

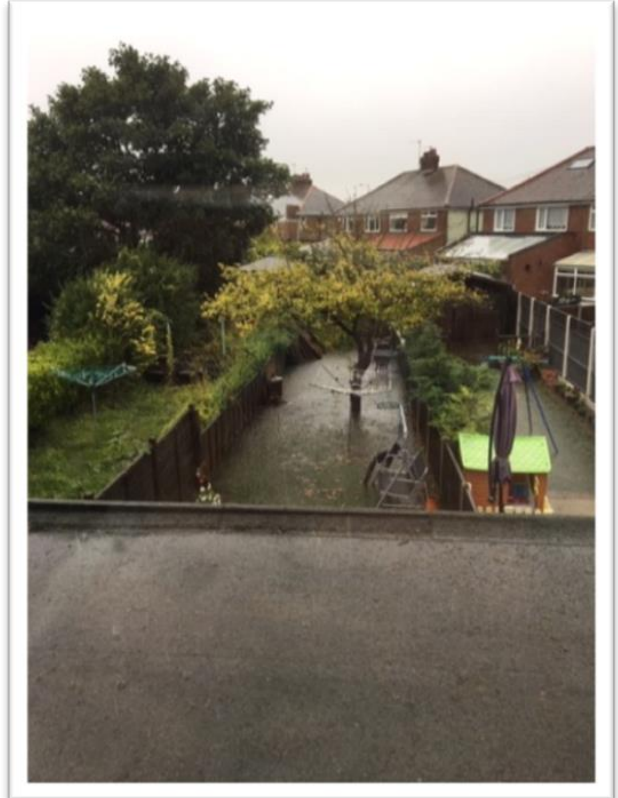


# Norfolk County Council

## Investigation Report into the flooding across Norfolk on the 6<sup>th</sup> October 2019

Report Reference: FIR048

Draft Report prepared by Mark Henderson, Nathan Harris, Abygail Hadley and Nathalie Harris on 14<sup>th</sup> January 2020.



## **Introduction**

Flooding occurred across Norfolk on the 6<sup>th</sup> October 2019. 102 properties have confirmed internal flooding on this day and 1 critical road was closed in two places due to flooding. 96 of these reports are included in this investigation. The remaining reports will be investigated in an additional report.

Prior to the flooding on the 6<sup>th</sup> October there was a high amount of rainfall in the last week and a half of September. Across the East, in September the area received 131% of its monthly long-term average for rainfall, with some areas, such as North West Norfolk, experiencing 151% of its long-term rainfall. This meant that many watercourses were already experiencing high flows and the water table was elevated. On the 6<sup>th</sup> October some areas experienced up to 69mm of rainfall, meaning many areas experienced a months' worth of rainfall in one day.

For the purpose of this report and ease of presentation we have divided the report by District, then settlement.

We would like to acknowledge and thank staff from the Environment Agency who supported the LLFA in providing information and guidance to residents in response to the flooding that occurred on the 6<sup>th</sup> October 2019.

## **Table of Contents**

<a href="#">Flooding in Broadland District</a> .....	4
<a href="#">Flooding in Great Yarmouth Borough</a> .....	61
<a href="#">Flooding in North Norfolk</a> .....	86
<a href="#">Flooding in Breckland</a> .....	104
<a href="#">Flooding in South Norfolk</a> .....	112

## 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 in 6th October 2019 as:

- multiple residential properties were internally flooded.
- multiple commercial properties were internally flooded.
- multiple critical services installations were affected by 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:

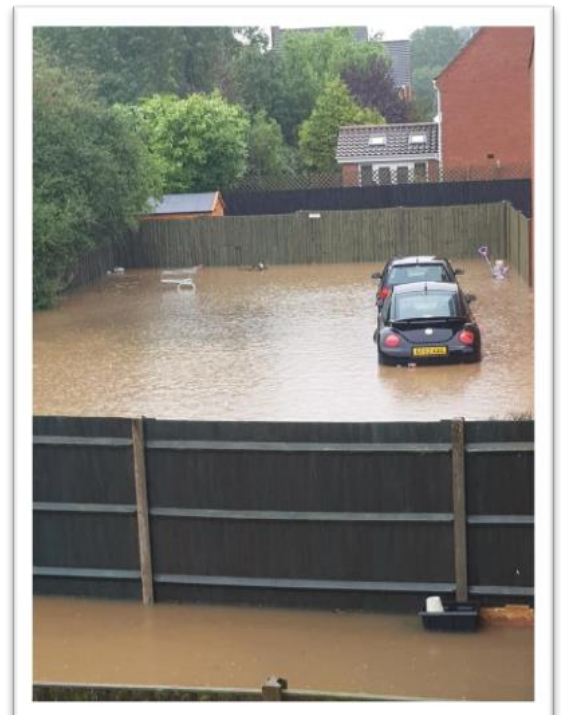
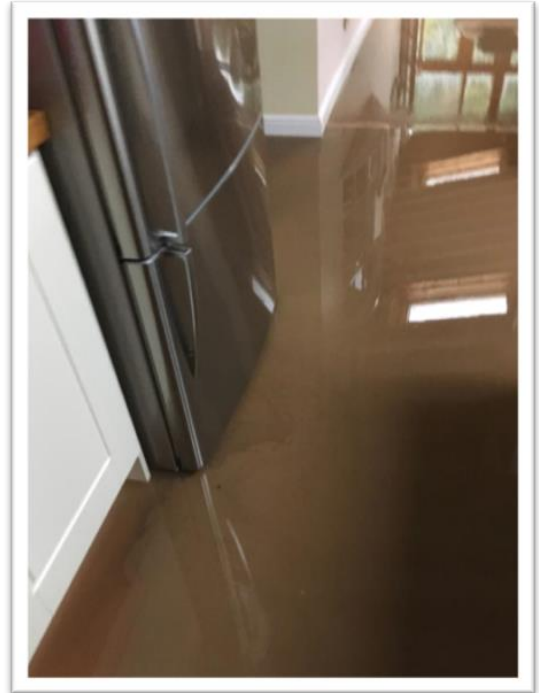
- Resolve the flooding issues or provide designed solutions.
- Force authorities to undertake any of the recommended actions.



# Norfolk County Council

## Broadland - 6th October 2019

Draft Report prepared by Abygail Hadley and Nathalie Harris on 19<sup>th</sup> December 2019



## **Executive Summary**

### **(a) Flooding incidents**

Flooding occurred across the Broadland District on the 6<sup>th</sup> October 2019. 49 properties were reported to have experienced internal flooding on this day and 1 critical road was closed in two places due to flooding. For the purpose of this report and ease of presentation we have set out the report based on areas in which the incidents were located. When only one or two properties have been flooded in an area a catchment has not been generated. A summary of the 50 incidents affected in each area can be found below:

Location	Catchment	Number of Internally Flooded Properties/critical roads	Page Number
Coltishall	Coltishall East	2 Properties	Pg 8
Brundall (Rose Walk and Oakdale)		5 Properties	Pg 12
Hellesdon		1 property	Pg 16
Brundall	Lackford Run	1 property	Pg 20
Blofield	Lackford Run	20 Properties	Pg 20
Rackheath	Lackford Run	7 Properties	Pg 20
Thorpe St Andrew	Thorpe St Andrew	5 properties	Pg 37
Lingwood and Burlingham	Acle Dike	3 Properties	Pg 44
Freethorpe	Acle Dike	1 Property	Pg 44
Swanton Abbott		1 Property	Pg 52
A47	Stakebridge Beck	1 Critical Road closed in two places	Pg 54
Drayton		1 Property	Pg 56
Wroxham		2 Properties	Pg 59

### **(b) Flooding causes**

The flooding incidents covered within this report are from across a large area, however key trends seen throughout the report are:

- Properties were sitting along an overland flow path on which rainfall was concentrated.
- The drainage systems are not designed to cope with a significant event and in such cases were exceeded.
- Surface run-off from rainfall made its way on to private tracks/roads/highway and flowed towards affected properties which sat below these features.
- Drainage systems were partially or fully blocked contributing to the extent of the flooding.
- Significant rainfall was directed into surface water, foul and combined drainage systems causing it to surcharge elsewhere. This surcharging contributed to the flooding at some affected properties.

### **(b) Key recommendations**

The recommendations set out in the report have been summarised below. Specific recommendations for each individual catchment are set out within the report. Please note a number of these

recommendations have already been followed up by the respective organisations identified. Progress against these recommendations will be assessed as part of an addendum to this report to be undertaken a year from the date of publication of this report.

**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;

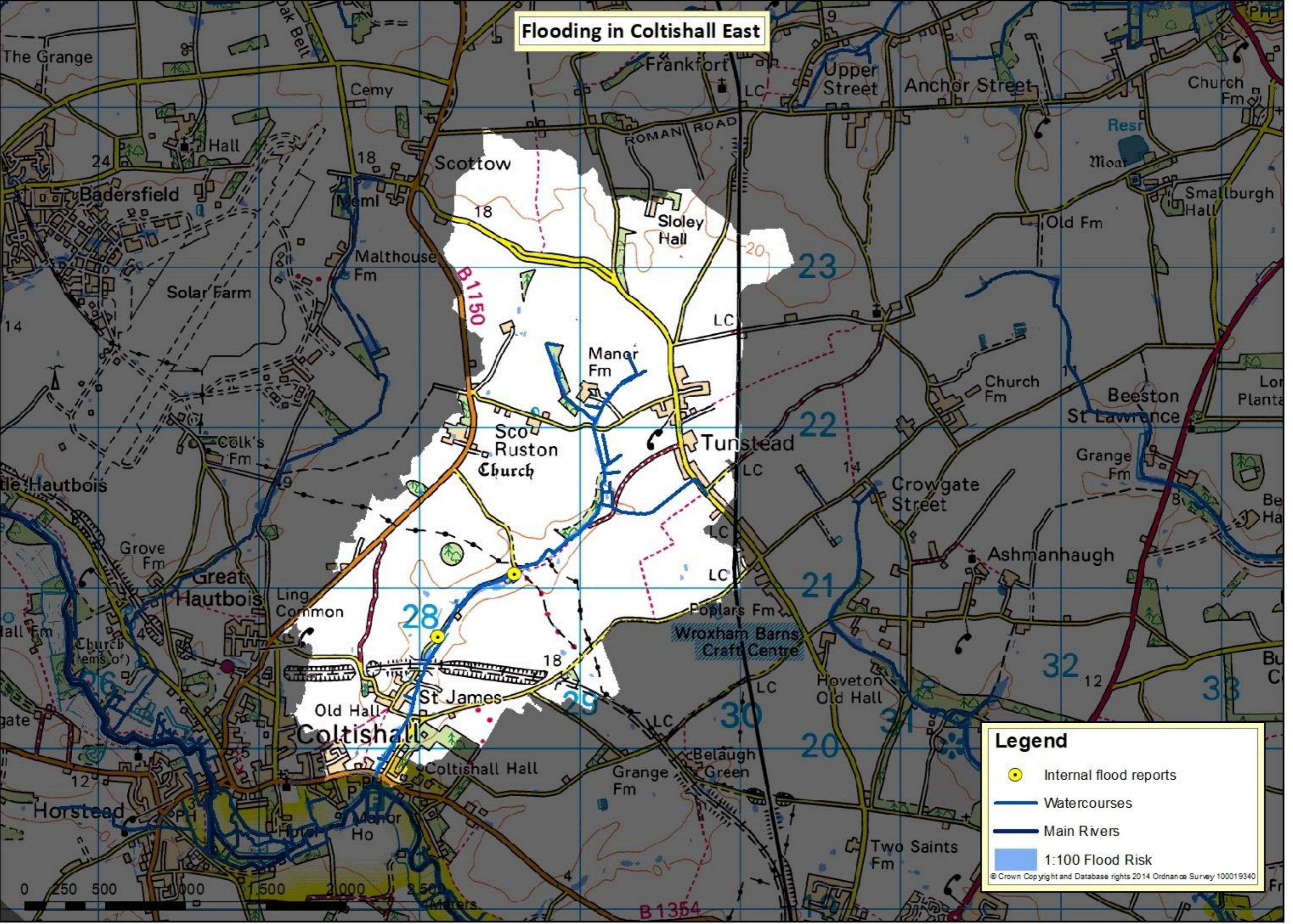
- Work with partner organisations to identify funding for flood mitigation. This would include assessing the potential to install property level protection measures, reduce run-off and increase the attenuation of flood water to reduce the impacts of flooding.
- Work with property owners to consider opportunities 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.

**Highways England** should;

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



### Flooding in Coltishall East

**Legend**

- Internal flood reports
- Watercourses
- Main Rivers
- 1:100 Flood Risk

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

0 250 500 1000 1500 2000 2500 meters

### Description of catchment

This catchment covers the North East of Coltishall and its outlying rural settlements within the Broadland District Council area. It is bounded by low ground in all directions within the rural environment. As such, there is a significant overland flow path and low areas of pooling water associated with the topography which falls towards the river Bure 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	0	0
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	0	2	0
[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 2 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 2 properties were internally flooded on The Street, Coltishall. These incidents were reported by: Broadland District Council via email correspondence on the 17 <sup>th</sup> October 2019, (1421) A neighbour during a site visit by Norfolk County Council officers on the 8 <sup>th</sup> November 2019, (1495)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• The Fire and Rescue Service carried out measures to minimise the impact of flooding during the incident.</li><li>• Adjoining landowners carried out maintenance of the watercourse to increase capacity.</li></ul>

### 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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain gauge at Belaugh registered a 1:40 rainfall return period.

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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 Coltishall

Location: **Coltishall East**

**The Street**– Report of internal flooding on 6<sup>th</sup> October to two properties.

### Causes –

- Run-off from significant rainfall was concentrated along overland flow paths on which the affected properties are adjacent to.
- Run-off from significant rainfall was directed towards the land drainage network. These flows could not be accommodated as the system was already overloaded and parts were obstructed by debris, silt and overgrown vegetation. This directed flood water towards the affected properties.

### Recommendations –

- Norfolk County Council should approach landowners to seek improvements in land management to allow the true flow to continue downstream.
- Norfolk County Council will work with landowners to assess potential options to manage and improve the drainage in the area.
- 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.



## Flooding in Rose Walk & Oakdale

### Flood incidents within this area

Within this area 5 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
06/10/2019	On the 06/10/2019 - 4 properties were internally flooded on Rose Walk, Brundall. These incidents were reported by: The Fire and Rescue Service via an electronic report on the 7 <sup>th</sup> October 2019, (1418, 1407, 1300, 1299)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• The Fire and Rescue Service carried out measures to minimise the impact of flooding during the incident.</li></ul>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Oakdale, Brundall. This incident was reported by: Norfolk County Council via email correspondence on the 9 <sup>th</sup> October 2019, (1327)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• The media visited affected residents to gather information during the incident.</li><li>• Norfolk County Council corresponded with affected residents to offer advice and to gather information after the incident.</li></ul>

### Recent rainfall within the area

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the area 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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain gauge at Belaugh registered a 1:40 rainfall return period.

### 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	The residents reported numerous historical flooding in the Oakland area.	All moderate to heavy rainfall.

Causes of flooding within this area and recommendations

The findings of the investigation are detailed on the following maps including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the maps.

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 report.

# Flooding on Rose Walk



Location: Rose Walk, Brundall

**Rose Walk**– Report of internal flooding on 6<sup>th</sup> October to four properties.

**Causes –**

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

**Recommendations –**

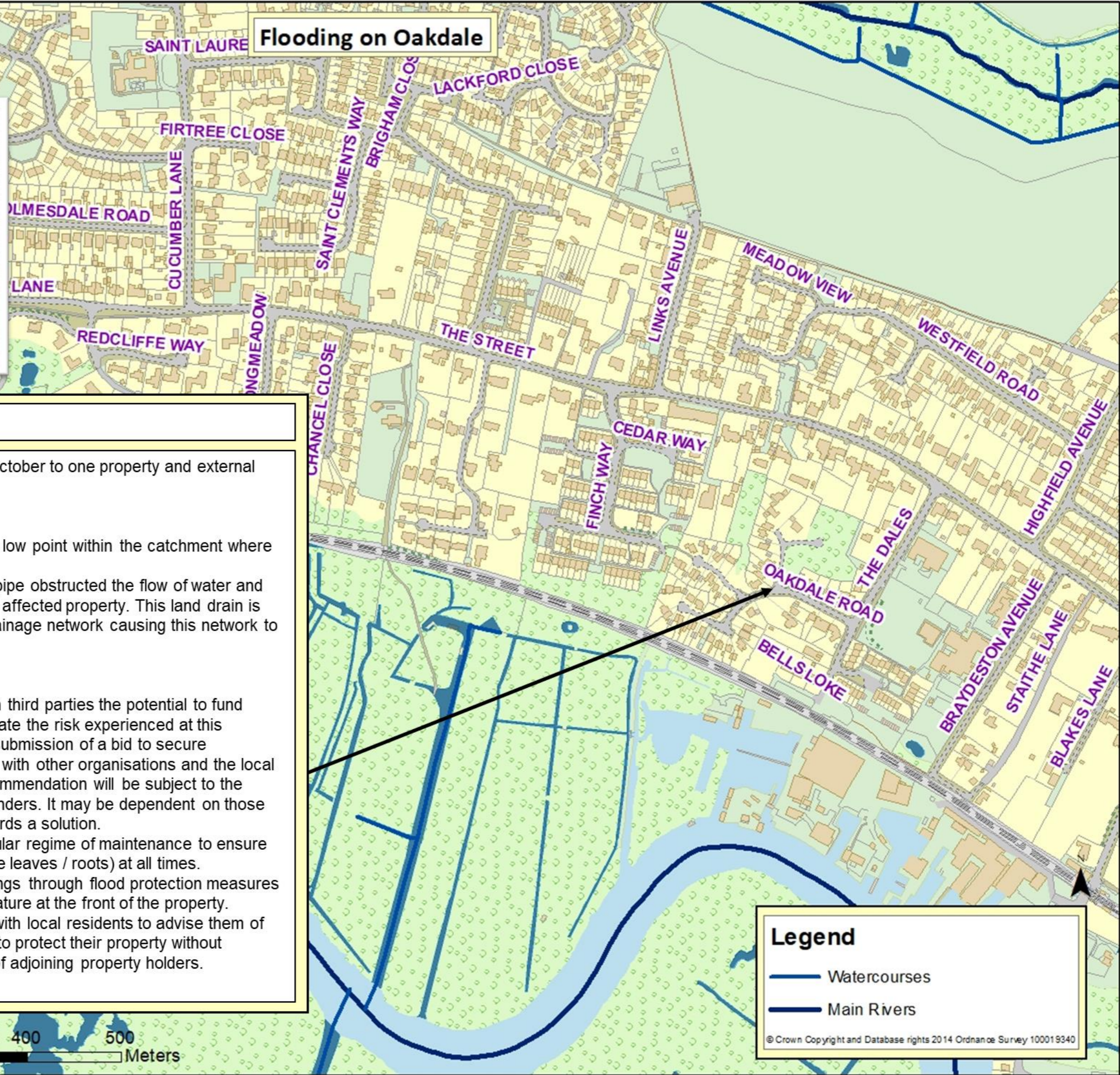
- Anglian Water should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.
- Property owners should report incident to Anglian Water.

**Legend**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

# Flooding on Oakdale



Location: Oakdale, Brundall

**Oakdale**– Report of internal flooding on 6<sup>th</sup> October to one property and external flooding to the road.

**Causes –**

- Run-off from significant rainfall pooled at a low point within the catchment where there is no drainage affecting properties.
- An illegally constructed private land drain pipe obstructed the flow of water and caused it to surcharge in the garden of the affected property. This land drain is illegally connected to the surface water drainage network causing this network to become quickly overloaded.

**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.
- 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.
- Property owners should protect their buildings through flood protection measures where appropriate such as a soakaway feature at the front of the property. 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**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



## Flooding in Hellesdon

### Flood incidents within this area

Within this area 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Prince Andrews Road, Hellesdon. This incident was reported by: Broadland District Council via email correspondence on the 9 <sup>th</sup> October 2019, (1354)	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

### Recent rainfall within the area

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the area 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.

This incident of internal flooding was within 2.4km of a rain gauge. 43.4mm of rain was recorded as falling in 13 hours and 15 minutes at the Norwich Heigham rainfall monitoring station. The intensity of rainfall for the total duration equates to a 1:6 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
Various	Residents recalled numerous historical flooding incidents over a period of years.	Moderate to heavy rainfall

### Causes of the flooding and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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 Hellesdon

Location: Hellesdon

**Prince Andrews Road**– Report of internal flooding on 6<sup>th</sup> October to one property and external flooding to neighbouring properties.

### Causes –

- Run-off from significant rainfall pooled at a low point within the catchment affecting the property.
- Surface run-off from significant rainfall that had made its way onto the highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.
- 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 property.

### Recommendations –

- Norfolk County Council will investigate with third parties the potential for retro-fitting permeable areas and 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.
- 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.

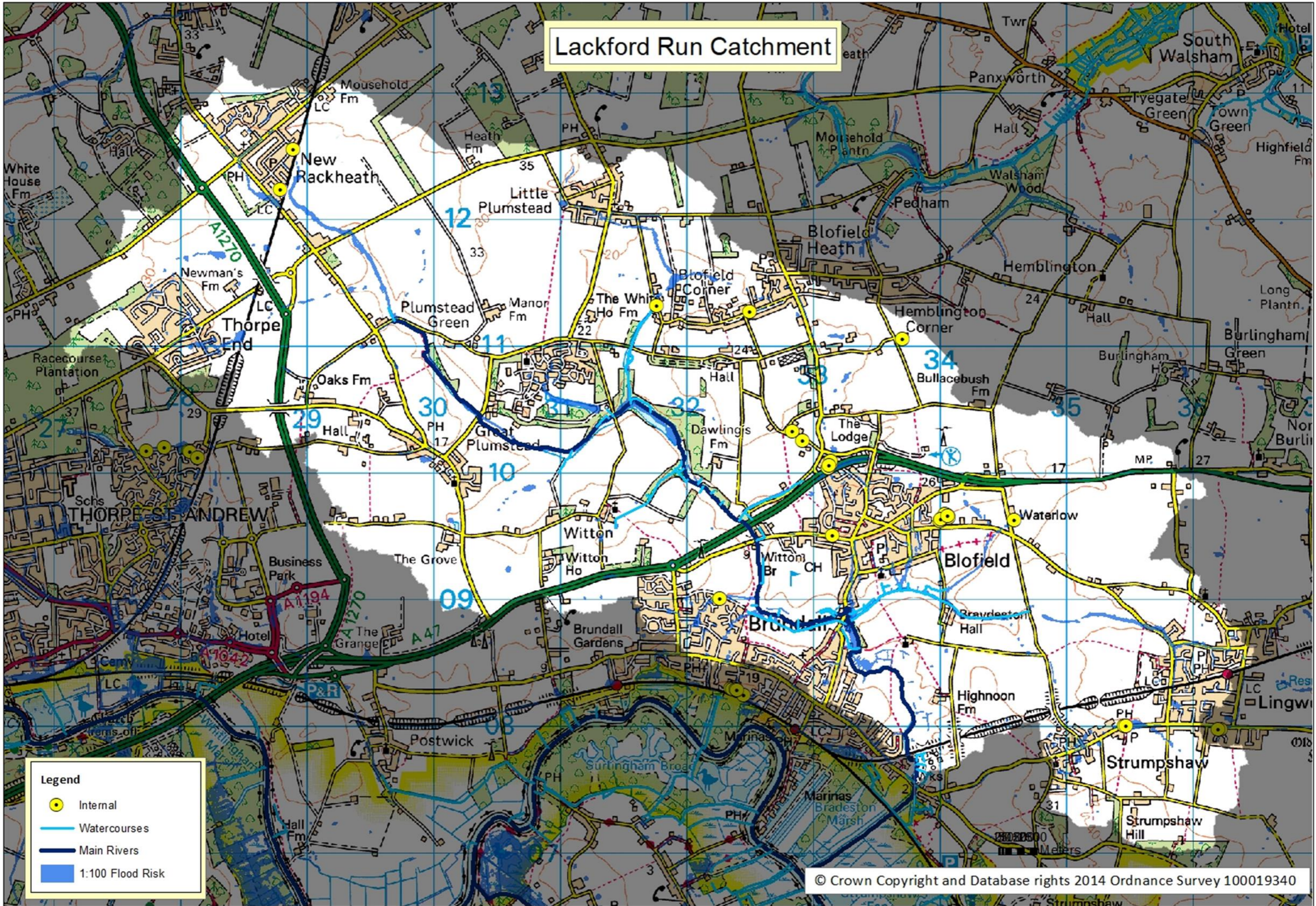


### Legend

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Flooding and flood risk within the Lackford Run catchment



Lackford Run Catchment

**Legend**

- Internal
- Watercourses
- Main Rivers
- 1:100 Flood Risk

### Description of catchment

This catchment covers the South East of the Broadland District Council area. The water falls south along overland flow paths 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. There are a number of ordinary watercourses throughout the catchment which play an important role in surface water drainage, particularly in the rural areas.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	1	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	1	0
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	1	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 24 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	<p>On the 06/10/2019 - 1 property was internally flooded on Berryfields, Brundall. This incident was reported by: Norfolk County Council via email correspondence on the 8<sup>th</sup> October 2019, (1316)</p> <p>Map 1.</p>	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• The Fire and Rescue Service offered advice over the phone during the incident.</li><li>• The resident has carried out measures to minimise the risk of future flooding after the event.</li><li>• Norfolk County Council cleaned and jetted the system.</li></ul>

		<ul style="list-style-type: none"> <li>Norfolk County Council undertook a survey of the system in this location.</li> </ul>
06/10/2019	<p>On the 06/10/2019 - 3 properties were internally flooded on Blofield Corner Road, Blofield. This incident was reported by:</p> <p>The Fire and Rescue Service via an electronic report on the 7<sup>th</sup> October 2019, (1285, 1302)</p> <p>Map 2.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>Residents carried out measures to minimise the impact of flooding during the incident.</li> <li>Norfolk County Council carried out a survey of the drainage system in the area.</li> </ul>
06/10/2019	<p>A resident via an online flood report form on the 30<sup>th</sup> October 2019, (1456)</p> <p>Map 3.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>Residents carried out measures to minimise the impact of flooding during the incident.</li> <li>Norfolk County Council have arranged a meeting with relevant landowners to discuss clearance of the watercourse.</li> </ul>
06/10/2019	<p>On the 06/10/2019 - 8 properties were internally flooded on Shreeve Road, Blofield. These incidents were reported by:</p> <p>A resident via an online flood report form on the 11<sup>th</sup> October 2019, (1483, 1385)</p> <p>A member of the public via email correspondence on the 18<sup>th</sup> October 2019, (1432, 1431, 1424, 1423, 1419, 1416)</p> <p>Map 4.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>Residents carried out measures to minimise the impact of flooding during the incident.</li> </ul>
06/10/2019	<p>On the 06/10/2019 - 1 property was internally flooded on Waterlow, Blofield. This incident was reported by:</p> <p>A resident via an online flood report form on the 25<sup>th</sup> October 2019, (1430)</p> <p>Map 5.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.</li> </ul>
	<p>On the 06/10/2019 - 2 properties were internally flooded on Holly Lane,</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice</li> </ul>

	<p>Blofield. These incidents were reported by: A resident via an online flood report form on the 11<sup>th</sup> October 2019, (1403, 1386)</p> <p>Map 6.</p>	<p>and to gather information after the incident.</p> <ul style="list-style-type: none"> <li>Residents carried out measures to minimise the impact of flooding during the incident.</li> </ul>
	<p>On the 06/10/2019 - 1 property was internally flooded on Ranworth Road, Blofield. This incident was reported by: A resident via an online flood report form on the 14<sup>th</sup> October 2019, (1361)</p> <p>Map 7.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>The Fire and Rescue Service responded and pumped out during the incident.</li> </ul>
	<p>On the 06/10/2019 - 4 properties were internally flooded on Lower Globe Lane, Blofield. These incidents were reported by: The Fire and Rescue Service via an electronic report on the 7<sup>th</sup> October 2019, (1373, 1372, 1369, 1331)</p> <p>Map 8.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>Norfolk County Council carried out maintenance work to the highway drainage system after the incident.</li> <li>Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li> <li>The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.</li> </ul>
	<p>On the 06/10/2019 - 1 property was internally flooded on Yarmouth Road, Blofield. This incident was reported by: A resident via an online flood report form on the 14<sup>th</sup> October 2019, (1359)</p> <p>Map 9.</p>	<ul style="list-style-type: none"> <li>The Fire and Rescue Service responded and pumped out during the incident.</li> <li>Norfolk County Council cleaned and jetted the system.</li> </ul>
	<p>On the 06/10/2019 - 1 property was internally flooded on Vera Road, Rackheath. This incident was reported by: A resident via an online flood report form on the 7<sup>th</sup> October 2019, (1269)</p> <p>Map 10.</p>	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>Norfolk County Council cleaned and jetted the system.</li> </ul>
	<p>On the 06/10/2019 2 properties were internally flooded on Bernard Close, Rackeath. This incident was reported by:</p>	<ul style="list-style-type: none"> <li>Norfolk County Council met with the resident following the incident to gather information.</li> </ul>

	<p>The Fire and Rescue service via an electronic report on the 28<sup>th</sup> November 2019 (1534)</p> <p>The neighbour during a site visit on the 11<sup>th</sup> November 2019 (1688)</p> <p>Map 11.</p>	<ul style="list-style-type: none"> <li>• Norfolk County Council met with Anglian Water and the residents as part of a multi-agency response to the flooding.</li> <li>• Norfolk County Council have surveyed the highways drainage system which was found to be in working order.</li> <li>• Norfolk County Council have contacted Network Rail requesting a blocked culvert underneath the railway line to be cleared.</li> </ul>
--	---	--

#### 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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain gauge at Belagh registered a 1:40 rainfall return period.

