

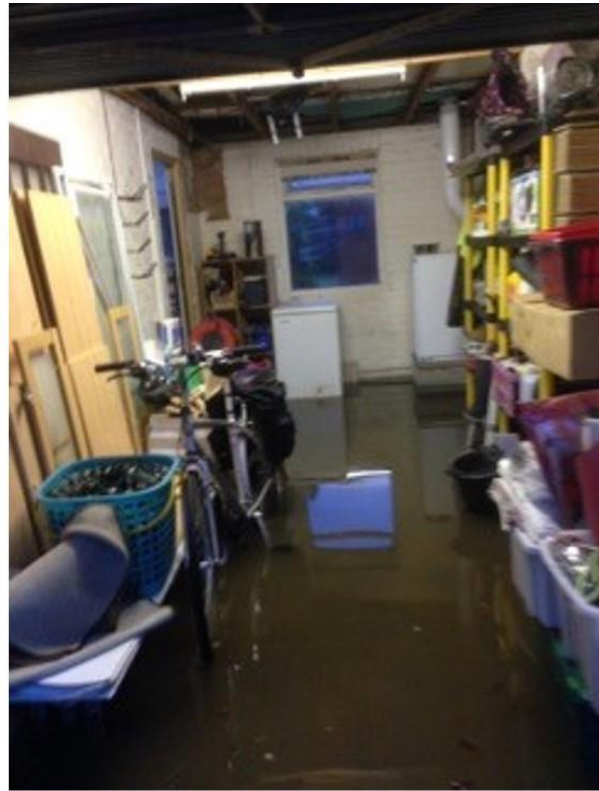


Norfolk County Council

Investigation Report into the flooding in North Norfolk District Council

Report Reference: FIR035

Draft Report prepared by Mark Henderson on 09 May 2019



Executive Summary

(a) Flooding incidents and causes

This report includes the internal flooding of 17 properties (19 incidents) over a series of dates ranging from 2016-2018. Of these 9 occurred during 23rd June 2016, which was a significant date as several hundred properties across Norfolk internally flooded. Principally those included in this report are individual properties located across North Norfolk District Council within the following parishes:

- **Sidestrand** - Main Road,
- **Southrepps** - Chapel Street,
- **Trimingham** - Staden Park,
- **Sidestrand** - Tower Lane,
- **Cromer** - Station Road,
- **Erpingham** - Aldborough Road
- **Kelling** - Meadow Lane
- **Hickling** - Broadlands Road
- **Hindringham** - Wells Road
- **Tunstead** - Crowgate Street
- **Knapton** - Mundesley Road
- **Antingham** - Southrepps Road
- **Swanton Abbott** - The Street

(b) Flooding causes

The flooding that occurred across North Norfolk related to the following causes:

- Surface run-off flowpaths.
- Surface water washed off public highway by vehicles;
- Individual property drainage of insufficient capacity;
- Drainage system or outfall blockage, unmaintained or obstructed;
- Surcharging of the drainage system;
- Individual property drainage unmaintained;
- Drainage system overloaded;
- Increased run-off;
- Properties had structural issues and Entry of flood water into property.

(c) 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.

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 North Norfolk District Council in Various as:

- multiple residential properties were internally flooded.
- one commercial property was internally flooded.

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

The flood investigation report aims to:

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

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

The flood investigation report cannot:

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

Flooded Properties in North Norfolk



Flooding and flood risk at Hindringham

Flood incidents within Hindringham

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
07/01/2016	On the 07/01/2016 - 1 property was internally flooded on Wells Road, Hindringham. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 12 February 2016, (FWF/16/1/2368)	Norfolk County Council assessed the capacity of their drainage system after the incident. The landowner assessed the capacity of their drainage system after the incident. The landowner identified the need to renew [or replace] the existing drainage scheme that serves the flooding location after the incident.

Recent rainfall within Hindringham

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

Historic flooding incidents within Hindringham

Norfolk LLFA have been formally investigating flooding since 2011. To date, there are no historic flooding events recorded at this location by Norfolk LLFA apart from the above mentioned report.

Causes of flooding within the locations of the properties affected 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.



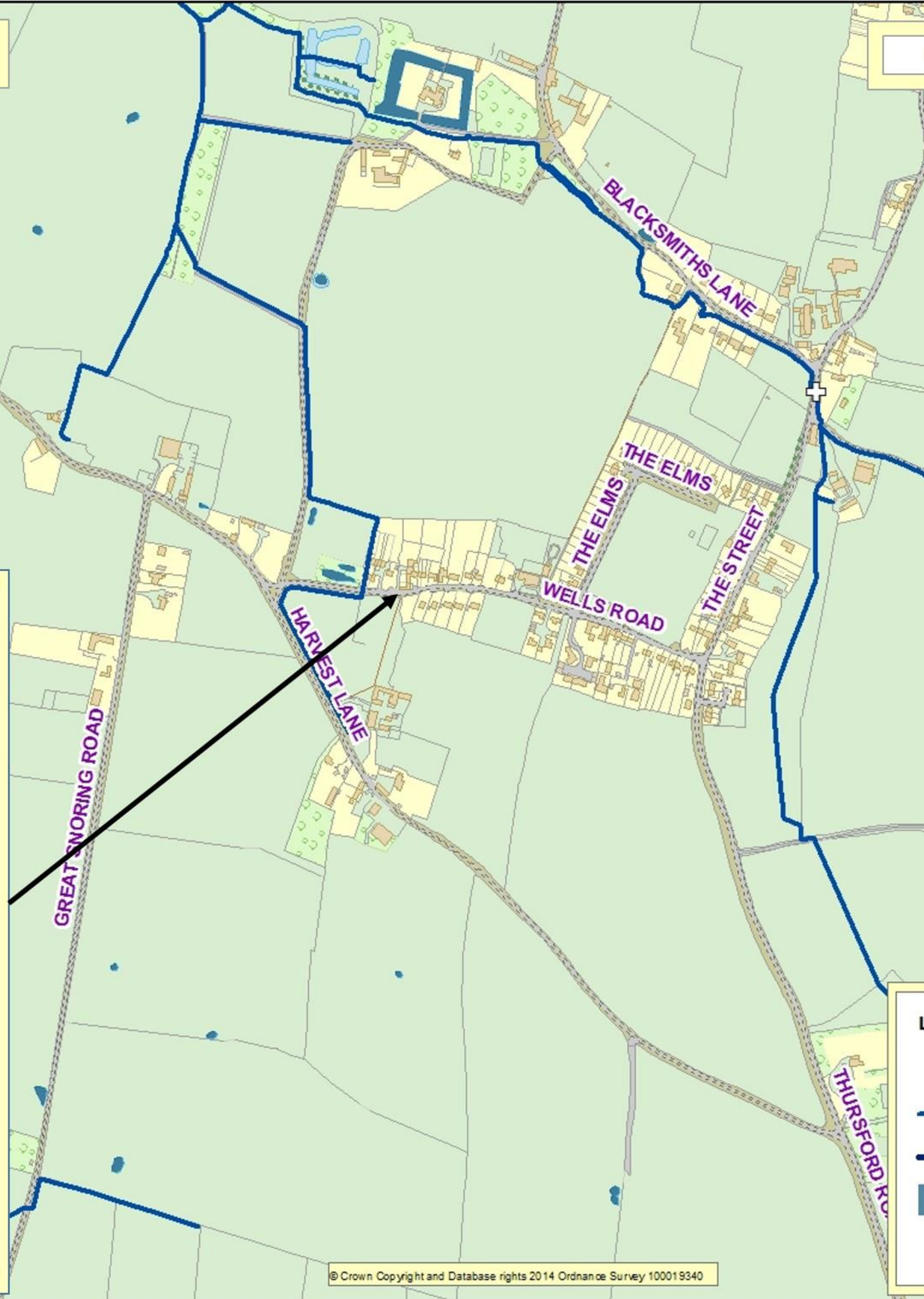
Wells Road, Hindringham – Internal flooding experienced January 1st 2016

