidal effect.
- Is over 2.5km away from an Environment Agency rain gauge
- This area was covered by the flood risk modelling in the Norwich Urban Area Surface Water Management Plan. The area was not taken forward for detailed assessment and no location specific actions exist in the plan to mitigate surface water flood risk.
- The Highway is publically maintainable and there are drainage gullies evident within the carriageway.
- Is shown by Anglian Water records to only be served by foul water sewers.

29.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Anglian Water, Norwich City Council Highways and riparian owners.

⁶⁴ Email correspondence from resident 25 July 2014 (948)

⁶⁵ Email correspondence from resident 24 July 2014 (942)

⁶⁶ Flood questionnaires for cases 941, 943, 944, 945, 946, & 947

30. Summary of impacts

30.1 Information relating to the impacts⁶⁷ experienced at the flood location are detailed below;

Risk to life: Yes (some of the flood events put vulnerable residents at risk of injury e.g. where householders were isolated by deep flood water or manholes were lifted by pipes surcharging. Specifically on Kerrison Road water ingress through electricity conduits into the electricity distribution room).

Internal Flooding: Yes

External Flooding: Yes

Critical services: Yes

Priority Routes: Yes

Obstruction of Access: No

⁶⁷ These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.

31. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
<p>Barrack Street</p> <p>St James Meadow</p>	<p>[C1] Run-off from significant rainfall was concentrated at a low point within the catchment in which the affected properties are positioned.</p> <p>[C4] Water is directed off the highway by dropped kerbs on to the property access which concentrates flood water towards the affected properties.</p>	<p>Norwich City Council Highways for cause C4</p> <p>Property owners</p>	<p>The Fire and Rescue service pumped out the property on St James Meadow</p>	<p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R25) Norwich City Council could investigate the feasibility of amending the road structure to route flood water away from the affected properties to alternative points of discharge.</p> <p>(R4) Norwich City highways could determine the wider systems integrity and/or capacity to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.</p>
<p>Telegraph Lane East</p>	<p>[C1] Run-off from significant rainfall was concentrated at a low point within the catchment and directed toward the affected property.</p>	<p>Property owners for cause C1</p>	<p>The property managers are planning to undertake works to</p>	<p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p>

⁶⁸

The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
			attenuate or redirect the surface water flows away from the property.	
Beatrice Road Ella Road Marion Road	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties are positioned.</p> <p>[C7] Run-off from significant rainfall was directed into the Norwich City Council highway and Anglian Water surface water drainage network. This exceeded the design capacity of the system on Beatrice Road and Marion Road. This contributed to the accumulation of flood water at the affected properties.</p> <p>[C8] The surface water drainage network on Beatrice Road, Quebec Road and Primrose Road was fully/ partially obstructed by debris or silt in some gullies. This reduced the efficiency of the upstream drainage system contributing to the accumulation of flood water at the affected properties. On Ella Road blocked gullies on the communal walkway above the properties caused water to flow through a retaining wall and into the basements of the affected properties.</p>	Norwich City Council Highways for causes C7 and C8 Anglian Water Services Ltd Property owners	<p>Anglian Water carried out a survey of their surface water system, identified and removed tree root ingress from the highway drainage system that was partially blocking it and reducing its capacity.</p> <p>Norwich City Council moved a number of gullies in Quebec Road to capture an increased amount of surface water. They also removed and cleaned blockages within Quebec Road, Primrose Road and Beatrice Road.</p>	<p>(R9) Norwich City Council Highways and Anglian Water could identify the appropriate level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of their respective maintenance programme. This work could also be coordinated between Norwich City Council Highways and Anglian Water where there is an interaction between their responsibilities for the drainage systems.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
	<p>[C10] Due to development of impermeable surfaces, localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p>		<p>Property owners in Marion Road have taken preventative measures to reduce the impact of flooding, including the removal of a wall to allow surface water to flow in the event of a significant flood event.</p> <p>On Ella Road, Norwich City Council repaired and replaced gullies in the walkway and are liaising with the owner of the wall to have it repaired. Anglian Water attended at the time of the flooding and found blocked gullies. Anglian Water also informed residents of the health and safety issues with associated with the lifting of covers by</p>	