#### 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
2017	Resident reports external flooding on <b>Waterlow</b> caused by a burst water main.	Unknown
Various	Resident reports that a property on <b>Holly Lane</b> has flooded internally once historically, and externally numerous times.	Unknown
23/06/2016	One property on <b>Ranworth Road</b> flooded internally (Ref:3041).	Unknown
Various	Resident on <b>Vera Road</b> has flooded internally twice historically.	Unknown

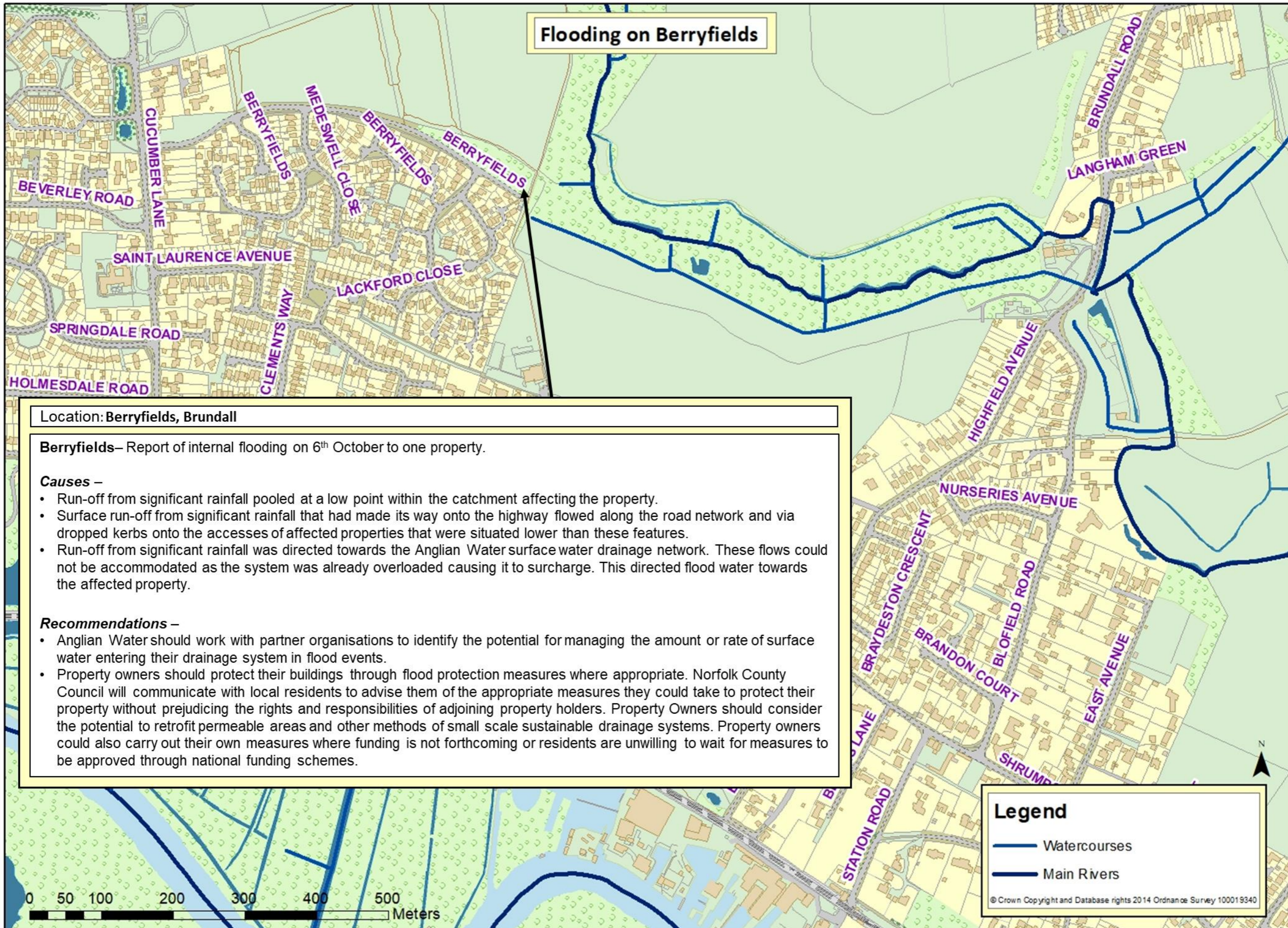
Properties in Ranworth Road have experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for Broadland Various 2013-2017 (FIR037), which can be found at: <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/fir037-broadland-various-2013-2017.pdf>

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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 Blofield Corner Road**

Location: Blofield Corner Road, Blofield

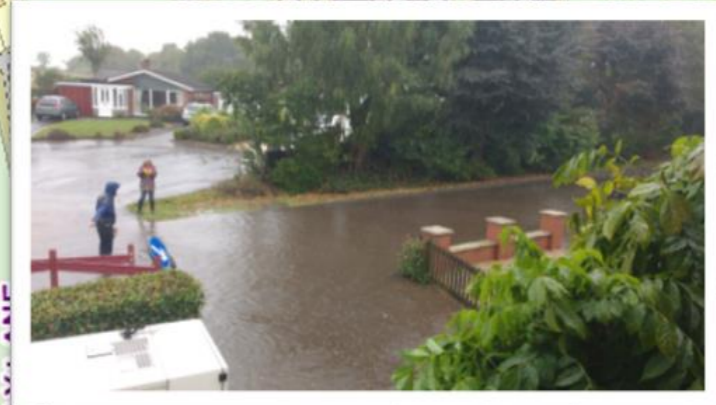
**Blofield Corner Road**– Report of internal flooding on 6<sup>th</sup> October to two properties and external flooding to neighbouring properties.

**Causes –**

- 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.
- Norfolk County Council suspect an issue with the integrity of the outfall pipe along a private track.
- The flood water entered the property through low thresholds at entrances.

**Recommendations –**

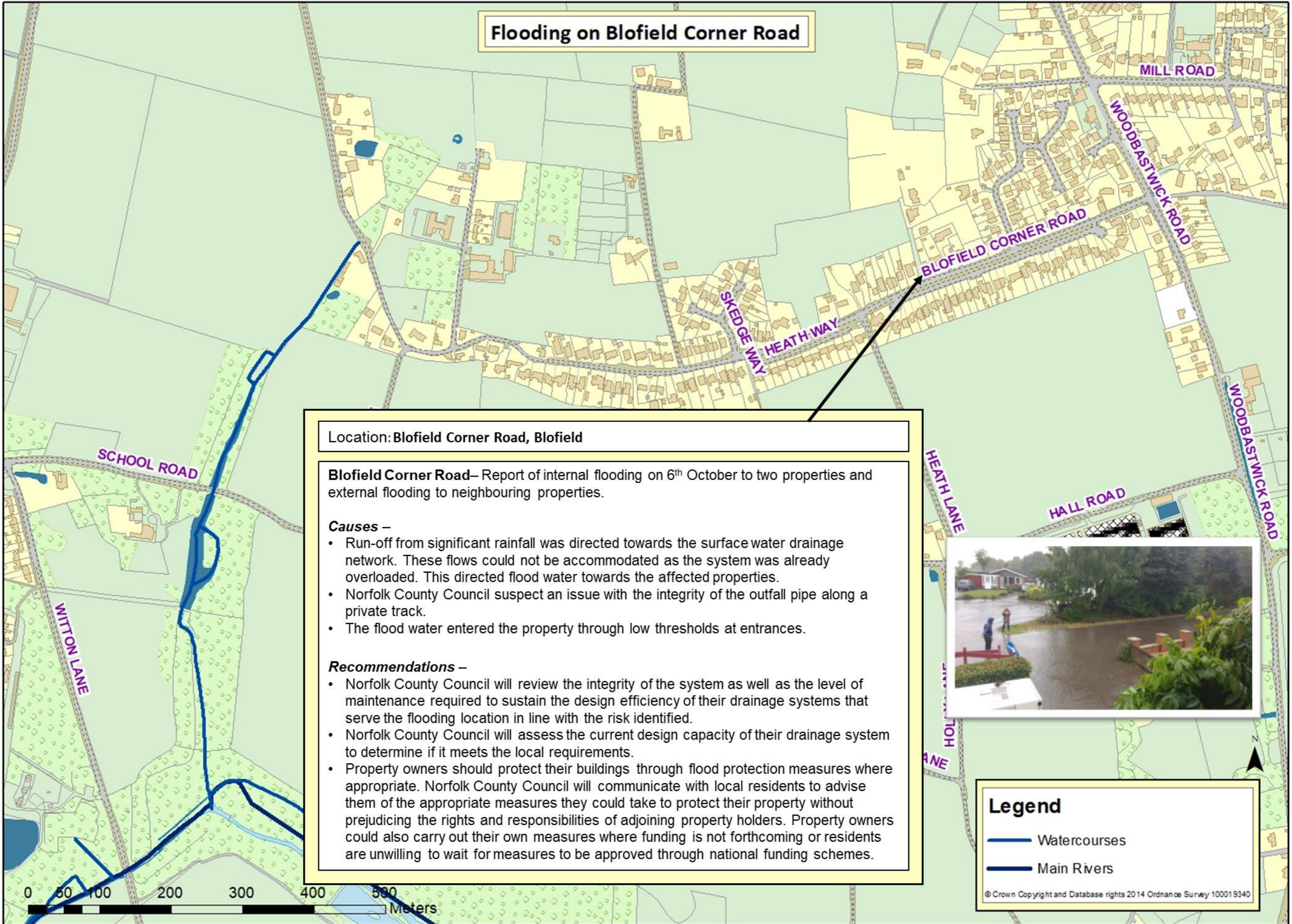
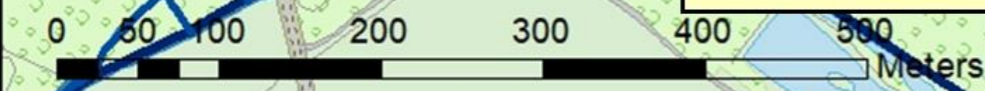
- Norfolk County Council will review the integrity of the system as well as the level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- Norfolk County Council will assess the current design capacity of their drainage system to determine if it meets the local requirements.
- 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.



**Legend**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



Location: **Lackford Run**

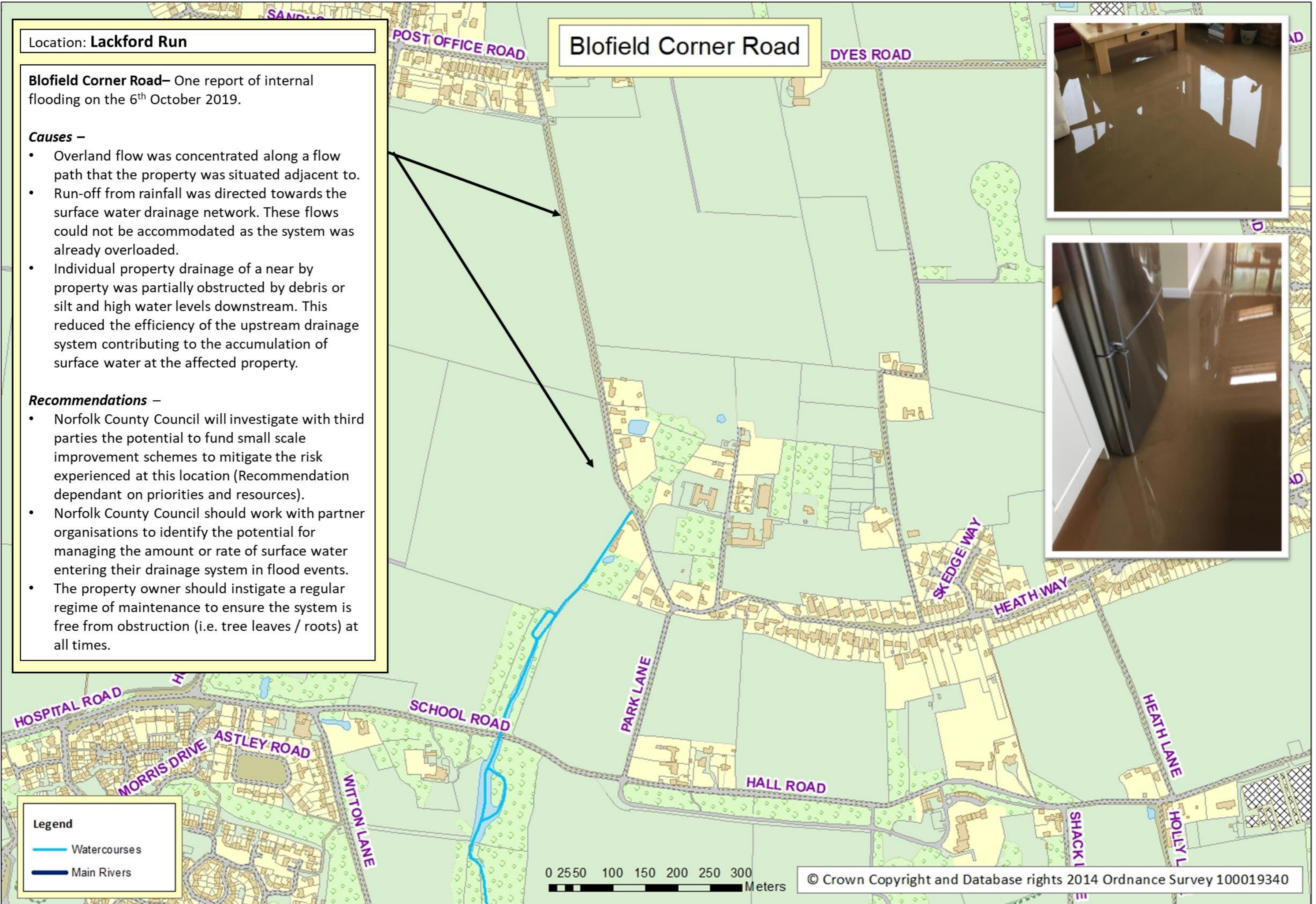
**Blofield Corner Road**— One report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Overland flow was concentrated along a flow path that the property was situated adjacent to.
- Run-off from rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded.
- Individual property drainage of a near by property was partially obstructed by debris or silt and high water levels downstream. This reduced the efficiency of the upstream drainage system contributing to the accumulation of surface water at the affected property.

**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 (Recommendation dependant on priorities and resources).
- 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.
- 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.



### Shreeve Road

Location: **Lackford Run**

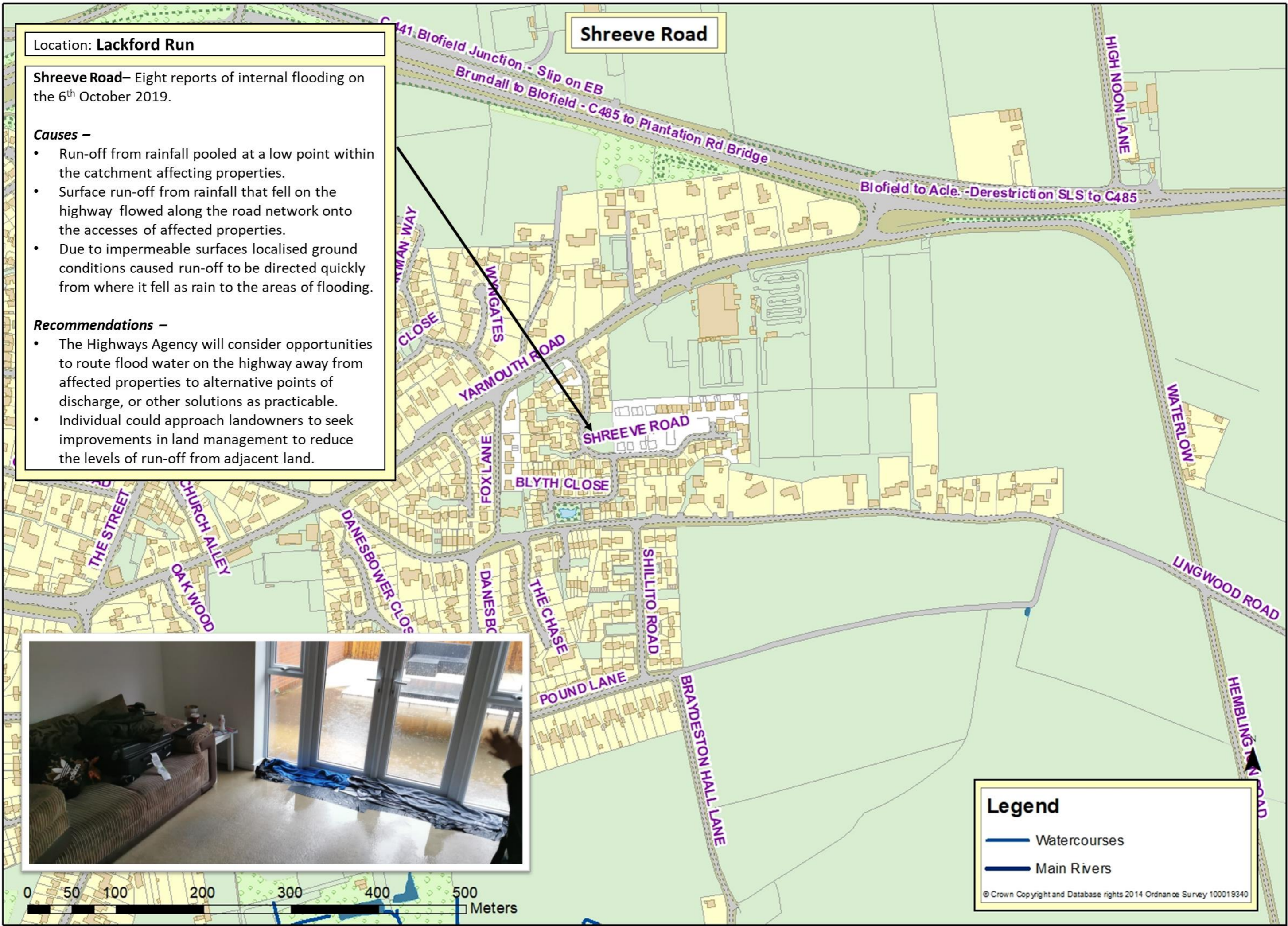
**Shreeve Road**– Eight reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes** –

- Run-off from rainfall pooled at a low point within the catchment affecting properties.
- Surface run-off from rainfall that fell on the highway flowed along the road network onto the accesses of affected properties.
- Due to impermeable surfaces localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding.

**Recommendations** –

- The Highways Agency will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- Individual could approach landowners to seek improvements in land management to reduce the levels of run-off from adjacent land.



### Legend

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Location: **Lackford Run**

**Waterlow** – One report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Surface run-off from rainfall on the highway flowed along the road network, onto the field adjacent to the property and onto the accesses of affected properties that were situated lower than these features.
- The surface water drainage system was partially obstructed by debris or silt. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- The flood water entered the property through low thresholds at entrances.

**Recommendations –**

- The Highways Agency should 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 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.

**Legend**

- Watercourses
- Main Rivers

Waterlow

HIGH NOON LANE

ation Rd Bridge

Blfield to Acle. - End dual to opp.C444 Lingwood Rd

WOOD ROAD

WATERLOW

HEMBLINGTON ROAD

FIELD ROAD



0 250 100 150 200 250 300 Meters

Location: **Lackford Run**

**Holly Lane** – Two reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Surface water run-off from an adjacent field flowed towards the property and contributed to flooding.
- Run-off from rainfall was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded.
- Surface run-off from rainfall made its way onto highway and flowed along the road network and onto the accesses of affected properties that were situated lower than these features.
- Run-off from rainfall pooled at a low point within the catchment affecting properties
- The surface water drainage system was fully obstructed by silt and vegetation. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.

**Recommendations –**

- Norfolk County Council will work with riparian owners to establish ownership of the drainage system and communicate maintenance responsibilities to those identified.
- Property owners should protect their buildings through flood protection measures where appropriate such as a rollover in front of the access to the property. 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.

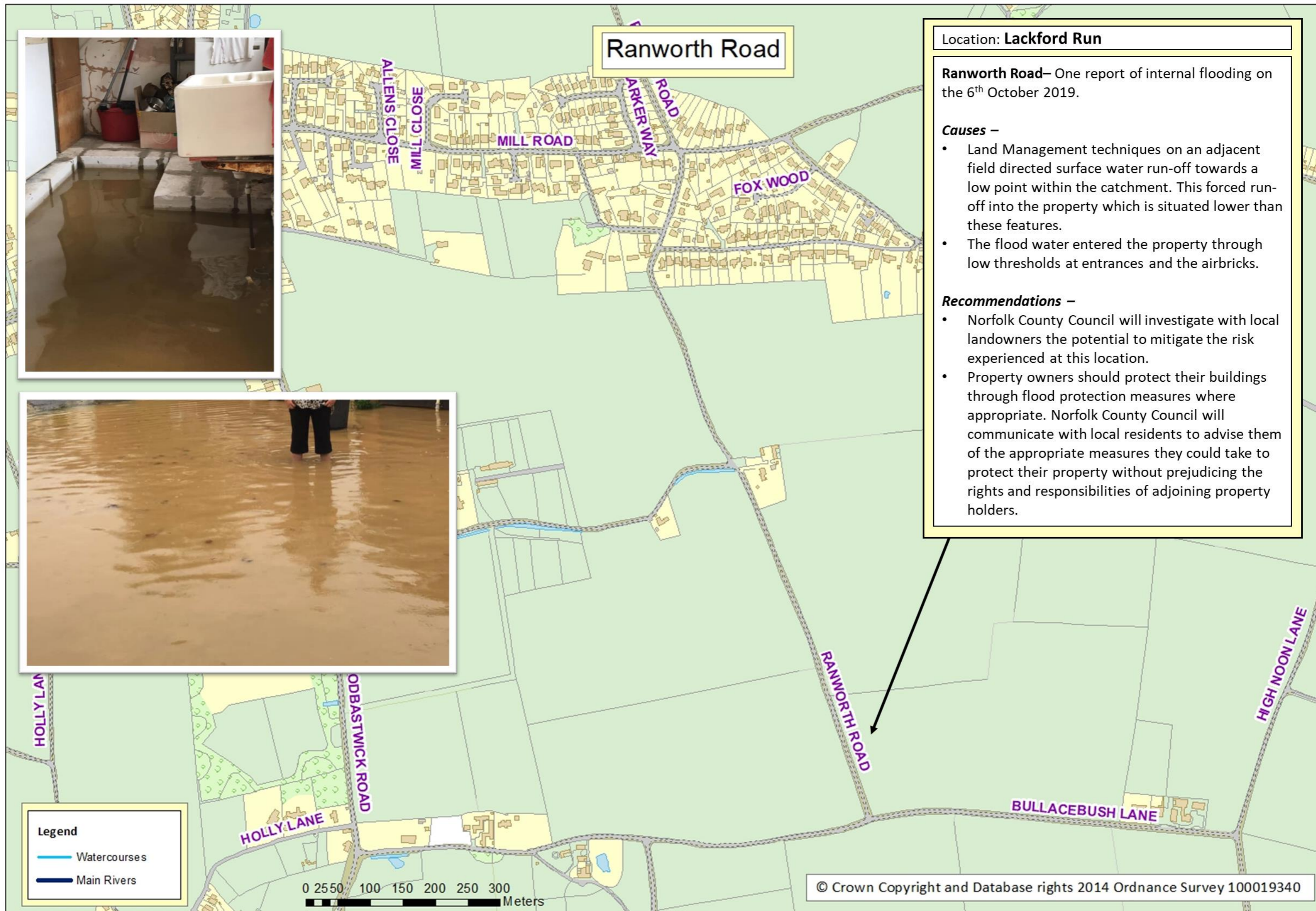


**Legend**

- Watercourses
- Main Rivers

0 25 50 100 150 200 250 300 Meters

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



Location: **Lackford Run**

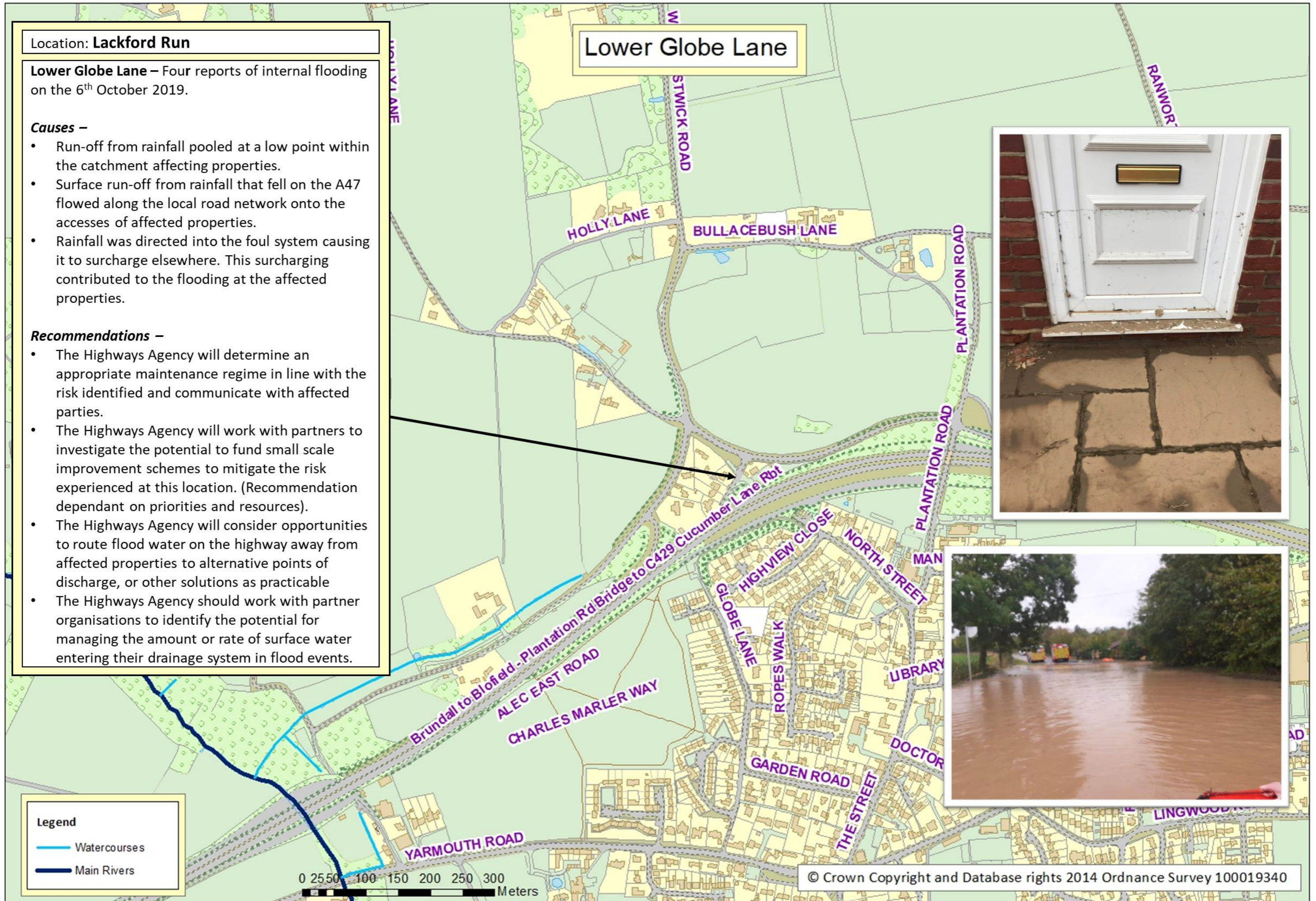
**Lower Globe Lane** – Four reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall pooled at a low point within the catchment affecting properties.
- Surface run-off from rainfall that fell on the A47 flowed along the local road network onto the accesses of affected properties.
- Rainfall was directed into the foul system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.

