Norfolk County Council

Investigation Report into the flooding in Broadland Various in 2013-2016

Report Reference: FIR037

Report prepared by Nathalie Harris and Published on 16 August 2019

Executive Summary

(a) Flooding incidents and causes

This report includes the internal flooding of 36 properties and highway flooding of 3 roads over a series of dates ranging from 2013-2016. Principally those included in this report are individual properties located across Broadland District within the following parishes:

- Acle
- Beighton
- Blofield
- Buxton with Lammas
- Foulsham
- Great and Little Plumstead
- Hellesdon
- Horsford
- Lingwood & Burlingham
- Newton St Faith
- Pettywell
- Reepham
- Salhouse
- Strumpshaw
- Wroxham

Catchments:

- Hellesdon
- Lackford Run
- Reepham Beck

The flooding that occurred was caused by:

- Drainage system overloaded
- Increased run-off
- Drainage system or outfall blockage, unmaintained or obstructed
- Surface run-off from roads
- Surcharging of the drainage system; Entry of flood water into property
- Property(ies) had structural issues
- Neighbouring property
- Obstruction of surface run-off flow paths by structures
- Obstruction of surface run-off flow paths by debris.

This led to the internal flooding of 36 properties.

(b) Key recommendations

Risk Management Authorities should;

- Communicate with affected residents where their assets have given rise to the flooding of properties.
- Review the appropriateness of their response to flooding.

- Determine the integrity and/or capacity of their assets and their maintenance where they have contributed to the flooding of properties to understand the systems role in accommodating rainfall events as well as mitigating flooding.

Property owners of affected properties should;

- Confirm the integrity, capacity and appropriateness of their property drainage
- Determine if works are needed to remove the risk posed by structures that form obstructions to flows.
- Determine if it is appropriate for them to protect their buildings through flood protection measures.
- Seek their own legal advice if they are concerned about the responsibilities and liabilities of themselves and/or others.
- **All property owners** should remove any inappropriate surface water connections to the foul sewer system and direct flows to alternative points of discharge where it doesn't increase flood risk.

Norfolk County Council should;

- Work with partner organisations to identify funding for flood mitigation. This would include assessing the potential to install property level protection measures, reduce run-off and increase the attenuation of flood water to reduce the impacts of flooding.
- Work with property owners to consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Seek to remind riparian owners of their responsibility to undertake appropriate levels of maintenance to sustain the efficiency of the drainage systems.
- Communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders
- Determine if works are needed to remove the risk posed by structures that form obstructions to watercourse flows and communicate with affected parties and riparian owners
- Review and monitor the delivery of recommendations within this and other relevant flood investigation reports.

Anglian Water should;

- Work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.

Please note that an addendum has been published to provide an update on subsequent actions taken following the initial response of Risk Management Authorities and individuals to the flood event as detailed within this report. This addendum can be found at the following link.

Justification for Flood Investigation

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.

The Norfolk Local Flood Risk Management Strategy Policy UC2 (Flood Investigation) sets out the thresholds the Lead Local Flood Authority will apply to its formal flood investigation role. This states an investigation will be undertaken where it is determined that;
(a) There is ambiguity surrounding the source or responsibility for a flood incident, and/or;
(b) There is cause to investigate the flood incident, due to either its impact, or consequence

In judging the impact or consequence of a flood event Norfolk County Council uses the criteria set out below;

- 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 person's 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.

It was deemed necessary to complete a formal Investigation Report into the flooding in Broadland Various in 2013-2016 as:

- multiple residential properties were internally flooded.
- A section of a national category 3 road or above was made impassable due to flooding.

This impact met Norfolk County Council's threshold for triggering the undertaking of a formal flood investigation.

The flood investigation report aims to:

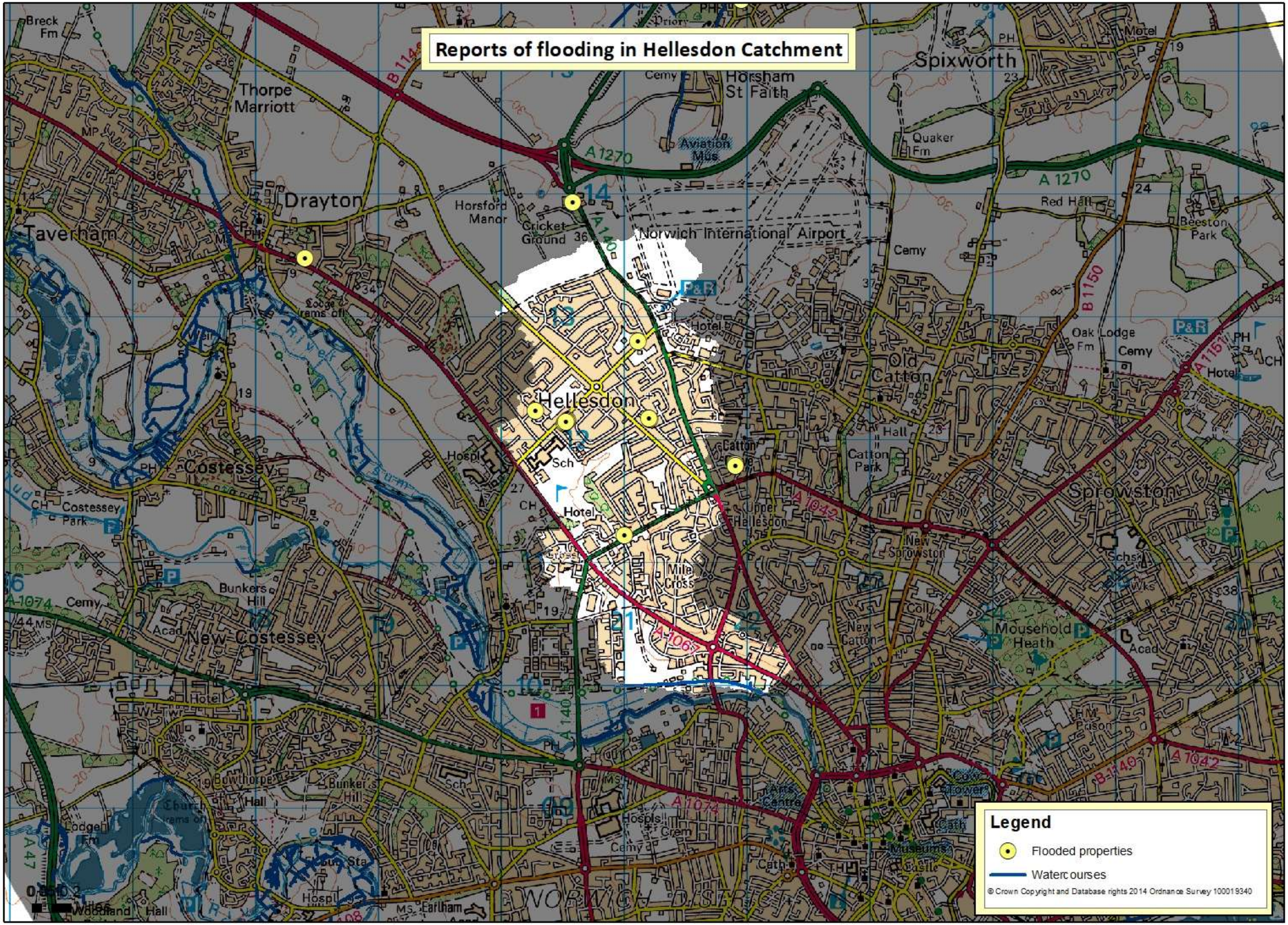
- provide a transparent and consistent review of recent flooding.
- identify those organisations and individuals who have responsibility to manage the causes of the flooding.
- identify what their response has been or will be to the flooding.
- make recommendations as to how the flood risk could be mitigated or reduced.
- provide new evidence of the level of risk faced by communities in Norfolk that can be used in current funding bids in support of flood mitigation schemes.

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

The flood investigation report cannot:

- Resolve the flooding issues or provide designed solutions.
- Force authorities to undertake any of the recommended actions.

Flooded Property Locations in Broadland District


Reports of flooding in Hellesdon Catchment
Legend
Flooded properties
Watercourses
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

What are catchments?

To aid the investigation process and, for ease of presentation, the incidents of flooding have been grouped within this document based on hydrological catchments where possible. The purpose of viewing flooding incidents based on catchments reflects the reality that flooding does not respect the administrative boundaries of water management organisations. Hydrological catchments catch water 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.

Description of catchment

This catchment covers the North West of Norwich and its outlying urban settlements within the Broadland District Council area. 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 is 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.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	135	36
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	350	83
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	0	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 13 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
23/06/2016	On the 23rd June 2016, 2 properties were internally flooded on Hawthorne Avenue, Hellesdon. This incident was	• Norfolk County Council (Lead Local Flood Authority) assessed

	reported by a resident via a telephone call on the 24th June 2016 (3038 & 3037a)	the validity and impact of the flood report after the incident. • Anglian Water Services Ltd responded and pumped out during and after the incident.
23/06/2016	On the 23rd June 2016, 6 properties were internally flooded on Middletons Lane, Hellesdon. These incidents were reported by: • Broadland District Council via email correspondence on the 28th June 2016 (2900) • a resident via a telephone call on the 30th August 2016 (3229) • the Fire and Rescue Service via an online flood report form on the 10th July 2016 (3230 & 3288) • a resident via an online flood report form on the 24th June 2016 (3917) • a resident via an online flood report form on the 22nd December 2016 (4111)	• The Fire and Rescue Service responded and pumped out during the incident. • Police carried out measures to minimise the impact of flooding during the incident. • Anglian Water Services Ltd and Norfolk County Council visited affected residents to offer advice and to gather information after the incident. • Anglian Water Services Ltd assessed the capacity of their drainage system after the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident
	On the 23rd June 2016, 1 property was internally flooded on Woods Close, Hellesdon. This incident was reported by the Fire and Rescue Service via an online flood report form on the 23rd June 2016 (3657)	• Residents carried out measures to minimise the impact of flooding during the incident. • The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Drayton High Road, Hellesdon. This incident was reported by Broadland District Council via an electronic report on the 24th June 2016 (2803)	• The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Nursery Close, Hellesdon. This incident was reported by a resident via a telephone call on the 24th June 2016 (2814)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.

23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Lilian Close, Hellesdon. This incident was reported by the Fire and Rescue Service via an online flood report form on the 10th July 2016 (3340)	• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • The Fire and Rescue Service responded and pumped out during the incident.
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Coldershaw Road, Hellesdon. This incident was reported by the Fire and Rescue Service via an online flood report form on the 10th July 2016 (3350)	• The Fire and Rescue Service responded and pumped out during the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

13 of the incidents of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

23rd June 2016- 29mm rainfall was recorded as falling in 30 minutes at the Norwich Heigham STW rainfall monitoring stations. The intensity of rainfall for the total duration equates to a 36 year rainfall event.

Historic flooding incidents within the catchment

The following table lists flooding incidents within the catchment that have been recorded:

Date of incident	Impact	Rainfall intensity
Several	Hawthorne avenue had been flooded on several occasions before. Anglian Water had taken out some remedial works that fixed some problems.	Various
Several	Woods Close had been flooded both externally and internally before this event.	Various
5 incidents over a period of 5 years	Middletons Lane had been flooded both externally and one property reported internally before. This was reported to Anglian Water at the time.	Various

Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. There is a map for each address affected. The maps detail the causes that led to flooding within the catchment as well as when and

where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The maps set out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Following flooding to people, property and infrastructure;

- Risk Management Authorities should
  - communicate with affected residents where their assets have given rise to the flooding of properties.
  - review the appropriateness of their response to flooding.
  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- Property owners of affected properties should seek their own legal advice.
- NCC should
  - incorporate all relevant information of actual flooding into the review of the Norfolk Preliminary Flood Risk Assessment ("PFRA").
  - review and monitor the delivery of recommendations within this and other relevant flood investigation reports.

Flooding on Hawthorne Avenue

Location: Hawthorne Avenue- 2 reports of internal flooding on the 23rd June 2016

Causes –

- Run-off from significant rainfall was concentrated along overland flowpaths on which the affected properties are positioned.
- Significant rainfall was directed into the surface water and foul water system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.