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
			residents to direct flood water into foul system.	
Thorpe Road	[7] Run-off from significant rainfall was directed into the surface water drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties.	Anglian Water for causes C7	Reported to Anglian Water for a follow up investigation Property owner carried out a survey and intends to install property level protection	(R4) Anglian Water Services Ltd could determine the wider systems integrity and/or capacity and identify where the drainage network conveys flows to. (R8) Based on investigations into the capacity of the drainage system, Anglian Water could consider the feasibility for a capital drainage scheme in the medium to long term to improve. This would be dependant on available funding and based on a cost benefit basis. (R27) Where the rainfall event exceeded the design capacity of the drainage system Anglian Water would communicate to affected residents to explain how they would support on-going partnership projects e.g. Surface Water Management Plans.
Carrow Road	The surface water drainage system is complex and serves a number of areas	Anglian Water for causes C6 and C8	Norwich City Highways and	(R1) Norfolk County Council could work with Risk Management

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
<p>Clarence Harbour Court</p> <p>Kerrison Road</p>	<p>including Carrow Road, Kerrison Road, and Clarence Harbour Court. A highway drainage system discharges into an Anglian Water surface water system. This discharges into the River Wensum alongside a culverted watercourse that runs under and adjacent to the Football stadium.</p> <p>[[C8] The surface water drainage network was partially obstructed by debris or silt. This caused the failure of the upstream drainage system contributing to the accumulation of surface water flood water at the affected properties. There has been no regular maintenance of the surface water drainage systems by Anglian Water.</p> <p>[C10] On Clarence Harbour Court due to development of impermeable surfaces (including the roof and the adjoining car park) localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p> <p>The above causes were exacerbated by the factors below:</p> <p>[B] The structure of the affected property on Kerrison Road was not able to withstand the impacts of flood water. As</p>	<p>Riparian owners for cause C8</p> <p>Environment Agency for cause C6</p> <p>Norwich City Highways for causes C6 and C8</p>	<p>Anglian Water have both undertaken survey work on Carrow Road and cleansing operations to alleviate the flooding.</p> <p>Anglian Water have placed the surface water sewer in Carrow Rd on a maintenance regime</p>	<p>Authorities to identify structures or features that have an effect on local flood risk within the catchment. Where structure or features are associated with significant flood risk these will be included on Norfolk County Council's public register. This will provide transparency for residents as to ownership and condition of structures or features</p> <p>(R7) Where it is identified that there is not appropriate capacity within the drainage system (in line with national standards) the RMA/riparian owner should consider how they might rectify the lack of capacity in their element of the system.</p> <p>(R13) RMAs and riparian owners to determine the appropriate maintenance regime in line with the risk identified. This could include the coordination of any future capital or maintenance programmes.</p> <p>(R20) Lead Local Flood Authority and partner authorities should communicate with riparian owners to ensure that the appropriate level of maintenance is carried out for those elements of the drainage system in their ownership.</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
	<p>such flood water entered the property through the airbricks and electricity conduit, (a UK Power Networks Inspection Chamber).</p> <p>[C] The loss of historic drainage features within the catchment. Specifically this relates to the loss of a watercourse and the alteration by new development of Anglian Water sewers and outfalls.</p> <p>[E] On Clarence Harbour Court individual property drainage has insufficient capacity to cope with heavy rainfall.</p> <p>[F] The river levels within the River Wensum were high.</p>			<p>(R4) RMAs should determine the level of drainage capacity provided by the drainage network outfalls into the River Wensum. Where it is identified that these do not provide appropriate capacity, RMAs should consider how this might be rectified.</p> <p>(R17) Where planning applications are made within the local catchment, potential drainage improvements (to be facilitated by the new development) should be sought. The evidence and lessons learnt from past flooding and drainage surveys need to be incorporated into any possible drainage strategy identified for any proposed development.</p> <p>(R18) Local Planning Authorities should note that as there is an automatic right to connect to the public sewer. As such Anglian Water's ability to reduce the risk of flooding within current systems is limited if new development is approved in a manner which does not provide appropriate mitigation. Despite Anglian Water not being a statutory consultee to the planning process LPAs should include Anglian Water as a consultee for significant</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁶⁸
				developments in this or similar areas.