**Recommendations –**

- The Highways Agency will determine an appropriate maintenance regime in line with the risk identified and communicate with affected parties.
- The Highways Agency will work with partners to investigate the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. (Recommendation dependant on priorities and resources).
- The Highways Agency will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable
- The Highways Agency 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.



Location: **Lackford Run**

**Yarmouth Road** – One report of internal flooding on the 6<sup>th</sup> October 2019.

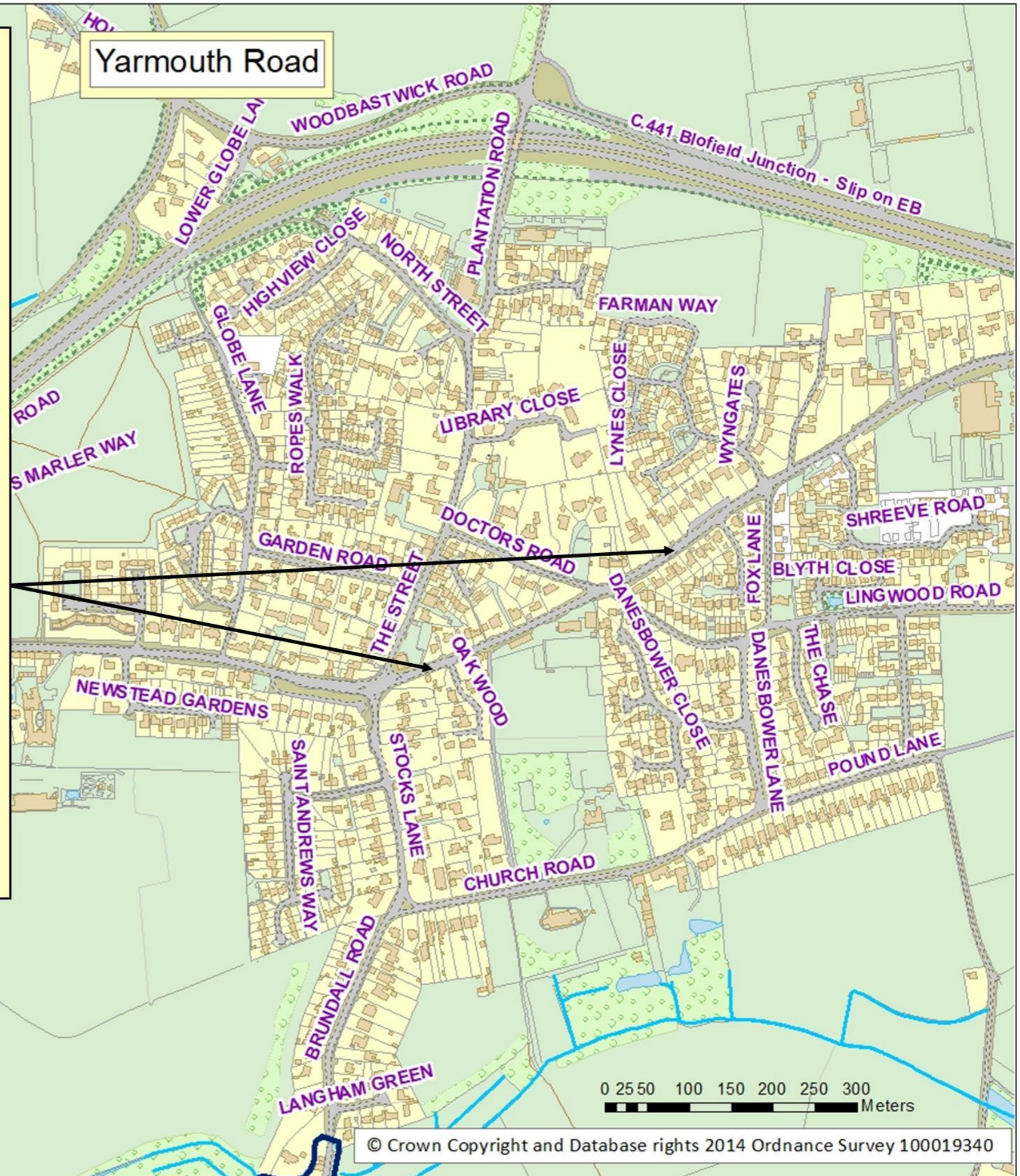
**Causes –**

- Run-off from rainfall and a burst pipe was concentrated along overland flowpaths on which the affected property is positioned adjacent to.
- The surface water drainage system was partially obstructed by debris or silt. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected 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.
- 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.
- 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.

Yarmouth Road



**Legend**

- Watercourses
- Main Rivers

0 25 50 100 150 200 250 300 Meters



Location: **Lackford Run**

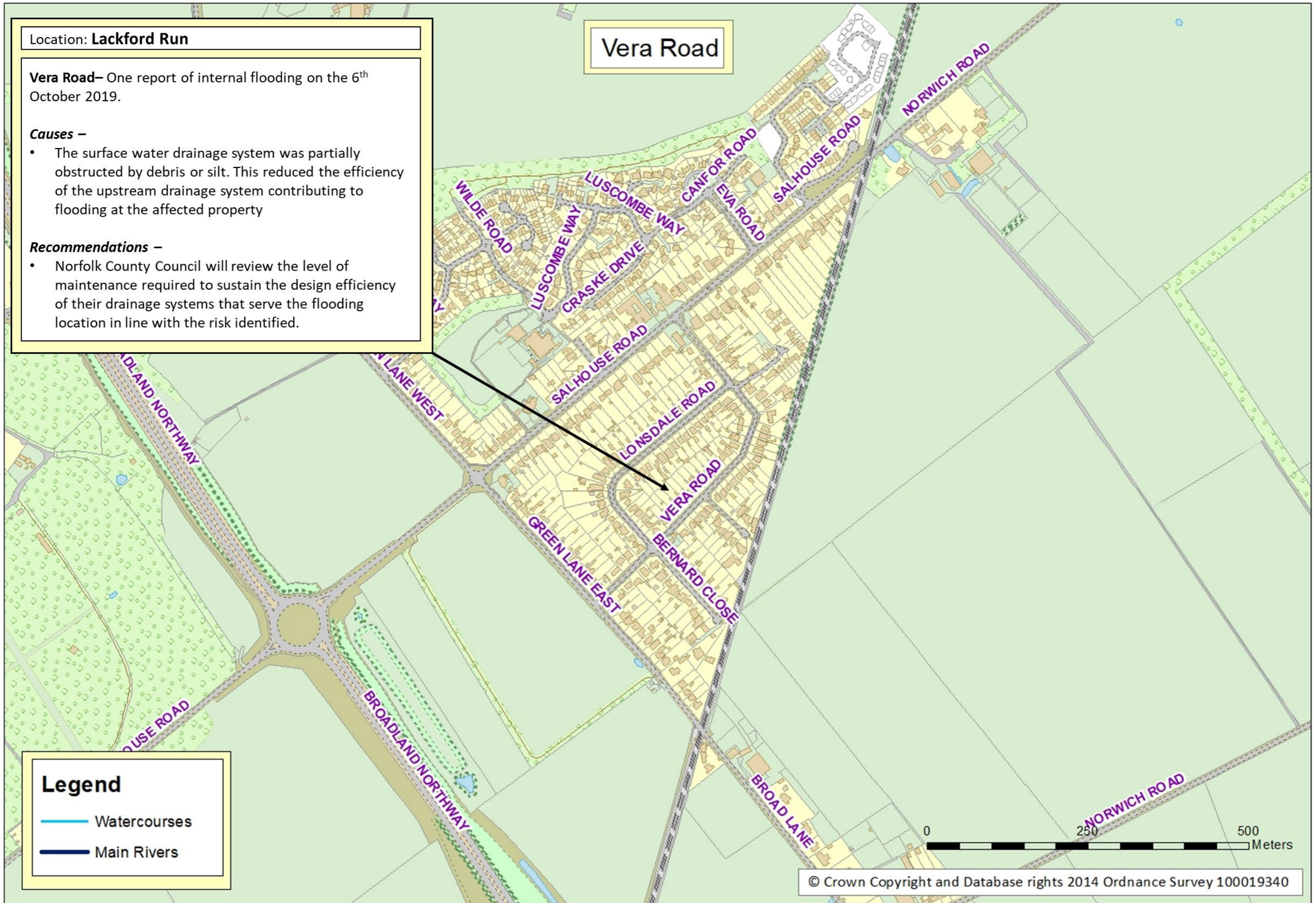
**Vera Road**– One report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- The surface water drainage system was partially obstructed by debris or silt. 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.



Location: **Lackford Run**

**Bernard Close**— Two reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall pooled at a low point within the catchment affecting property.
- The surface water drainage system outfall below the railway line was fully obstructed by structural failure. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- Run-off from rainfall was obstructed by man-made constructions which directed flood water towards the affected properties.
- Rainfall was directed into the foul system causing it to surcharge and lift the manhole cover near the affected property. This surcharging contributed to the flooding at the affected properties.
- The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding.

**Recommendations –**

- Network Rail should undertake work to ensure the system under the railway line is clear from obstruction.
- Norfolk County Council and Anglian Water will review the capacity & 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 Norfolk county Council and partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.

**Bernard Close**

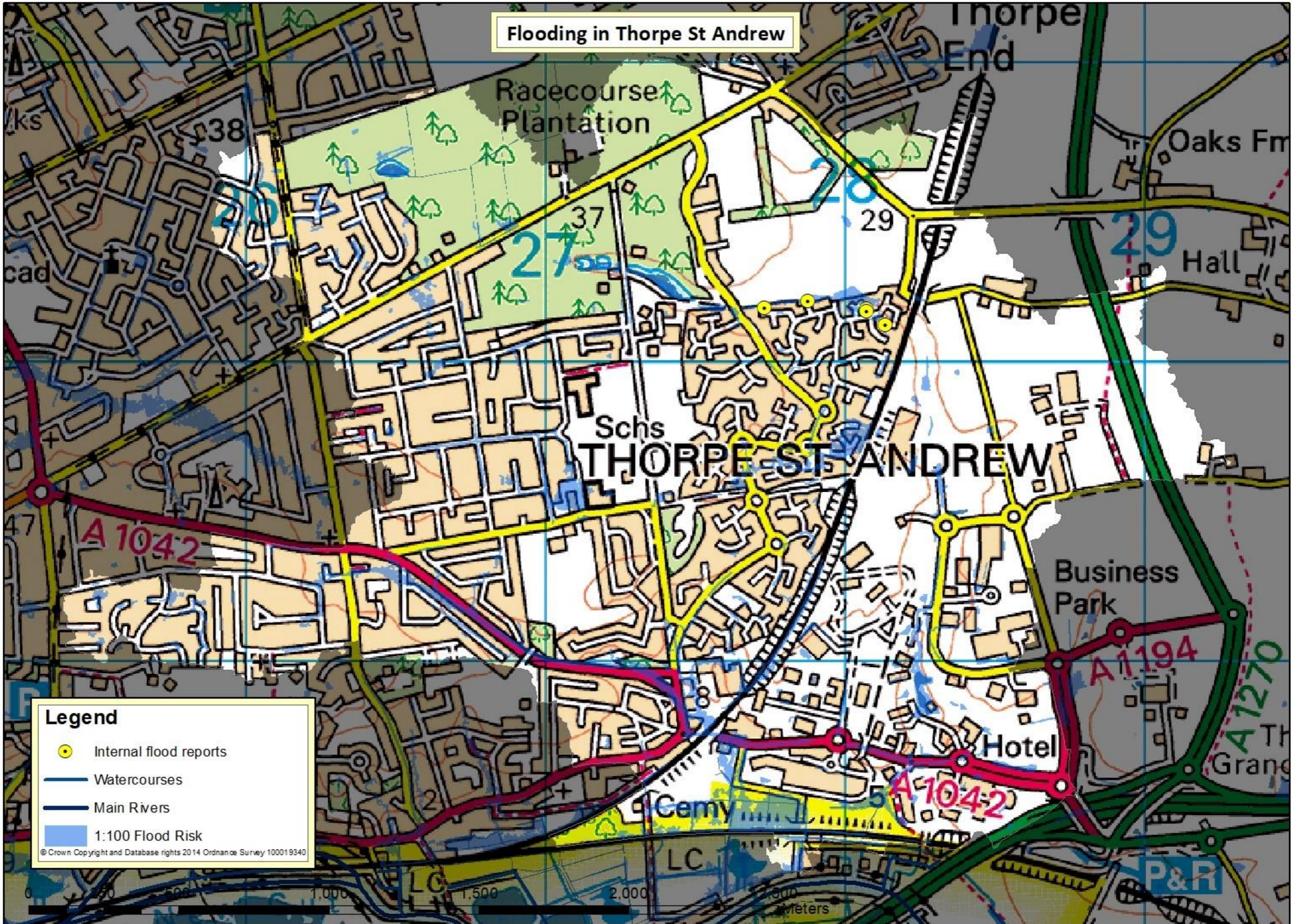


**Legend**

- Watercourses
- Main Rivers

Flo

### Flooding in Thorpe St Andrew



### Description of catchment

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 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.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	2	0	8
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	6	278	40
[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 5 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Joyce Way, Thorpe St Andrew. This incident was reported by: The Fire and Rescue Service via an electronic report on the 9 <sup>th</sup> October 2019, (1325)  Map 1.	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• A resident carried out maintenance measures to direct the water towards the drains helping it to clear.</li></ul>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Waller Close,	<ul style="list-style-type: none"><li>• The Fire and Rescue service attended and pumped water to</li></ul>

	<p>Thorpe St Andrew. This incident was reported by: A resident via an online flood report form on the 9<sup>th</sup> October 2019, (1309)</p> <p>Map 1.</p>	<p>an adjacent drain during the incident.</p> <ul style="list-style-type: none"> <li>• A resident carried out measures to minimise the impact of flooding during the incident.</li> <li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
06/10/2019	<p>On the 06/10/2019 - 2 properties were internally flooded on Pikeman Place, Thorpe St Andrew. These incidents were reported by: The Fire and Rescue Service via an electronic report on the 7<sup>th</sup> October 2019, (1297, 1289)</p> <p>Map 2.</p>	<ul style="list-style-type: none"> <li>• The Fire and Rescue Service gave advice.</li> <li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
06/10/2019	<p>On the 06/10/2019 - 1 property was internally flooded on Pym Close, Thorpe St Andrew. This incident was reported by: A resident via an online flood report form on the 6<sup>th</sup> October 2019, (1268)</p> <p>Map 3.</p>	<ul style="list-style-type: none"> <li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> <li>• A resident carried out measures to minimise the impact of flooding during the incident and carried out maintenance work to their drainage system after the incident.</li> </ul>

#### 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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain at Belaugh gauge registered a 1:40 rainfall return period.

#### 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	There have been external incidents in these areas previously.	Heavy rain

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following maps including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the maps.

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 Joyce Way & Waller Close

Location: Joyce Way & Waller Close, Thorpe St Andrew

**Joyce Way**– Report of internal flooding on 6<sup>th</sup> October to one property and external flooding to neighbouring properties.

**Waller Close**- Report of internal flooding on 6<sup>th</sup> October to one property.

**Causes –**

- Surface run off from significant rainfall was concentrated along overland flow paths from a neighbouring field pooling at a low point in the catchment. This run off brought silt from the field into the Anglian Water and Norfolk County Council drainage networks causing an obstruction to flow.
- The flood water entered the property through low thresholds at entrances.

**Recommendations –**

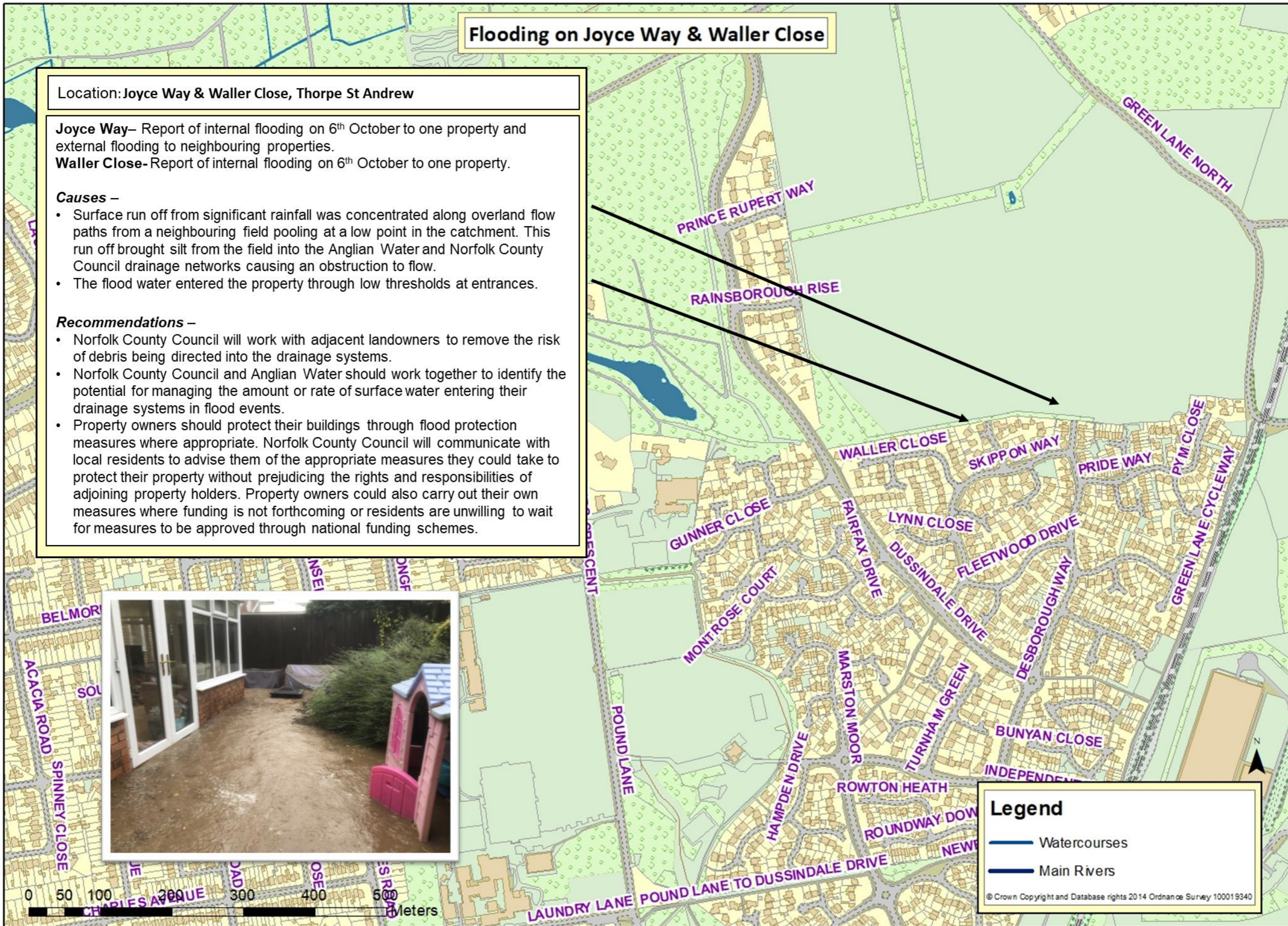
- Norfolk County Council will work with adjacent landowners to remove the risk of debris being directed into the drainage systems.
- Norfolk County Council and Anglian Water should work together to identify the potential for managing the amount or rate of surface water entering their drainage systems 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.



**Legend**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



### Flooding on Pikeman Place

**Location:** Pikeman Place, Thorpe St Andrew

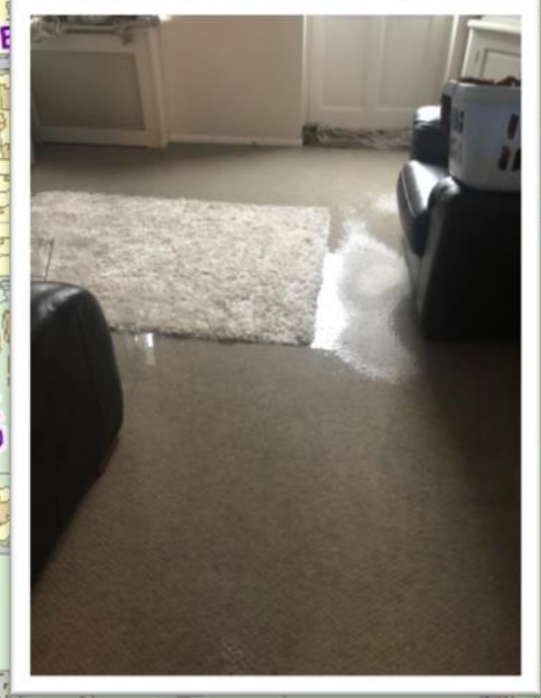
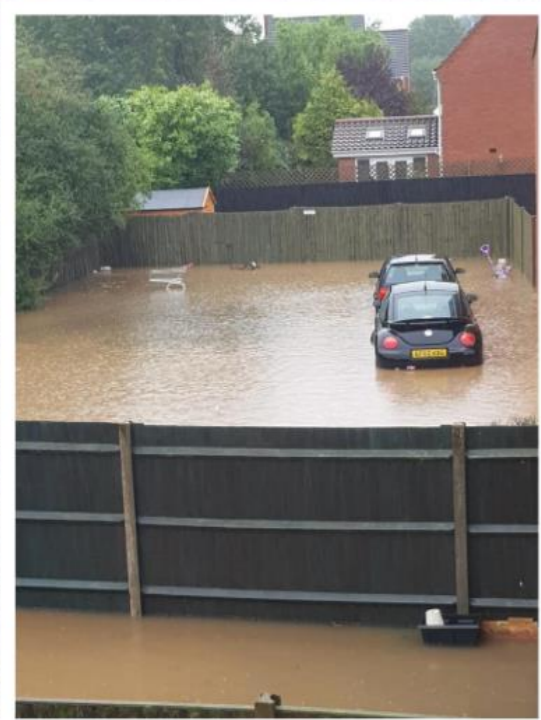
**Pikeman Place**— Report of internal flooding on 6<sup>th</sup> October to two properties and external flooding to neighbouring properties.

**Causes –**

- Surface run off from significant rainfall was concentrated along overland flow paths from a neighbouring field pooling at a low point in the catchment. This run off brought silt from the field into the Anglian Water and Norfolk County Council drainage networks causing an obstruction to flow.
- The flood water entered the property through low thresholds at entrances.

**Recommendations –**

- Norfolk County Council will work with adjacent landowners to remove the risk of debris being directed into the drainage systems.
- Norfolk County Council and Anglian Water should work together to identify the potential for managing the amount or rate of surface water entering their drainage systems 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.



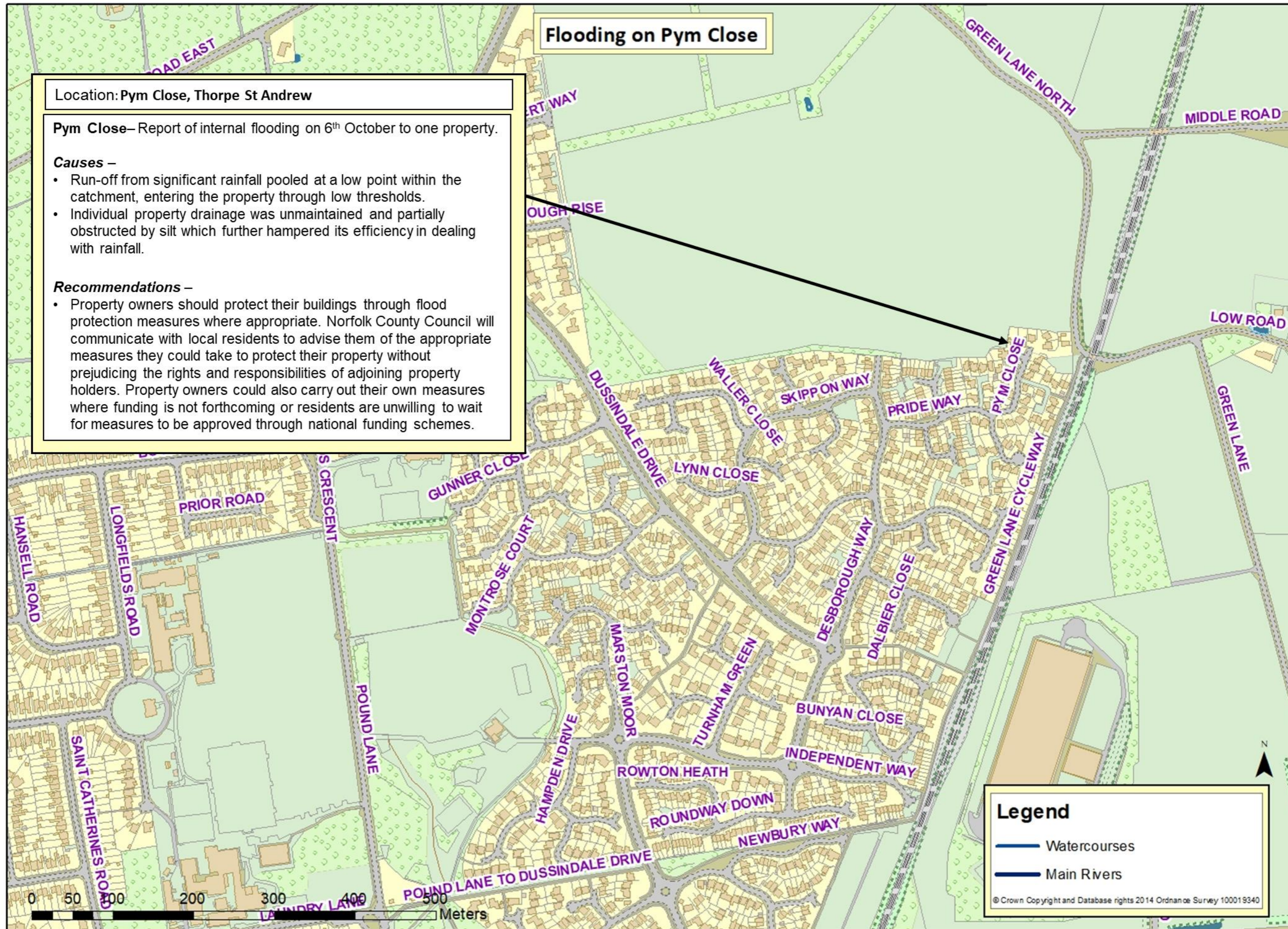
**Legend**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



Map 3.