Causes - Run-off from rainfall was concentrated along overland flowpaths on which the affected property is adjacent to. Individual property drainage was partially obstructed by structural failure downstream of the property. This caused the failure of the upstream drainage system contributing to the accumulation of surface flood water at the affected property.

Recommendation:

The riparian owners should instigate a regular regime of maintenance to ensure the system is free from obstruction (i.e. tree leaves / roots) at all times.

The property owner should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.



Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

Flooding and flood risk within Crowgate Street, Tunstead

Flood incidents within this Tunstead

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

Date of Incident	Incident as reported	What was the response to the flood incident
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on Crowgate Street, Tunstead. This incident was reported by a resident via personal communication on the 15 July 2016, (FWF/16/1/3037)	Norfolk County Council visited affected residents to offer advice and to gather information after the incident. The adjacent landowner has carried out works to divert the surface water away from the flooding location after the incident.

Recent rainfall within Tunstead

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

Historic flooding incidents within Tunstead

Norfolk LLFA have been formally investigating flooding since 2011. To date, there are no historic flooding events recorded at this location by Norfolk LLFA apart from the above mentioned reports.

Causes of flooding within the locations of the properties affected 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.

Map 3: Drainage and Flood Details

Location: Crowgate Street, Tunstead

Crowgate Street, Tunstead – Internal flooding experienced 23rd June 2016

Causes: Landowners property drainage was restricted and could not cope with heavy rainfall. Individual property drainage was obstructed by structural failure. This caused the failure of the downstream drainage system contributing to the accumulation of surface water at the affected property.

Recommendation:

Landowners should instigate a regular regime/carry out works to ensure the system is free from obstruction at all times.

Landowners should determine the adequacy of the on-site drainage and where appropriate amend the existing drainage system.

Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

Flood incidents within Sidestrand

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

Date of Incident	Incident as reported	What was the response to the flood incident
30/11/2017	On the 30/11/2017 - 1 property was internally flooded on Main Road, Sidestrand. This incident was reported by a resident via email correspondence on the 30 November 2017, (FWF/17/1/5815)	NCC assessed the validity and impact of the flood report.
23/06/2016	On the 23/06/2016 - 3 properties were internally flooded on Main Road, Sidestrand. These incidents were reported by: a resident via an online flood report form on the 2 May 2017, (FWF/16/1/4596) a resident via an electronic report on the 28 July 2016, (FWF/16/1/3204) a resident via an online flood report form on the 26 September 2016, (FWF/16/1/3365)	A resident carried out measures to minimise the impact of flooding after the incident.

Recent rainfall within Sidestrand

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

Historic flooding incidents within this location

Norfolk LLFA have been formally investigating flooding since 2011. To date, there are no historic flooding events recorded at this location by Norfolk LLFA apart from the above mentioned reports.

Causes of flooding within the locations of the properties affected 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.

Map 4: Drainage and Flood Details

Location: Main Road, Sidestrand

Main Road, Sidestrand – Internal flooding experienced 23rd June 2016 and 30th November 2017

Causes:

Run-off from rainfall was concentrated along overland flowpaths.

Surface run-off from rainfall that had made its way onto the highway flowed along the road network.

The downstream ordinary watercourse network was obstructed.