F. Thorpe St Andrew Catchments

32. Location of the flood incidents within the catchment

32.1 This catchment covers the East of the city and its outlying urban settlements. A small part of this area is within the Norwich City Council area whilst the majority of the area is within the Broadland District Council area. It is bounded by high ground within the urban environment to the West and North. It extends outside the urban area from the high ground in the East. All catchments in this area fall towards the River Yare to the South. As such there are a number of overland flow paths associated with this topography which aggregate as they fall towards the river and its associated watercourses. In addition there are numerous outfalls of surface water management systems into this network.

32.2 The flooding incidents reported within this catchment relate to;

- A small catchment (Lion Wood Catchment) and flow path emanating just South of Plumstead Road that flows South East in the direction of the River Yare.
- A short catchment (River Green Catchment) that directs water along isolated flow paths toward the River Yare.
- A large catchment (Thorpe St Andrew Catchment) that directs water from the North West towards the River Yare to the South.

32.3 The flood risk to properties within these catchments is set out below for 2 different rainfall events;

	1 in 30	1 in 100
Lion Wood Catchment	12 properties	61 properties
River Green Catchment	18 properties	71 properties
Thorpe St Andrew Catchment	117 properties	363 properties

33. Flood Incident as reported

33.1 The number of properties that flooded internally within this area is 7. The majority of these properties were flooded on the 27 May 2014 , 8 July and the 20 July 2014 rainfall events. A minority of properties have experienced repeat flooding.

33.2 The breakdown of flooding incidents by event is listed below; (please see Map 7 for approximate locations of incidents within the catchment).

33.3 **Laundry Close** - 2 properties were internally flooded on Laundry Close. These properties were affected by flooding on the 27 May, 8-

9, 13 and 20 July 2014 rainfall events⁶⁹. These incidents were reported by the residents to the LLFA and Anglian Water.

- 33.4 **Yarmouth Road** – 1 property was internally flooded on Yarmouth Road⁷⁰. This property was flooded on the 27 May and 8 July 2014 rainfall events. Other properties reported external flooding to roads and gardens. These incidents were reported by the affected party.
- 33.5 **Wellesley Road South** – 2 properties were internally flooded on Wellesley Road South⁷¹. These properties were flooded on the 27 May rainfall event. 1 other property reported significant external flooding. Another property on nearby Cintra Road⁷² reported flooding to the highway on the 5 August. These incidents were reported by the residents to Norwich City Council and to the LLFA.
- 33.6 External flooding was also experienced on the Ring Road in the vicinity of Thorpe Avenue⁷³.
- 33.7 **The Denes** – 2 properties were internally flooded on The Denes.⁷⁴ These properties were flooded on the 20 July 2014. Six other properties were also affected by significant external flooding. These incidents were reported to Norfolk County Council Highways.
⁷⁵

34. Desk Study

- 34.1 The location of the flooding:
- Is situated within an area of geology likely to have good rates of infiltration.
 - Is within Broadland District Council's administrative boundary
 - Is located within the Environment Agency's Essex, Norfolk and Suffolk admin and water management areas.
 - Is associated with surface water overland flow paths mentioned above in section 33.
 - One flooding incident is within Flood Zones 2 & 3, however all the incidents relate to surface water flooding rather than flooding from the river.
 - Is outside 2.5km of an Environment Agency rain gauge
 - This area was covered by the flood risk modelling in the Norwich Urban Area Surface Water Management Plan. The

⁶⁹ Flood questionnaire for case 685; Email correspondence with resident 19 August 2014 for case 974.