Recommendations –

- Anglian Water and Norfolk County Council will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the location in line with the risk identified (please see addendum).
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

MEADOW CLOSE
MEADOW CLOSE
SAINT PAULS CLOSE
HEATH CLOSE
HEATH CRESCENT
PRINCE ANDREWS ROAD
CROMER ROAD
HAWTHORN AVENUE
HAWTHORN AVENUE
BROOM AVENUE
WARREN AVENUE
BRABAZON ROAD
WALDEMAR PARK
BRACKEN AVEN

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding on Middletons Lane

Location: Middletons Lane- 6 reports of internal flooding on 23rd June 2016

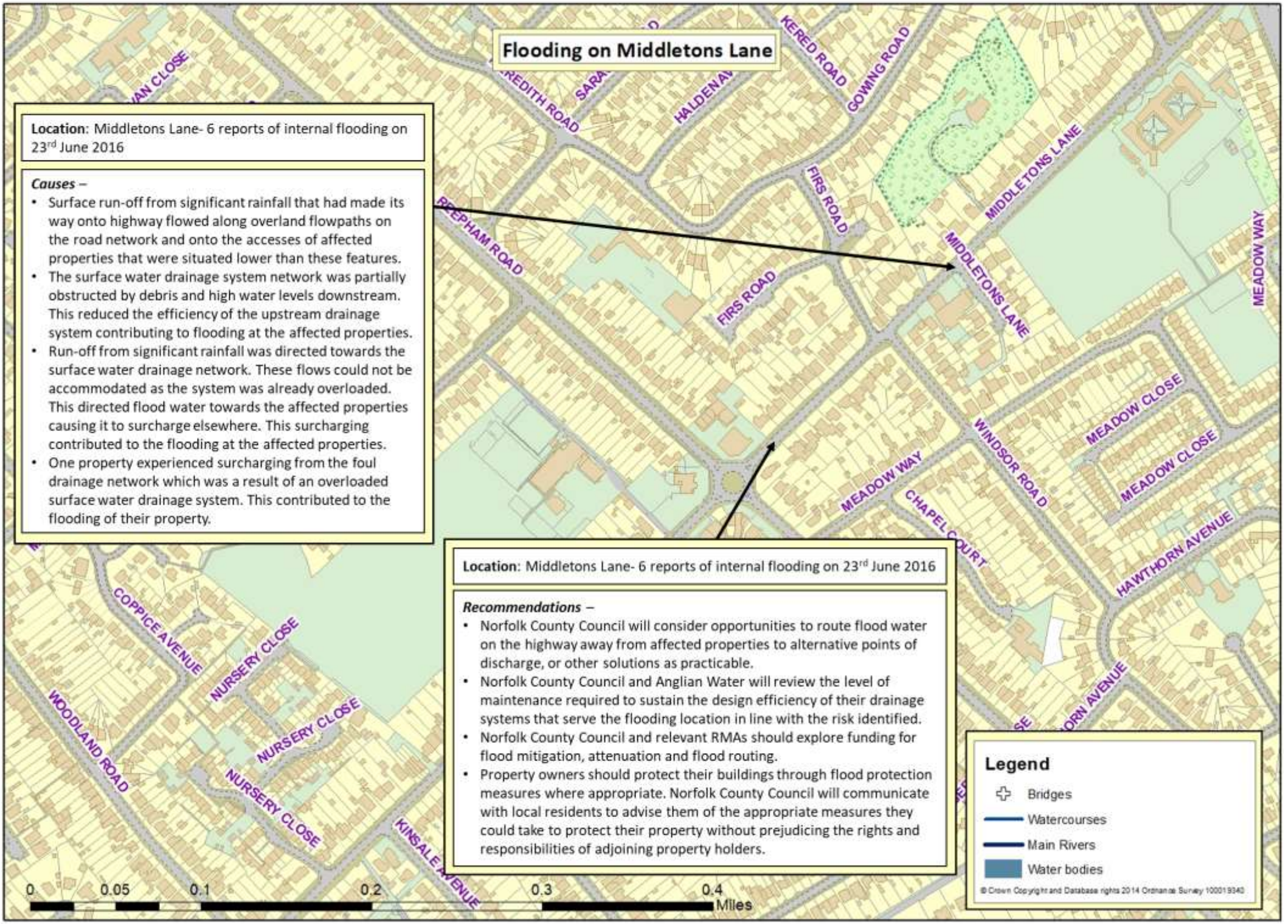
Causes –

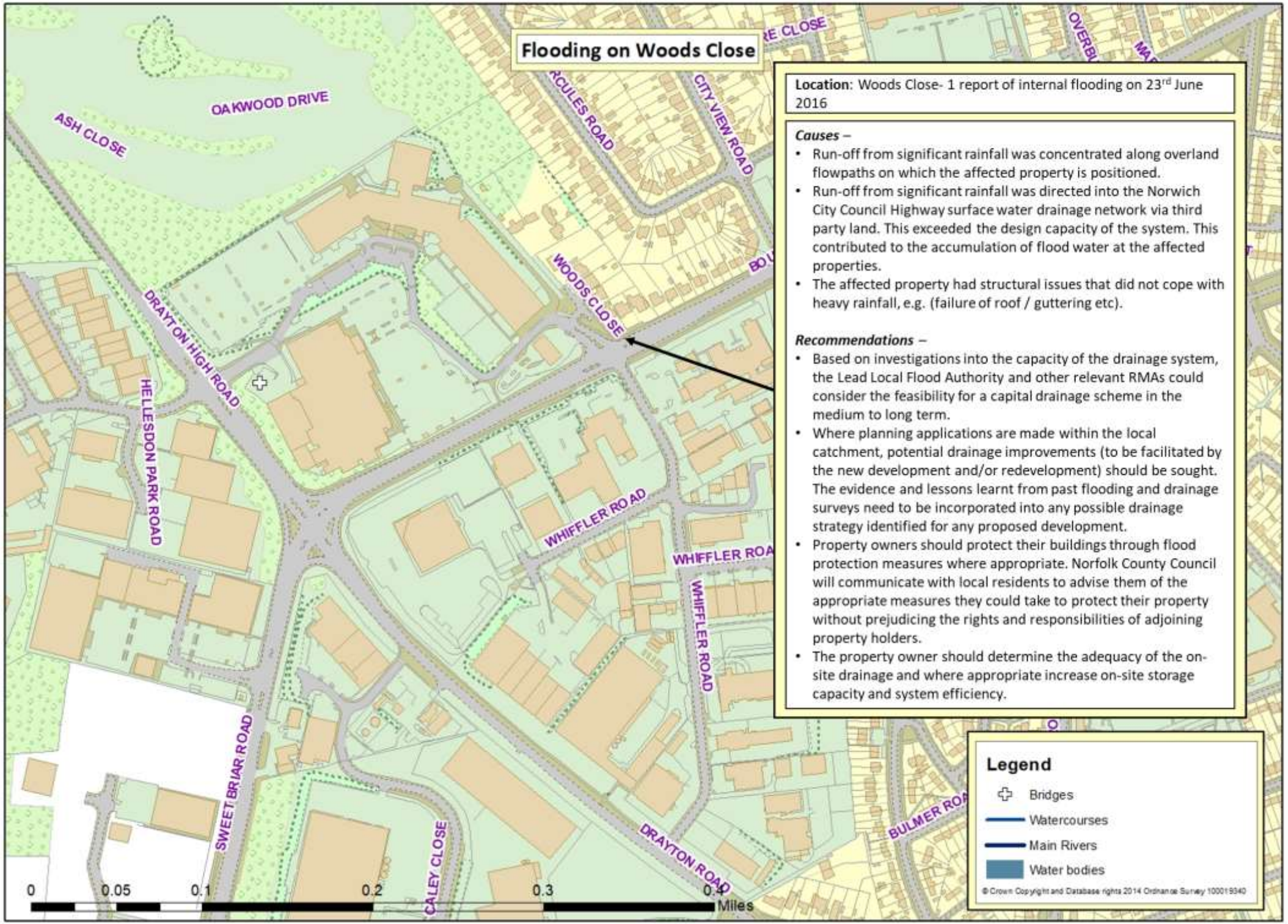
- Surface run-off from significant rainfall that had made its way onto highway flowed along overland flowpaths on the road network and onto the accesses of affected properties that were situated lower than these features.
- The surface water drainage system network was partially obstructed by debris and high water levels downstream. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- Run-off from significant rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected properties causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.
- One property experienced surcharging from the foul drainage network which was a result of an overloaded surface water drainage system. This contributed to the flooding of their property.

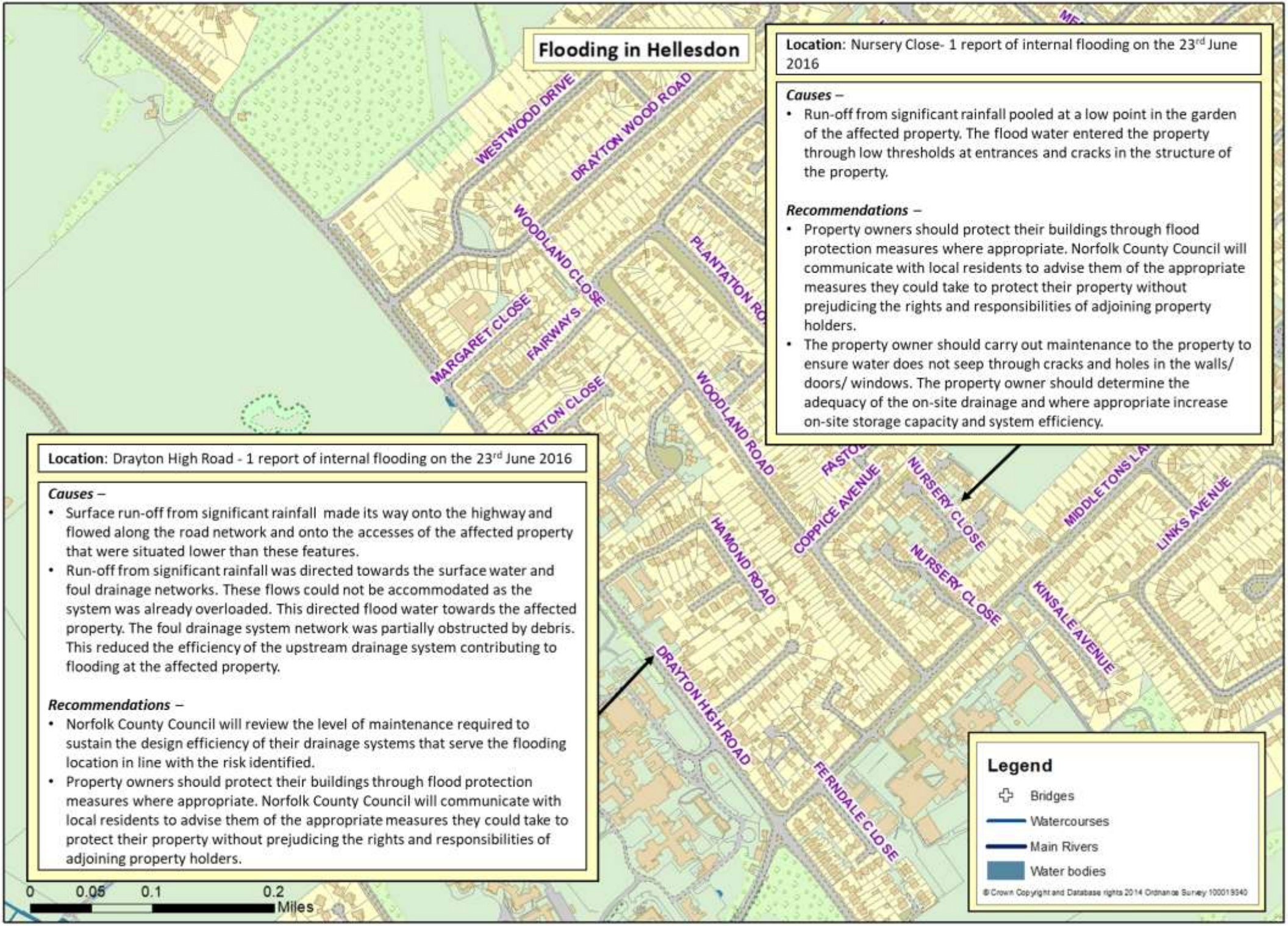
Location: Middletons Lane- 6 reports of internal flooding on 23rd June 2016