### Description of catchment

This catchment is located towards the Eastern boundary of the Broadland District Council area. The area is mostly rural. All catchments in this area fall towards the Broads to the north. 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.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	1	25	3
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	2	14	0
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	4	32	26
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	4	32	26
[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	2	1
[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	2	2

### 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.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 3 properties were internally flooded on Norwich Road, Lingwood & Burlingham. These incidents were reported by: The Fire and Rescue Service via an electronic report on the 7 <sup>th</sup> October 2019, (1313, 1307) A resident via an online flood report form on the 9 <sup>th</sup> October 2019, (1308)	<ul style="list-style-type: none"><li>• A resident carried out measures to minimise the impact of flooding during the incident.</li><li>• Fire and Rescue attended and pumped water out of the property during the incident.</li></ul>
06/10/2019	On the 06/10/2019 – 1 property was internally flooded on The Green, Freethorpe. These incidents were reported by:	<ul style="list-style-type: none"><li>• Norfolk County Council undertook maintenance to their drainage system following the incident.</li></ul>

	Norfolk County Council via an electronic report on the 12 <sup>th</sup> November 2019, (1497)	<ul style="list-style-type: none"> <li>The resident took measures during the incident to reduce the impact of the flooding</li> </ul>
--	---	---

#### 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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain at Belaugh gauge registered a 1:40 rainfall return period.

#### 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	The residents reported that the foul drainage network blocks frequently and backs up towards the properties.	Moderate.

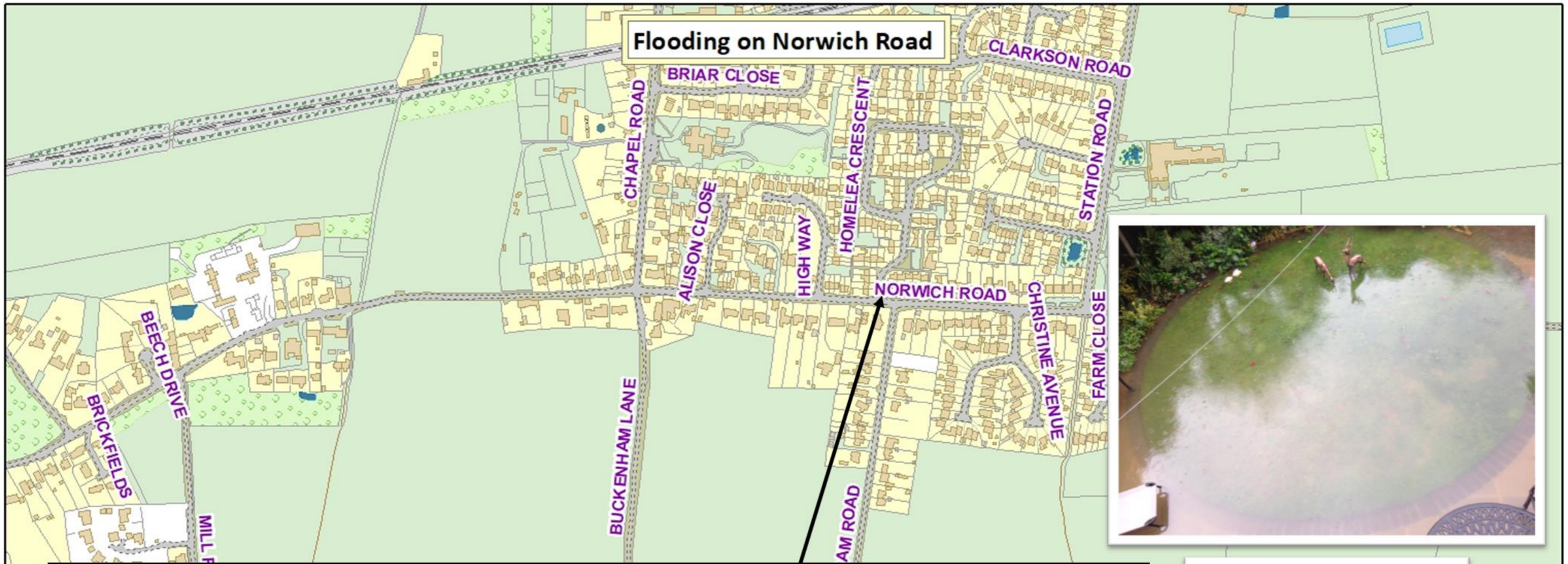
#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following maps including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the maps.

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 Norwich Road



Location: Norwich Road, Lingwood and Burlingham

**Norwich Road**– Report of internal flooding on 6<sup>th</sup> October to three properties and external flooding to the road.

### Causes –

- Surface run-off from significant rainfall that had made its way onto the highway flowed along the road network and via dropped kerbs onto the accesses of affected properties that were situated lower than these features.
- Significant rainfall was directed into the foul drainage system which was blocked and overloaded causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.
- The flood water entered the properties through low thresholds at entrances.

### Recommendations –

- Norfolk County Council and Anglian Water should work together to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- Norfolk County Council and Anglian Water should work together to review the system capacity and 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. [Property Owners should consider the potential to retrofit permeable areas and other methods of small scale sustainable drainage systems.] Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.

### Legend

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Location: **Acle Dike**

**The Green**— One report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes** –

- The surface water drainage system was fully obstructed by debris or silt. This caused the failure of the upstream drainage system contributing to flooding at the affected properties.
- 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.
- 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.



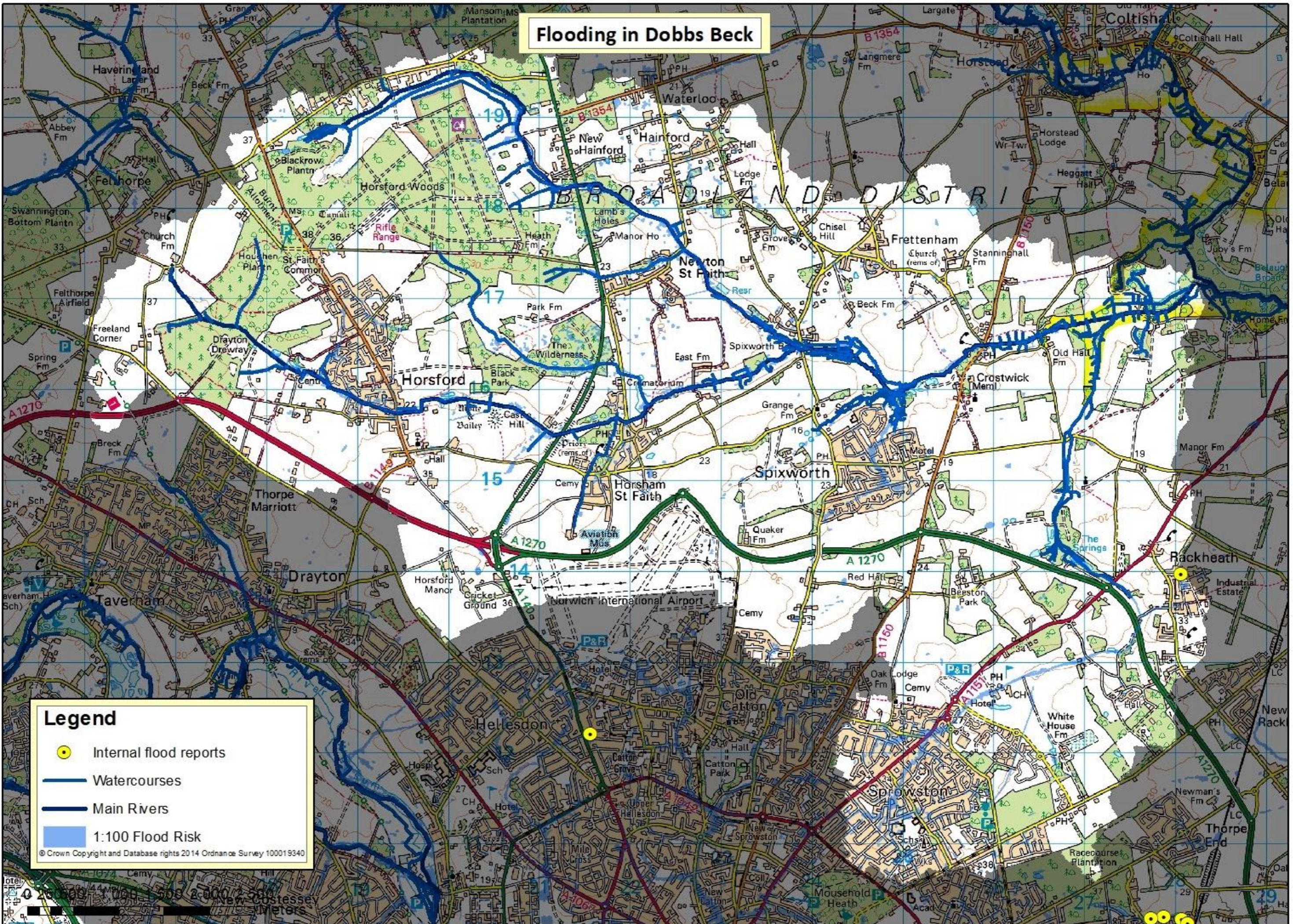
**Legend**

- Watercourses
- Main Rivers

0 2550 100 150 200 250 300  
Meters

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

# Flooding and flood risk within the Dobbs Beck catchment



### Description of catchment

Dobbs Beck is a large catchment north of Norwich. In the north west of the catchment it is characterised by woodland. The rest of the catchment has a combination of agricultural and urban land. Spixworth Beck flows from the west of the Catchment through Horsford and towards Spixworth. Stone Beck flows from the north west towards Spixworth where north of the town the two converge and flow east out of the catchment. Water also flows from the south of the catchment in Sproswton in a Northly direction where it joins Spixworth Beck.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	2	220	30
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	5	653	81
[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.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	<p>On the 06/10/2019 - 4 properties were internally flooded on Wendover Road, Rackheath. These incidents were reported by:</p> <p>A resident via an online flood report form on the 7<sup>th</sup> October 2019, (1282)</p> <p>Breckland District Council via email correspondence on the 14<sup>th</sup> October 2019, (1352)</p> <p>Norfolk County Council (Lead Local Flood Authority) via a site visit on the 8<sup>th</sup> October 2019, (1323, 1315)</p>	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• Norfolk County Council undertook maintenance of the drainage system after the incident.</li><li>• A resident carried out measures to minimise the impact of flooding during the incident.</li></ul>



		<ul style="list-style-type: none"> <li>Norfolk County Council have proposed a works scheme for the area to alleviate flood risk here.</li> </ul>
--	--	--

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.

The affected properties were just outside the range of the nearest rain gauge. However, it should be noted that there were a number of properties internally flooded within the district of Broadland and the nearest rain at Belaugh gauge registered a 1:40 rainfall return period.

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	When reporting this event, residents referred to a historical problem with external flooding on the estate.	Any rainfall

Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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 Wendover Road

Location: Wendover Road, Rackheath

**Wendover Road**– Report of internal flooding on 6<sup>th</sup> October to one property and external flooding to the road.

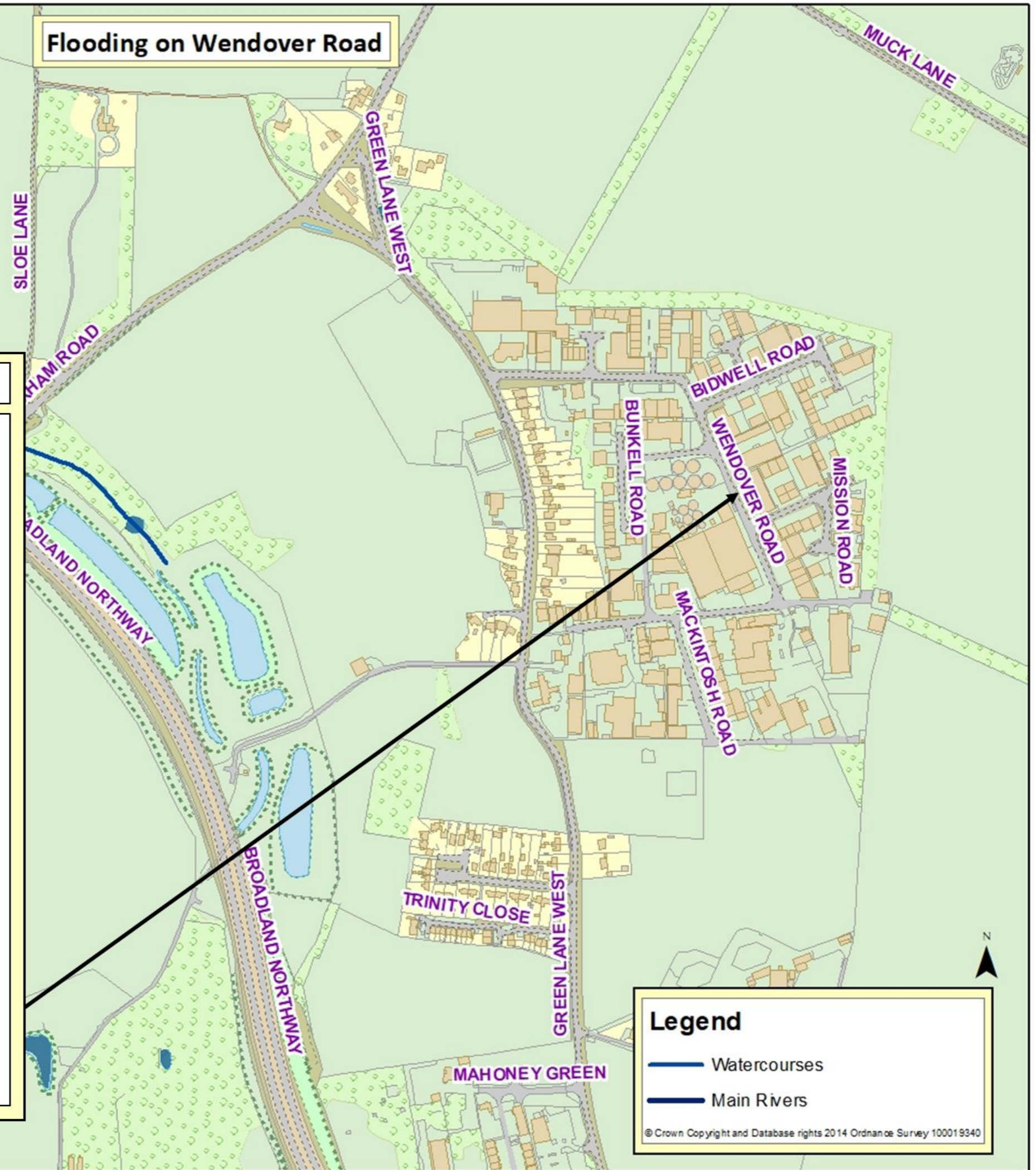
### Causes –

- The affected properties are located in an area with a very high water table.
- The surface water drainage system was fully obstructed by silt. This caused the failure 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.
- The flood water entered the properties through low thresholds at entrances.

### 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. [Property Owners should consider the potential to retrofit permeable areas and other methods of small scale sustainable drainage systems.] Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.

0 50 100 200 300 400 500 Meters



### Legend

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

### **Flooding in Swanton Abbott.**

#### Flood incidents within Swanton Abbott.

Within this area 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on The Hill, Swanton Abbott. This incident was reported by: A resident via an online flood report form on the 7 <sup>th</sup> October 2019, (1280)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>• A resident carried out measures to minimise the impact of flooding during the incident.</li></ul>

#### Recent rainfall within the area

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 incident of flooding.

#### Historic flooding incidents within the catchment

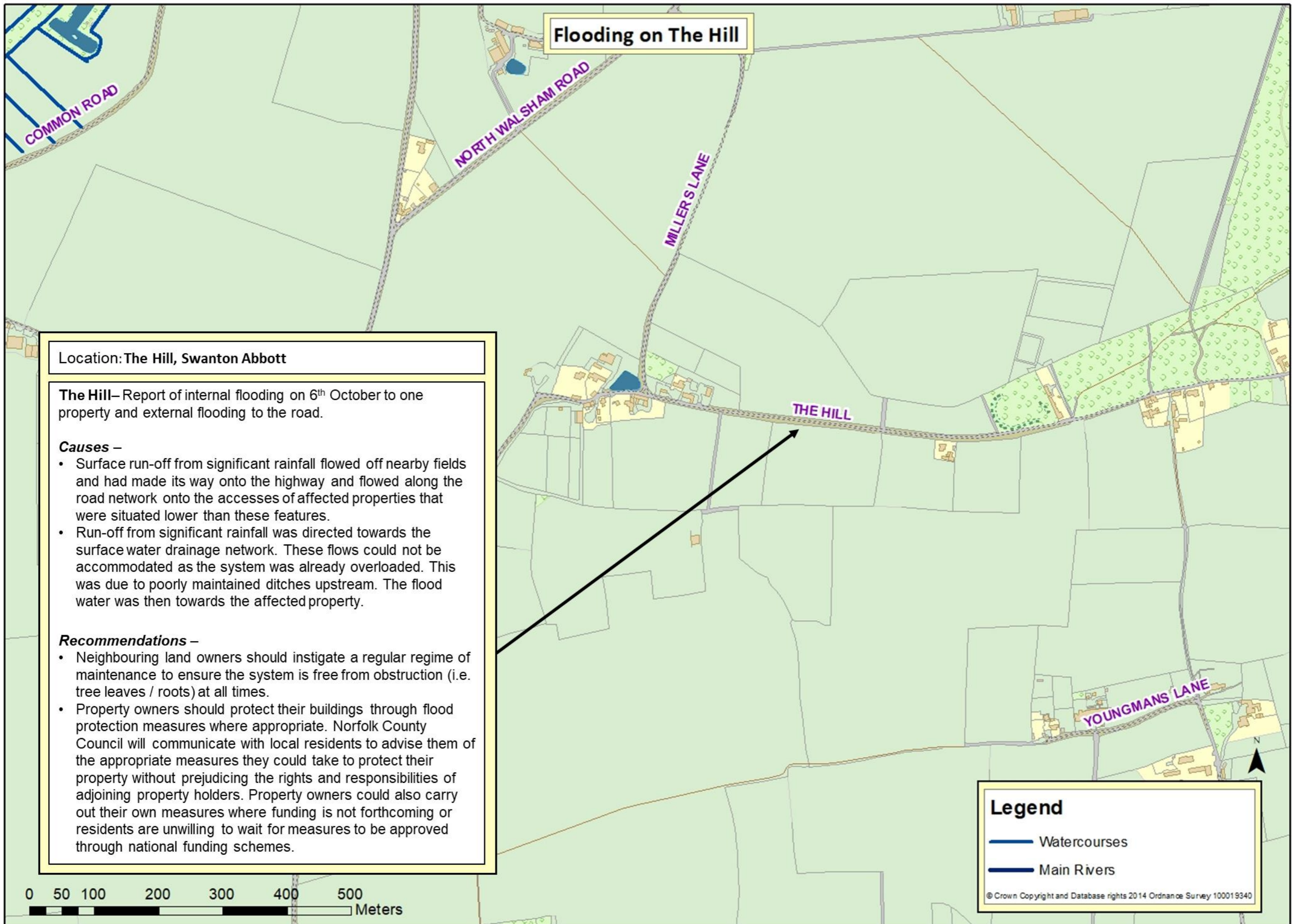
There are no records of historic flooding incidents on The Hill that have been recorded.

#### Causes of flooding and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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 the A47**

### **Flood incidents within this area**

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - One critical road was flooded – A47. This incident was reported by: Norfolk County Council via a media report on the 11 <sup>th</sup> November 2019 (1488)	<ul style="list-style-type: none"><li>Norfolk Police closed part of the road during the incident.</li></ul>

### **Recent rainfall within the area**

This report seeks to draw on rainfall data to ascertain the intensity of the rainfall events experienced in the area 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.

### **Historic flooding incidents within the catchment**

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

<b>Date of incident</b>	<b>Impact</b>	<b>Rainfall intensity</b>
Various	The A47 has flooded numerous times over the past 6 years.	Unknown

### **Causes of flooding and recommendations**

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition, the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.

Location: Tud

**A47 – Between Honingham and Easton**– One report of flooding to the road on the 6<sup>th</sup> October 2019.

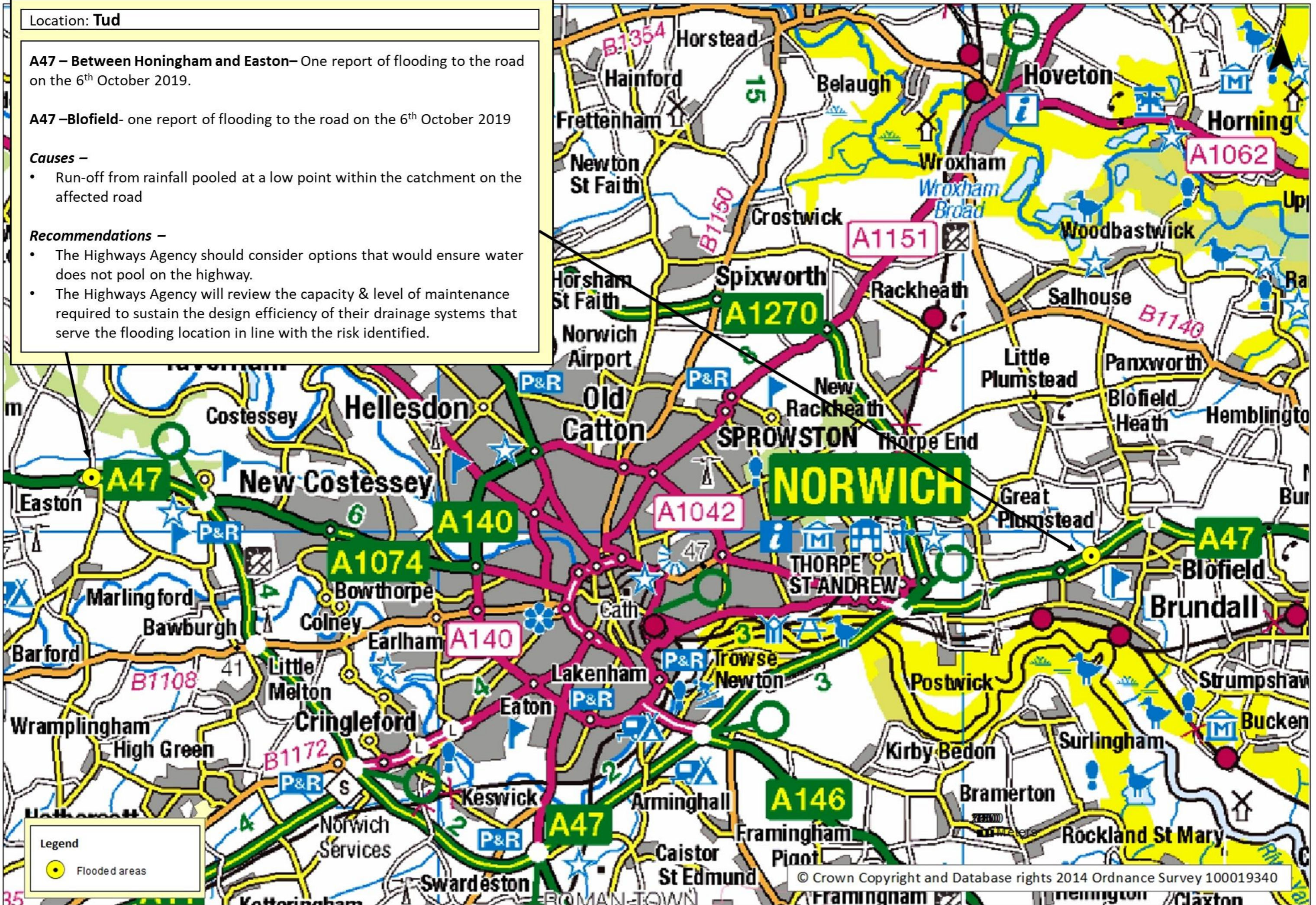
**A47 –Blofield**- one report of flooding to the road on the 6<sup>th</sup> October 2019

**Causes –**

- Run-off from rainfall pooled at a low point within the catchment on the affected road

**Recommendations –**

- The Highways Agency should consider options that would ensure water does not pool on the highway.
- The Highways Agency will review the capacity & level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.



### **Flooding in the Drayton area.**

#### **Flood incidents within this area.**

Within this area 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Pond Lane, Drayton. This incident was reported by: The Fire and Rescue Service via email correspondence on the 26 <sup>th</sup> November 2019, (1544)	<ul style="list-style-type: none"><li>• The resident took measures during the incident to reduce the impact of the flooding.</li><li>• The Fire and Rescue Service carried out measures to minimise the impact of flooding during the incident.</li><li>• Anglian Water visited the resident following the incident.</li><li>• Norfolk County council visited the resident following the flooding to undertake a flood investigation.</li><li>• Norfolk County Council have begun exploring natural flood management techniques in the area and will look to progress a project here subject to third party landowner buy in and funding.</li></ul>

#### **Recent rainfall within the area.**

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 area.

#### **Causes of flooding and recommendations**

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.



Location: Drayton

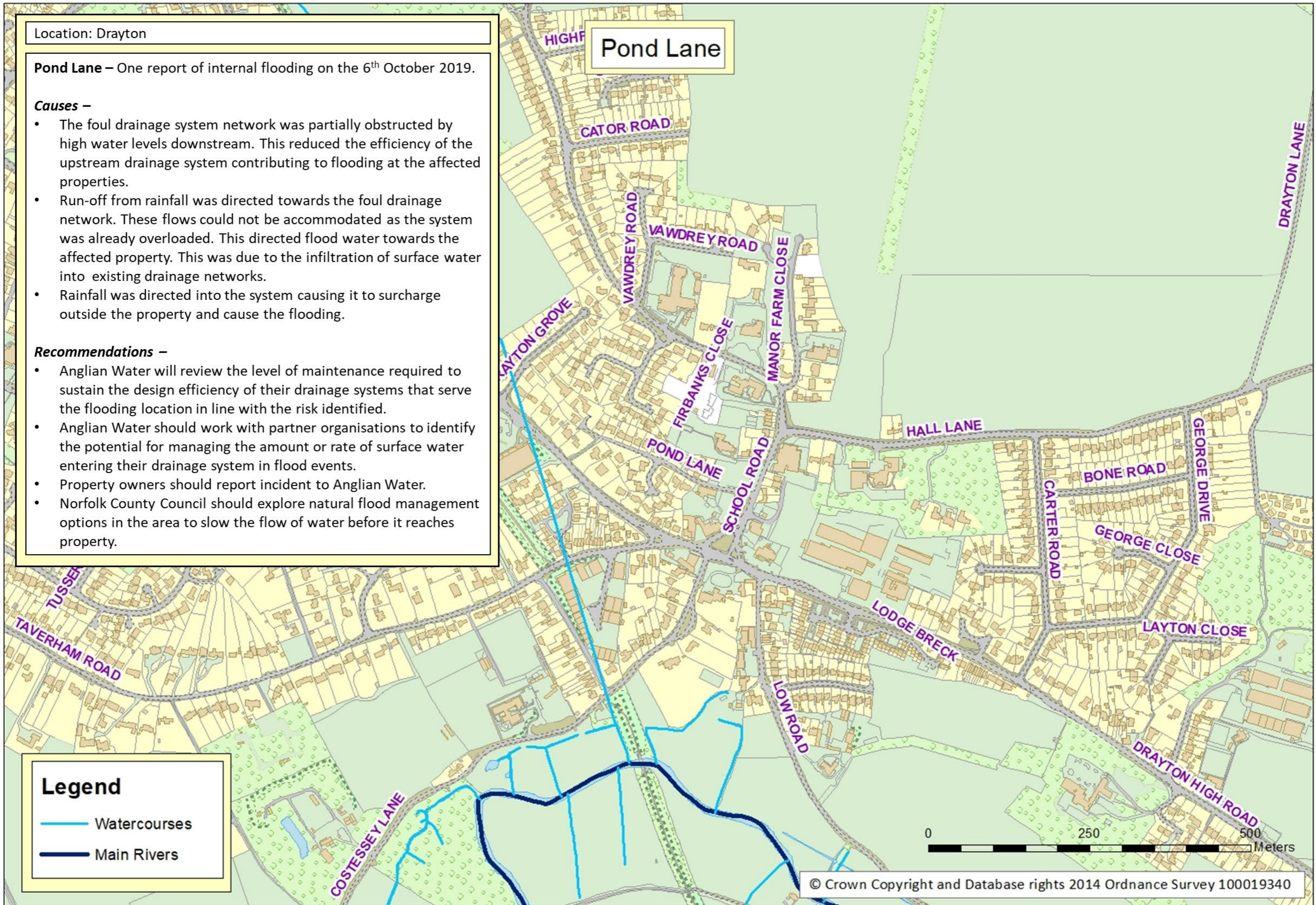
**Pond Lane** – One report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- The foul drainage system network was partially obstructed by high water levels downstream. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- Run-off from rainfall was directed towards the foul drainage network. These flows could not be accommodated as the system was already overloaded. This directed flood water towards the affected property. This was due to the infiltration of surface water into existing drainage networks.
- Rainfall was directed into the system causing it to surcharge outside the property and cause the flooding.