⁷⁰ Flood questionnaire for case 956

⁷¹ Resident 2014 pers. comm., 30 Oct (763). Email correspondence with resident 21 September 2014 for case 952.

⁷² Email correspondence to Norwich City Highways regarding case 1059, 5 August 2014

⁷³ Public Enquiry Manager Record 485387

⁷⁴ Flood questionnaires for cases 2043 and 2044.

⁷⁵ Report to NCC Highways

area was not taken forward for detailed assessment and no location specific actions exist in the plan to mitigate surface water flood risk.

- Is adjacent to highway that is publically maintainable. However Laundry Close is private so is maintained at the owner's expense.
- Is shown by Anglian Water records to only be served by foul water sewers. It is of note that Laundry Close is served by privately owned sewer systems.

34.2 From the desk study it is indicated that the management of local drainage is primarily the responsibility of Anglian Water, Highways and riparian owners.

35. Summary of impacts

35.1 Information relating to the impacts⁷⁶ experienced at the flood location are detailed below;

Risk to life: No

Internal Flooding: Yes

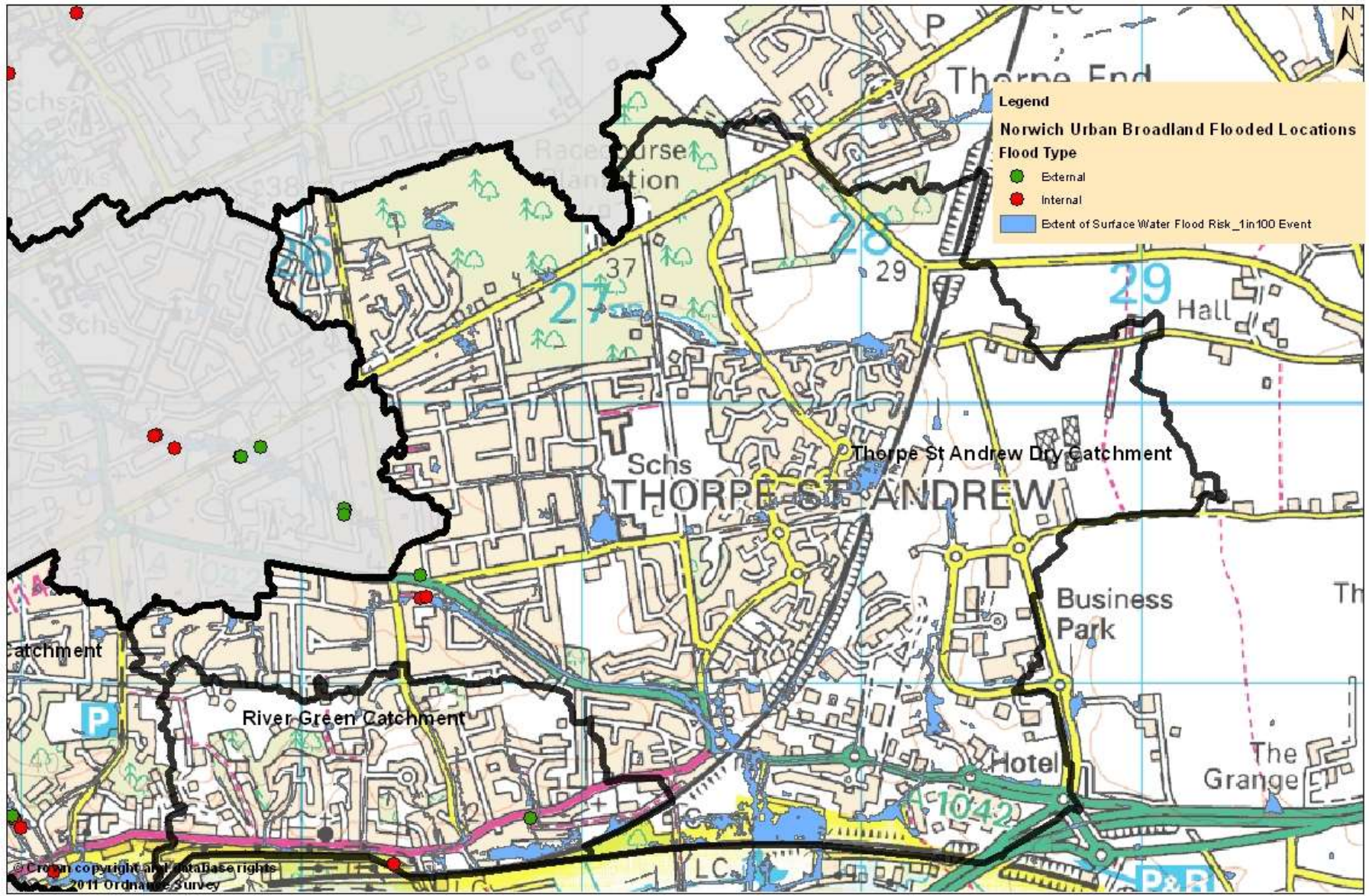
External Flooding: Yes

Critical services: No

Priority Routes: No

Obstruction of Access: No

⁷⁶ These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.



Map 6: Thorpe St Andrew Catchments- Showing key flow paths and approximate locations of flooding

36. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁷⁷
<p>Wellesley Avenue South</p> <p>The Denes</p>	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties on Wellesley Avenue South and The Denes are positioned.</p> <p>[C7] Run-off from significant rainfall was directed into the highway surface water drainage network. This system is connected to the Anglian Water surface water sewer. This exceeded the design capacity of the system serving Wellesley Avenue South and The Denes. This contributed to the accumulation of flood water at the affected properties. The drainage serving surrounding roads (including Cintra Road) joins the surface water system serving Wellesley Avenue South.</p>	<p>Norwich City Council Highways for cause C7</p> <p>Anglian Water Services Ltd for cause C7</p> <p>Property owners</p> <p>Upstream Landowners</p>	<p>Norwich City Council cleared away the debris, from the entrance to Lion Wood, which was blocking highway gullies.</p> <p>Wherry Housing carried out maintenance on the un-adopted sections of the road serving properties in The Denes.</p>	<p>(R7) Lead Local Flood Authority and the RMAs to identify and determine the capacity of the drainage system within the catchment in line with national standards. Where the capacity is not appropriate the RMA should consider how they might rectify the lack of capacity in their element of the system. This work could include a range of options e.g. the removal of surface water to alternative points of discharge.