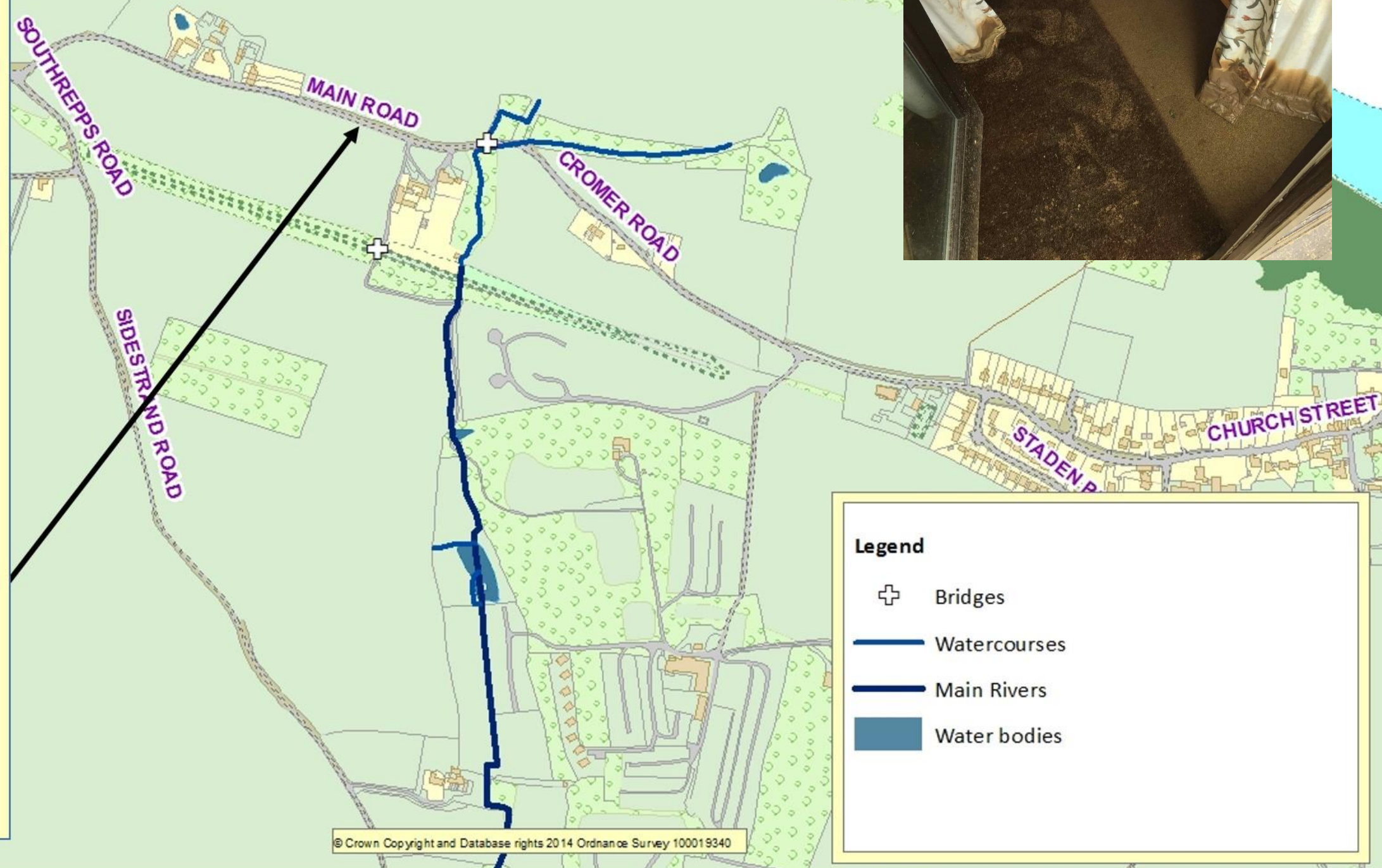
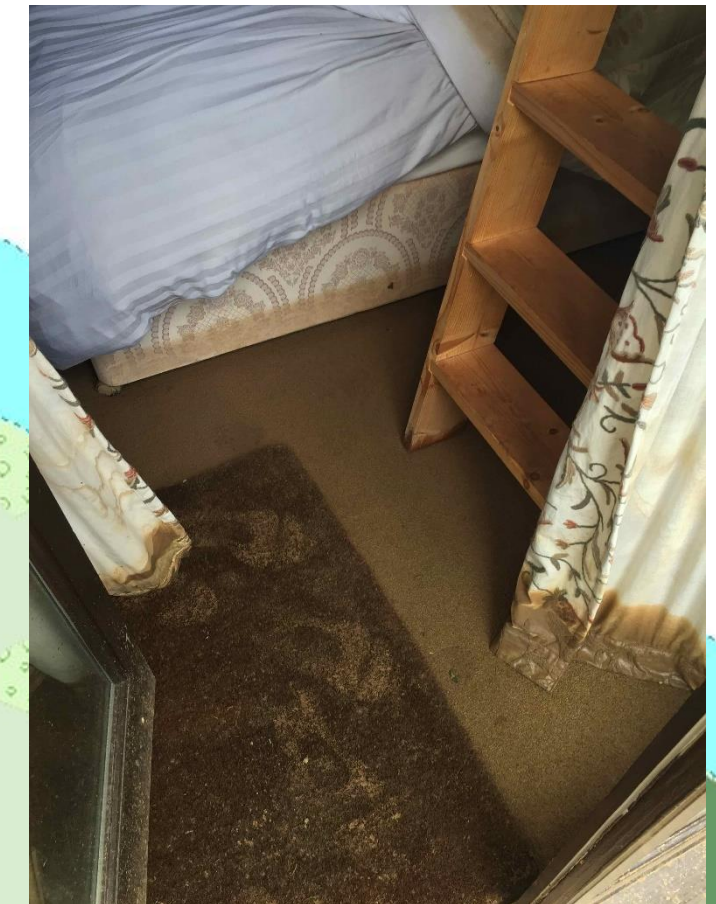
In addition one property (case file FWF/17/1/5815) experienced flooding due to structural issues e.g. failure of property level protection measures.

Recommendation:

The adjacent landowner of the watercourse should instigate a regular regime of maintenance to ensure the system is free from obstruction at all times.

The property owner should take measures to implement property level resilience 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.



Flood incidents within Southrepps

Within this location 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
30/11/2017	On the 30/11/2017 - 1 property was internally flooded on Chapel Street, Southrepps. This incident was reported by a resident via personal communication on the 21 December 2017, (FWF/16/1/5833)	NCC assessed the validity and impact of the flood report.
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on Chapel Street, Southrepps. This incident was reported by a resident via a telephone call on the 22 December 2017, (FWF/16/1/5834)	Norfolk County Council (LLFA) visited affected residents to offer advice and to gather information after the incident. A resident carried out measures to minimise the impact of flooding after the incident.

Recent rainfall within Southrepps

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

Historic flooding incidents within the location

Norfolk LLFA have been formally investigating flooding since 2011. To date, there are no historic flooding events recorded at this location by Norfolk LLFA apart from the above mentioned reports.

Causes of flooding within the locations of the properties affected 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.

Map 5: Drainage and Flood Details

Location: Chapel Street, Southrepps

Chapel Street, Southrepps – Internal flooding experienced 23rd June 2016 and 30th November 2017

Causes:

Run-off from rainfall was concentrated along overland flowpaths. Surface water burst through the banks of the adjacent field allowing surface water to flow along the highway and onto the accesses of affected properties that were situated lower than these features.

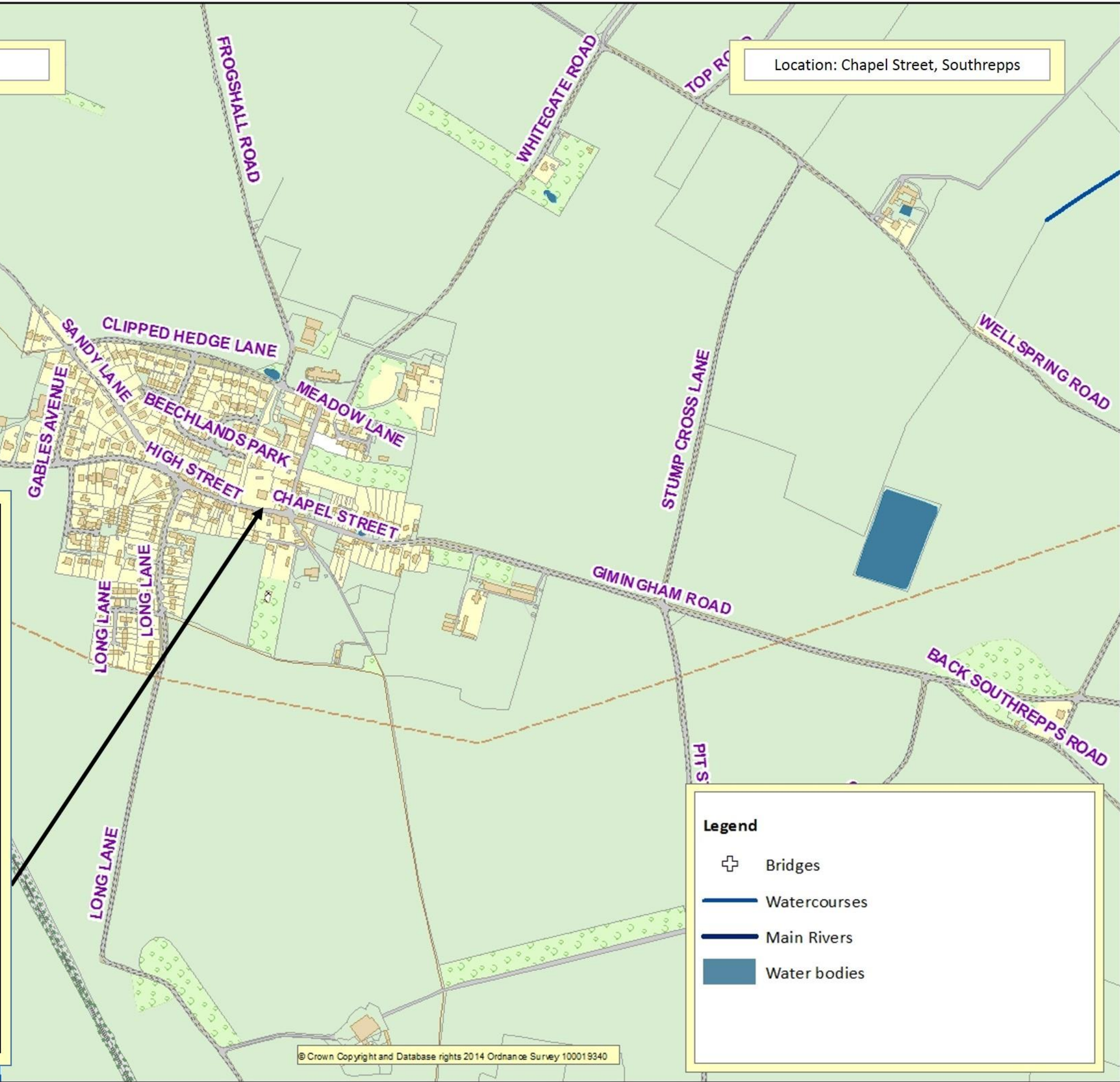
Recommendations:

Landowners should consider options that would ensure water does not flow from adjacent land.

NCC Highways could assess and amend the road structure to route flood water away from the affected properties to alternative points of discharge.

Adjacent landowner(s) should consider options that would ensure water does not flow from adjacent land.

Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location.



Flood incidents within Calthorpe/Erpingham

Within Calthorpe 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
02/06/2018	On the 02/06/2018 - 1 property was internally flooded on Aldborough Road, Erpingham. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 5 June 2018, (FWP/18/1/6605)	NCC assessed the validity and impact of the flood report.
06/07/2016	On the 06/07/2016 - 1 property was internally flooded on Aldborough Road, Erpingham. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 25 July 2016, (FWF/16/1/3987)	Norfolk County Council (Highways) undertook works to raise the level of the kerb on the road after the incident. Norfolk County Council (Highways) identified the need to renew the existing drainage scheme that serves the flooding location after the incident.

Recent rainfall within Calthorpe

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

Historic flooding incidents within the location

Norfolk LLFA have been formally investigating flooding since 2011. To date, there are no historic flooding events recorded at this location by Norfolk LLFA apart from the above mentioned reports.

Causes of flooding at the 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.

Chapel Street, Southrepps – Internal flooding experienced 23rd June 2016 and 30th November 2017

Causes:

Run-off from rainfall was concentrated along overland flowpaths. Surface water burst through the banks of the adjacent field allowing surface water to flow along the highway and onto the accesses of affected properties that were situated lower than these features.

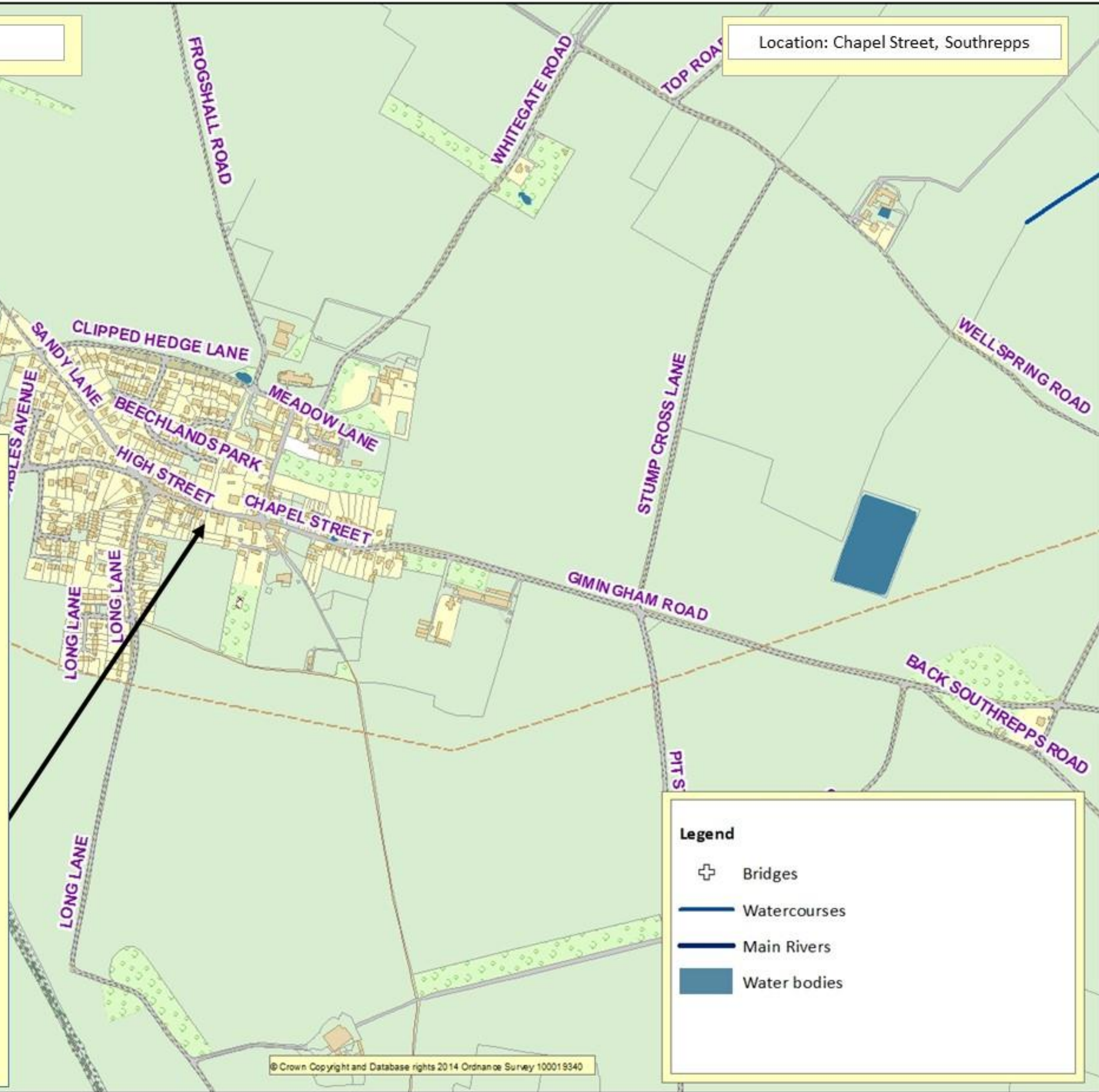
Recommendations:

Landowners should consider options that would ensure water does not flow from adjacent land.