**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 report incident to Anglian Water.
- Norfolk County Council should explore natural flood management options in the area to slow the flow of water before it reaches property.



**Legend**

- Watercourses
- Main Rivers

0 250 500 Meters

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

### Flood incidents within Wroxham

Within this catchment 2 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
06/10/2019	On the 06/10/2019 - 2 properties were internally flooded on Hartwell Road, Wroxham. This incident was reported by a resident via an online flood report form on the 14 October 2019, (1463) a member of the public via a flood questionnaire received on the 23 December 2019, (1642)	<ul style="list-style-type: none"><li>Norfolk County Council assessed validity and impact of the flood report after the incident.</li><li>Norfolk County Council have visited the area and begun investigation work into the network.</li></ul>

### 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.

2 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 67mm rainfall was recorded as falling in 9 hours 0 minutes at the Belaugh STW rainfall monitoring station. This intensity of rainfall for the total duration equates to a 42 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
26/08/2015	2 properties were internally flooded	1 in 2 rainfall event

Properties on Hartwell Road have experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for Broadland District (FIR037), which can be found at <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/fir037-broadland-various-2013-2017.pdf>

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.

Location: **Wroxham**

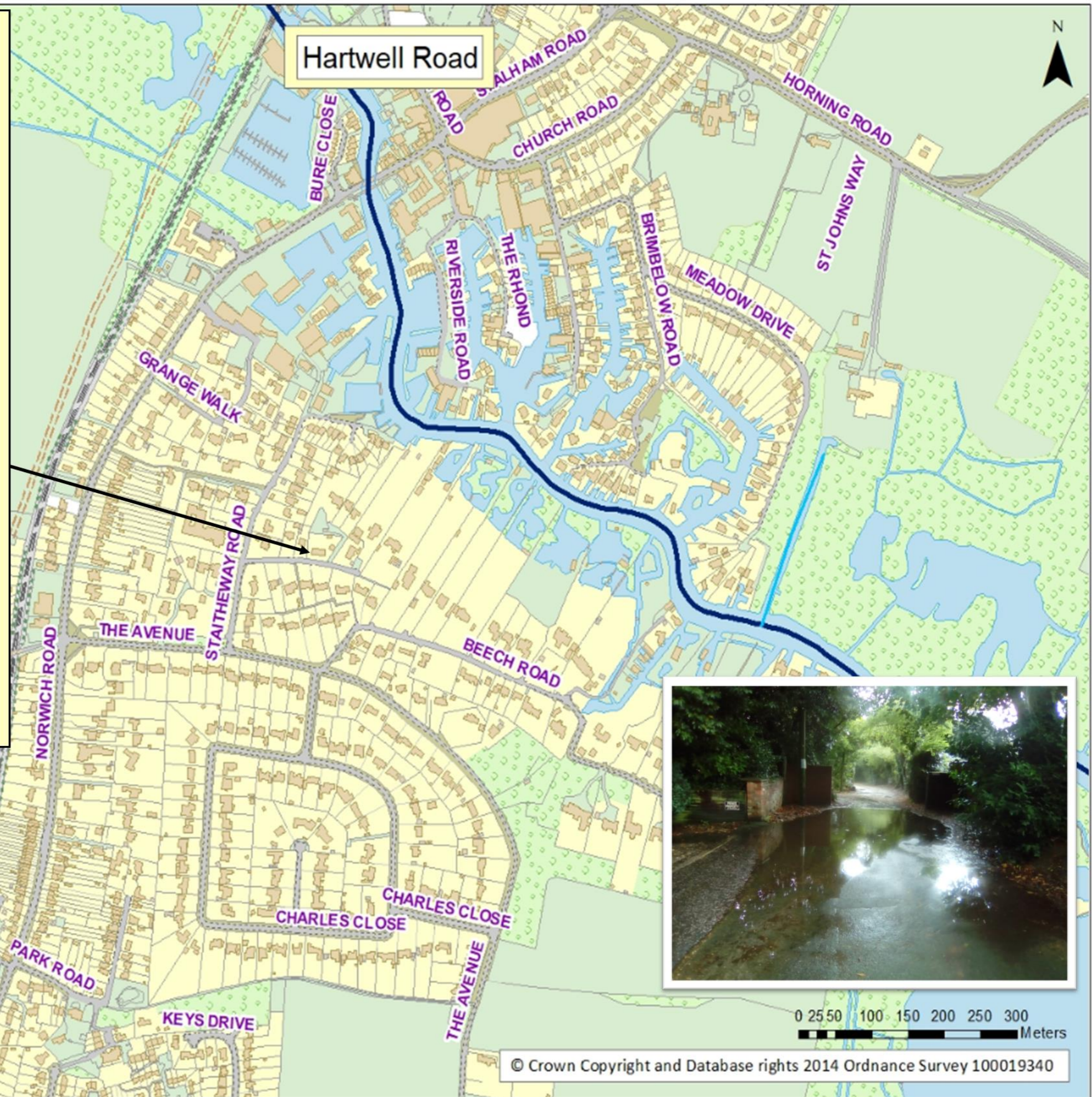
**Hartwell Road** – Report of internal flooding on the 6th October 2019 to two properties.

*Causes –*

- Surface run-off from rainfall that had made its way onto highway flowed along the road network and pooled at a low point.
- Run-off was directed towards the surface water drainage network, however these flows could not be accommodated as the system is of insufficient capacity and was already overloaded and this directed flood water towards the affected property.

*Recommendations –*

- Norfolk County Council will review the capacity & level of maintenance required to sustain the design efficiency of their drainage systems that serves the flooding location in line with the risk identified.
- NCC will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- NCC 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 investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location
- Property owners should protect their buildings through flood protection measures where appropriate. NCC can advise on the appropriate measures that can be taken to protect the property without prejudicing the rights and responsibilities of adjoining property holders.



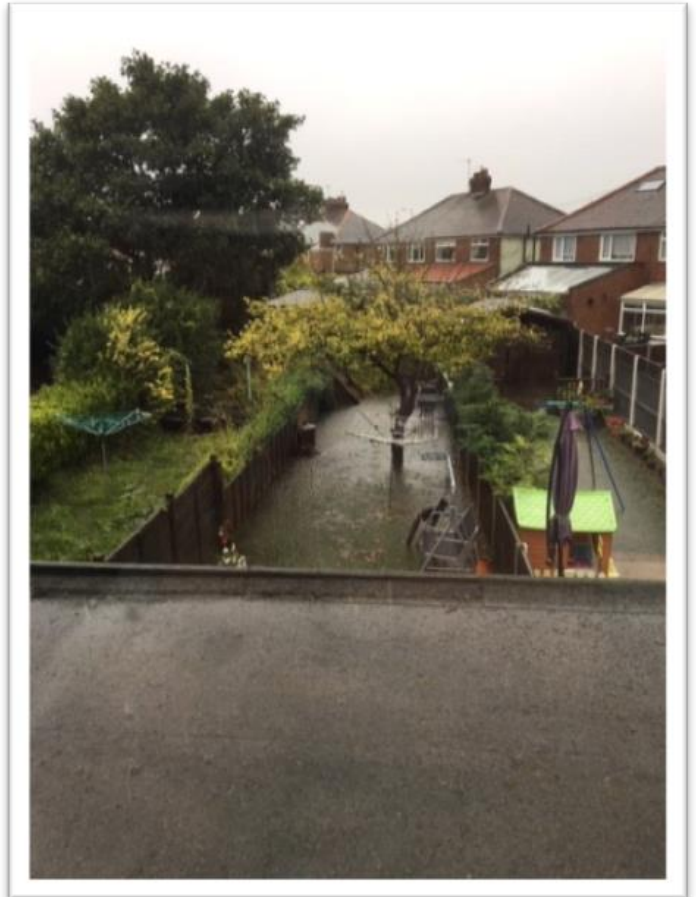
**Legend**  
— Watercourses  
— Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



## Great Yarmouth Borough - 6th October 2019

Draft Report prepared by Mark Henderson on 19<sup>th</sup> December 2019



## **Executive Summary**

### **(a) Flooding incidents and causes**

Flooding occurred across the borough of Great Yarmouth on the 6<sup>th</sup> October 2019. This led to the internal flooding of 25 properties. For the purpose of this report and ease of presentation we have set out the report based on areas in which the incidents were located. For the purpose of this report the majority of the properties shall be grouped into the following catchments. (Where there is only one isolated property a catchment will not exist):

- Claydon Catchment
- Bradwell Catchment
- Gorleston-on-Sea Catchment

A summary of the 21 incidents affected in each area can be found below:

<b>Location</b>	<b>Catchment</b>	<b>Number of Internally Flooded Properties/critical roads</b>	<b>Page Number</b>
Beccles Road	Claydon	6 Properties	65
Burgh Road	Claydon	4 Properties	65
Church Lane	Gorleston on Sea	1 Property	70
Baker Street	Gorleston on Sea	2 properties	70
High Street	Gorleston on Sea	1 property	70
Lowestoft Road	Gorleston on Sea	1 property	70
Gainsborough Avenue	Bradwell	2 Properties	75
Turner Close	Bradwell	1 Property	75
Burgh Road	Bradwell	2 Properties	75
Cherry Road, Great Yarmouth		1 Property	78
High Road, Burgh Castle		1 Property	80
Lichfield Road, Great Yarmouth		1 Property	83

### **(b) Flooding causes**

The flooding incidents covered within this report are across several parts of Great Yarmouth, however key trends seen throughout the report are:

- Surcharging of drainage systems located within overland flowpaths
- Surface water washed off public highway by vehicles exacerbating flooding to properties
- Surface water was concentrated on an overland flow path on which the affected properties were situated

### **(c) Key recommendations**

#### **Property owners**

- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures. Property owners could also carry out their own measures where funding is not forthcoming, or residents are unwilling to wait for measures to be approved through national funding schemes.

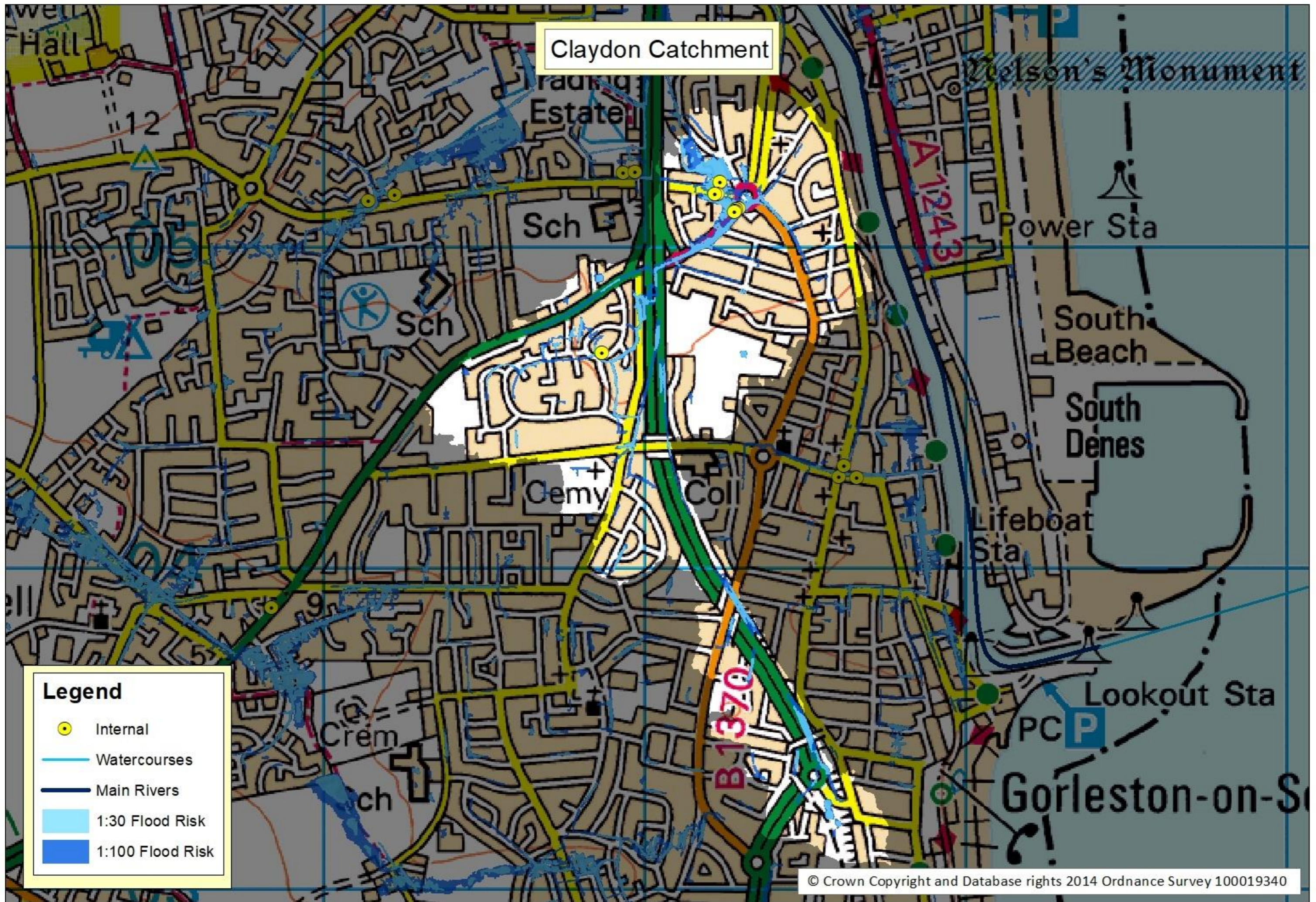
### **Norfolk County Council**

- 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 will 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.
- Norfolk County Council should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures.

### **Anglian Water**

- Anglian Water, with support from Norfolk County Council Highways, should take the lead in investigating the potential to increase the capacity of the existing system sewer system and/or divert surface water from the sewer system at the location of the affected areas. This will be subject to funding.
- 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.

# Flooding and flood risk within the Claydon catchment



### Description of catchment

Fully urban catchment with little permeable ground to drain from. Some areas of the catchment sit below sea level and are served by a pumping station, Morton Crescent SPS. Water flows northeast and to the north, outfalling into a ditch network which makes its way via a series of culverts to Breydon Water.

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	2	69	0
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	2	124	2
[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 10 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	<p>On the 06/10/2019 - 6 properties were internally flooded on Beccles Road, Great Yarmouth. These incidents were reported by:</p> <ul style="list-style-type: none"><li>Norfolk County Council via personal communication on the 9 October 2019, (1417, 1475, 1548, 1389, 1575, 1555)</li></ul>	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident</li><li>Residents carried out measures to minimise the impact of flooding during the incident.</li><li>Anglian Water Services Ltd carried out measures to minimise the impact of flooding after the incident.</li></ul>
06/10/2019	<p>On the 06/10/2019 - 4 properties were internally flooded on Burgh Road, Great</p>	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and</li></ul>



	<p>Yarmouth. These incidents were reported by:</p> <ul style="list-style-type: none"> <li>• Norfolk County via personal communication on the 9 December 2019. (1560, 1563, 1572)</li> <li>• Anglian Water via email communication on the 24 February (2217)</li> </ul>	<p>to gather information after the incident.</p> <ul style="list-style-type: none"> <li>• Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident.</li> <li>• A resident carried out measures to minimise the impact of flooding during the incident.</li> </ul>
--	--	---

#### 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:

<b>Date of incident</b>	<b>Impact</b>	<b>Rainfall intensity</b>
13 July 2014	<p>One resident at Beccles Road reported external flooding at their property on this date.</p> <p>Two residents on Beccles Road reported internal surface water flooding on this date.</p>	Unknown
6 March 2015	One resident reported surface water flooding occurring on this date causing external flooding.	Unknown
26 February 2016	One resident on Burgh Road reported surface water flooding occurring on this date causing internal flooding.	Unknown
12 July 2016	One resident on Burgh Road reported surface water flooding occurring on this date causing internal flooding.	Unknown
13 July 2016	Two residents (one in Burgh road and one in Beccles Road) reported surface water flooding occurring on this date causing internal flooding.	Unknown

17 July 2017	Three residents reported surface water flooding on Burgh Road on this date causing external flooding.	Unknown
--------------	---	---------

A number of properties in Burgh Road and Beccles Road experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for Gorleston (FIR024), which can be found at <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/flood-investigations>.

Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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

# Beccles Road and Burgh Road

Location: **Claydon**

**Beccles Road & Burgh Road** – reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall was concentrated along overland flowpaths. Significant rainfall entered the surface and foul water and this surcharged the drainage system which entered properties through low thresholds at entrances, electricity conduits and air bricks.
- The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding.
- High ground water levels exist within the location of the flooded properties
- Rainfall was concentrated on the highway. Vehicles using the highway passed through the flood water causing it to wash towards the affected properties.
- Naturally high ground water levels exist within the location of the flooded property (based on nearby publicly accessible borehole records).

**Recommendations–**

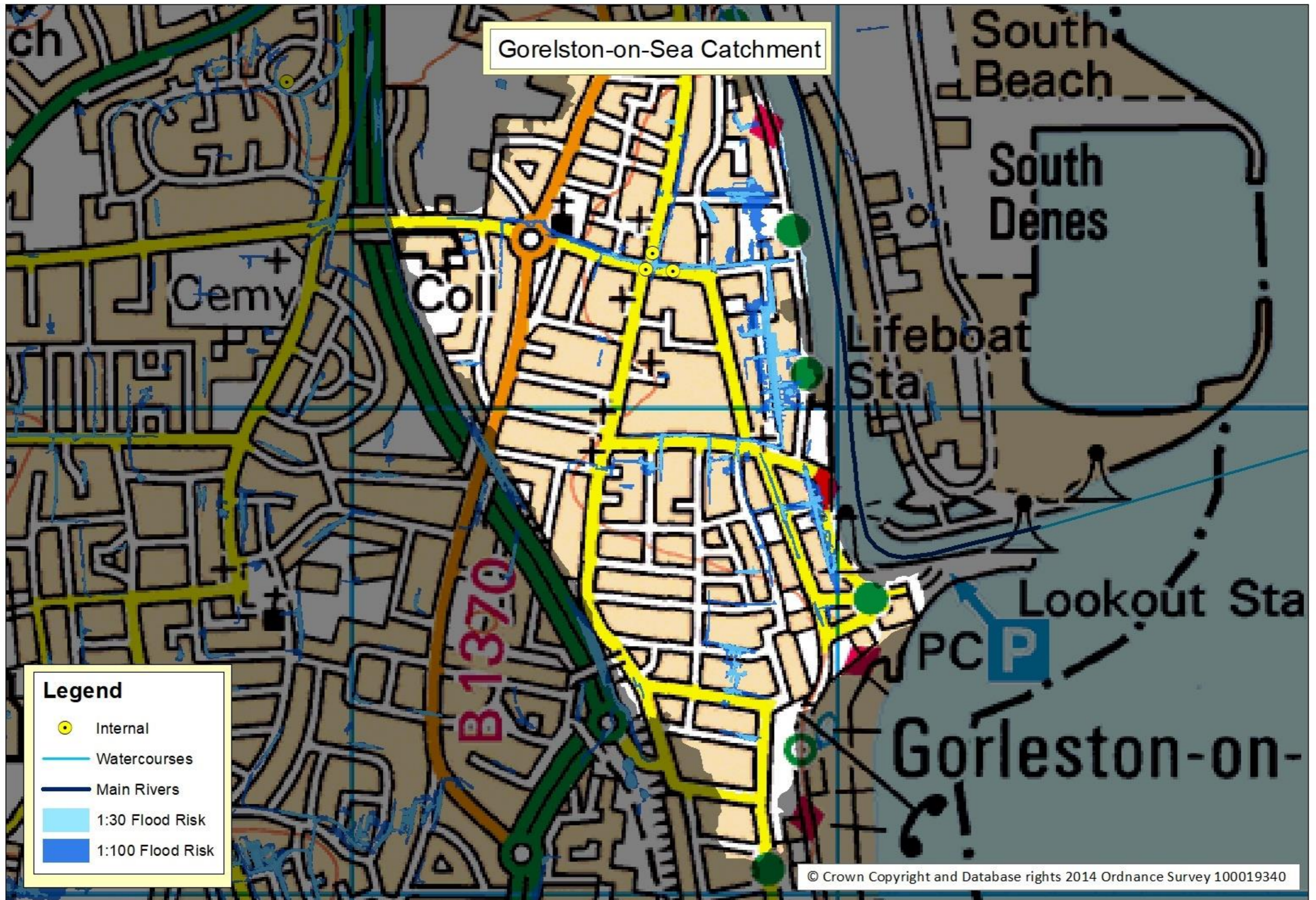
- Anglian Water, with support from Norfolk County Council Highways, should take the lead in investigating the potential to increase the capacity of the existing system sewer system and/or divert surface water from the sewer system at the location of the affected areas. This will be subject to funding.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council should work with partner organisations to communicate with and support residents in identifying and accessing funding for property level measures. Property owners could also carry out their own measures where funding is not forthcoming, or residents are unwilling to wait for measures to be approved through national funding schemes.
- 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 (Lead Local Flood Authority) to discuss with partner organisations the potential for mitigating the groundwater flooding associated with the flood event.
- Norfolk County Council to discuss with partner organisations e.g. Internal Drainage Boards the management of water levels within the catchment.
- 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.



## Legend

- Watercourses
- Main Rivers

# Flooding and flood risk within the Gorleston-on-Sea catchment



## Flooding and flood risk within the Gorleston-on-Sea Catchment

### Description of catchment

Steep, urban catchment which flows directly east to the River Yare. The majority of the drainage network is pumped up to Caister Water Treatment Works.

### 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:	2	35	19
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	3	145	51
[c] No. of properties subject to flood risk from rivers and the sea at 1 in 30 year event:	0	0	2
[d] No. of properties subject to flood risk from rivers and the sea at 1 in 100 year event:	0	0	2
[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	1

### Flood incidents within this catchment

Within this catchment 5 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
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Church lane, Great Yarmouth. This incident was reported by: Norfolk County Council (Lead Local Flood Authority) by personal communication on the 9 October 2019 (1573)	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
06/10/2019	On the 06/10/2019 – 2 properties were internally flooded on Baker Street, Great Yarmouth. These incidents were reported by: Norfolk County Council via personal communication on the 9 October 2019, (1283, 1574)	<ul style="list-style-type: none"> <li>Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> </ul>

06/10/2019	On the 06/10/2019 - 1 property was internally flooded on High Street, Great Yarmouth. This incident was reported by: Norfolk County Council via personal communication on the 9 October 2019, (1310)	<ul style="list-style-type: none"> <li>Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> </ul>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Lowestoft Road, Great Yarmouth. This incident was reported by: Norfolk County via personal communication on the 9 October 2019, (1571)	<ul style="list-style-type: none"> <li>Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> </ul>

#### 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
12 July 2016	Great Yarmouth Borough Council reported surface water flooding at the High Street, Gorleston on this date. (FWF/16/6/3065)	Unknown
30 July 2017	One resident on Baker Street reported surface water flooding occurring on this date causing internal flooding.	Unknown

Two properties experienced repeat flooding and the previous incident in Baker Street was included in the Flood Investigation Report for Gorleston (FIR024) at <https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/flood-investigations>

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.

Location: **Gorleston**

**Church Lane**— reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall was directed towards Individual property drainage. These flows could not be accommodated as the system is of insufficient capacity to deal with this amount of water. This directed flood water towards the affected property.

**Recommendations –**

- The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.

**Baker St, High Rd, Lowestoft Rd, Church In**

**Baker Street and The High Street** – reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall was concentrated along overland flowpaths. Significant rainfall entered the surface and foul water and this surcharged the drainage system. Significant rainfall was concentrated on the highway. Vehicles using the highway passed through the flood water causing it to wash towards the affected properties that were situated lower than these features.

**Recommendations –**

- 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.
- 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 should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.
- 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.

**Lowestoft Road**— reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

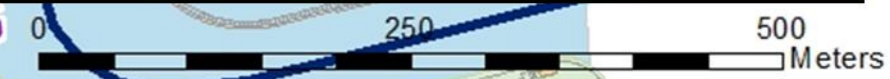
- The affected property had structural issues that did not cope with heavy rainfall, e.g. failure of roof / guttering etc.

**Recommendations –**

- Property owners should protect their buildings through flood protection measures where appropriate.