</p> <p>(R9) RMAs to determine the appropriate maintenance regime in line with the risk identified. This could include the coordination of any future capital or maintenance programmes.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R1) Where structures or features</p>

⁷⁷ The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁷⁷
				are associated with significant flood risk these will be included on Norfolk County Council's public register. This will provide transparency for residents as to ownership and condition.
Laundry Close	<p>It should be noted that the two properties are new buildings (built in 2011), in a low lying area and connected to the Anglian Water sewer via a private pumped system to a private lateral drain. Laundry Close is also a private road.</p> <p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties on Laundry Close are positioned. One property was directly affected internally by this cause.</p> <p>[C4] Water is directed off the highway by low kerbs and the camber of the road on to the property access which concentrates flood water towards the affected properties.</p> <p>[C7] Run-off from significant rainfall was directed into the foul drainage network. This exceeded the design capacity of the system. This led directly to the internal flooding of one property.</p>	<p>Property owners</p> <p>Adjacent Landowners</p> <p>Anglian Water Services Ltd for cause C7</p> <p>Norfolk County Council Highways for causes C4 and C8</p>	<p>Affected property owners bailed out the premises</p> <p>Anglian Water undertook a site survey of the foul water system.</p> <p>Norfolk County Council Highways jetted the drainage system from the junction of Thunder Lane (as this road is also on the flow path) to ensure it was working following initial flood reports.</p>	<p>(R12) The property owners should aim to protect their buildings through flood protection measures where appropriate. This could also include flood routing to direct flood water away from properties.</p> <p>(R7) Anglian Water, Norfolk County Council Highways and the Lead Local Flood Authority could work with the property owners to identify the potential option for reducing the amount of surface water entering the foul drainage system.</p> <p>(R25) Norfolk County Council Highways could amend the road structure to route flood water away from the affected properties to alternative points of discharge.</p> <p>(R9) Norfolk County Council Highways could identify the appropriate level of maintenance required to sustain the design</p>