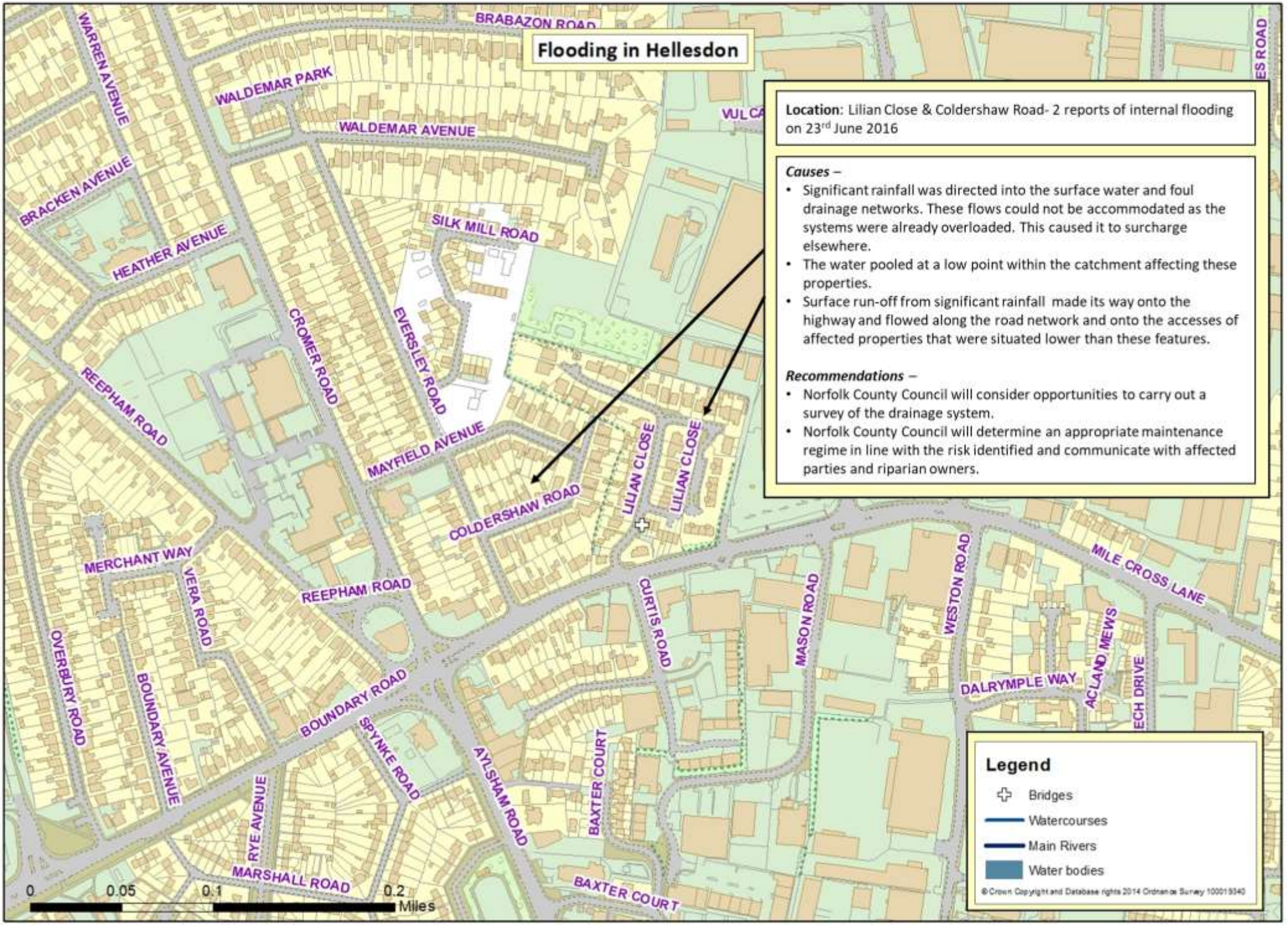
Recommendations –

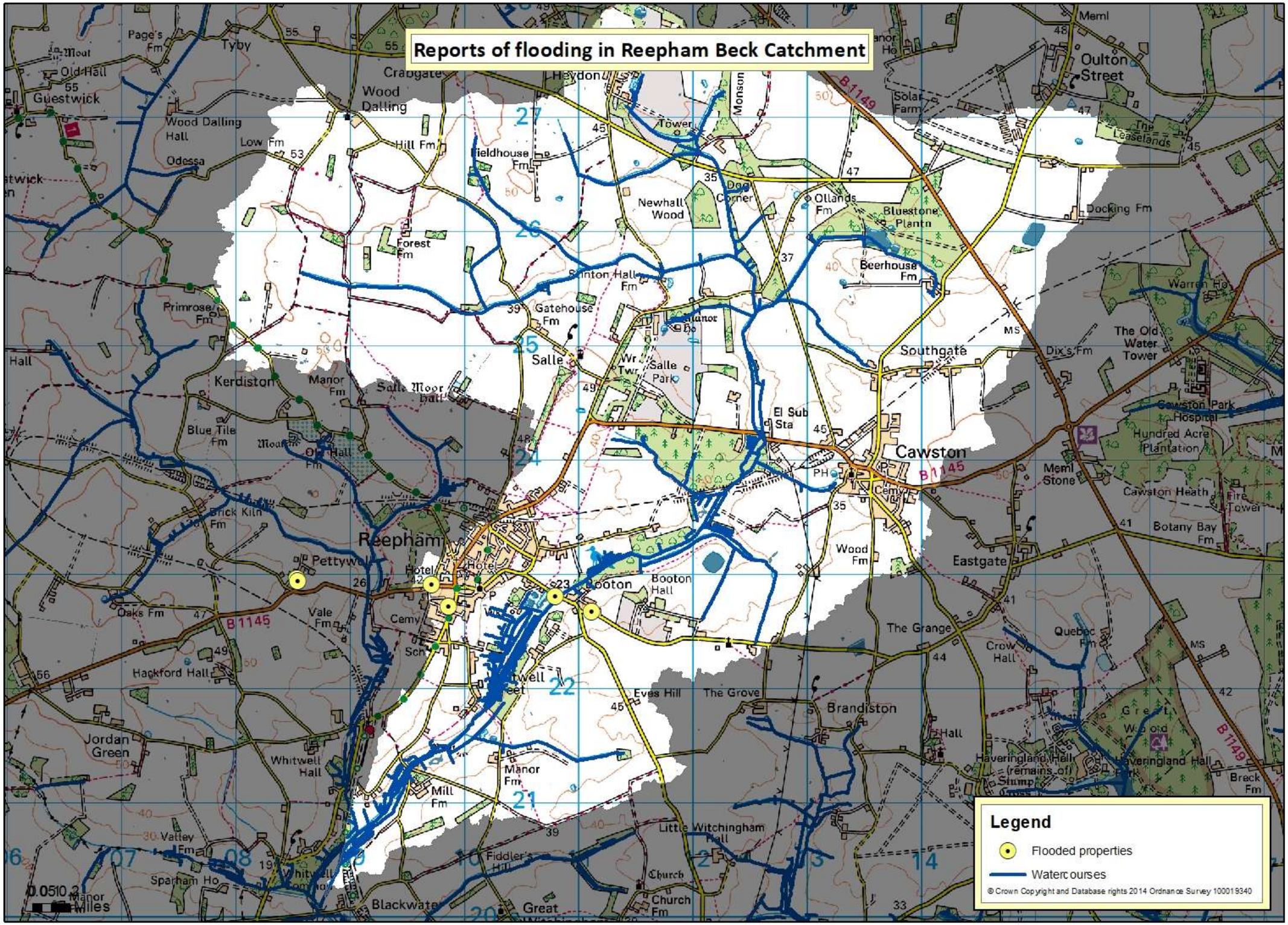
- Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Norfolk County Council and Anglian Water will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- Norfolk County Council and relevant RMAs should explore funding for flood mitigation, attenuation and flood routing.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.




Flooding on Woods Close
Location: Woods Close- 1 report of internal flooding on 23rd June 2016
Causes –
• Run-off from significant rainfall was concentrated along overland flowpaths on which the affected property is positioned.
• 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.
• The affected property had structural issues that did not cope with heavy rainfall, e.g. (failure of roof / guttering etc).
Recommendations –
• 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.
• 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 drainage surveys need to be incorporated into any possible drainage strategy identified for any proposed development.
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
• The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.
OAKWOOD DRIVE
ASH CLOSE
DRAYTON HIGH ROAD
HELLESDON PARK ROAD
WOODS CLOSE
CITY VIEW ROAD
WHIFFLER ROAD
SWEET BRIAR ROAD
CALEY CLOSE
DRAYTON ROAD
BULMER ROAD
Legend
Bridges
Watercourses
Main Rivers
Water bodies
0 0.05 0.1 0.2 0.3 0.4 Miles
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Flooding in Hellesdon
WESTWOOD DRIVE
DRAYTON WOOD ROAD
WOODLAND CLOSE
MARGARET CLOSE
FAIRWAYS
PLANTATION RO
WOODLAND ROAD
COPPICE AVENUE
NURSERY CLOSE
NURSERY CLOSE
HAMOND ROAD
MIDDLETONS LA
LINKS AVENUE
KINSALE AVENUE
DRAYTON HIGH ROAD
FERNDALE CLOSE
Location: Nursery Close- 1 report of internal flooding on the 23rd June 2016
Causes –
• Run-off from significant rainfall pooled at a low point in the garden of the affected property. The flood water entered the property through low thresholds at entrances and cracks in the structure of the property.
Recommendations –
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
• The property owner should carry out maintenance to the property to ensure water does not seep through cracks and holes in the walls/ doors/ windows. The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.
Location: Drayton High Road - 1 report of internal flooding on the 23rd June 2016
Causes –
• Surface run-off from significant rainfall made its way onto the highway and flowed along the road network and onto the accesses of the affected property that were situated lower than these features.
• Run-off from significant rainfall was directed towards the surface water and foul drainage networks. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected property. The foul drainage system network was partially obstructed by debris. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected property.
Recommendations –
• Norfolk County Council will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
0 0.05 0.1 0.2 Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Flooding in Hellesdon
Location: Lilian Close & Coldershaw Road- 2 reports of internal flooding on 23rd June 2016
Causes –
• Significant rainfall was directed into the surface water and foul drainage networks. These flows could not be accommodated as the systems were already overloaded. This caused it to surcharge elsewhere.
• The water pooled at a low point within the catchment affecting these properties.
• Surface run-off from significant rainfall made its way onto the highway and flowed along the road network and onto the accesses of affected properties that were situated lower than these features.
Recommendations –
• Norfolk County Council will consider opportunities to carry out a survey of the drainage system.
• Norfolk County Council will determine an appropriate maintenance regime in line with the risk identified and communicate with affected parties and riparian owners.
BRABAZON ROAD
WARREN AVENUE
WALDEMAR PARK
WALDEMAR AVENUE
BRACKEN AVENUE
HEATHER AVENUE
SILK MILL ROAD
CROMER ROAD
EVERSLEY ROAD
REEPHAM ROAD
MAYFIELD AVENUE
COLDERSHAW ROAD
LILIAN CLOSE
LILIAN CLOSE
MERCHANT WAY
VERA ROAD
REEPHAM ROAD
CURTIS ROAD
MASON ROAD
WESTON ROAD
MILE CROSS LANE
OVERBURY ROAD
BOUNDARY AVENUE
BOUNDARY ROAD
SPYNKE ROAD
AYLSHAM ROAD
BAXTER COURT
DALRYMPLE WAY
ACLAND MEWS
RYE AVENUE
MARSHALL ROAD
BAXTER COURT
0
0.05
0.1
0.2
Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Reports of flooding in Reepham Beck Catchment
Legend
Flooded properties
Watercourses
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340
0 0.5 1 2
Miles
Reepham
Cawston
Southgate
Eastgate
Booton
Salle
Brandiston
Oulton Street
Guestwick
Kerdiston
Jordan Green
Whitwell Hall
Hackford Hall
Little Witchingham Hall
Haveringland Hall (remains of)
Haveringland Hall Park
Wood Dalling
Wood Dalling Hall
Newhall Wood
Beerhouse Fm
Docking Fm
Dix's Fm
Cawston Park Hospital
Hundred Acre Plantation
Botany Bay Fm
Quebec Fm
The Grange
Crow Hall
Eves Hill
The Grove
Booton Hall
Salle Park
Salle Moor Hall
Gatehouse Fm
Manor Fm
Mill Fm
Church Fm
Fiddler's Hill
Brick Kiln Fm
Blue Tile Fm
Primrose Fm
Forest Fm
Hill Fm
Fieldhouse Fm
Dog Corner
Ollands Fm
Bluestone Plantn
Warren Ho
The Old Water Tower
Meml Stone
Cawston Heath
Fire Tower
Wood Fm
Vale Fm
Oaks Fm
Valley Fm
Sparham Ho
Breck Fm
The Leaselands
Solar Farm
Tyby
Page's Fm
Old Hall
Crabgate
Heydon
Tower
Monson
Low Fm
Odessa
Dix's Fm
El Sub Sta
PH
Cemy
Hotel
Sch
Pettywell
B1145
B1149

What are catchments?

To aid the investigation process and, for ease of presentation, the incidents of flooding have been grouped within this document based on hydrological catchments. The purpose of viewing flooding incidents based on catchments reflects the reality that flooding does not respect the administrative boundaries of water management organisations. Hydrological catchments catch water 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.