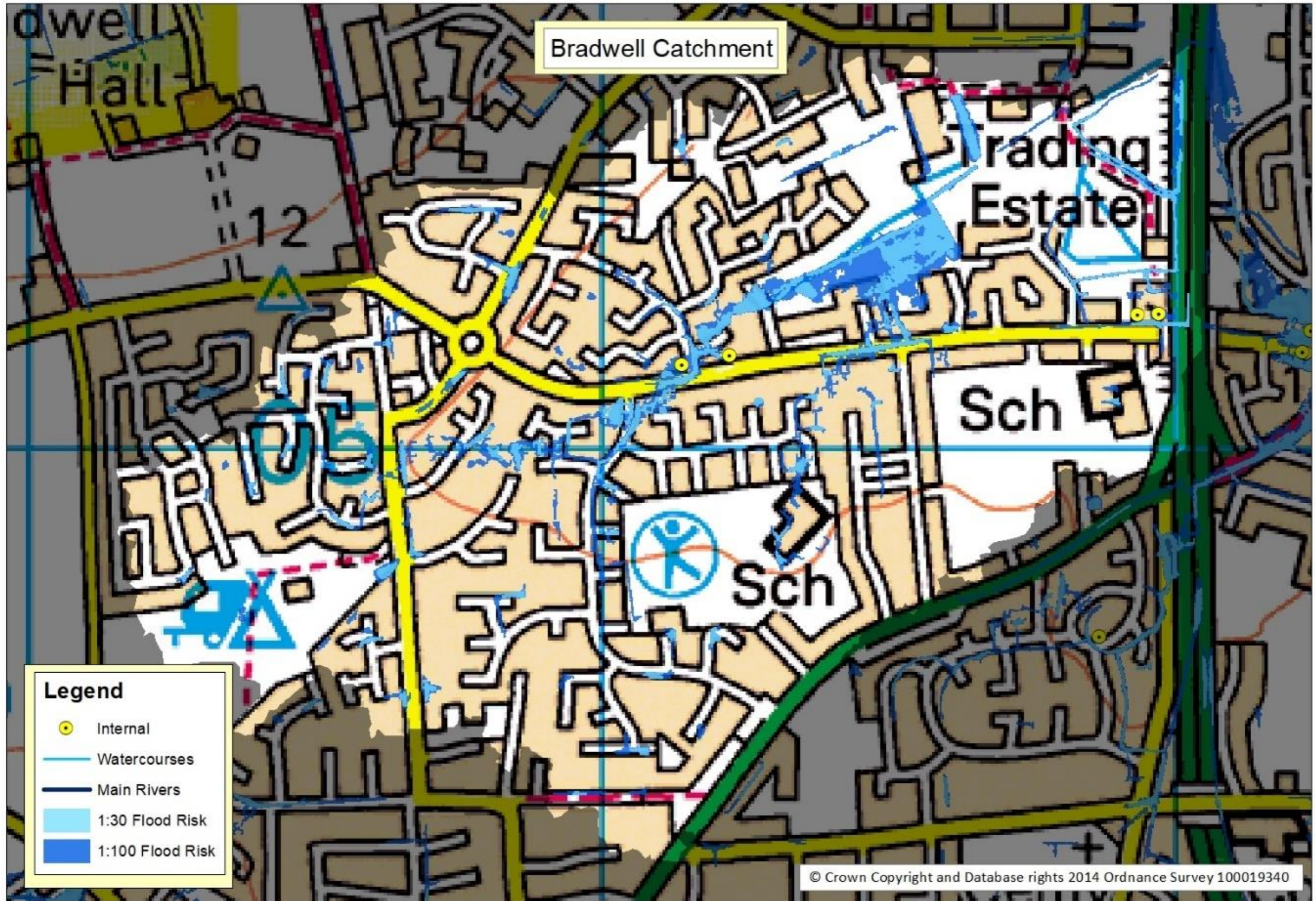
**Legend**

- Watercourses
- Main Rivers





Flooding and flood risk within the Bradwell catchment



### Description of catchment

This catchment is heavily urbanised which flows in a northerly and easterly direction into an Internal Drainage Board drainage system. This drainage system is part of a pumped system discharging into the River Yare

### 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.

<b>Flood Risk Data Source</b>	<b>Critical Services</b>	<b>Residential</b>	<b>Non-residential</b>
[a] No. of properties subject to surface water flood risk at 1 in 30 year event:	0	39	1
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	3	132	2
[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.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 2 properties were internally flooded on Gainsborough Avenue, Bradwell. These incident's were reported by: Norfolk County Council) via personal communication on the 8 October 2019, (1317,1314)	<ul style="list-style-type: none"><li>• Norfolk County visited affected residents to offer advice and to gather information after the incident.</li><li>• A resident carried out measures to minimise the impact of flooding during the incident.</li></ul>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Turner Close, Bradwell. This incident was reported by: Norfolk County Council via personal communication on the 8 October 2019, (1368)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

06/10/2019	On the 06/10/2019 - 2 properties were internally flooded on Burgh Road, Great Yarmouth. This incident was reported by: Norfolk County via personal communication on the 8 October 2019, (1562, 1607)	<ul style="list-style-type: none"> <li>Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> </ul>
------------	---	---

#### 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.

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.

N

Location: Bradwell

**Gainsborough Avenue, Turner Close and Burgh Road – reports of internal flooding on the 6<sup>th</sup> October 2019.**

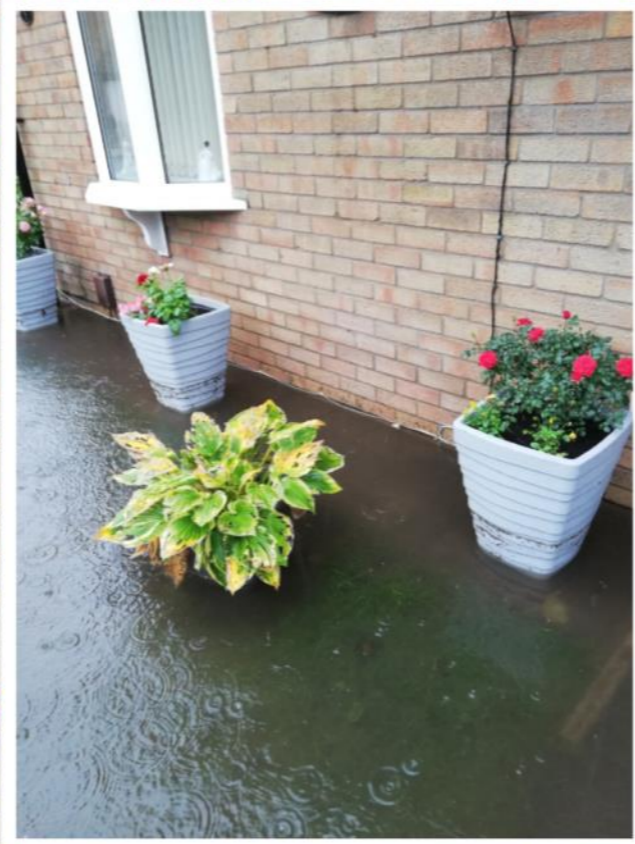
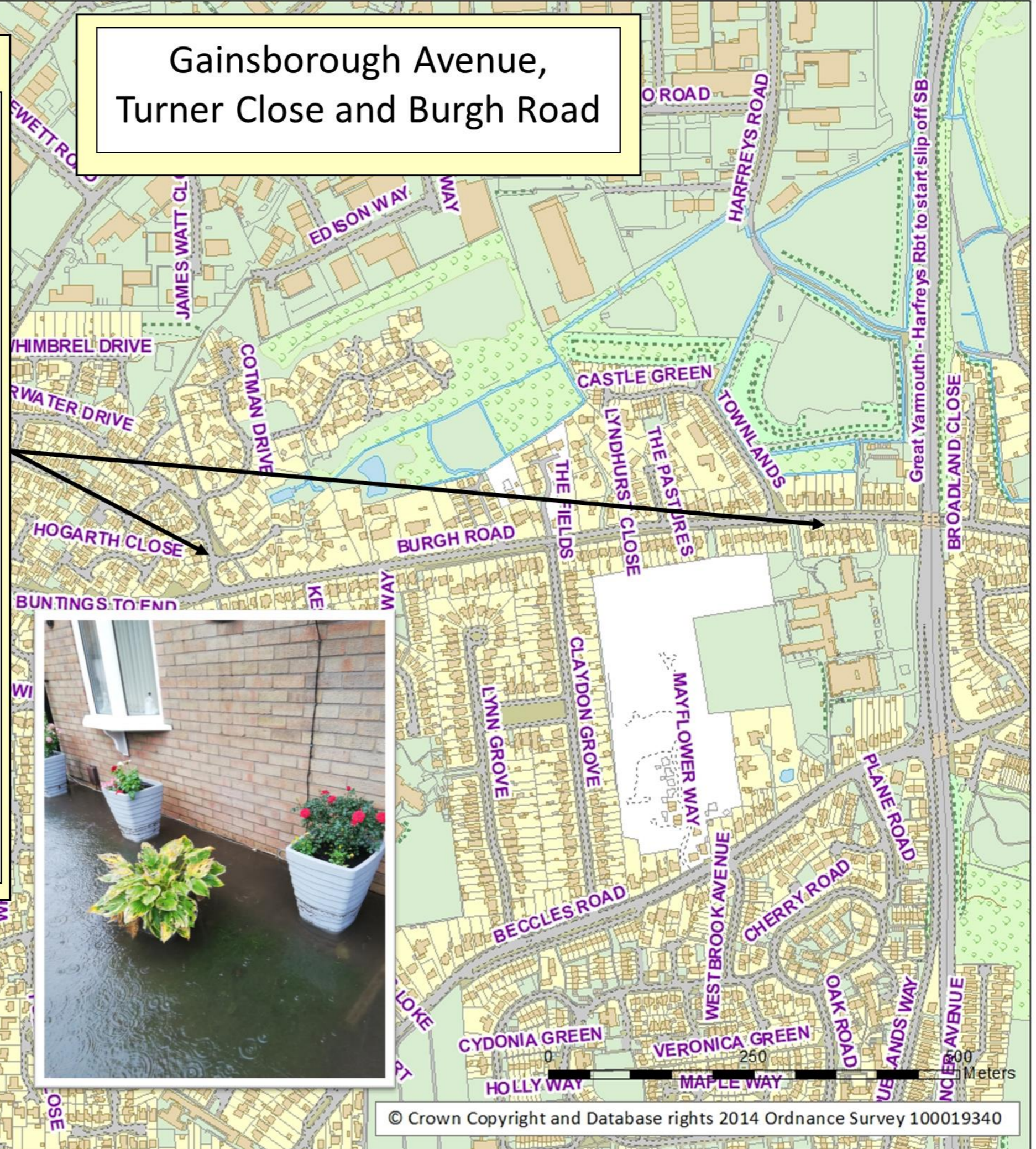
**Causes –**

- Run-off from rainfall was concentrated along overland flowpaths and entered the surface and foul water and this surcharged and made its way onto the highway flowed along the road network and via dropped kerbs/due to the camber of the roads onto the accesses of affected properties.

**Recommendations–**

- Anglian Water, with support from Norfolk County Council Highways, should take the lead in investigating the potential to increase the capacity of the existing system sewer system and/or divert surface water from the sewer system at the location of the affected areas. This will be subject to funding.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures. Property owners could also carry out their own measures where funding is not forthcoming, or residents are unwilling to wait for measures to be approved through national funding schemes.
- 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.

# Gainsborough Avenue, Turner Close and Burgh Road



### Legend

-  Watercourses
-  Main Rivers

## Flooding and flood risk at Cherry Road, Great Yarmouth

### Flood incidents within this location

Within this location 1 incident of internal flooding has 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
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Cherry Road, Great Yarmouth. This incident was reported by: Norfolk County Council via personal communication on the 9 October 2019, (1567)	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>A resident carried out measures to minimise the impact of flooding during the incident.</li></ul>

### 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.

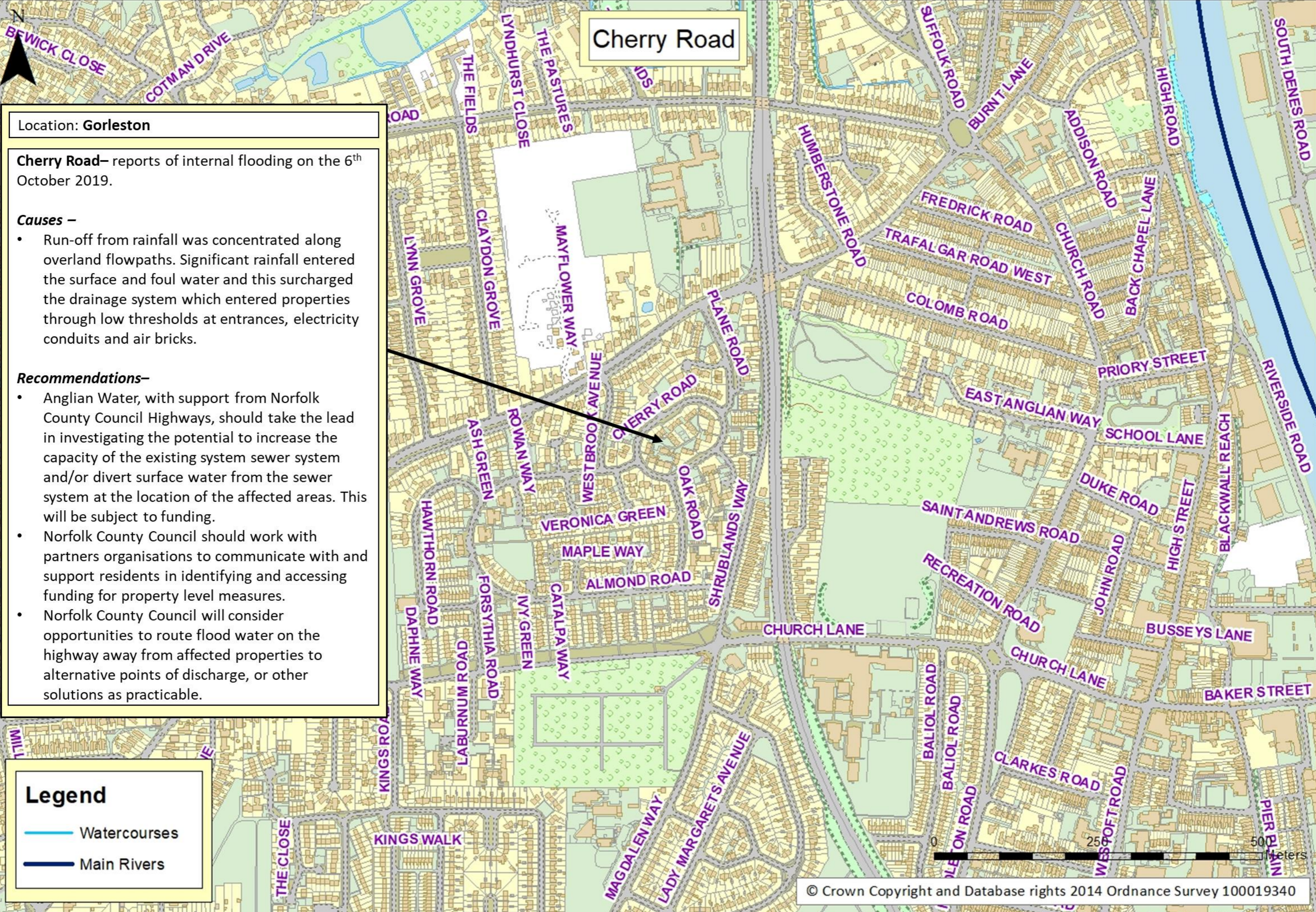
There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.



**Cherry Road**

Location: **Gorleston**

**Cherry Road**– reports of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

- Run-off from rainfall was concentrated along overland flowpaths. Significant rainfall entered the surface and foul water and this surcharged the drainage system which entered properties through low thresholds at entrances, electricity conduits and air bricks.

**Recommendations–**

- Anglian Water, with support from Norfolk County Council Highways, should take the lead in investigating the potential to increase the capacity of the existing system sewer system and/or divert surface water from the sewer system at the location of the affected areas. This will be subject to funding.
- Norfolk County Council should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures.
- 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.

**Legend**

- Watercourses
- Main Rivers

## Flooding and Flood Risk within Burgh Castle

Within this location 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on High Road, Burgh Castle. This incident was reported by: Norfolk County Council via personal communication on the 9 October 2019, (1425)	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>Anglian Water Services Ltd visited.</li></ul>

### Recent rainfall within this location

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 this location

The following table lists flooding incidents at this location that have been recorded:

Date of incident	Impact	Rainfall intensity
15 January 2016	One resident on the High Road reported surface water flooding occurring on this date causing external flooding.	Unknown
31 May 2016	One resident on the High Road reported surface water flooding occurring on this date causing internal flooding.	Unknown
13 June 2016	One resident on the High Road reported surface water flooding occurring on this date causing internal flooding.	Unknown
30 July 2016	One resident on the High Road reported surface water flooding occurring on this date causing external flooding.	Unknown

14 August 2016	One resident on the High Road reported surface water flooding occurring on this date causing external flooding on the road.	Unknown
30 November 2017	One resident on the High Road reported surface water flooding occurring on this date causing external flooding.	Unknown

Causes of flooding within this location and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.





Location: **Burgh Castle**

**High Road**— reports of internal flooding on the 6<sup>th</sup> October 2019.

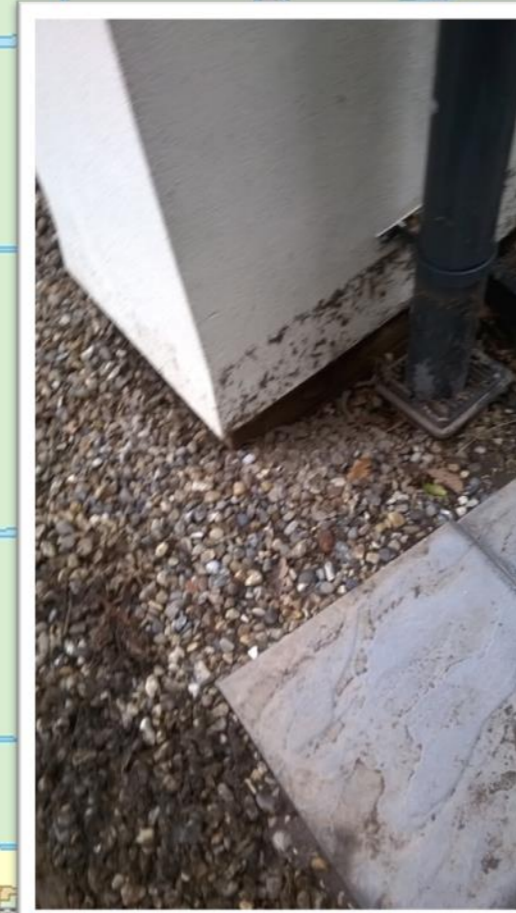
**Causes –**

- Run-off from rainfall was concentrated along overland flowpaths that had made its way onto highway flowed along the road network and via dropped kerbs onto the accesses of affected properties that were situated lower than these features.

**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 will 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. Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.
- 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 will contact adjacent landowners to discuss measures that could be taken to manage the amount or rate of surface water entering the road/property.

**High Road**



**Legend**

- Watercourses
- Main Rivers

## Flooding and Flood Risk within Lichfield Road, Great Yarmouth

### Flood incidents within this catchment

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Lichfield Road, Great Yarmouth. This incident was reported by: A resident via email correspondence on the 21 October 2019, (1409)	<ul style="list-style-type: none"><li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li><li>Anglian Water Services Ltd responded to test for the presence of flooding from their drainage systems.</li><li>A resident carried out measures to minimise the impact of flooding after the incident.</li></ul>

### 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 this location

The following table lists flooding incidents at this location that have been recorded:

Date of incident	Impact	Rainfall intensity
1 March 2014	A resident report internal flooding of two properties. This was due to a blocked sewer which was resolved by Anglian Water	Unknown

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map including the causes that led to the flooding and which Risk Management Authorities have responsibility to help manage the causes of the flooding. In addition the recommendations to mitigate the causes and impacts of the flooding experienced within this location are also included within the map.

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.

# Lichfield Road

Location: **Great Yarmouth**

**Lichfield Road**— report of internal flooding on the 6<sup>th</sup> October 2019.

**Causes –**

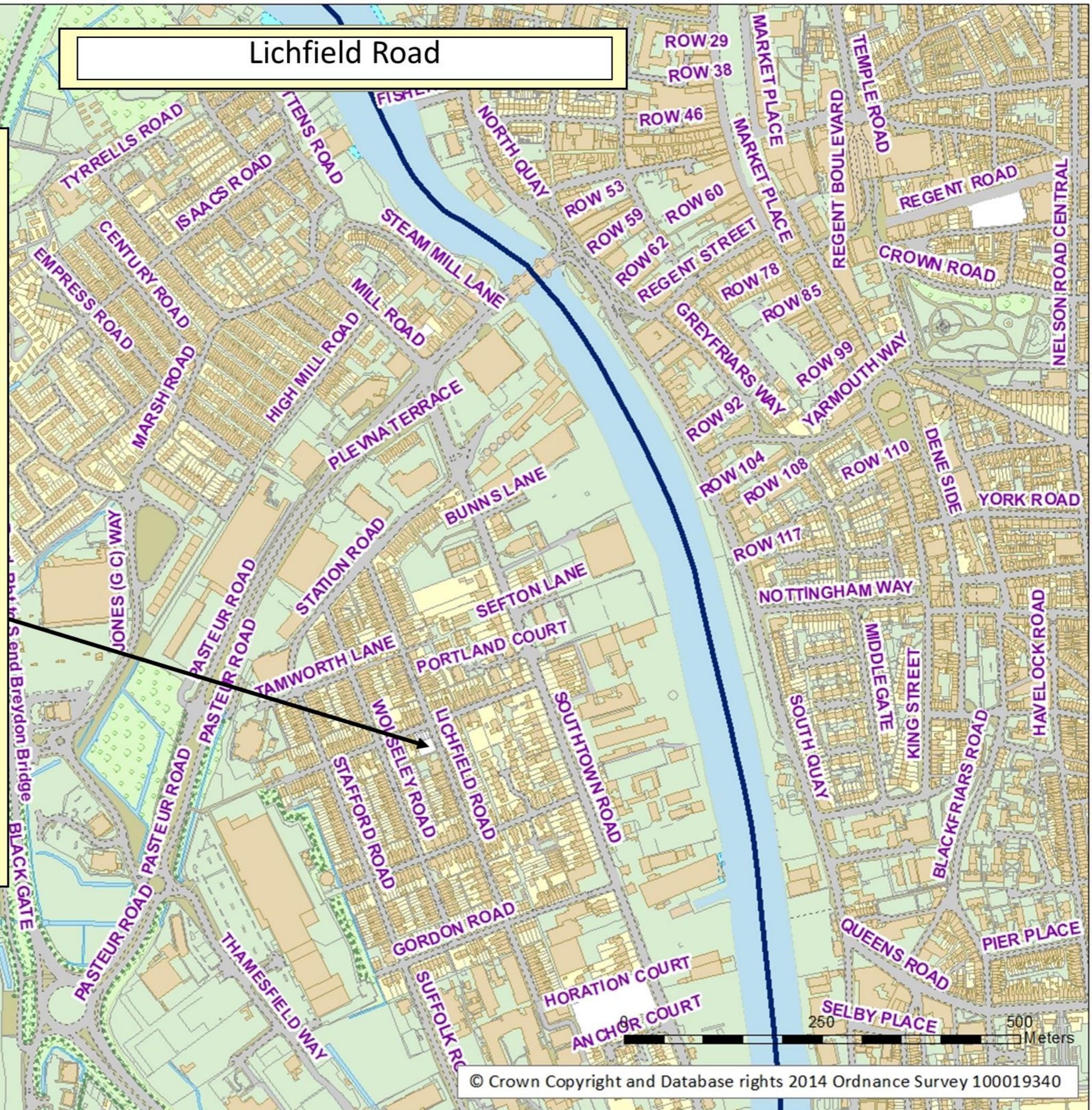
- Naturally high ground water levels exist within the location of the flooded property (based on nearby publicly accessible borehole records).
- Prolonged periods of rain along with a significant rainfall event on the date of the event would have exacerbated the existing high ground water levels

**Recommendations—**

- Norfolk County Council (Lead Local Flood Authority) to discuss with partner organisations the potential for mitigating the groundwater flooding associated with the flood event.
- Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council should work with partners organisations to communicate with and support residents in identifying and accessing funding for property level measures. Property owners could also carry out their own measures where funding is not forthcoming, or residents are unwilling to wait for measures to be approved through national funding schemes.

## Legend

- Watercourses
- Main Rivers

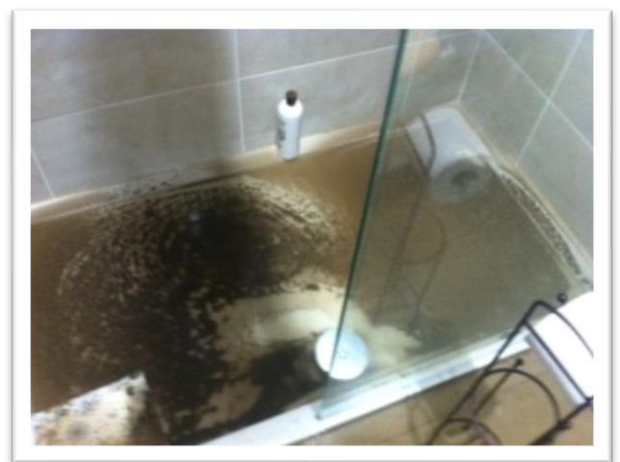




# Norfolk County Council

## North Norfolk - 6th October 2019

Draft Report prepared by Nathan Harris on 7 January 2020.



## Executive Summary

Flooding occurred across the North Norfolk on the 6<sup>th</sup> October 2019. 14 properties were reported to have experienced internal flooding on this day and 1 critical road was closed due to flooding. For the purpose of this report and ease of presentation we have set out the report based on areas in which the incidents were located. When one or two properties have been flooded in an area a catchment has not been generated. A summary of the 14 incidents affected in each area can be found below:

Location	Catchment	Number of Internally Flooded Properties/critical roads	Page Number
Cromer	East and West	11	89
North Walsham		2	97
Thornage		1	100
Thorpe Market		1	102

### (b) Flooding causes

The flooding incidents covered within this report are from across a large area, however key trends seen throughout the report are:

- Properties were sitting along an overland flow path on which rainfall was concentrated
- Surface run-off from rainfall made its way on to private tracks/ highway and flowed towards affected properties which sat below these features
- Due to the development the saturation of soils localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding.
- Surface water pooled at low points within the catchment

### (c) 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.

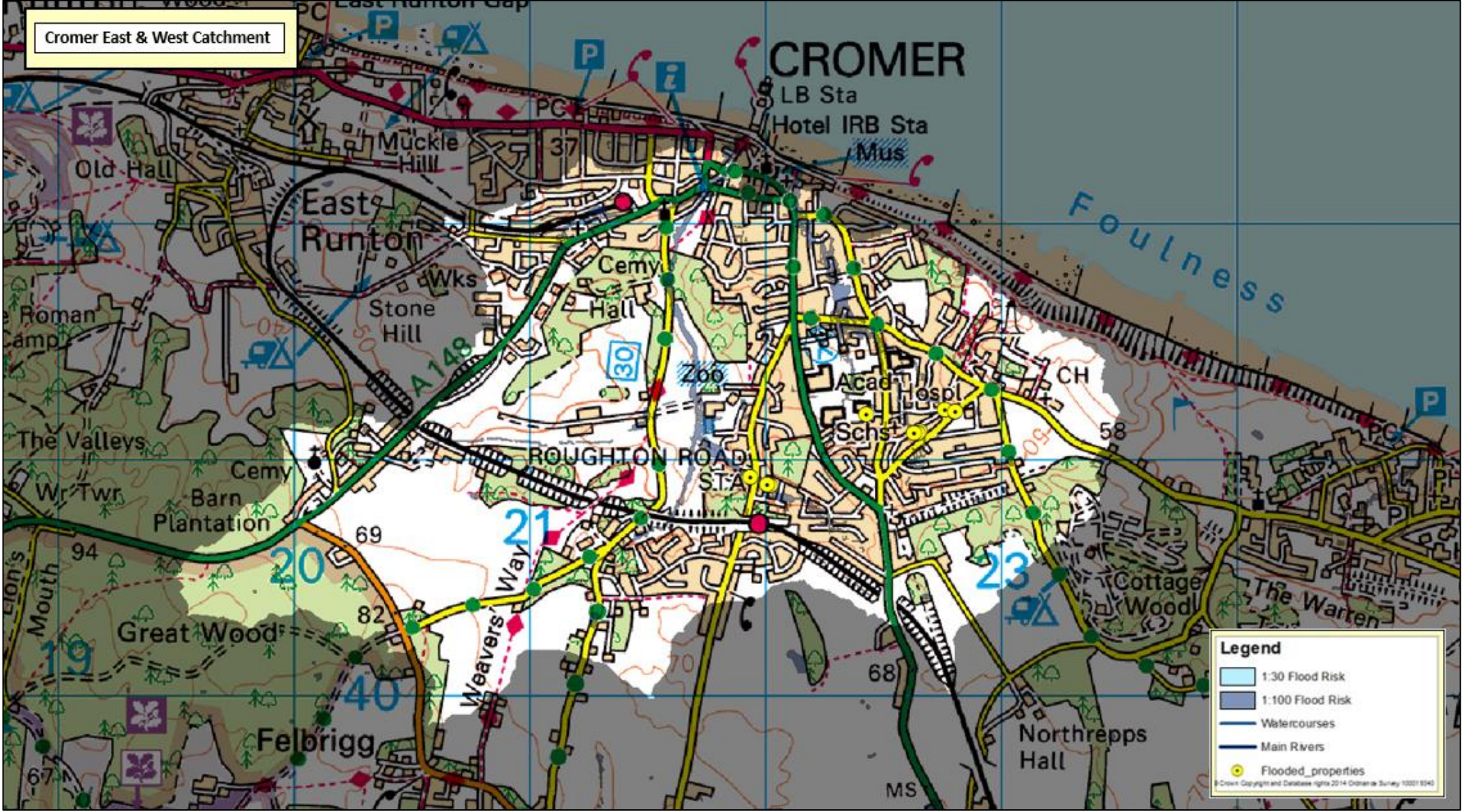
**Norfolk County Council** should;

- 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

# Flooding and flood risk within the Cromer East and West catchment





## West Cromer Catchment.

### Description of catchment

A large coastal catchment encompassing Western Cromer and Great Wood. The Catchment head is to the South of the town near Felbrigg. Flows move from this area South to North and discharge in the sea within the town.