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁷⁷
	<p>[C8] The surface water drainage network was partially obstructed by debris or silt. This reduced the efficiency of the drainage system causing water to bypass the gullies on the ring road. This contributed to the accumulation of surface water flood water at the affected properties.</p>			<p>efficiency of their drainage systems that serves the flooding location. These works could then be prioritised as part of their maintenance programme.</p>
Yarmouth Road	<p>[C1] Run-off from significant rainfall was concentrated at a low point within the catchment in the vicinity of the affected property.</p> <p>[C7] Run-off from significant rainfall was directed into the Anglian Water foul sewer network. This exceeded the design capacity of the system. This led directly to the internal flooding of one property through the toilets.</p>	<p>Property owners</p> <p>Anglian Water Services Ltd for cause C7</p>		<p>(R12) The property owners should aim to protect their buildings through flood protection measures where appropriate. This could also include flood routing to direct flood water away from properties.</p> <p>(R7) Anglian Water, Norfolk County Council Highways and the Lead Local Flood Authority could work with the property owners to identify the potential option for reducing the amount of surface water entering the foul drainage system.</p>

G. Other Flooding Locations

37. Location of the flood incidents

- 37.1 2 other properties reported flooding in Norwich. These properties were outside of the areas of concentrated flooding within the contiguous urban area of the city. One property on Heigham Street is located to the far North West of Mancroft Ward. The other property is located on Long John Hill to the far South East of the city within a catchment known as Lakenham Catchment.

38. Flood Incident as reported

- 38.1 **Heigham Street** - 1 property was internally flooded on Heigham Street. This property was flooded on the 27 May 2014 rainfall event⁷⁸. Other properties reported external flooding to roads and gardens. These incidents were reported by the Fire and Rescue Service.
- 38.2 **Long John Hill** - 1 property was internally flooded on Long John Hill⁷⁹. This property was flooded on the 27 May 2014 rainfall event. Other properties reported external flooding to roads and gardens. These incidents were reported by Norwich City Council.
- 38.3 **Brazen Gate** – following heavy rainfall on the 20 July 2014 the Brazen Gate road under Southwell Road Bridge was closed to traffic by Norwich City Council. This incident was reported by Norwich City Council and the media⁸⁰.
- 38.4 **Hall Road** – 1 property was internally flooded on Hall Road⁸¹. This property was flooded on the 20 July 2014 rainfall event. The junction of Hall Road and Gordon Square also experienced flooding. This incident was reported by the media⁸².

39. Summary of impacts

- 39.1 Information relating to the impacts⁸³ experienced at the flood location are detailed below;

Risk to life: No
Internal Flooding: Yes
External Flooding: Yes
Critical services: No
Priority Routes: Yes
Obstruction of Access: Yes

⁷⁸ Flood questionnaire for case 709.

⁷⁹ Via Norwich City Council (1012)

⁸⁰ EDP24 Article July 21, 2014; (683)

⁸¹ Property Owner 2014 pers. comm., 12 Nov (1065).