Description of catchment

This catchment covers the North West of the Broadland District Council area. It is a largely rural catchment and the water falls towards the River Wensum to the South along overland flowpaths and tributaries. As such there is 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.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	42	12
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	119	26
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	3	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 6 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
13/07/2014	On the 13th July 2014 - 1 property was internally flooded on Norwich Road, Reepham. This incident was reported by the Environment Agency via email	• Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.

	correspondence on the 17th July 2014 (706)	
13/07/2014	On the 13th July 2014 - 1 property was internally flooded on Church Road, Booton. This incident was reported by a resident via an online flood report form on the 11th August 2014 (825)	• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
13/07/2014	On the 13th July 2014 - 1 property was internally flooded on Sun Barn Walk, Reepham. This incident was reported by Norfolk County Council (Highways) via email correspondence on the 17th July 2014 (1245)	• Norfolk County Council (Lead Local Flood Authority) Norfolk County Council assessed validity and impact of the flood report after the incident.
13/07/2014	On the 13th July 2014 - 1 property was internally flooded on Dereham Road, Reepham. This incident was reported by a resident via an online flood report form on the 14th July 2014 (679)	• Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
13/07/2014	On the 13th July 2014 - 2 properties were internally flooded on Pettywell, Reepham. This incident was reported by the Fire and Rescue Service via an online flood report form on the 11th August 2014 (832) and via a flood questionnaire on the 7th April 2016 (2500)	• The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

4 of the incidents of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

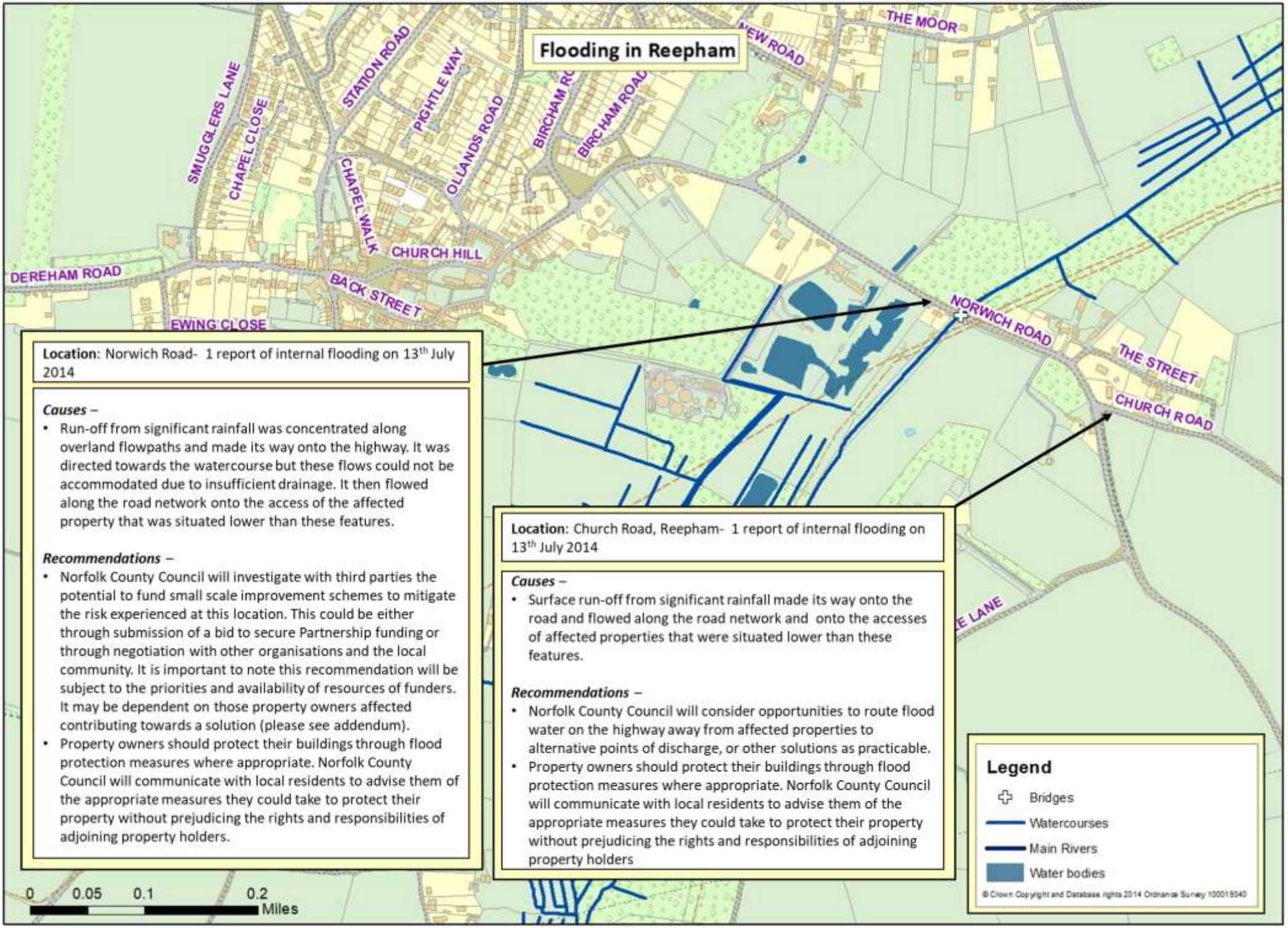
13th July 2014- 22.60mm rainfall was recorded as falling in 1 hour at the Salle STW rainfall monitoring stations. The intensity of rainfall for the total duration equates to a 7 year rainfall event.

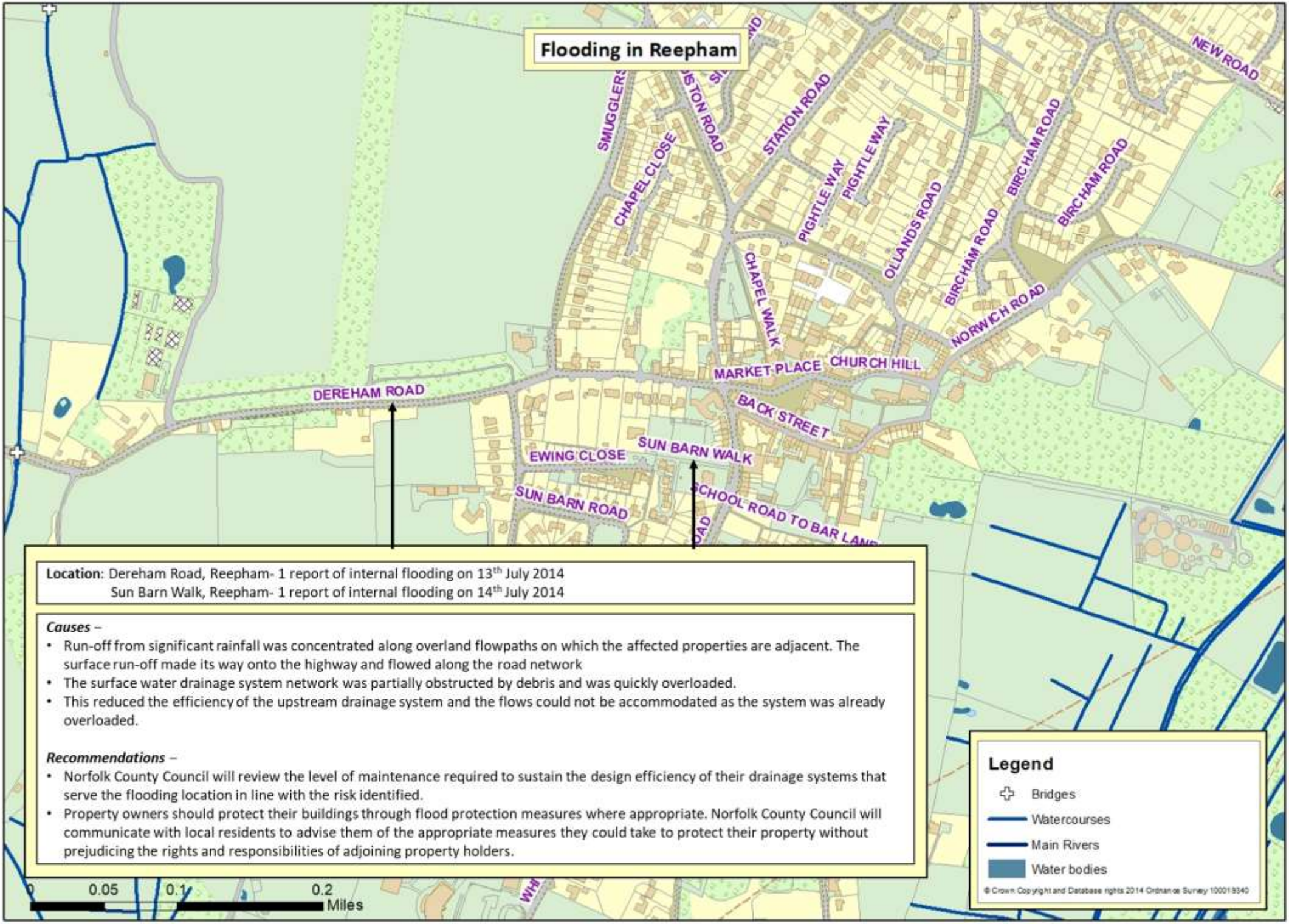
Causes of flooding within the catchment and recommendations

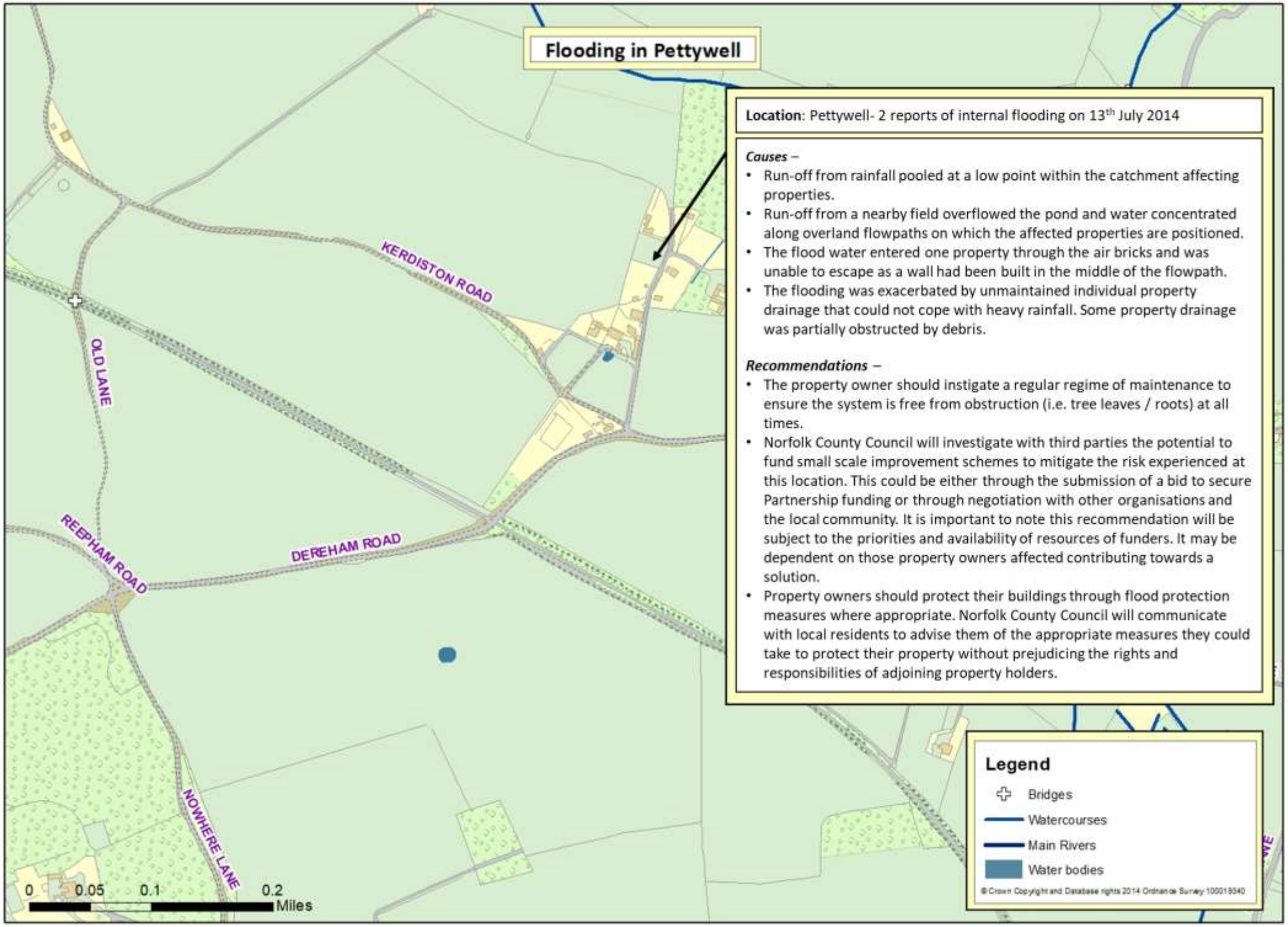
The findings of the investigation are detailed on the following pages. There is a map for each address affected. The maps detail the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The maps set out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