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.

Adjacent landowner(s) should consider options that would ensure water does not flow from adjacent land.

Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location.



Flood incidents within Kelling

Within Kelling 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
29/05/2018	On the 29/05/2018 - 1 property was internally flooded on Meadow Lane, Kelling. This incident was reported to Norfolk County Council (Lead Local Flood Authority) via an online flood report form on the 30 May 2018, (FWF/18/1/6580)	Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident.
19/07/2017	On the 19/07/2017 - 1 property was internally flooded on Meadow Lane, Kelling. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 26 July 2017, (FWF/17/1/5091)	Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within Kelling

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.

2 incidents of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by gauges were not available as Weybourne Rain Gauge as this gauge was discontinued in 2015 and therefore results were not available for these events.

Causes of flooding within the 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.

Map 7: Drainage and Flood Details

Location: Meadow Lane, Kelling,

Meadow Lane, Kelling – Internal flooding
experienced 19 July 2017 and 29th May 2018

Causes:

Run-off from rainfall was concentrated along overland flowpaths on which the affected properties are adjacent to.

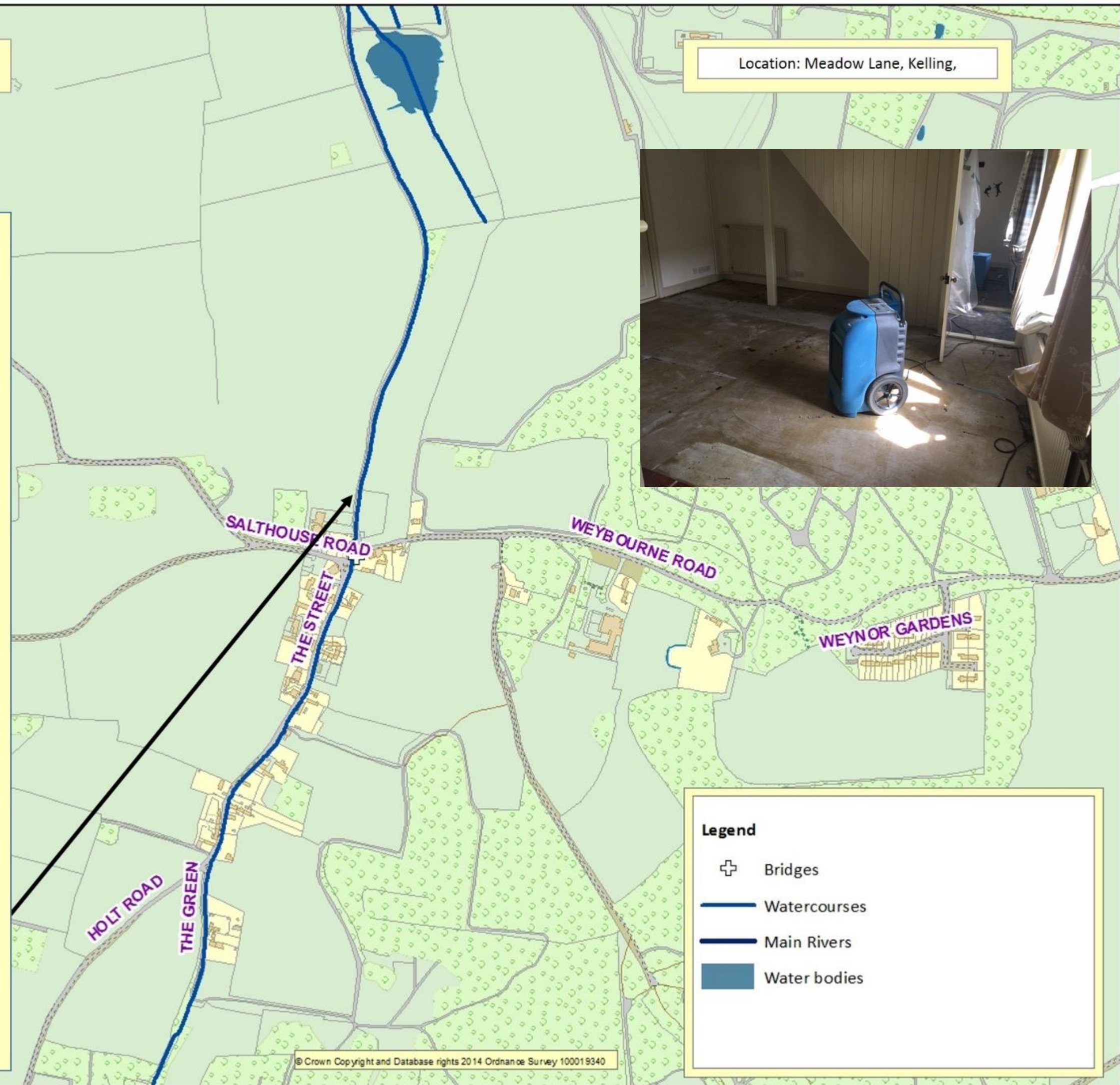
Surface run-off from rainfall that had made its way onto highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.

Recommendations:




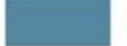
Norfolk County Council will investigate with third parties the potential to fund small scale improvement schemes to mitigate the risk experienced at this location. This could be either through the submission of a bid to secure Partnership funding or through negotiation with other organisations and the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

Norfolk County Council will consider 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 as Lead Local Flood Authority will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.



Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flood incidents within Hickling

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
09/08/2017	On the 09/08/2017 - 1 property was internally flooded on Broadlands Road, Hickling. This incident was reported by a resident via email correspondence on the 9 August 2017, (FWF/17/1/5155)	A resident carried out measures to minimise the impact of flooding during the incident.

Recent rainfall within Hickling

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 of internal flooding in this catchment are within 2.5km of a rain gauge. The rainfall events recorded by the gauge at Hickling Stubb Mill were insignificant and therefore this suggests that the rainfall event was very localised.

Causes of flooding at the 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.

Broadlands Road, Hickling – Internal flooding experienced 9th August 2017

Causes:

Surface run-off from rainfall that had made its way onto highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.