### 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:	1	182	58
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	1	272	93
[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 3 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
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Yaxley Loke, Cromer. This incident was reported by: Norfolk County Council via personal communication on the 9 <sup>th</sup> October 2019, (1377)	<ul style="list-style-type: none"> <li>Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> <li>Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li> </ul>
	On the 06/10/2019 - 1 property was internally flooded on Brownhill, Cromer. This incident was reported by: Norfolk County Council via personal communication on the 9 <sup>th</sup> October 2019, (1360)	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>

29/09/2019	On the 29/09/2019 - 1 property was internally flooded on Brownhill, Cromer. This incident was reported by: Norfolk County Council via personal communication on the 9 <sup>th</sup> October 2019, (1243)	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
------------	--	---

#### 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.

3 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 46mm rainfall was recorded as falling in 8 hours 45 minutes at the Cromer rainfall monitoring station. This intensity of rainfall for the total duration equates to a 11 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
23/06/2016	Internal Flooding	1 in 2 rainfall event

Properties in Brownhill have experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for Cromer (FIR027), which can be found at <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/cromer-2016.pdf>.

As of the 6<sup>th</sup> Oct, further anecdotal evidence of numerous occasions of flooding to properties on Brownhill has been provided, however these events have not formally been recorded other than that mentioned above.

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.

Location: **Cromer**

**Yaxley Loke** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

*Causes –*

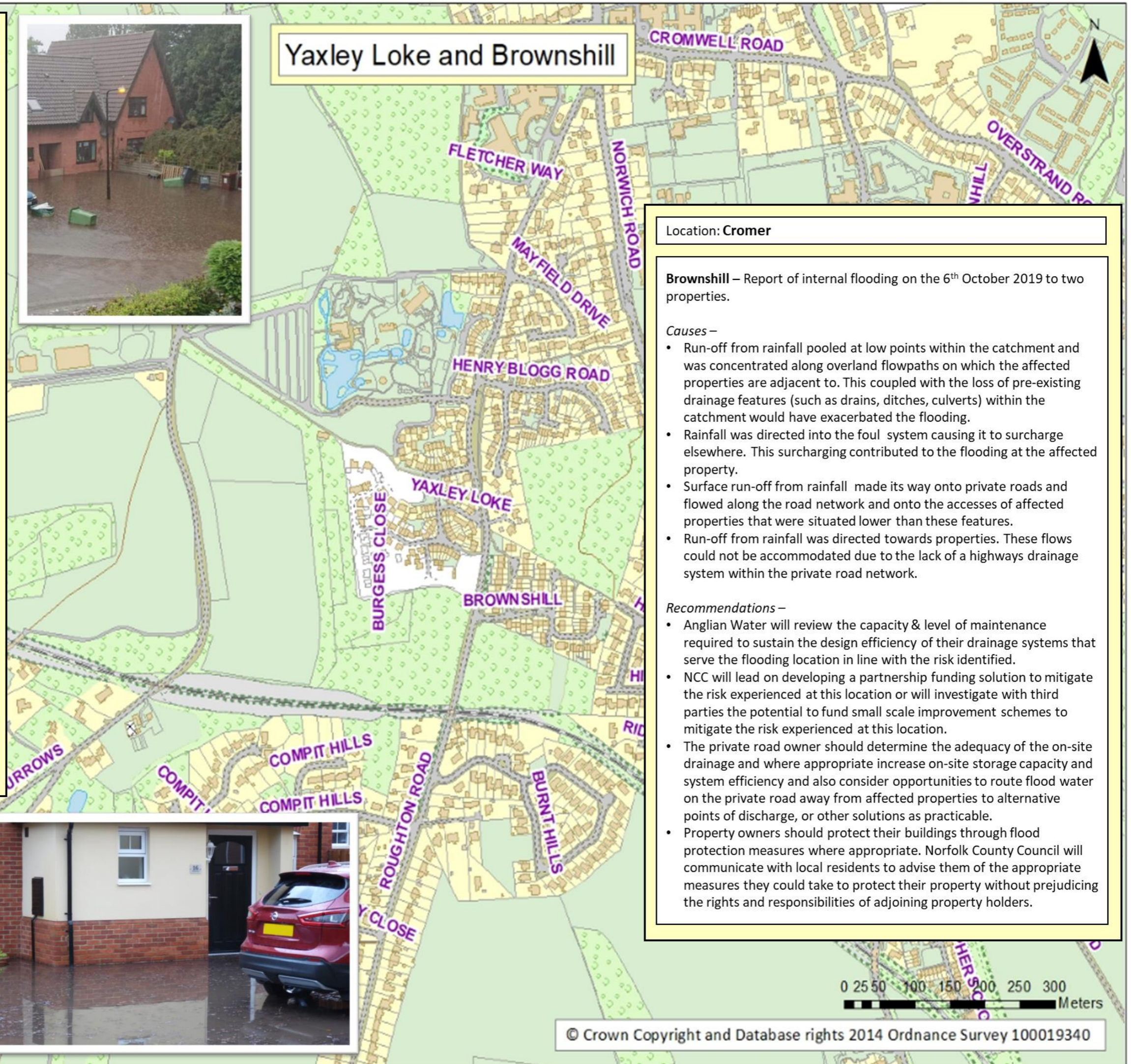
- Run-off from rainfall was concentrated along the highway and overland flow paths on which the affected property is positioned on. Vehicles using the highway passed through the flood water causing it to wash towards the affected property via dropped kerbs entering the property through low thresholds.

*Recommendations –*

- Norfolk County Council and Anglian Water will review the capacity & level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- NCC & AW to work together to identify the potential for managing the amount or rate of surface water entering the drainage system in flood events.
- NCC will consider options that would prevent water from pooling on the highway along with 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.



# Yaxley Loke and Brownshill



Location: **Cromer**

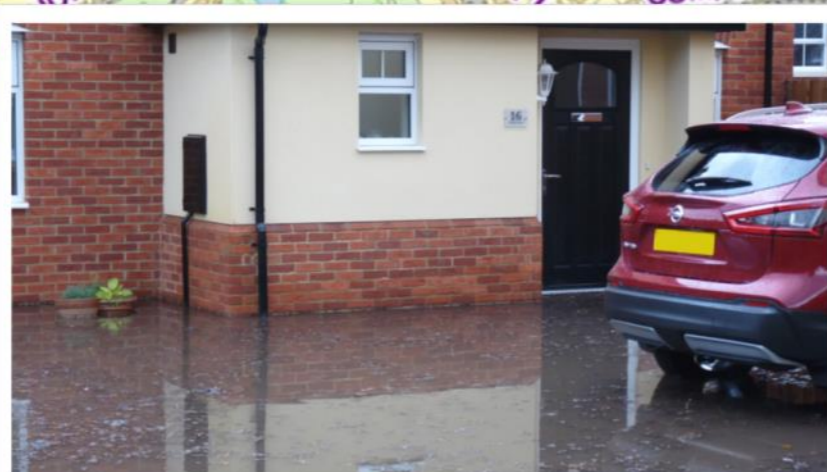
**Brownshill** – Report of internal flooding on the 6<sup>th</sup> October 2019 to two properties.

*Causes –*

- Run-off from rainfall pooled at low points within the catchment and was concentrated along overland flowpaths on which the affected properties are adjacent to. This coupled with the loss of pre-existing drainage features (such as drains, ditches, culverts) within the catchment would have exacerbated the flooding.
- Rainfall was directed into the foul system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.
- Surface run-off from rainfall made its way onto private roads and flowed along the road network and onto the accesses of affected properties that were situated lower than these features.
- Run-off from rainfall was directed towards properties. These flows could not be accommodated due to the lack of a highways drainage system within the private road network.

*Recommendations –*

- Anglian Water will review the capacity & level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- NCC will lead on developing a partnership funding solution to mitigate the risk experienced at this location or will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location.
- The private road owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency and also consider opportunities to route flood water on the private road 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**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

## East Cromer Catchment.

### Description of catchment

A smaller coastal catchment encompassing Eastern Cromer. The Catchment head is to the South East of the town. Flows move from this area in a North Easterly direction and discharge in to the sea within the town.

### 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:	2	166	9
[b] No. of properties subject to surface water flood risk at 1 in 100 year event:	5	268	21
[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 7 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
06/10/2019	<p>On the 06/10/2019 - 2 properties were internally flooded on Station Road, Cromer. These incidents were reported by:</p> <p>Anglian Water Services Ltd via email correspondence on the 11<sup>th</sup> October 2019, (1378)</p> <p>Anglian Water Services Ltd via email correspondence on the 11<sup>th</sup> October 2019, (1458)</p>	<ul style="list-style-type: none"> <li>• Anglian Water Services Ltd visited affected residents to offer advice and to gather information during the incident.</li> <li>• Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident.</li> <li>• Norfolk County visited affected residents to offer advice and to gather information after the incident.</li> <li>• The landowner carried out measures to minimise the impact of flooding during the incident.</li> </ul>

	<p>On the 06/10/2019 - 1 property was internally flooded on Cliff Road, Cromer. This incident was reported by:          Anglian Water Services Ltd via email correspondence on the 11<sup>th</sup> October 2019, (1454)</p>	<ul style="list-style-type: none"> <li>• Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident.</li> <li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
	<p>On the 06/10/2019 - 4 properties were internally flooded on Harbord Road, Cromer. These incidents were reported by:          Anglian Water Services Ltd via email correspondence on the 11<sup>th</sup> October 2019, (1448, 1433, 1461, 1447)</p>	<ul style="list-style-type: none"> <li>• Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li> <li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
	<p>On the 06/10/2019 - 1 property was internally flooded on Mill Road, Cromer. This incident was reported by:          A member of the public via an electronic report on the 9<sup>th</sup> October 2019, (1311)</p>	<ul style="list-style-type: none"> <li>• The Fire and Rescue Service responded and pumped out during the incident.</li> <li>• Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li> </ul>

#### 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.

7 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 46mm rainfall was recorded as falling in 8 hours 45 minutes at the Cromer rainfall monitoring station. This intensity of rainfall for the total duration equates to a 11 year rainfall event.

#### Historic flooding incidents within the catchment

No historic flooding has previously been recorded at these locations.

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.



# Cliff Road and Station Road

Location: **Cromer**

**Station Road & Cliff Road – Report of internal flooding on the 6<sup>th</sup> October 2019 to two properties.**

*Causes –*

- Surface run-off from rainfall that had made its way onto highway flowed along the road network and pooled at a low point within the catchment.
- Rainfall was directed into the Anglian Water combined system, however these flows could not be accommodated as the system is of insufficient capacity to deal with this amount of water causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected properties.
- The run-off was also concentrated along overland flow paths, on which the affected properties are adjacent to, and via dropped kerbs flowed onto the accesses of the affected properties that are situated lower than the carriageway and entered the properties through low thresholds at entrances.

*Recommendations –*

- Norfolk County Council will consider options that would prevent water from pooling on the highway along with opportunities to route flood water on the highway away from affected properties to alternative points of discharge or other solutions as practicable.
- Anglian Water will review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooded location in line with the risk identified.
- AW should work with Norfolk County Council to mitigate the risk experienced at this location and will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location.
- Property owners should protect their buildings through flood protection measures where appropriate. NCC 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**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

Location: **Cromer**

**Mill Road** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

**Causes –**

- Run-off from rainfall was directed towards Individual property drainage. These flows could not be accommodated as the system is of insufficient capacity to deal with this amount of water.
- The loss of pre-existing drainage features such as drains, dykes, ditches within the immediate area exacerbated the flooding
- This directed flood water towards the affected property, the flood water entered the property through low thresholds at entrances.
- The affected property experienced structural issues that did not cope with heavy rainfall, i.e. guttering/downpipe.

**Recommendations –**

- The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.
- The property owner should protect their buildings through flood protection measures where appropriate. NCC can advise on the appropriate measures that can be taken to protect the property without prejudicing the rights and responsibilities of adjoining property holders.

# Mill Road and Harbord Road

Location: **Cromer**

**Harbord Road** – Report of internal flooding on the 6<sup>th</sup> October 2019 to three properties.

**Causes –**

- Rainfall was directed into the combined system causing it to surcharge elsewhere. Run-off from rainfall was also concentrated along overland flow paths on which the affected properties are positioned on and adjacent to.
- The surcharged water that had made its way onto the highway then flowed along the road network and via dropped kerbs onto the accesses of affected properties that were situated lower than these features.
- The flood water then entered the properties through low thresholds and air bricks.

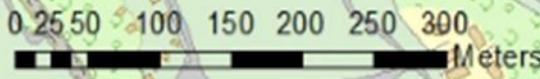
**Recommendations –**

- Anglian Water will review the capacity and/or level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooded location in line with the risk identified.
- NCC will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge as well as working with partner organisations to identify the potential for managing the amount or rate of surface water entering the drainage system in flood events.
- Property owners should protect their buildings through flood protection measures where appropriate. NCC 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**

- Watercourses
- Main Rivers



© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

## **Flooding and flood risk within North Walsham.**

### Flood incidents within North Walsham

Within this catchment 2 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Spenser Avenue, North Walsham. This incident was reported by: A member of the public via an online flood report form on the 9 <sup>th</sup> November 2019, (1487)	<ul style="list-style-type: none"><li>• Norfolk County visited affected residents to offer advice and to gather information after the incident.</li></ul>
	On the 06/10/2019 - 1 property was internally flooded on Folgate Road Industrial Estate, North Walsham. This incident was reported by: A member of the public via email correspondence on the 11 <sup>th</sup> October 2019, (1380)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

### 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.

2 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 40mm rainfall was recorded as falling in 9 hours at the North Walsham STW rainfall monitoring station. This intensity of rainfall for the total duration equates to a 7 year rainfall event.

### Historic flooding incidents within the catchment

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

<b>Date of incident</b>	<b>Impact</b>	<b>Rainfall intensity</b>
23/06/2016	Internal flooding	1 in 33 rainfall event

Properties on Folgate Road have experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for North Walsham (FIR018), which can be found at <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/north-walsham-fir.pdf>

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.



Location: North Walsham

**Folgate Road Industrial Estate** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

*Causes –*

- Surface run-off from rainfall that had made its way onto the highway, flowed along the road network and was directed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded.
- The run-off was then concentrated along overland flow paths, on which the affected properties are adjacent to, and via dropped kerbs flowed onto the accesses of the affected properties that are situated lower than the carriageway and entered the properties through low thresholds at entrances.
- The surface water drainage system outfall was obstructed by debris and high water levels downstream. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.
- Due to the development of impermeable surfaces localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding.
- Run-off from rainfall was directed towards Individual property drainage. These flows could not be accommodated as the system is of insufficient capacity to deal with this amount of water. This directed flood water towards the affected property.

Folgate Road

Location: North Walsham

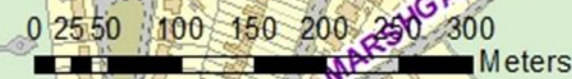
**Folgate Road Industrial Estate** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

*Recommendations –*

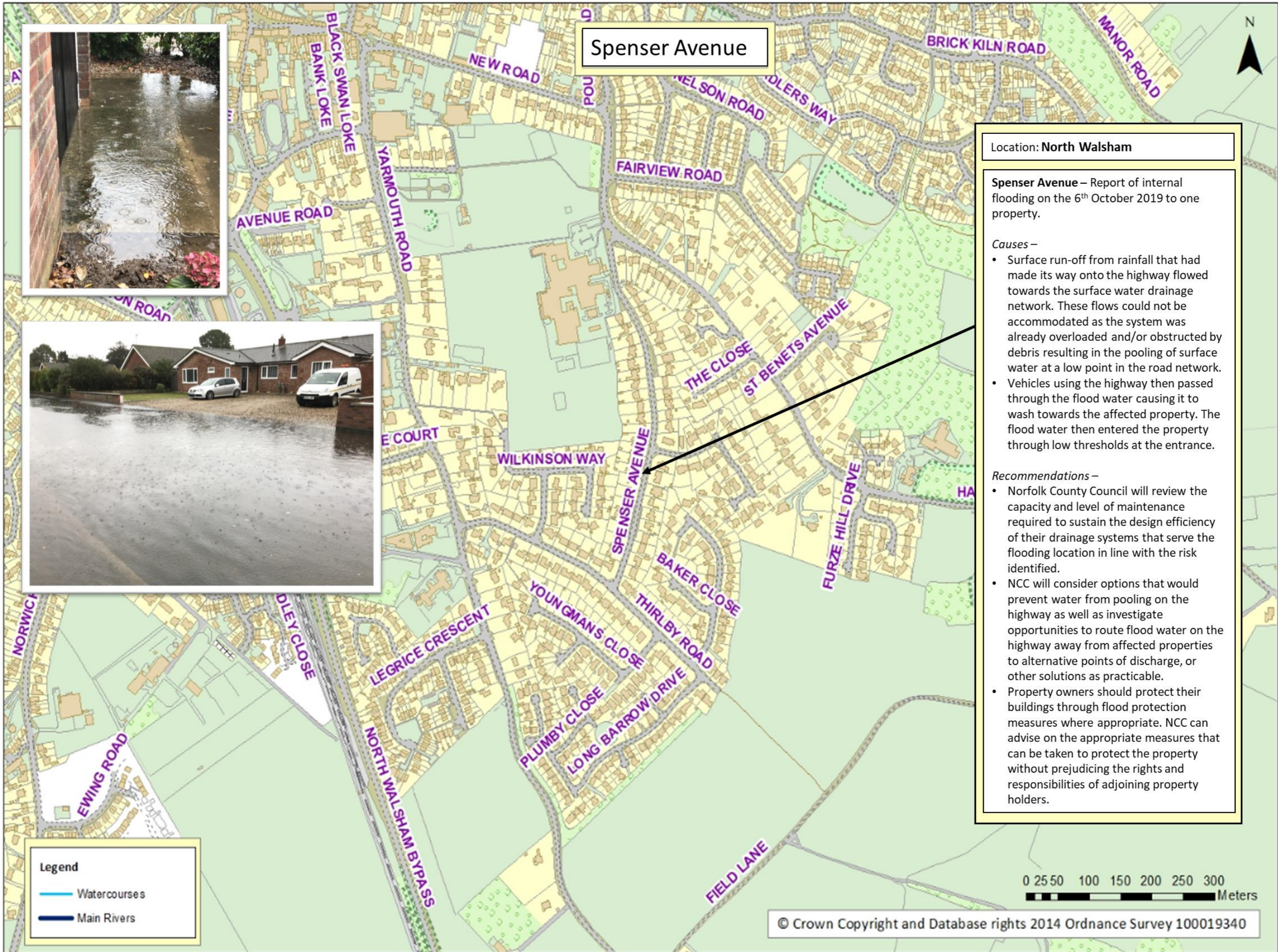
- Norfolk County Council & Anglian Water will review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- NCC should work with partner organisations to identify the potential for managing the amount or rate of surface water entering their drainage system in flood events.
- NCC will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.
- NCC will review with landowners 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.
- NCC will investigate with third parties the potential for retro-fitting permeable areas and other methods of small scale sustainable drainage systems
- The property owner should determine the adequacy of the on-site drainage and where appropriate increase on-site storage capacity and system efficiency.
- Property owners should protect their buildings through flood protection measures where appropriate. NCC can advise on the appropriate measures that can be taken to protect the property without prejudicing the rights and responsibilities of adjoining property holders.

**Legend**

- Watercourses
- Main Rivers



© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



Spenser Avenue

Location: **North Walsham**

**Spenser Avenue** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

- Causes* –
- Surface run-off from rainfall that had made its way onto the highway flowed towards the surface water drainage network. These flows could not be accommodated as the system was already overloaded and/or obstructed by debris resulting in the pooling of surface water at a low point in the road network.
  - Vehicles using the highway then passed through the flood water causing it to wash towards the affected property. The flood water then entered the property through low thresholds at the entrance.

- Recommendations* –
- Norfolk County Council will review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
  - NCC will consider options that would prevent water from pooling on the highway as well as investigate 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. NCC can advise on the appropriate measures that can be taken to protect the property without prejudicing the rights and responsibilities of adjoining property holders.



**Legend**

- Watercourses
- Main Rivers



© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

## **Flooding and flood risk within Thornage.**

### Flood incidents within Thornage

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on The Street, Thornage. This incident was reported by: Norfolk County Council via a telephone call on the 14 <sup>th</sup> October 2019, (1362)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

### 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

There are no records of historic flooding at this location.

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.

Location: **Thornage**

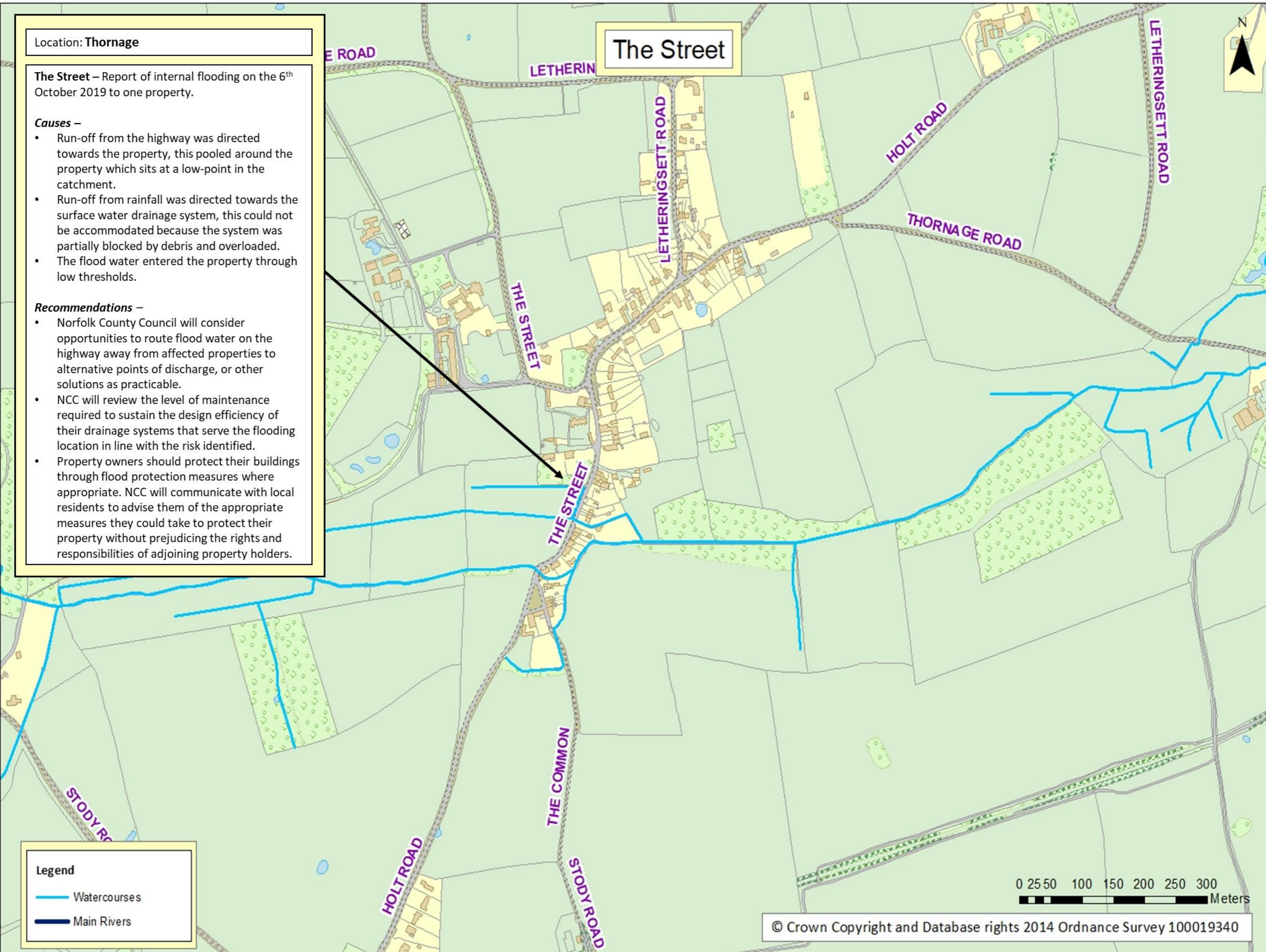
**The Street** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

**Causes –**

- Run-off from the highway was directed towards the property, this pooled around the property which sits at a low-point in the catchment.
- Run-off from rainfall was directed towards the surface water drainage system, this could not be accommodated because the system was partially blocked by debris and overloaded.
- The flood water entered the property through low thresholds.

**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.
- NCC 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. NCC 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**

- Watercourses
- Main Rivers

## **Flooding and flood risk within Thorpe Market.**

### Flood incidents within Thorpe Market

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on The Loke, Thorpe Market. This incident was reported by: A member of the public via an online flood report form on the 7 <sup>th</sup> October 2019, (1298)	<ul style="list-style-type: none"><li>• Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

### 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

There are no records of historic flooding at this location.

### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.

Location: **Thorpe Market**

**The Loke** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

**Causes –**

- Report from residents suggests failure of local pumping station, linked to the foul drainage system, being responsible for high water levels in the downstream network causing a partial obstruction. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected property.
- Rainfall was directed into the foul system causing it to surcharge at the affected property. This surcharging caused the flooding at the affected property.

**Recommendations –**

- Anglian Water will review the capacity and 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 and 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.



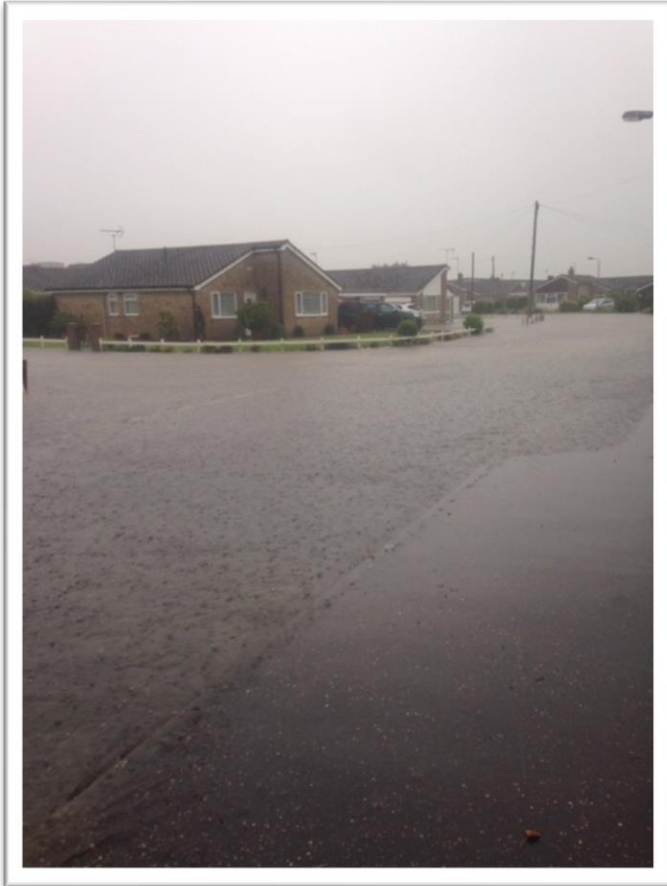
© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



# Norfolk County Council

## Breckland - 6th October 2019

Draft Report prepared by Nathan Harris on 7 January 2020.