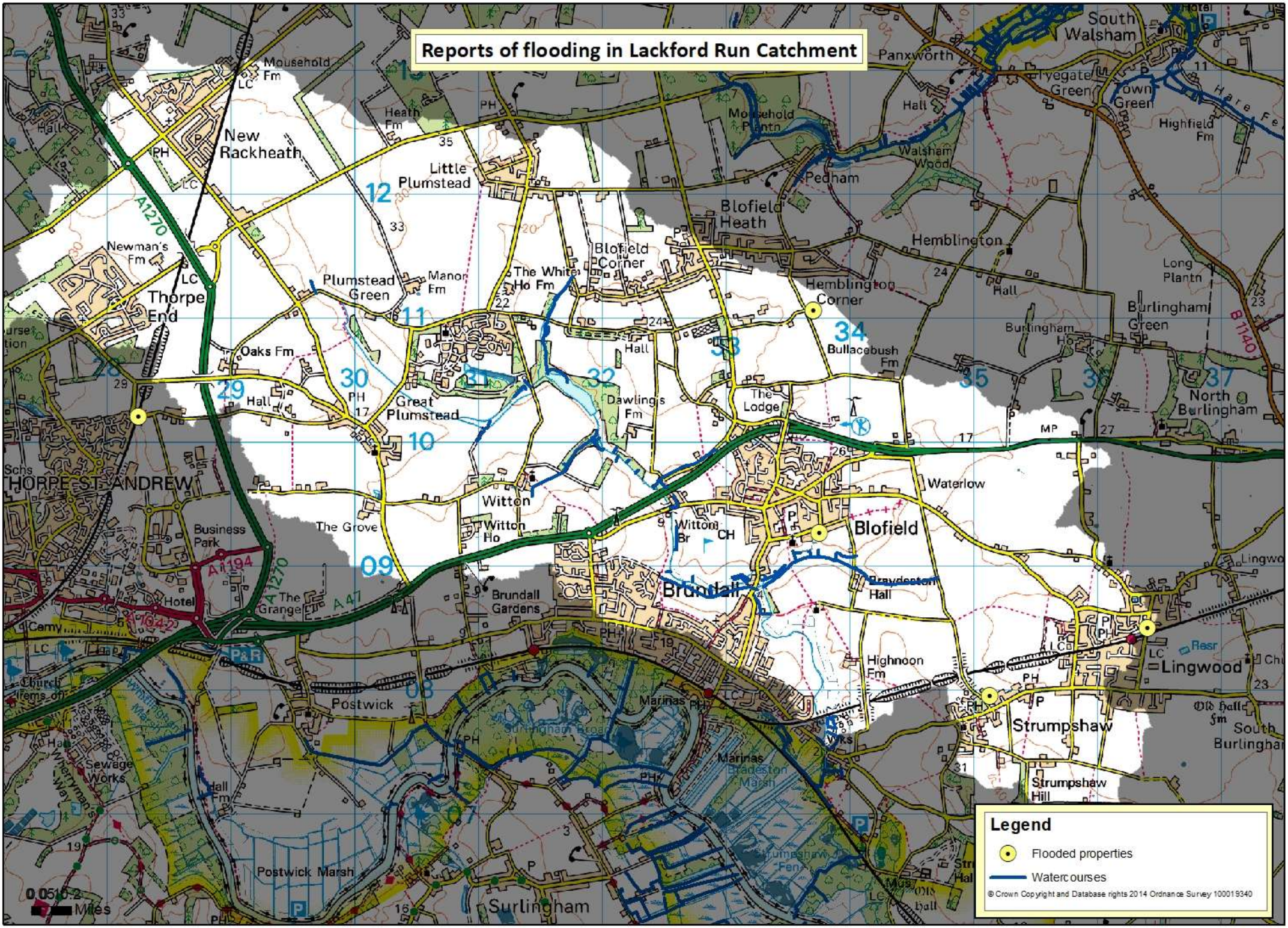
Following flooding to people, property and infrastructure;

- Risk Management Authorities should
  - communicate with affected residents where their assets have given rise to the flooding of properties.
  - review the appropriateness of their response to flooding.
  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- Property owners of affected properties should seek their own legal advice.
- NCC should
  - incorporate all relevant information of actual flooding into the review of the Norfolk Preliminary Flood Risk Assessment ("PFRA").
  - review and monitor the delivery of recommendations within this and other relevant flood investigation reports.


Flooding in Reepham
THE MOOR
STATION ROAD
PIGHTLE WAY
OLLANDS ROAD
BIRCHAM ROAD
SMUGGLERS LANE
CHAPEL CLOSE
CHAPEL WALK
CHURCH HILL
DEREHAM ROAD
BACK STREET
EWING CLOSE
NORWICH ROAD
THE STREET
CHURCH ROAD
Location: Norwich Road- 1 report of internal flooding on 13th July 2014
Causes –
• Run-off from significant rainfall was concentrated along overland flowpaths and made its way onto the highway. It was directed towards the watercourse but these flows could not be accommodated due to insufficient drainage. It then flowed along the road network onto the access of the affected property that was situated lower than these features.
Recommendations –
• Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through submission of a bid to secure Partnership funding or through negotiation with other organisations and the local community. It is important to note this recommendation will be subject to the priorities and availability of resources of funders. It may be dependent on those property owners affected contributing towards a solution (please see addendum).
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
Location: Church Road, Reepham- 1 report of internal flooding on 13th July 2014
Causes –
• Surface run-off from significant rainfall made its way onto the road and flowed along the road network and onto the accesses of affected properties that were situated lower than these features.
Recommendations –
• Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340
0 0.05 0.1 0.2
Miles


Flooding in Reepham
NEW ROAD
SMUGGLERS
CHAPEL CLOSE
STATION ROAD
PIGHTLE WAY
PIGHTLE WAY
OLLANDS ROAD
BIRCHAM ROAD
BIRCHAM ROAD
BIRCHAM ROAD
CHAPEL WALK
NORWICH ROAD
MARKET PLACE
CHURCH HILL
DEREHAM ROAD
BACK STREET
EWING CLOSE
SUN BARN WALK
SUN BARN ROAD
SCHOOL ROAD TO BAR
Location: Dereham Road, Reepham- 1 report of internal flooding on 13th July 2014
Sun Barn Walk, Reepham- 1 report of internal flooding on 14th July 2014
Causes –
• Run-off from significant rainfall was concentrated along overland flowpaths on which the affected properties are adjacent. The surface run-off made its way onto the highway and flowed along the road network
• The surface water drainage system network was partially obstructed by debris and was quickly overloaded.
• This reduced the efficiency of the upstream drainage system and the flows could not be accommodated as the system was already overloaded.
Recommendations –
• Norfolk County Council will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
0 0.05 0.1 0.2
Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Flooding in Pettywell
KERDISTON ROAD
OLD LANE
REEPHAM ROAD
DEREHAM ROAD
NOWHERE LANE
0 0.05 0.1 0.2 Miles
Location: Pettywell- 2 reports of internal flooding on 13th July 2014
Causes –
• Run-off from rainfall pooled at a low point within the catchment affecting properties.
• Run-off from a nearby field overflowed the pond and water concentrated along overland flowpaths on which the affected properties are positioned.
• The flood water entered one property through the air bricks and was unable to escape as a wall had been built in the middle of the flowpath.
• The flooding was exacerbated by unmaintained individual property drainage that could not cope with heavy rainfall. Some property drainage was partially obstructed by debris.
Recommendations –
• The property owner should instigate a regular regime of maintenance to ensure the system is free from obstruction (i.e. tree leaves / roots) at all times.
• Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through the submission of a bid to secure Partnership funding or through negotiation with other organisations and the local community. It is important to note this recommendation will be subject to the priorities and availability of resources of funders. It may be dependent on those property owners affected contributing towards a solution.
• Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Reports of flooding in Lackford Run Catchment
Legend
Flooded properties
Watercourses
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340
0 0.5 1 2
Miles
New Rackheath
Little Plumstead
Thorpe End
Plumstead Green
Great Plumstead
Blofield Heath
Blofield Corner
Hemblington
Hemblington Corner
Bullacebush Fm
Blofield
Brundall
Brundall Gardens
Witton
Witton Ho
Witton Br
Waterlow
Braydeston Hall
Lingwood
Strumpshaw
Strumpshaw Hill
Postwick
Postwick Marsh
Surlingham
Marinas
Highnoon Fm
Oaks Fm
Manor Fm
The White Ho Fm
Dawlings Fm
The Lodge
Burlingham Green
North Burlingham
South Walsham
Panxworth
Pedham
Walsham Wood
Highfield Fm
Long Plantn
Business Park
The Grange
The Grove
Brundall Gardens
Sewage Works
Marinas
Braydeston Marsh
Strumpshaw Fen
Old Hall Fm
South Burlingham
A1270
A47
A1042
A1194
B1140

What are catchments?

To aid the investigation process and, for ease of presentation, the incidents of flooding have been grouped within this document based on hydrological catchments. The purpose of viewing flooding incidents based on catchments reflects the reality that flooding does not respect the administrative boundaries of water management organisations. Hydrological catchments catch water 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.

Description of catchment

This catchment covers the South East of the Broadland District Council area. The water falls south along overland flowpaths eventually reaching the River Yare. As such there is 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.

Flood Risk within the catchment

The flood risk from local sources (ordinary watercourses and surface run-off) and strategic sources (fluvial above 3 square km and the sea) of flooding within this catchment has been assessed. The number of properties at risk are set out in the table below for two different risk bandings, the 1 in 30 year event and the 1 in 100 year event. This assessment does not take into account flood risk from groundwater or reservoir failure.

Flood Risk Data Source	Critical Services	Residential	Non-residential
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	55	4
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	2	177	9
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	0	0
[e] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 30 year event:	0	0	0
[f] No. of properties only subject to both flood risk from surface water and rivers and the sea (combined risk) at 1 in 100 year event:	0	0	0

Flood incidents within this catchment

Within this catchment 4 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
13/07/2014	On the 13th July 2014 - 1 property was internally flooded on Church Road, Blofield. This incident was reported by Norfolk County Council (Highways) via	• Norfolk County Council (Highways) visited affected residents to offer advice and to gather information during the incident.

	an electronic report on the 14th July 2014 (788)	
08/10/2014	On the 8th October 2014 - 1 property was internally flooded on Hemblington Road, Strumpshaw. This incident was reported by a resident via email correspondence on the 8th October 2014 (908)	• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information during the incident.
12/11/2014	On the 12th November 2014 - 1 property was internally flooded on Station Road, Lingwood & Burlingham. This incident was reported by a resident via an electronic report on the 1st December 2014 (1155)	• Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident. • Norfolk County Council (Lead Local Flood Authority) carried out measures to minimise the impact of flooding after the incident.
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Ranworth Road, Blofield. This incident was reported by Broadland District Council via email correspondence on the 11th July 2016 (0297)	• The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.

Recent rainfall within the catchment

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

Historic flooding incidents within the catchment

The following table lists flooding incidents within the catchment that have been recorded:

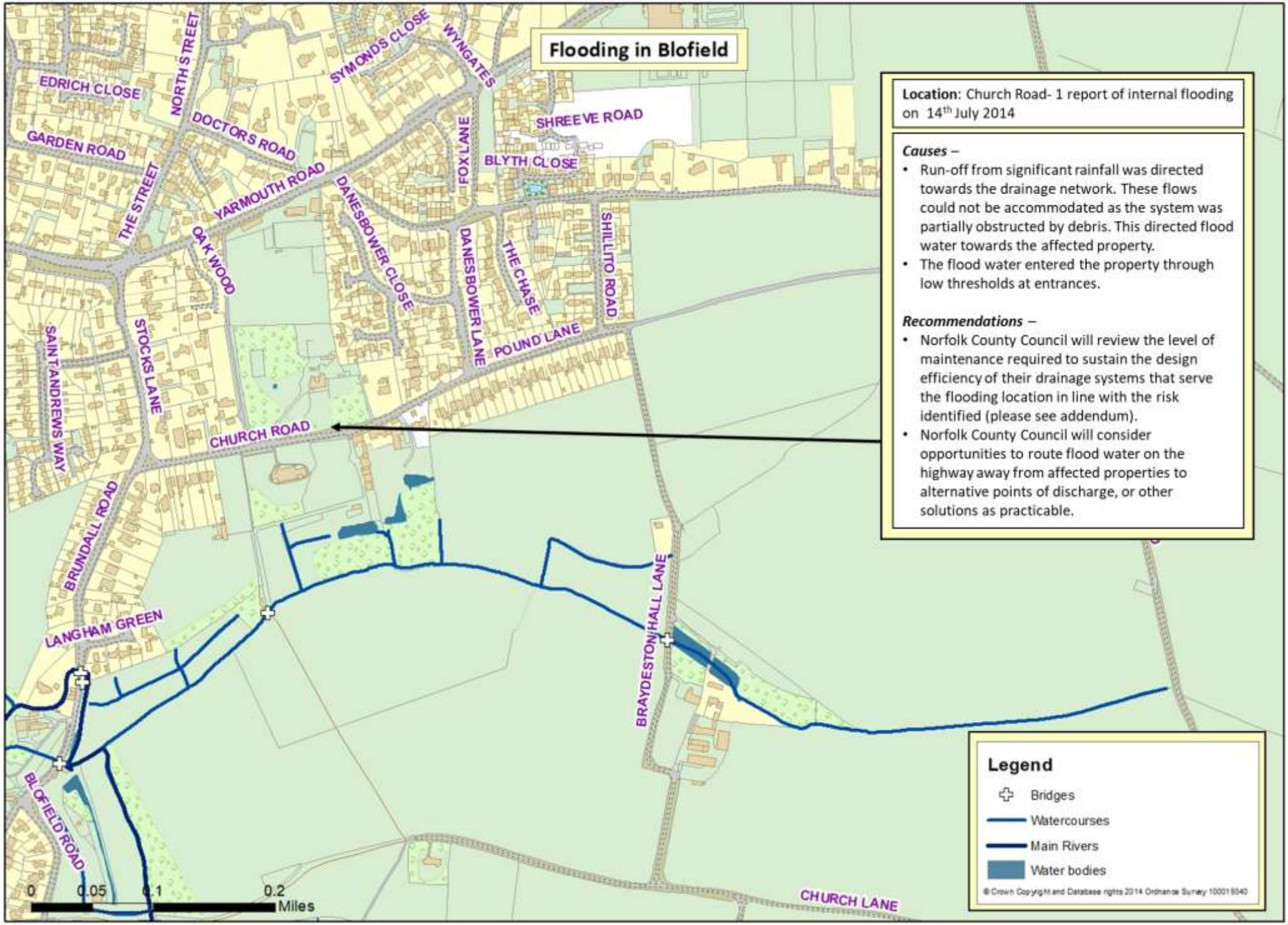
Date of incident	Impact	Rainfall intensity
Various	Resident of Hemblington Road mentioned several incidents of historic flooding when reporting this incident	Unknown
Various	Resident of Station Road mentioned regular flooding when reporting this incident	Unknown
Various	Resident of Ranworth Road mentioned several incidents of flooding within a couple of months in which the fire brigade had to attend three times	Unknown