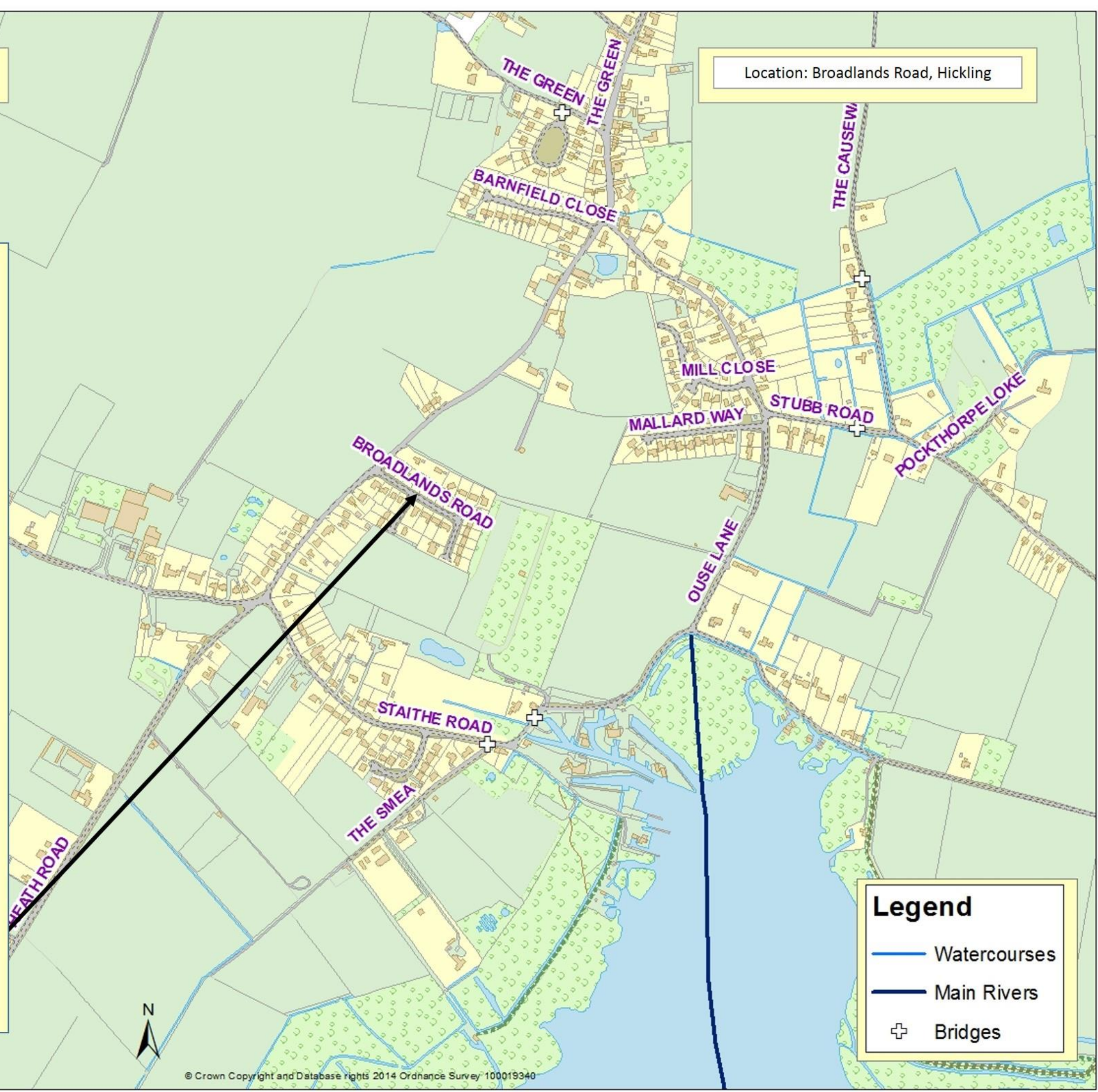
A resident stated that the surface water drainage system network was obstructed. This would have reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.

Recommendations:

Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council as Lead Local Flood Authority 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.

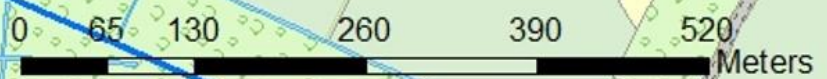
Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.

Norfolk County Council & landowners should 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.



Legend

- Watercourses
- Main Rivers
- ⊕ Bridges



Flood incidents within Trimmingham

Within Trimingham 1 incident 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
24/06/2016	On the 24/06/2015 - 1 property was internally flooded on Staden Park, Trimmingham. This incident was reported by Anglian Water Services Ltd via an electronic report on the 30 June 2016, (FWF/16/1/4526)	The Fire and Rescue Service visited affected residents to offer advice and to gather information during the incident.

Recent rainfall within Trimmingham

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

Causes of flooding within Trimmingham 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.

Staden Park, Trimmingham - Internal flooding experienced on the 24th June 2015

Causes:

Run-off from rainfall was concentrated along overland flowpaths on which the affected property is positioned.

Surface run-off from rainfall that had made its way onto the highway flowed along the road network and onto the accesses of the affected property that were/was situated lower than these features.

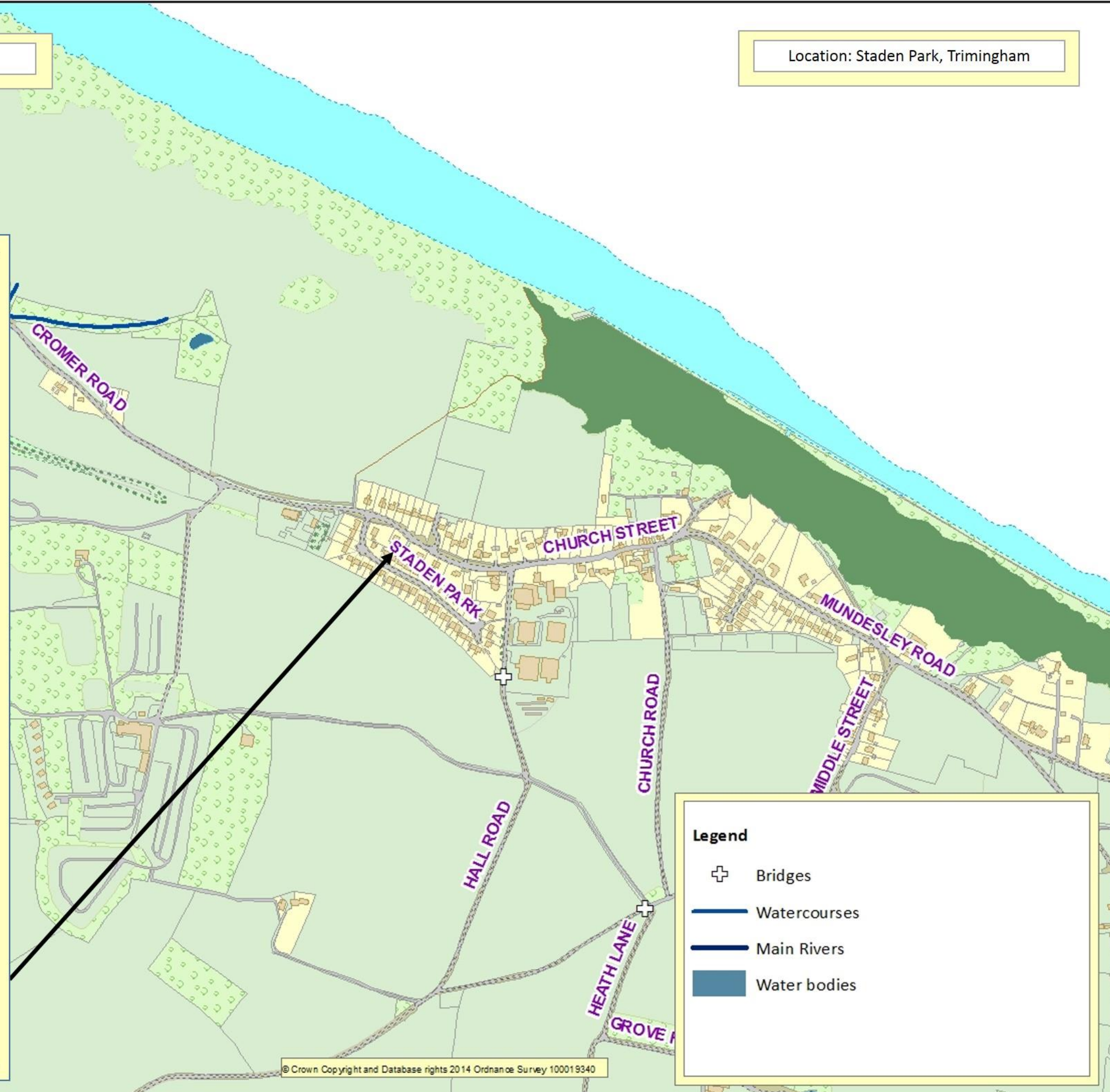
Structural failure of the foul system occurred upstream of the affected property and led to the foul system being overloaded and surcharging into the affected property.