## Executive Summary

### (a) Flooding incidents

Flooding occurred across the Breckland District on the 6<sup>th</sup> October 2019. 2 properties were reported to have experienced internal flooding on this day. A summary of the 2 incidents affected in Breckland can be found below:

Location	Number of Internally Flooded Properties	Page Number
Watton	1 Property	107
Besthorpe	1 Property	109

### (b) Key recommendations

The recommendations set out in the report have been summarised below. Specific recommendations for each individual catchment are set out within the report. Please note a number of these recommendations have already been followed up by the respective organisations identified. Progress against these recommendations will be assessed as part of an addendum to this report to be undertaken a year from the date of publication of this report.

**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.

**Flooding and flood risk within the Watton.**  
Flood incidents within Watton

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Langmere Road, Watton. This incident was reported by: A member of the public via email correspondence on the 15 <sup>th</sup> October 2019, (1465)	<ul style="list-style-type: none"> <li>Norfolk County Council Norfolk County Council assessed validity and impact of the flood report after the incident.</li> </ul>

#### 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.

1 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 38mm rainfall was recorded as falling in 7 hours 25 minutes at the Watton rainfall monitoring station. This intensity of rainfall for the total duration equates to a 6 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
26/06/2019	Internal flooding to three properties	1 in 46 rainfall event

Properties on Langmere Road have experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report for Watton (FIR015), which can be found at <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/flood-investigation-report-watton.pdf>

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.



### **Flooding and flood risk within Besthorpe.**

#### **Flood incidents within Besthorpe**

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Norwich Road, Besthorpe. This incident was reported by: A resident via email correspondence on the 14 <sup>th</sup> October 2019, (1287)	<ul style="list-style-type: none"><li>Norfolk County Council assessed validity and impact of the flood report after the incident.</li></ul>

#### **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.

1 of the incidents (100%) of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges for this catchment are;

6 October 2019 - 49mm rainfall was recorded as falling in 10 hours 15 minutes at the Morley St Botolph No 2/gsm rainfall monitoring station. This intensity of rainfall for the total duration equates to a 12 year rainfall event.

#### **Historic flooding incidents within the catchment**

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

<b>Date of incident</b>	<b>Impact</b>	<b>Rainfall intensity</b>
20/06/2019	Internal flooding to property	N/A
10/06/2019	Internal flooding to property	N/A
04/06/2019	Internal flooding to property	N/A
10/04/2019	Internal flooding to property	N/A
21/11/2019	Internal flooding to property	N/A
21/12/2018	Internal flooding to property	N/A
10/11/2018	Internal flooding to property	N/A
02/06/2018	Internal flooding to property	1 in 126-year rainfall
19/09/2014	Internal flooding to property	N/A

Property on Norwich Road has experienced repeat flooding. Previous reports of flooding to these properties were included in the Flood Investigation Report South Norfolk & Breckland (FIR032), which can be found at <https://www.norfolk.gov.uk/-/media/norfolk/downloads/rubbish-recycling-planning/flood-and-water-management/flood-investigation-reports/investigation-report-flooding-south-norfolk-and-breckland.pdf>

In response to the previous incidents of flooding to the flooding In Strumpshaw the following actions have taken place;

The LLFA have assessed the capacity of the surface water system serving the highway. NCC Highways are currently reviewing options to increase capacity or remove/divert surface water from the flooded location.

NCC Highways continue to remove surface water from the flooded location when there is significant pooling on the highway.

Anglian Water have assessed if an improvement to the existing system could be made, however they have provided flood protection measures e.g. Non-Return Valve and flood boards

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.

Location: **Besthorpe**

**Norwich Road** – Report of internal flooding on the 6th October 2019 to one property.

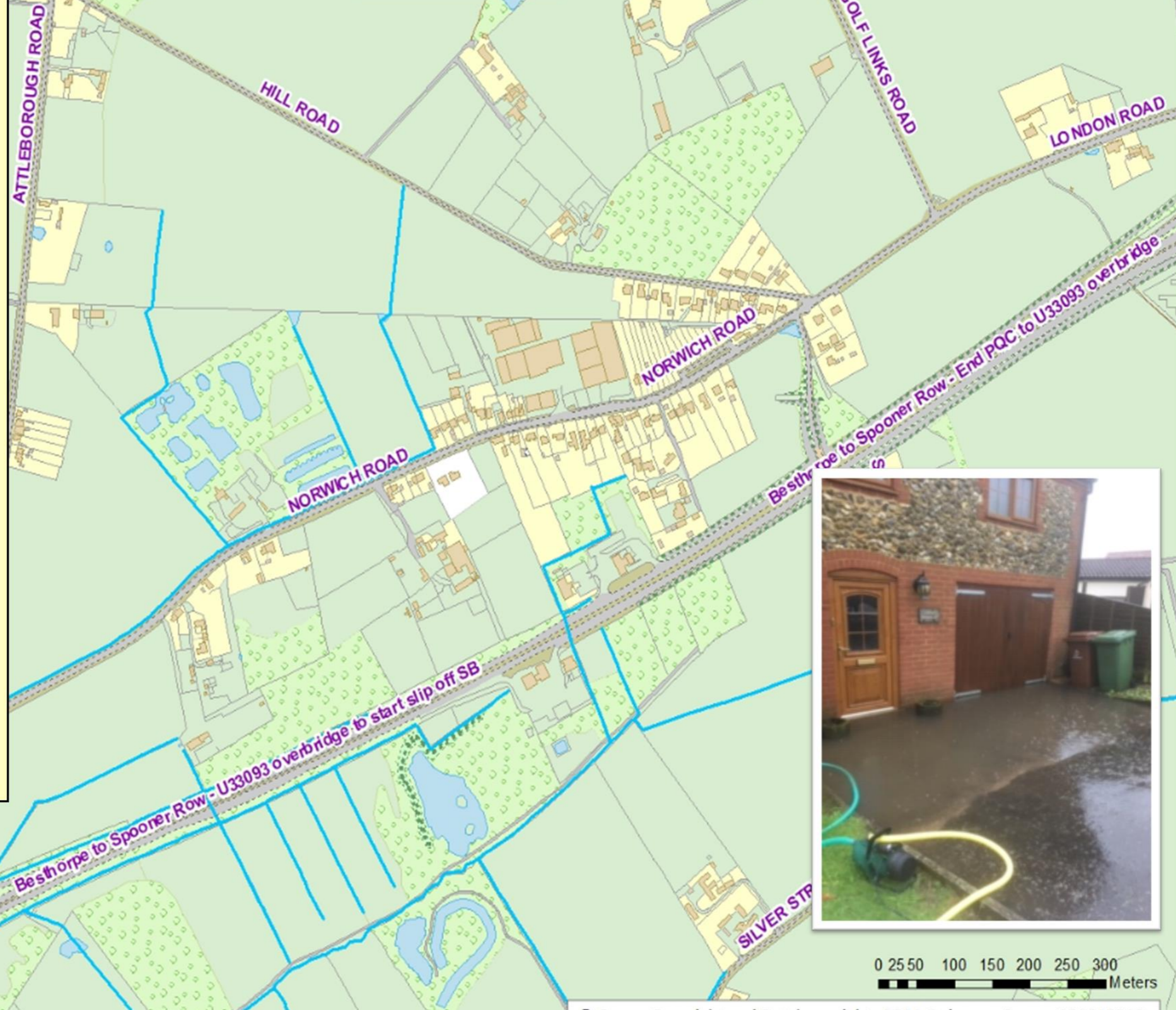
*Causes –*

- Run-off from rainfall was concentrated along the highway and was directed towards the surface water drainage network. However, the loss of the water course that the highway drainage system discharges into exacerbated the flooding.
- Water pooled outside the affected property, vehicles using the highway passed through the flood water causing it to wash towards it via dropped kerbs onto the property access that is situated lower than these features entering the property through low thresholds at entrances.

*Recommendations –*

- Norfolk County Council will consider opportunities that would prevent water from pooling on the highway and routes flood water away from affected properties to alternative points of discharge, or other solutions as practicable.
- NCC will review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- NCC will investigate with third parties the potential for the loss of pre-existing water course and their reinstatement.
- Property owners should protect their buildings through flood protection measures where appropriate. NCC can advise on the appropriate measures that can be taken to protect the property without prejudicing the rights and responsibilities of adjoining property holders.

Norwich Road



**Legend**

- Watercourses
- Main Rivers

© Crown Copyright and Database rights 2014 Ordnance Survey 100019340



# Norfolk County Council

## South Norfolk - 6th October 2019

Draft Report prepared by Nathan Harris on 7 January 2020.



## **Executive Summary**

### **(a) Flooding incidents**

Flooding occurred across the South Norfolk District on the 6<sup>th</sup> October 2019. 5 properties were reported to have experienced internal flooding on this day. For the purpose of this report and ease of presentation we have set out the report based on areas in which the incidents were located. A summary of the 48 incidents affected in each area can be found below:

Location	Number of Internally Flooded Properties	Page Number
Barnham Broom	1 Property	115
Thurton	1 Property	117
Mundham	2 properties	119
Bergh Apton	1 property	121

### **(b) Flooding causes**

The flooding incidents covered within this report are from across a large area, however key trends seen throughout the report are:

- Drainage systems were partially or fully blocked contributing to the extent of the flooding
- The water entered properties through low thresholds at entrances and air bricks
- Due to the saturation of soils, localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding
- The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding

### **(b) Key recommendations**

The recommendations set out in the report have been summarised below. Specific recommendations for each individual catchment are set out within the report. Please note a number of these recommendations have already been followed up by the respective organisations identified. Progress against these recommendations will be assessed as part of an addendum to this report to be undertaken a year from the date of publication of this report.

**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 local residents and landowners to seek improvements in land management to reduce the levels of run-off from agricultural land.
- Review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- Work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.
- Review and monitor the delivery of recommendations within this and other relevant flood investigation reports.

**Anglian Water** should;

- Review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified
- Work with partner organisations to identify the potential for managing the amount of surface water entering their drainage system in flood events.

**Flooding and flood risk within Barnham Broom.**

Flood incidents within Barnham Broom

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

Date of Incident	Incident as reported	What was the response to the flood incident
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Hillside, Barnham Broom. This incident was reported by: A resident via an online flood report form on the 9 <sup>th</sup> October 2019, (1312)	<ul style="list-style-type: none"> <li>Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li> </ul>
09/02/2020	On the 09/02/2020 – 1 property was internally flooded for a second time on Hillside, Barnham Broom. This incident was reported by: A resident via an online flood report form on the 12 <sup>th</sup> February 2020, (2196)	

#### 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

There are no records of historic flooding at this location.

#### Causes of flooding within the catchment and recommendations

The findings of the investigation are detailed on the following map.



Hillside



Location: **Barnham Broom**

**Hillside** – Report of internal flooding on the 6<sup>th</sup> October to one property.

*Causes* –

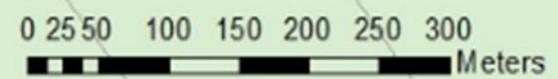
- Rainfall was directed into the surface system however these flows could not be accommodated as the drainage system was obstructed by debris. This reduced the efficiency of the upstream drainage system causing it to surcharge outside the flooded property. Flood water then flowed across the property and entered through a low threshold.

*Recommendations* –

- Norfolk County Council will review the capacity and level of maintenance required to sustain the design efficiency of their drainage systems that serve the flooding location in line with the risk identified.
- NCC 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. NCC 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**

- Watercourses
- Main Rivers



© Crown Copyright and Database rights 2014 Ordnance Survey 100019340

### **Flooding and flood risk within Thurton.**

#### **Flood incidents within Thurton**

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Ashby Road, Thurton. This incident was reported by: Norfolk County Council via email correspondence on the 7 <sup>th</sup> October 2019, (1390)	<ul style="list-style-type: none"><li>• Anglian Water Services Ltd visited affected residents to offer advice and to gather information after the incident.</li></ul>

#### **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**

There are no records of historic flooding at this location.

#### **Causes of flooding within the catchment and recommendations**

The findings of the investigation are detailed on the following map.

Location: **Thurton**

**Ashby Road** – Report of internal flooding on the 6<sup>th</sup> October 2019 to one property.

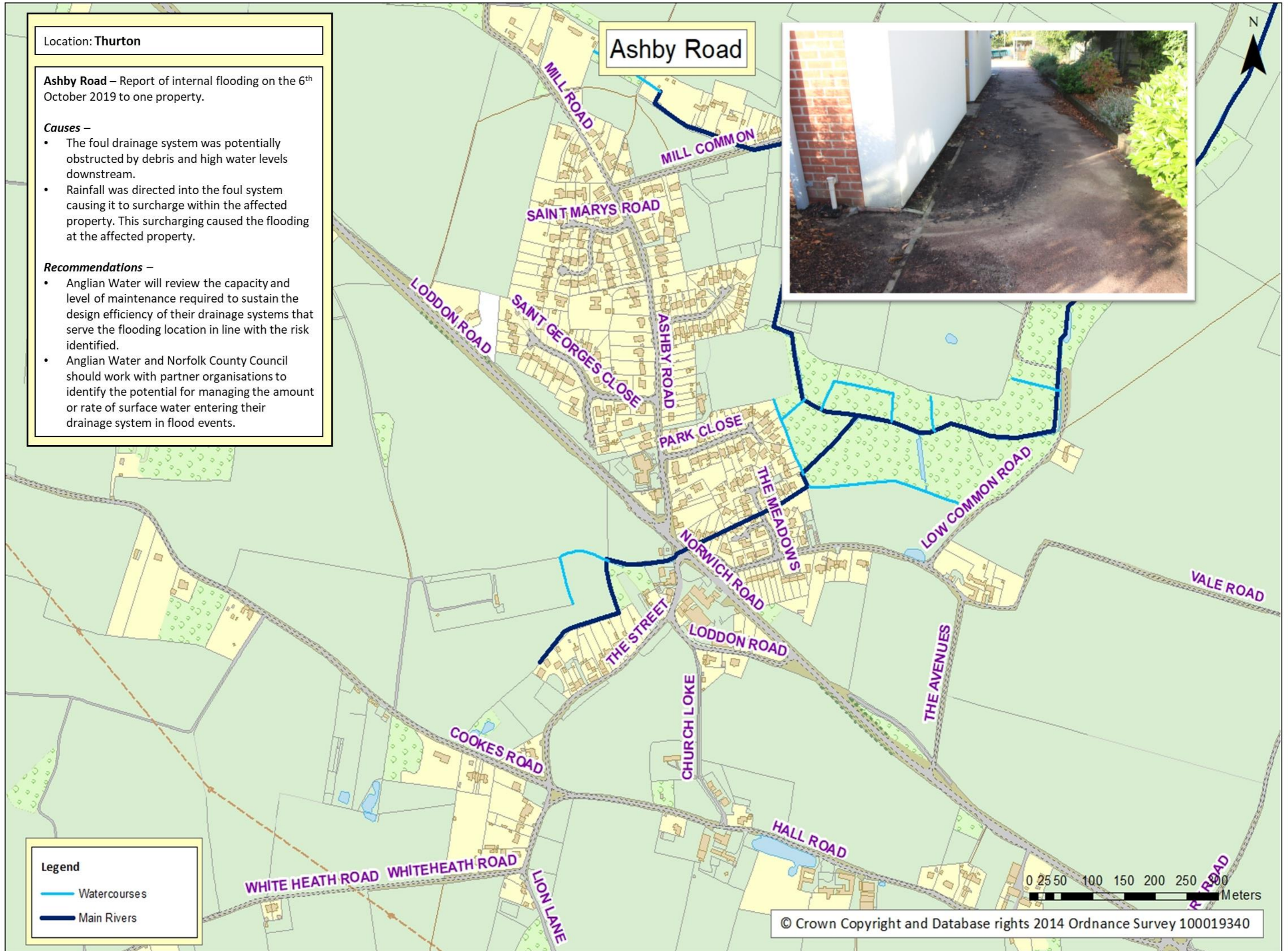
**Causes –**

- The foul drainage system was potentially obstructed by debris and high water levels downstream.
- Rainfall was directed into the foul system causing it to surcharge within the affected property. This surcharging caused the flooding at the affected property.

**Recommendations –**

- Anglian Water will review the capacity and 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 and 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.

**Ashby Road**



### **Flooding and flood risk within Mundham.**

#### **Flood incidents within Mundham**

Within this catchment 2 incidents of internal flooding have been assessed as part of this investigation. These incidents are detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 2 properties were internally flooded on Mill Cottages, Mundham. These incidents were reported by: A member of the public via an online flood report form on the 11 <sup>th</sup> October 2019, (1329) A resident via a telephone call on the 8 <sup>th</sup> October 2019, (1301)	<ul style="list-style-type: none"><li>• Norfolk County Council visited affected residents to offer advice and to gather information after the incident.</li></ul>

#### **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.

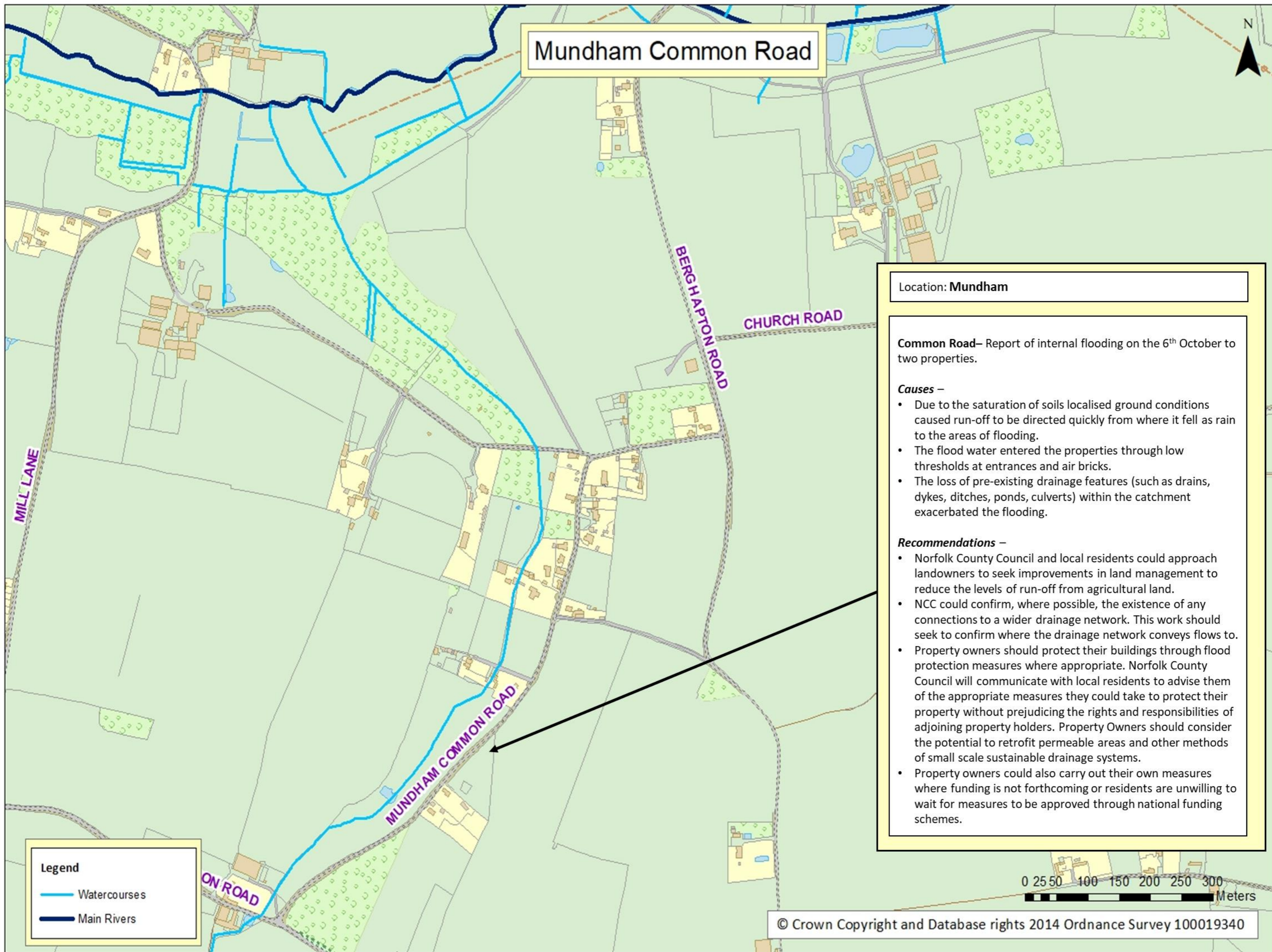
There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

#### **Historic flooding incidents within the catchment**

There are no records of historic flooding at this location.

#### **Causes of flooding within the catchment and recommendations**

The findings of the investigation are detailed on the following map.



Mundham Common Road

Location: **Mundham**

**Common Road**– Report of internal flooding on the 6<sup>th</sup> October to two properties.

**Causes** –

- Due to the saturation of soils localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding.
- The flood water entered the properties through low thresholds at entrances and air bricks.
- The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding.

**Recommendations** –

- Norfolk County Council and local residents could approach landowners to seek improvements in land management to reduce the levels of run-off from agricultural land.
- NCC 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. Property Owners should consider the potential to retrofit permeable areas and other methods of small scale sustainable drainage systems.
- Property owners could also carry out their own measures where funding is not forthcoming or residents are unwilling to wait for measures to be approved through national funding schemes.

**Legend**  
 — Watercourses  
 — Main Rivers

0 25 50 100 150 200 250 300 Meters

### **Flooding and flood risk within Bergh Apton.**

#### **Flood incidents within Bergh Apton**

Within this catchment 1 incident of internal flooding has been assessed as part of this investigation. This incident is detailed in the table below.

<b>Date of Incident</b>	<b>Incident as reported</b>	<b>What was the response to the flood incident</b>
06/10/2019	On the 06/10/2019 - 1 property was internally flooded on Loddon Road, Bergh Apton. This incident was reported by: Norfolk County Council via an electronic report on the 14 <sup>th</sup> October 2019, (1550)	<ul style="list-style-type: none"><li>• Norfolk County Council assessed validity and impact of the flood report after the incident.</li></ul>

#### **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.

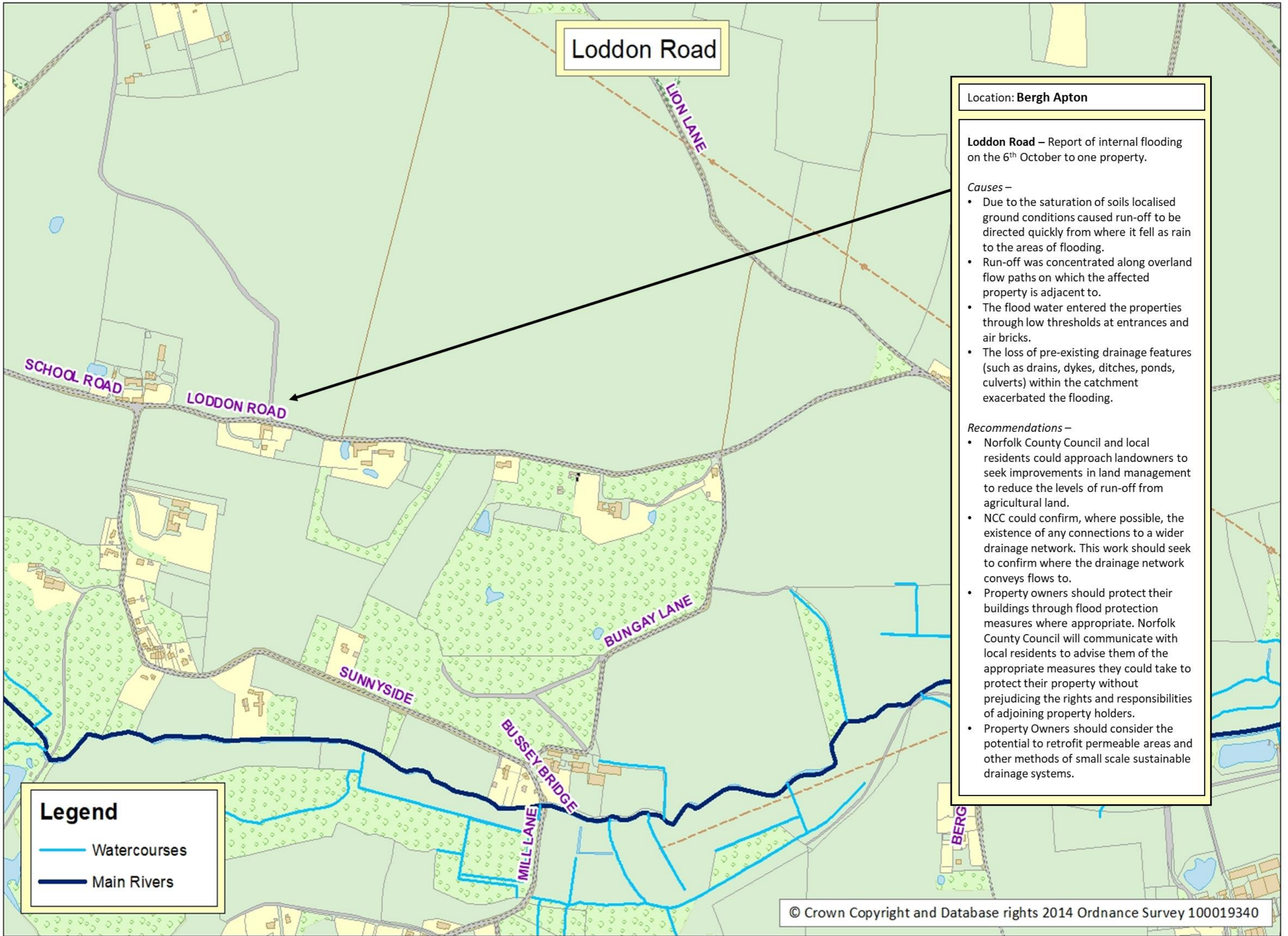
#### **Historic flooding incidents within the catchment**

There are no records of historic flooding at this location.

#### **Causes of flooding within the catchment and recommendations**

The findings of the investigation are detailed on the following map.





Loddon Road

Location: **Bergh Apton**

**Loddon Road** – Report of internal flooding on the 6<sup>th</sup> October to one property.

- Causes –*
- Due to the saturation of soils localised ground conditions caused run-off to be directed quickly from where it fell as rain to the areas of flooding.
  - Run-off was concentrated along overland flow paths on which the affected property is adjacent to.
  - The flood water entered the properties through low thresholds at entrances and air bricks.
  - The loss of pre-existing drainage features (such as drains, dykes, ditches, ponds, culverts) within the catchment exacerbated the flooding.

- Recommendations –*
- Norfolk County Council and local residents could approach landowners to seek improvements in land management to reduce the levels of run-off from agricultural land.
  - NCC 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.
  - Property Owners should consider the potential to retrofit permeable areas and other methods of small scale sustainable drainage systems.

**Legend**

- Watercourses
- Main Rivers

## **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.

Norfolk County Council forbids the reproduction of this report or its contents by any third party without prior agreement.

## **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.