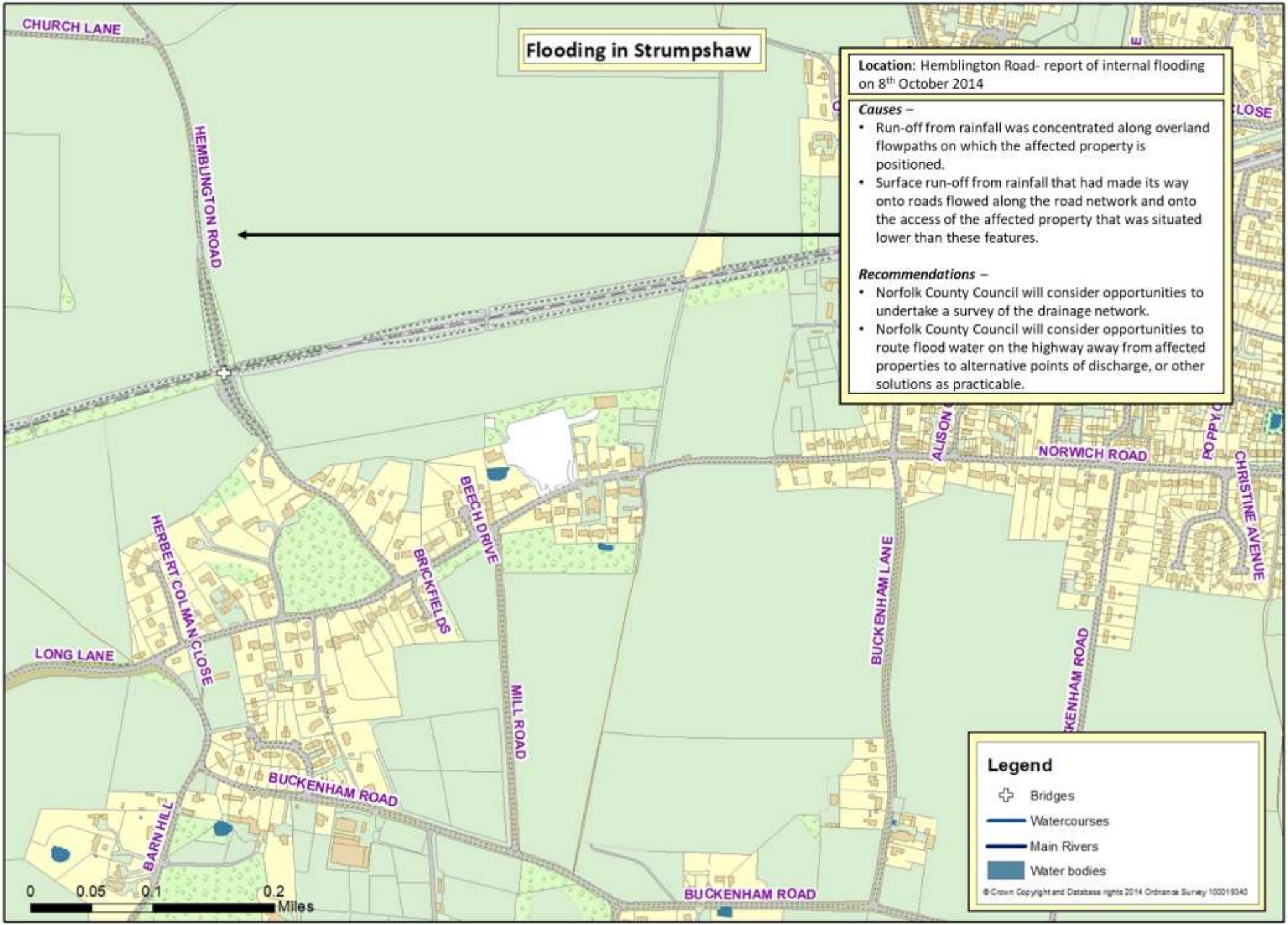
Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following pages. There is a map for each address affected. The maps detail the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The maps set out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

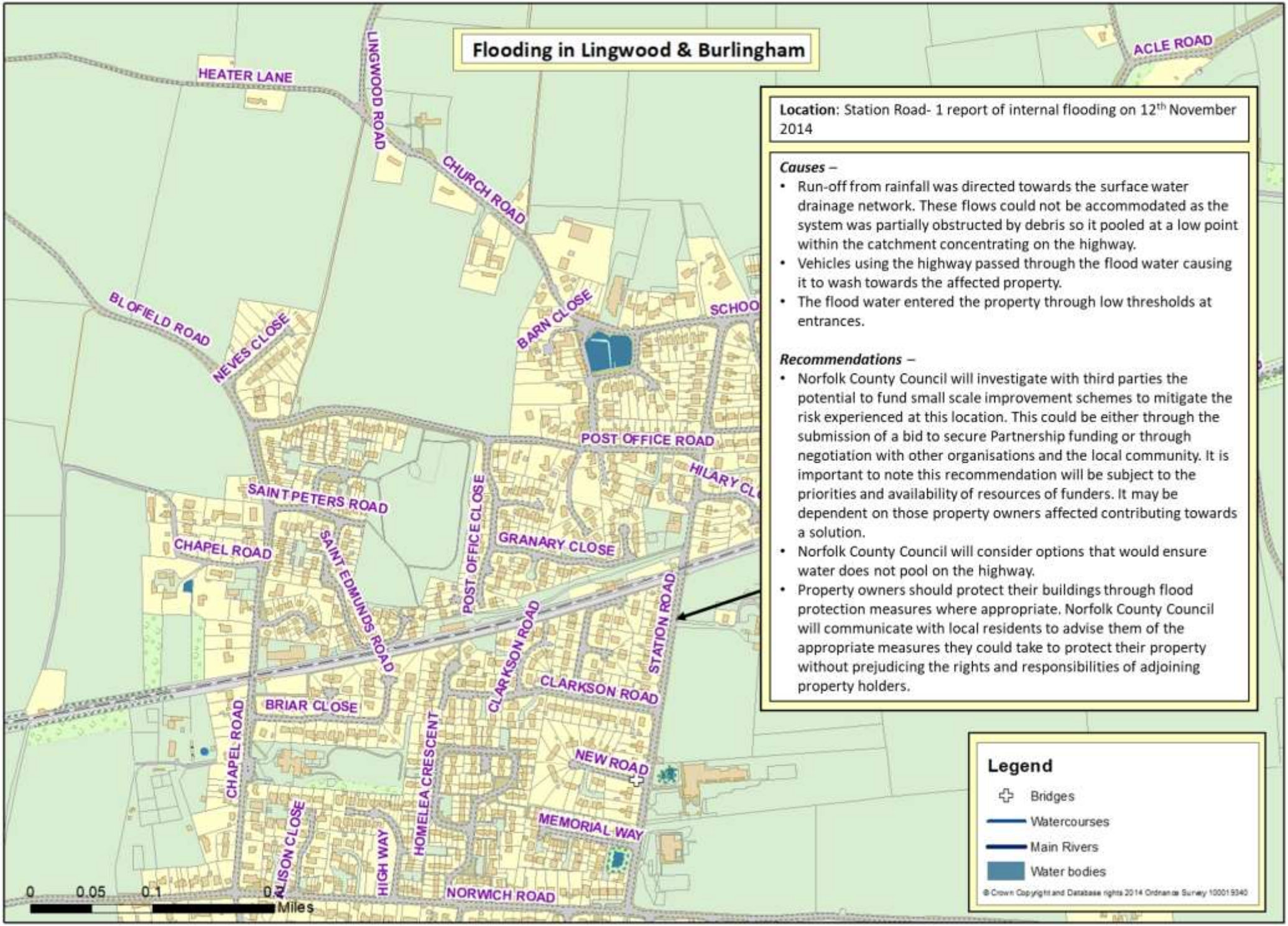
Following flooding to people, property and infrastructure;

- Risk Management Authorities should
  - communicate with affected residents where their assets have given rise to the flooding of properties.
  - review the appropriateness of their response to flooding.
  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- Property owners of affected properties should seek their own legal advice.
- NCC should
  - incorporate all relevant information of actual flooding into the review of the Norfolk Preliminary Flood Risk Assessment ("PFRA").
  - review and monitor the delivery of recommendations within this and other relevant flood investigation reports.


Flooding in Blofield
Location: Church Road- 1 report of internal flooding on 14th July 2014
Causes –
• Run-off from significant rainfall was directed towards the drainage network. These flows could not be accommodated as the system was partially obstructed by debris. This directed flood water towards the affected property.
• The flood water entered the property through low thresholds at entrances.
Recommendations –
• Norfolk County Council will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified (please see addendum).
• Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
EDRICH CLOSE
NORTH STREET
SYMONDS CLOSE
WYNGATES
GARDEN ROAD
DOCTORS ROAD
SHREEVE ROAD
FOX LANE
BLYTH CLOSE
THE STREET
YARMOUTH ROAD
DANESBOWER CLOSE
DANESBOWER LANE
THE CHASE
SHILLITO ROAD
OAK WOOD
SAINT ANDREWS WAY
STOCKS LANE
POUND LANE
CHURCH ROAD
BRUNDALL ROAD
LANGHAM GREEN
BRAYDESTON HALL LANE
BLOFIELD ROAD
CHURCH LANE
0
0.05
0.1
0.2
Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340


Flooding in Strumpshaw
Location: Hemblington Road- report of internal flooding on 8th October 2014
Causes –
• Run-off from rainfall was concentrated along overland flowpaths on which the affected property is positioned.
• Surface run-off from rainfall that had made its way onto roads flowed along the road network and onto the access of the affected property that was situated lower than these features.
Recommendations –
• Norfolk County Council will consider opportunities to undertake a survey of the drainage network.
• Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
CHURCH LANE
HEMBLINGTON ROAD
NORWICH ROAD
ALISON CLOSE
POPPY ROAD
CHRISTINE AVENUE
BEECH DRIVE
BRICKFIELDS
HERBERT COLMAN CLOSE
LONG LANE
MILL ROAD
BUCKENHAM LANE
BUCKENHAM ROAD
BARN HILL
BUCKENHAM ROAD
0 0.05 0.1 0.2 Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding in Lingwood & Burlingham



Location: Station Road- 1 report of internal flooding on 12th November 2014

Causes –

- Run-off from rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was partially obstructed by debris so it pooled at a low point within the catchment concentrating on the highway.
- Vehicles using the highway passed through the flood water causing it to wash towards the affected property.
- The flood water entered the property through low thresholds at entrances.

Recommendations –

- Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through the submission of a bid to secure Partnership funding or through negotiation with other organisations and the local community. It is important to note this recommendation will be subject to the priorities and availability of resources of funders. It may be dependent on those property owners affected contributing towards a solution.
- Norfolk County Council will consider options that would ensure water does not pool on the highway.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

Flooding in Blofield

Location: Ranworth Road- 1 report of internal flooding on 23rd June 2016

Causes –

- Land management techniques used in an adjacent field directed surface run-off towards a low point within the catchment. This forced run off into the property that was situated lower than these features.
- The flood water entered the property through low thresholds at entrances and the air bricks.