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 as Lead Local Flood Authority 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.



Flood incidents within this Knapton

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

Date of Incident	Incident as reported	What was the response to the flood incident
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on Mundesley Road, Knapton. This incident was reported to Norfolk County Council (Lead Local Flood Authority) via personal communication on the 30 November 2016, (FWF/16/1/3846)	Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within the Knapton

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

Historic flooding incidents within the location

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

Date of incident	Impact	Rainfall intensity

Causes of flooding at the 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.

Mundesley Road, Knapton- Internal flooding experienced on the 23rd June 2016

Causes:

Run-off from rainfall pooled at a low point within the catchment affecting property.





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.

Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council as Lead Local Flood Authority will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flood incidents within Sidestrand

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

Date of Incident	Incident as reported	What was the response to the flood incident
23/06/2016 10/07/2016	<p>On the 10/07/2016 - 1 property was internally flooded on Tower Lane, Sidestrand. This incident was reported by the Fire and Rescue Service via an electronic report on the 10 July 2016, (FWP/16/1/3311)On the 23/06/2016 –</p> <p>1 property was internally flooded on Tower Lane, Sidestrand. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 20 September 2016, (FWF/16/1/3704)</p>	<p>Norfolk County Council (Highways) assessed the capacity of their drainage system after the incident. The landowner identified the need to extend the existing drainage network to serve the flooding location after the incident.</p> <p>Norfolk County Council (Lead Local Flood Authority) visited affected residents to offer advice and to gather information after the incident.</p>

Recent rainfall within Sidestrand

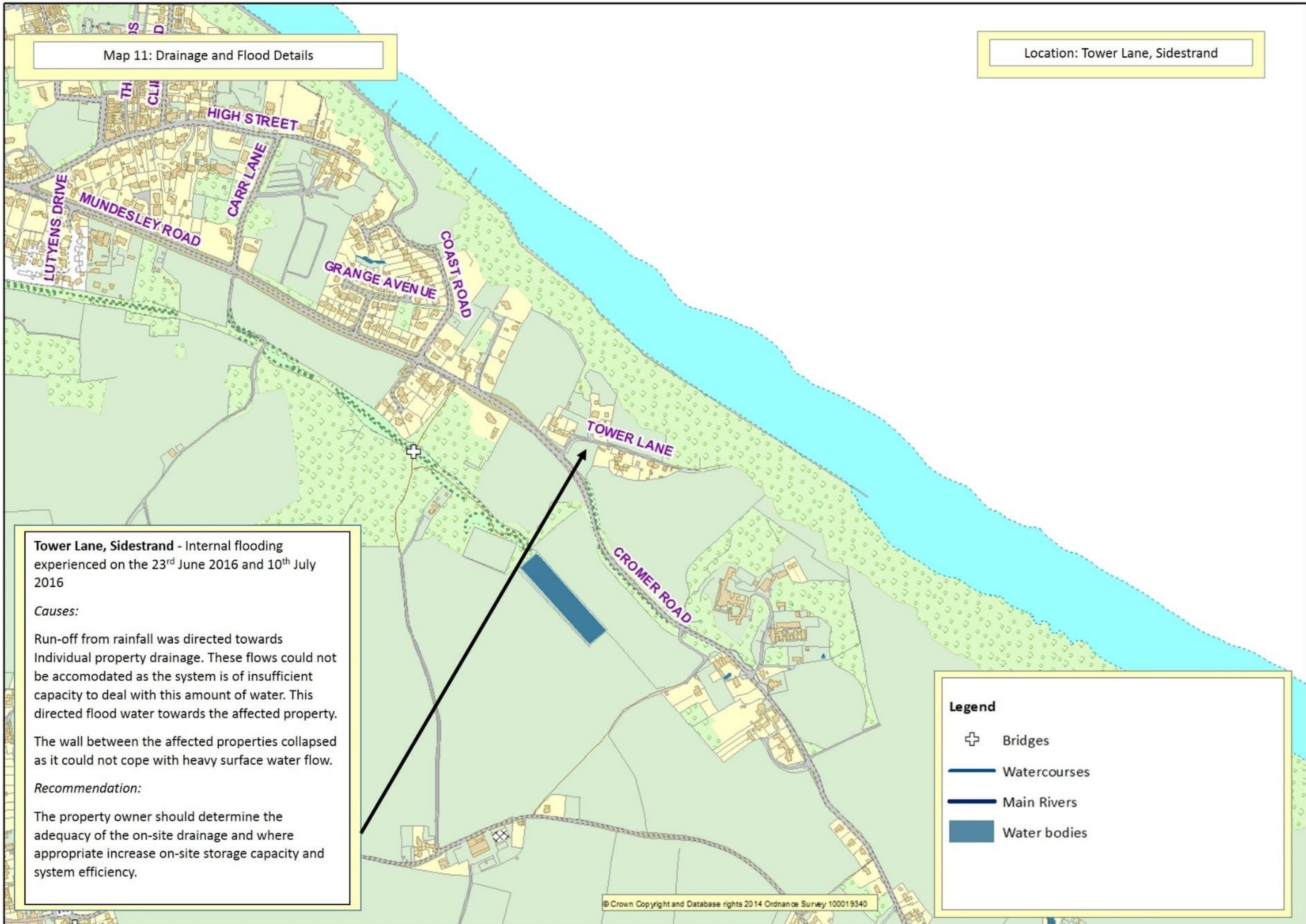
There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

Causes of flooding within the 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.

Map 11: Drainage and Flood Details

Location: Tower Lane, Sidestrand



Tower Lane, Sidestrand - Internal flooding experienced on the 23rd June 2016 and 10th July 2016

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.

The wall between the affected properties collapsed as it could not cope with heavy surface water flow.