⁸² ITV Article: Heatwave triggers storms and flash floods [Link](#)

⁸³ These impacts follow guidance on the classification of property type contained within Annex 6, Definitions of flood risk indicators, PFRA final guidance, 13 Dec 2010.

40. Investigation findings

Location	What caused the flooding?	Who has responsibilities to manage the cause(s) of the flood?	What was their response in relation to the cause of the flood?	Recommendations ⁸⁴
<p>Heigham Street</p> <p>Long John Hill</p> <p>Hall Road</p>	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties are positioned on Heigham Street, Long John Hill and Hall Road.</p> <p>[C4] Water is directed off the highway by the camber of the road on to the property access which concentrates flood water towards the affected properties on Heigham Street, Long John Hill and Hall Road.</p> <p>[C6] On Heigham Street the surface water drainage system outfall was partially obstructed by high water levels downstream. This reduced the efficiency of the upstream drainage system contributing to the accumulation of flood water at the affected properties.</p> <p>[C7] Run-off from significant rainfall was directed into the Highway and Anglian Water Service Ltd surface water and</p>	<p>Norwich City Council Highways for causes C4 and C7</p> <p>Anglian Water Services Ltd for cause C6 and C7</p> <p>Property owners for cause B.</p>	<p>The Fire and Rescue service pumped out property in response to flooding.</p> <p>Anglian Water intends to survey the surface water system and outfall.</p> <p>Norwich City Council have cleared the gully in Arnold Miller Road</p>	<p>(R4) Norwich City Council Highways and Anglian Water could determine the wider systems integrity and/or capacity to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.</p> <p>(R12) The property owners could protect their buildings through flood protection measures where appropriate.</p> <p>(R25) The relevant highways authority could amend the road structure to route flood water away from the affected properties to alternative points of discharge.</p>

⁸⁴ The recommendations highlighted in the table are referenced against the causes detailed above and should not be considered in isolation.

	<p>combined foul drainage network. This exceeded the design capacity of the system. This contributed to the accumulation of flood water at the affected properties on Heigham Street, Long John Hill and Hall Road.</p> <p>[C10] Due to development of impermeable surfaces localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding on Heigham Street, Long John Hill and Hall Road.</p> <p>The above causes were exacerbated by the factors below:</p> <p>[B] The structure of the affected properties on Heigham Street, Long John Hill and Hall Road were not able to withstand the impacts of flood water. As such flood water entered the property through low thresholds at entrances and airbricks.</p>			
Brazen Gate	<p>[C2] Run-off from significant rainfall was concentrated along overland flow paths on which the affected highway is positioned.</p> <p>[C7] Run-off from significant rainfall was directed into the highway surface water drainage network. This exceeded the</p>	Norwich City Highways and Anglian Water for cause C7	Norwich City Council Highways closed the road in response to significant pooling of flood water.	(R4) Norwich City Council Highways and Anglian Water could determine the wider systems integrity and/or capacity to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.

	<p>design capacity of the system. This contributed to the accumulation of flood water on the highway under the bridge.</p> <p>[C10] Due to development of impermeable surfaces localised ground conditions across the catchment caused water run-off to be directed quickly from where it falls as rain to the areas of flooding.</p>		<p>Norwich City Highways cleaned the gullies in May 2014</p>	<p>(R6) Norwich City Council Highways could identify the potential for providing or increasing attenuation to reduce the amount of water entering drainage systems.</p> <p>(R8) Based on investigations into the capacity of the drainage system, Norwich City Council Highways could consider the feasibility for a capital drainage scheme in the medium to long term to improve and/or link 'the road' surface water drainage system into an alternative positive drainage system.</p>
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Appendix A - Key definitions and responsibilities

What Is Flooding?