Recommendations –

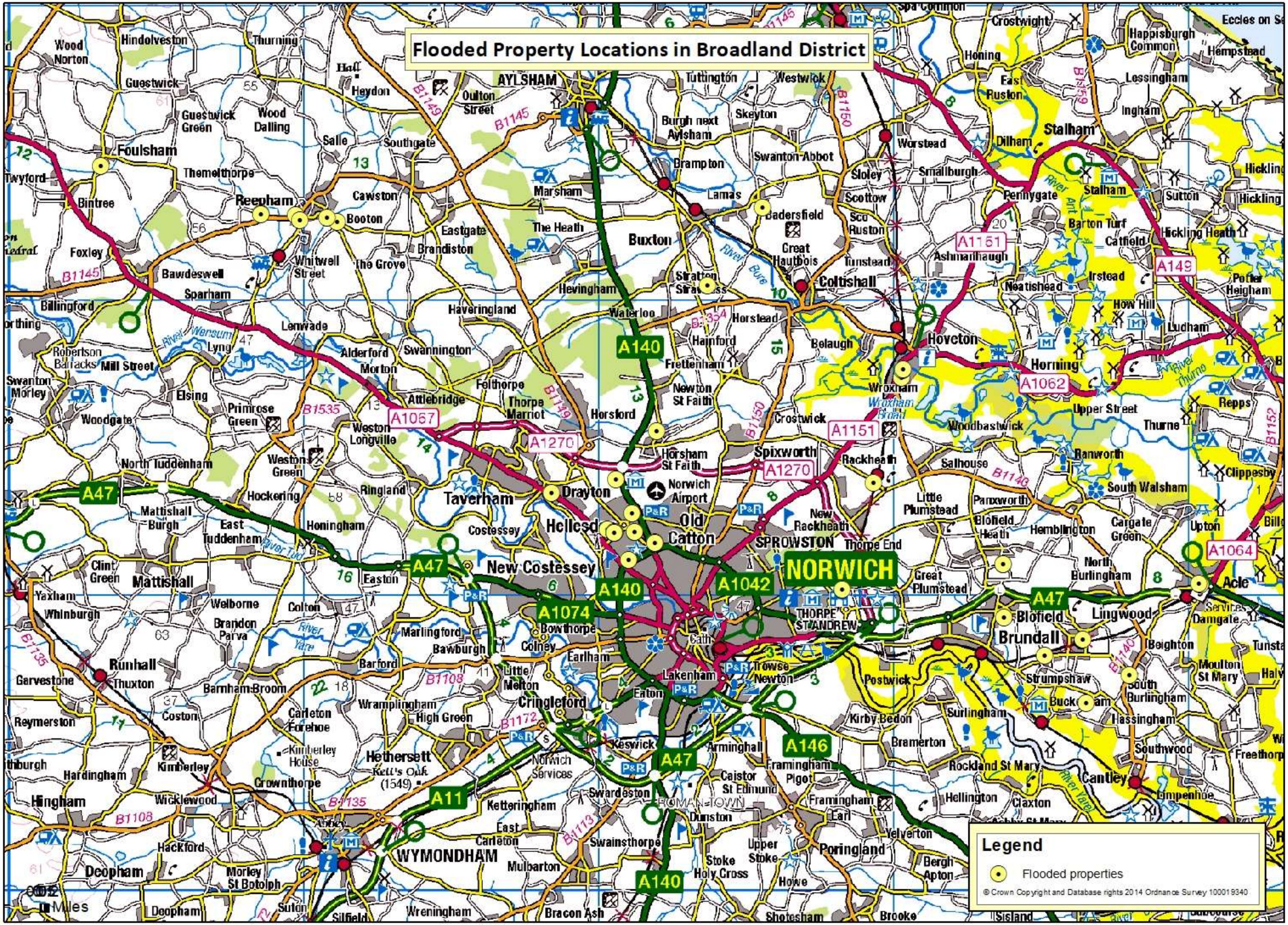
- Amendments should be made to neighbouring properties and land management techniques employed, to ensure water is not directed to other properties. The LLFA will work with riparian owners on this
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

ROSEMARY ROAD
ALLENS CLOSE
MILL CLOSE
HARKER WAY
PEDHAM ROAD
HALL ROAD
REED LANE
WOODBASTWICK ROAD
HOLLY LANE
RANWORTH ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies


Flooded Property Locations in Broadland District
Legend
Flooded properties
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340
NORWICH
AYLSHAM
WYMONDHAM
Reepham
Taverham
Drayton
Hellesdon
Old Catton
SPROWSTON
THORPE ST ANDREW
Brundall
Blofield
Acle
Coltishall
Hoveton
Wroxham
Horning
Foulsham
Buxton
Horsford
Spixworth
Rackheath
New Costessey
Cringleford
Hethersett
Poringland
Stalham

Various flood incidents within Breckland District

Within this area 13 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
27/06/2014	On the 27th June 2014 - 1 property was internally flooded on Charles Close, Wroxham. This incident was reported by a resident via email correspondence on the 27th August 2015 (751)	• Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
26/08/2015	On the 26th August 2015 - 2 properties were internally flooded on Hartwell Road, Wroxham. This incident was reported by a resident via an online flood report form on the 27th August 2015 (1868 & 1847)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
27/06/2014	On the 27th June 2014 – 3 properties were internally flooded on New Road, Acle. This incident was reported by a resident via a flood questionnaire on 4th February 2014 (2488, 2489 & 1253)	• A councillor from Norfolk County Council visited the affected resident after the incident and supplied sandbags.
17/07/2015	On the 17th July 2015 - 1 property was internally flooded on Station Road, Foulsham. This incident was reported by a resident via an electronic report on the 9th November 2015 (1875)	• Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
24/08/2015	On the 24th August 2015 - 1 property was internally flooded on Elizabeth Lane, Buxton with Lammas. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 13th September 2015 (1953) This property flooded again in 2016.	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Norwich Road, Horsham St Faith and Newton St Faith. This incident was reported by a resident via email correspondence on the 29th June 2016 (2902)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
23/06/2016	On the 23rd June 2016 - 1 property was internally flooded on Barnby Road, Buxton with Lammas. This incident was reported by the Fire and Rescue Service via an online flood report form on the 23rd June 2016 (3145)	• The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
07/07/2016	On the 23rd June 2016 - 1 property was internally flooded on Harts Hill, Horsford. This incident was reported by	• Norfolk County Council (Lead Local Flood Authority) assessed

	a resident via email correspondence on the 26th June 2016 (2846)	validity and impact of the flood report after the incident.
12/07/2016	On the 12th July 2016 - 1 property was internally flooded on School Road, Strumpshaw. This incident was reported by a resident via a flood questionnaire on the 13th July 2016 (3046)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident • Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
12/07/2016	On the 12th July 2016 - 1 property was internally flooded on Carn Close, Beighton. This incident was reported by a resident via email correspondence on the 21st July 2016 (3051)	• The Fire and Rescue Service responded and pumped out during the incident. • Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident.
26/01/2013	On the 26th January 2013- 1 car was stuck and had to be abandoned after flooding on Station Road underneath Salhouse Railway Bridge. This incident was reported by the media on 27th January 2013 (0161)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident. • Norfolk Police responded to the incident and secured the scene.
23/11/2014	On the 22nd November 2014- 1 car was stuck, requiring recovery after flooding on Green Lane North, Great Plumstead. This incident was reported by the media on 24th November 2014 (2287)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident. • Norfolk Police attended the scenes to close the road which remained closed for the whole weekend.
07/01/2016	On the 7th January 2016- 1 car was stuck in floodwater on Green Lane North, Great Plumstead. This incident was reported by the media on 7th January 2016 (2287)	• Norfolk County Council (Lead Local Flood Authority) assessed validity and impact of the flood report after the incident. • The Fire and Rescue Service responded after being called out.

<u>Recent rainfall within the area</u>

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the catchment that led to the flooding. This analysis is useful in assessing (in broad terms) if the design capacity of drainage systems within the affected areas was exceeded.

Norfolk County Council has sought to use data from rain gauges where incidents of flooding are located within a 2.5 km radius of the instrumentation. This distance meets the requirements of British Standards and aims to capture localised rainfall patterns. Where there is no available data within this radius this will be stated.

8 of the incidents of internal flooding in this area are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

27th June 2014- The rainfall recorded at Acle STW did not highlight any irregularities.

26th August 2015- 25.38mm rainfall was recorded as falling in 4 hours at the Belaugh STW rainfall monitoring stations. The intensity of rainfall for the total duration equates to a 2 year rainfall event.

23rd June 2016- 29mm rainfall was recorded as falling in 30 minutes at the Norwich Heigham STW rainfall monitoring stations. The intensity of rainfall for the total duration equates to a 36 year rainfall event. Horsham St Faith- Norwich airport no longer recording this is the closest one

27th June 2016- 17.98mm rainfall was recorded as falling in 1 hour and 15 minutes at the Belaugh STW rainfall monitoring stations. The intensity of rainfall for the total duration equates to a 3 year rainfall event.

Historic flooding incidents within the area
The following table lists flooding incidents within the catchment that have been recorded:

Date of incident	Impact	Rainfall intensity
Various	Residents of Hartwell Road both reported previous incidents of flooding in times of heavy rain	Unknown
Various	When the flood in Horsham St Faith was reported, the resident mentioned previous flooding incidents in the area	Unknown
Various	A resident of Harts Hill reported previous incidents of flooding prior to the even in July 2016	Unknown

Causes of flooding within the area and recommendations

The findings of the investigation are detailed on the following pages. There is a map for each address affected. The maps detail the causes that led to flooding within the catchment as well as when and where they were experienced. It also sets out which Risk Management Authorities have responsibility to help manage the causes of the flooding. The maps set out recommendations to mitigate the causes and impacts of the flooding experienced within this catchment.

Following flooding to people, property and infrastructure;

- Risk Management Authorities should
  - communicate with affected residents where their assets have given rise to the flooding of properties.
  - review the appropriateness of their response to flooding.
  - Determine the integrity and/or capacity of their assets where they have contributed to the flooding of properties to understand the systems role in accommodating normal rainfall events as well as mitigating flooding.
- Property owners of affected properties should seek their own legal advice.
- NCC should
  - incorporate all relevant information of actual flooding into the review of the Norfolk Preliminary Flood Risk Assessment ("PFRA").
  - review and monitor the delivery of recommendations within this and other relevant flood investigation reports.

Flooding in Wroxham

Location: Hartwell Road- 2 reports of internal flooding on 26th August 2015

Causes –

- Run-off from significant rainfall made its way onto the highway and flowed along the road network towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded.
- This directed flood water towards the affected properties that were situated lower than these features.

Recommendations –

- Norfolk County Council should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

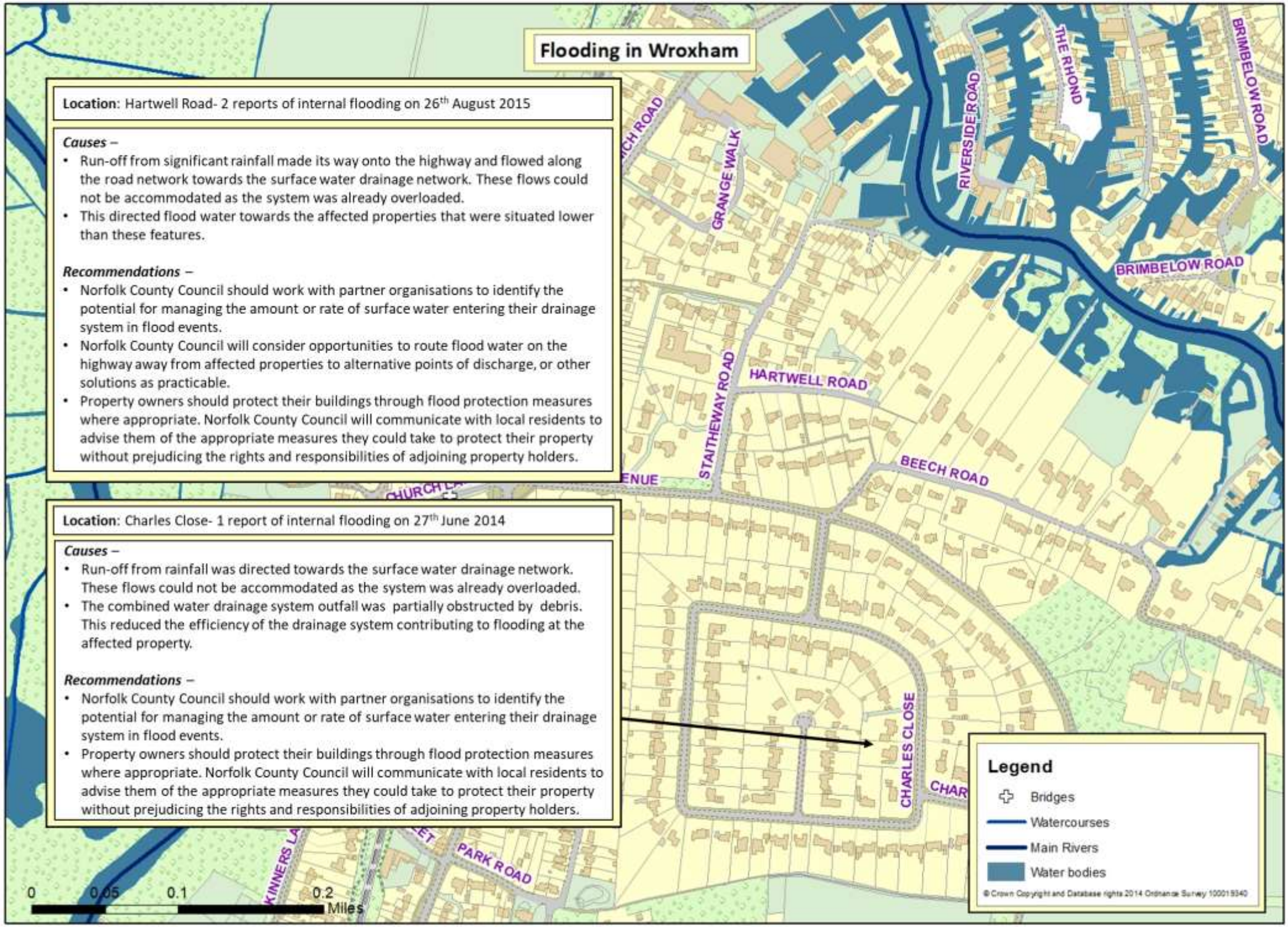
Location: Charles Close- 1 report of internal flooding on 27th June 2014

Causes –

- Run-off from rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded.
- The combined water drainage system outfall was partially obstructed by debris. This reduced the efficiency of the drainage system contributing to flooding at the affected property.