- A.1 Section 1 of the Flood and Water Management Act 2010 states that: “Flood” includes any case where land not normally covered by water becomes covered by water. In addition, this section adds the caveat: “But “flood” does not include – (a) a flood from any part of the sewerage system, unless wholly or partly caused by an increase in the volume of rainwater (including snow and other precipitation) entering or otherwise affecting the system, or (b) a flood caused by a burst water main (within the meaning given by Section 219 of the Water Industry Act 1991).”

What is internal and external flooding?

- A.2 For the purposes of this report, properties that have **internally flooded** are those where it is considered that water has entered the fabric of the building;
- Basements and below ground level floors are included.
 - Garages are included if in the fabric of the building. Garages adjacent or separate from the main building are not included.
 - Occupied caravans are included but not tents.
- A.3 **External flooding** included those properties where water has entered gardens or surrounding areas which restricts access, affects the highway or where flooding has disrupted essential services to the property such as sewerage. For businesses this includes those where the flood waters are directly preventing them trading as usual.

What is Local Flood Risk?

- A.4 Local Flood Risk is defined by the Flood and Water Management Act 2010 as being flood risk from surface runoff, groundwater and ordinary watercourses.
- ‘Surface runoff’ means rainwater (including snow and other precipitation) which is on the surface of the ground (whether or not it is moving) and, has not entered a watercourse, drainage system or public sewer.
 - ‘Groundwater’ means all water which is below the surface of the ground and in direct contact with the ground or subsoil.
 - ‘Ordinary Watercourse’ means a watercourse that does not form part of a main river and includes a reference to a lake, pond or other area of water which flows into an ordinary watercourse.

Roles and Responsibilities of Risk Management Authorities

- A.5 Below is a short summary of those groups and Risk Management Authorities (RMAs) that have a role in managing the flooding within the Norwich urban area. The listing of responsibilities includes those duties or powers that directly relate to managing the flood incidents or consequence. All RMA's have a duty to cooperate with other RMAs.

<p>Norfolk County Council (duties under the Flood and Water Management Act 2010 and the Civil Contingencies Act 2004)</p> <ul style="list-style-type: none"> • Duty to investigate significant flooding from any source • Duty to maintain a register of structures or features which affect flood risk from all sources • Power to undertake works to manage flood risk from surface run-off and groundwater • Powers to regulate activities on ordinary watercourses outside of Internal Drainage Board areas • Duties as a Category 1 Responder for Emergency Planning and the Fire & Rescue Service
<p>District Councils (Norwich City Council and Broadland District Council):</p> <ul style="list-style-type: none"> • Powers to undertake works on ordinary watercourses outside of IDB areas • The Local Planning Authority for their District area and determine the appropriateness of developments and their exposure and affect on flood risk • Duties as a Category 1 Responder for Emergency Planning
<p>Highway Authorities (Norfolk County Council and Norwich City Council acting as agent for the County Council):</p> <ul style="list-style-type: none"> • Powers to undertake works to manage water on the highway and to move water off the highway • Enforcement powers to unauthorised alterations, obstructions and interferences with highway drainage • Have responsibilities for culverts vested in the highway
<p>Water Companies (Anglian Water Services Ltd):</p> <ul style="list-style-type: none"> • Undertake capital schemes to alleviate or eliminate flooding where the flood event is associated with a failure of their assets • Duty to provide, improve, maintain and operate systems of public sewers and works for the purpose of effectually draining an area • Are responsible for flooding from their foul, combined and surface water sewers, and from burst water mains • Maintain 'At Risk Registers' for Ofwat that record properties that have flooded from public foul, combined and surface water sewers and that are at risk of flooding again. • Water companies respond to reports from the public of flooding associated with their assets and determine an appropriate response in line with their standards or customer service • Duties as a Category 2 Responder for Emergency Planning
<p>Riparian Owners:</p> <ul style="list-style-type: none"> • Duty of care towards neighbours upstream and downstream, avoiding any action likely to cause flooding • Entitled to protect their properties from flooding • May be required to maintain the condition of their watercourse to ensure that the proper flow of water is unimpeded