Recommendations –

- Norfolk County Council should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.



Flooding in Acle

Location: New Road- 3 reports of internal flooding on 27th June 2014

Causes –

- Significant rainfall was directed into the surface water and foul system. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected properties.
- The flood water entered the properties through low thresholds at entrances.
- The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding.

Recommendations –

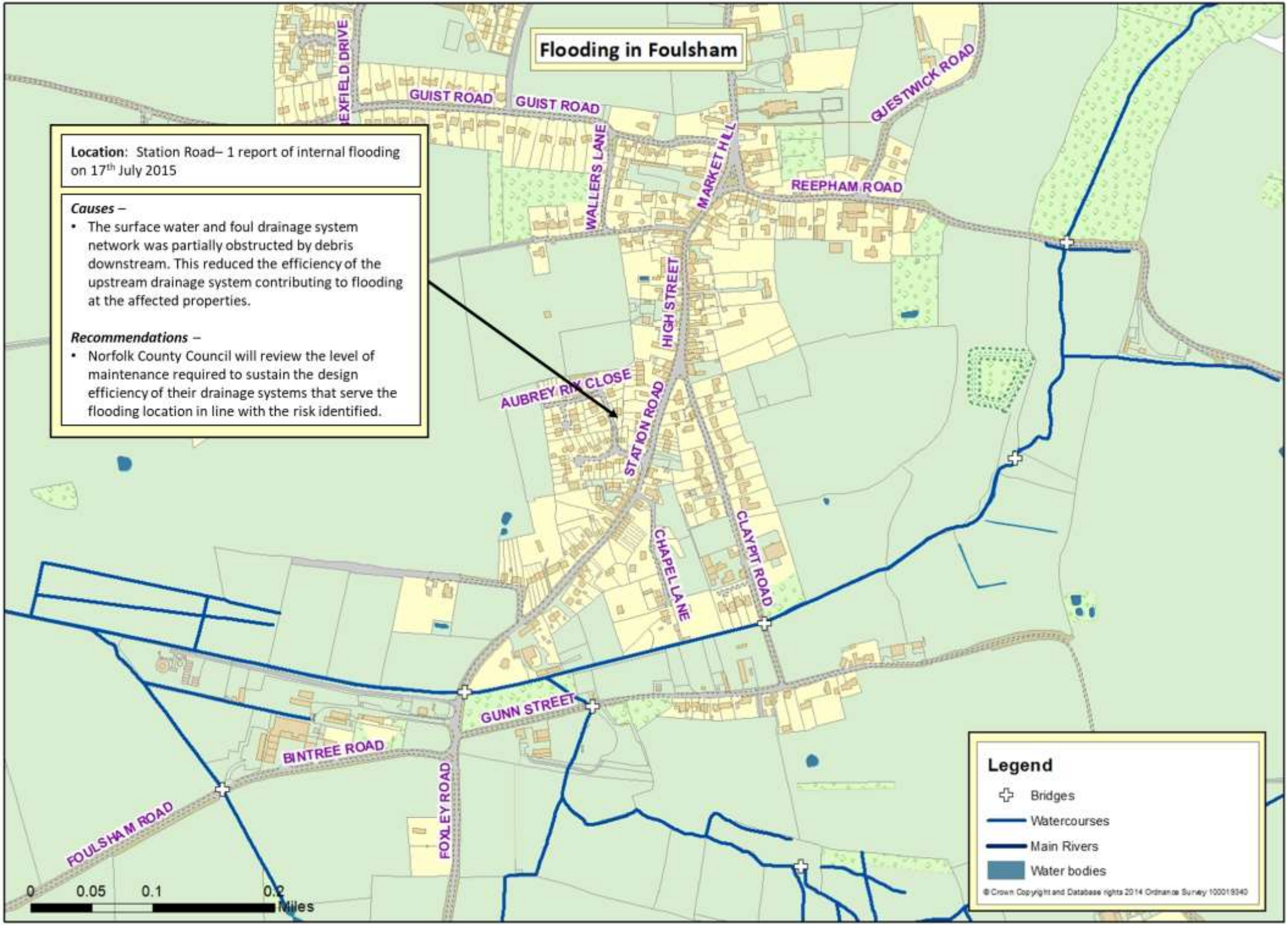
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.
- Norfolk County Council could confirm, where possible, the existence of any connections to a wider drainage network. This work should seek to confirm where the drainage network conveys flows to.
- Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Anglian Water should work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.

BENSLEY CLOSE
BRIDEWELL LANE
OLD ROAD
THE DRIVE
THE STREET
THE GREEN
ELM CLOSE
NEW CLOSE
OXCROFT
ACLE LINK ROAD
NEW ROAD
SPRINGFIELD
MARDLING RUN
THE STREET
PRIORY CLOSE
Acle - A1064 Rbt
MARKET MANOR
OLD MARKET CLOSE
B1140 centre / C to A1064 Acle Rbt
REEDHAM ROAD
Acle - A1064 Acle Rbt to B1140 centre
STATION ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies


Flooding in Foulsham
Location: Station Road– 1 report of internal flooding on 17th July 2015
Causes –
• The surface water and foul drainage system network was partially obstructed by debris downstream. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
Recommendations –
• Norfolk County Council will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
GUIST ROAD
GUIST ROAD
WALLERS LANE
MARKET HILL
GUESTWICK ROAD
REEPHAM ROAD
HIGH STREET
AUBREY RIX CLOSE
STATION ROAD
CHAPEL LANE
CLAYPIT ROAD
GUNN STREET
BINTREE ROAD
FOXLEY ROAD
FOULSHAM ROAD
0
0.05
0.1
0.2
Miles
Legend
Bridges
Watercourses
Main Rivers
Water bodies
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding in Buxton with Lammas

Location – Elizabeth Lane- 1 report of internal flooding on 24th August 2015

Causes –

- Surface run-off from significant rainfall was concentrated along overland flowpaths and made its way onto the road from a neighbouring field.
- The surface run- off pooled at a low point within the catchment and onto the access of the affected property that was lower than these features.
- The flood water entered the property through low thresholds at entrances.

Recommendations –

- Amendments should be made to neighbouring properties to ensure water is not directed to other properties.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

PATCHES LANE

BUXTON ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding in Newton St Faith

Location: Norwich Road- 1 report of internal flooding on 23rd June 2016

Causes –

- The foul drainage system was partially obstructed by debris or silt. This caused run off from significant rainfall to concentrate along overland flowpaths on which the affected property is adjacent to.
- The flood water entered the property through low thresholds at entrances.
- The intensity of rainfall recorded in this area equated to a 1 in 36 year event on this day.

Recommendations –

- Anglian Water will review the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- Anglian Water should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

Flooding in Buxton with Lammas

Location: Barnby Road-1 report of internal flooding on 23rd June 2016

Causes –

- Run-off from significant rainfall was concentrated along overland flowpaths and directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected property.
- The intensity of rainfall recorded in this area equated to a 1 in 36 year event on this day.

Recommendations –

- The roads in this location are unadopted and therefore the drainage network is privately owned. Works should be undertaken to determine the capacity and efficiency of the drainage network by the owner.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders

Flooding in Horsford

Location: Harts Hill- 1 report of internal flooding on 23rd June 2016

Causes –

- Run-off from rainfall pooled at a low point within the catchment affecting the property.
- Run-off from rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected property.

Recommendations –

- Norfolk County Council will continue with their current regular maintenance regime of the drainage network on the A140. The property affected by flooding is located on an unadopted road with a private drainage network. Therefore the owner(s) of this network should carry out a capacity and efficiency assessment
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding in Strumpshaw

Location: School Road-1 report of internal flooding on 12th July 2016

Causes –

- Run-off from significant rainfall was concentrated along overland flowpaths, washing away earth banks separating a field from the affected properties.
- Once the banks had washed away, the flood water entered the property through low thresholds at entrances and the air bricks.

Recommendations –

- The land owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.
- The property owner could confirm, where possible, the existence of any connections to a wider drainage network. This work should seek to confirm where the drainage network conveys flows to.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

SCHOOL ROAD

CHURCH ROAD

CARRS ROAD

CHURCH ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding in Beighton

Location: Carn Close – 1 report of internal flooding on 12th July 2016

Causes –

- Surface run-off from rainfall made its way onto roads and flowed along the road network towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded. This was due to a lack of maintenance and filling in of an adjacent drainage ditch. The flood water was then directed towards the affected property.

Recommendations –

- The riparian owner should instigate a regular regime of maintenance to ensure the system is free from obstruction (i.e. tree leaves / roots) at all times.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

HIGH ROAD

CHAPEL ROAD

NORWICH ROAD

SOUTHWOOD ROAD

WORLDS END

RUMPSHAW ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding in Salhouse

Location: Station Road – 1 report of highway flooding on 26th January 2013

Causes –

- After periods of cold, snowy weather, the temperature began to warm quickly melting the snow at a rapid pace. The localised ground conditions caused snow melt to run off fields onto a highway that was located below these features

Recommendations –

- Amendments should be made to neighbouring properties to ensure water is not directed to other properties.
- Norfolk County Council will consider opportunities to route flood water away from the highway to alternative points of discharge, or other solutions as practicable.
- Norfolk County Council will consider options that would ensure water does not pool on the highway.

HOWLETTS LOKE

HOWLETTS LOKE

WARREN GREEN

STATION ROAD

WOOD GREEN

NORWICH ROAD

0 0.05 0.1 0.2 Miles

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding in Great Plumstead

Location: Green Lane North– 1 report of highway flooding on 22nd November 2014

Causes –

- A yellow warning of rain was issued across the region predicting a risk of flooding due to saturated ground
- Surface run-off from significant rainfall made its way onto the highway, concentrated along overland flowpaths and along the road network

Recommendations –

- Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through the submission of a bid to secure Partnership funding or through negotiation with other organisations and the local community. It is important to note this recommendation will be subject to the priorities and availability of resources of funders. It may be dependent on those property owners affected contributing towards a solution.

Location: Green Lane North– 1 report of highway flooding on 7th January 2016

Causes –

- Flooding was reported across roads in Norfolk and Suffolk on this day; 23mm of rain fell in six hours across the region
- Surface run-off from significant rainfall made its way onto the highway, concentrated along overland flowpaths and along the road network

Recommendations –

- Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through the submission of a bid to secure Partnership funding or through negotiation with other organisations and the local community. It is important to note this recommendation will be subject to the priorities and availability of resources of funders. It may be dependent on those property owners affected contributing towards a solution.

GREEN LANE NORTH
LOW ROAD
LOW ROAD
BROADLAND NORTHWAY
BROADLAND NORTHW
PRIDE WAY
PYM CLOSE
GREEN LANE
ROUNDWAY DOWN

Legend

- Bridges
- Watercourses
- Main Rivers
- Water bodies

0 0.05 0.1 0.2 Miles

Disclaimer

Although every effort has been taken to ensure the accuracy of the information contained within the pages of the report, we cannot guarantee that the contents will always be current, accurate or complete.

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.

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.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by Norfolk County Council when preparing this report, including, but not limited to those key assumptions noted in the Report, including reliance on information provided by third parties.

Norfolk County Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the time of preparation and Norfolk County Council expressly disclaims responsibility for any error in, or omission from this report arising from or in connection with those opinions, conclusions and any recommendations.

The implications for producing Flood Investigation Reports and any consequences of blight have been considered. The process of gaining insurance for a property and/or purchasing/selling a property and any flooding issues identified are considered a separate and legally binding process placed upon property owners and this is independent of and does not relate to the County Council highlighting flooding to properties at a street level.

Appendix A - Key definitions and responsibilities

What is flooding?

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?

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.

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?

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

Below is a short summary of those groups and Risk Management Authorities ("RMAs") that have a role in managing flooding within Norfolk. The listing of responsibilities includes those duties or powers that directly relate to managing the flood incidents or consequence. All RMAs have a duty to cooperate with other RMAs.

1. Norfolk County Council (as Lead Local Flood Authority)

- 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.

2. District Councils

- 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 effect on flood risk.
- Duties as a Category 1 Responder for Emergency Planning.

3. Internal Drainage Boards ("IDBs")

- A duty to act in a manner consistent with the national and local strategies and guidance when exercising FCERM functions.
- Duty to act in a manner consistent with Local Flood Risk Management Strategies when exercising other functions that may affect flood risk.
- Powers to regulate activities on ordinary watercourses within IDB areas.
- Exercise a general power of supervision over all matters relating to the drainage of land within their district.
- Powers to undertake works on ordinary watercourses within IDB areas.

4. Highway Authorities (Norfolk County Council / Highways England)

- 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. Currently NCC discharges its responsibilities associated with bridges and culverts (whether as owner or highway authority) through the inspection of condition (undertaken by the Bridges team) and through maintenance activity (delivered on a as needs basis by the relevant Highways area team).

5. Water Companies

- Undertake cost beneficial 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.

6. Riparian Owners

- 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.