Recommendation:

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

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flood incidents within this Antingham

Within Antingham 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
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on Southrepps Road, Antingham. This incident was reported by Norfolk County Council (Highways) via an electronic report on the 24 June 2016, (FWF/16/1/3910)	Norfolk County Council (Highways) assessed the capacity of their drainage system after the incident. Norfolk County Council (Highways) carried out maintenance work to the highway drainage system after the incident. Norfolk County Council (Highways) visited affected residents to offer advice and to gather information after the incident.

Recent rainfall within Antingham

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

Causes of flooding within the 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.

Southrepps Road, Antingham, Internal flooding experienced on the 23rd June 2016

Causes:

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.

Surface run-off from 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.

The downstream surface water drainage network was partially obstructed by debris or silt. This reduced the efficiency of the upstream drainage system contributing to flooding at the affected properties.

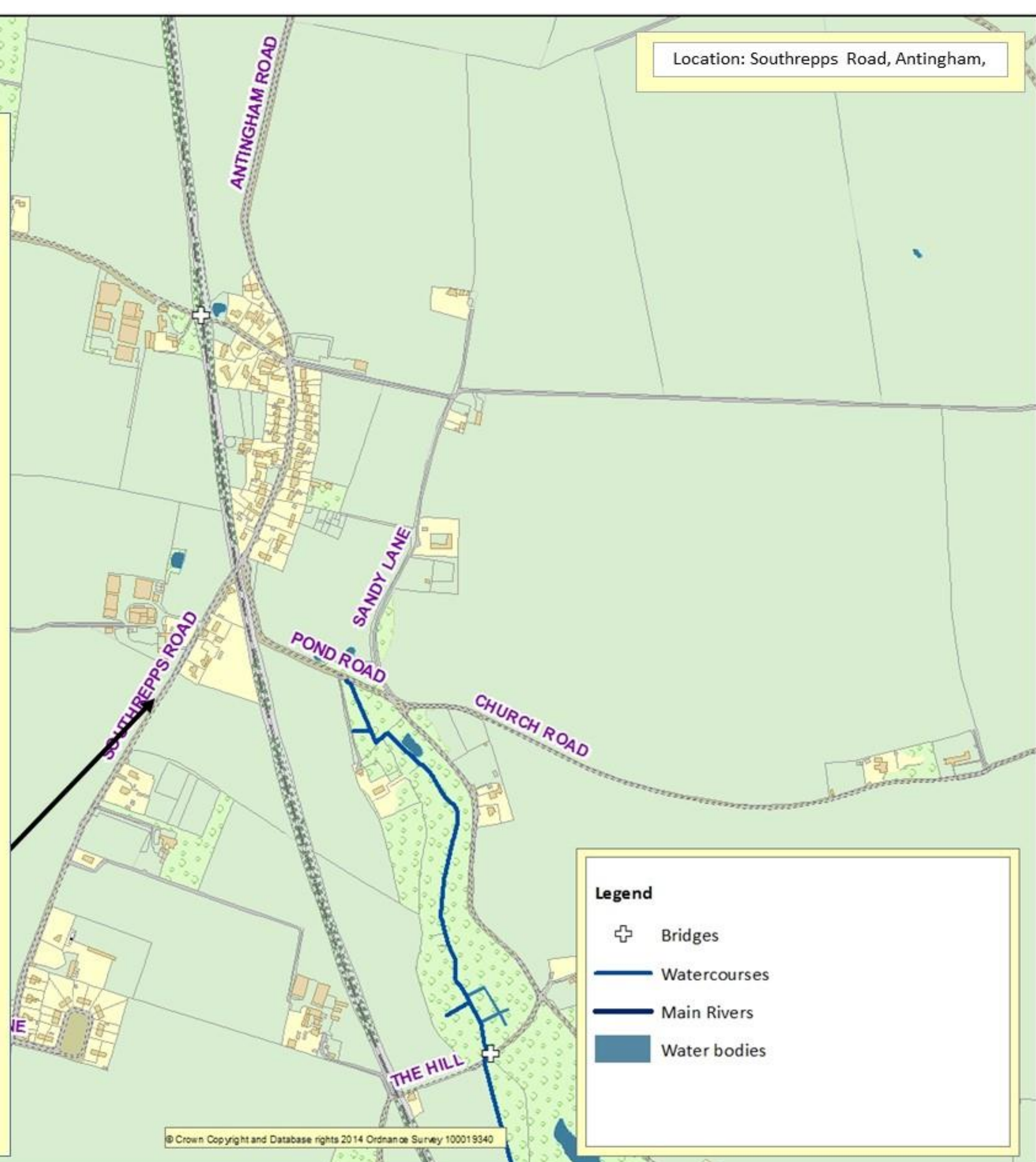
Rainfall was directed into the surface water system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Recommendations:

Property owners should protect their buildings through flood protection measures where appropriate. Norfolk County Council will communicate with local residents to advise them of the appropriate measures they could take to protect their property without prejudicing the rights and responsibilities of adjoining property holders.

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 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.



Flood incidents within Cromer

Within Cromer 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
08/08/2017	On the 08/08/2017 - 1 property was internally flooded on Station Road, Cromer. This incident was reported by a resident via a telephone call on the 8 August 2017, (FWF/17/1/5139)	Anglian Water Services Ltd visited to investigate a pollution issue linked to the flooding incident after the incident. Anglian Water Services Ltd assessed the capacity of their drainage system after the incident.

Recent rainfall within Cromer

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 (50%) of internal flooding in this catchment are within 2.5km of a rain gauge. rainfall events recorded for this catchment is measured by The Environment Agency Essex, Norfolk and Suffolk Area rainfall station (Name: CROMER STW RG (TELEM)) and is a tipping bucket automatic (ARG) rain-gauge.

Rainfall data was requested from the Environment Agency for the period from 01/08/2017 to 30/08/2017. During this period 94.52% data collection appears to have been achieved. Over this period it can be seen that 1 rainfall event that recorded a peak of over 4.5mm occurred on the afternoon of the 8th August. The average rainfall recorded was 0.66 mm over any given 15 min interval. This is calculated as a 1 in 2 year event. This relatively frequent rainfall event suggests that the volume of water alone was not necessarily to blame for the flooding problems caused. However, it is important to note here that the gauge was reported to be under-recording by 3.1% and some of the data was reported as 'Incomplete'. Therefore we must treat this data with caution when trying to draw conclusions.

Causes of flooding at 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.

Map 13: Drainage and Flood Details

Location: Station Road, Cromer

Station Road, Cromer - Internal flooding experienced on the 16 September 2016 and 8th August 2017

Causes:

Water was directed from a neighbouring property by their access drive towards the affected property[ies].

Run-off from rainfall was concentrated along overland flowpaths on which the affected property is positioned.

Surface run-off from rainfall that had made its way onto highway flowed along the road network and onto the accesses of affected properties that were situated lower than these features.

Rainfall was concentrated on the highway. Vehicles using the highway passed through the flood water causing it to wash towards the affected property.

Due to the development of impermeable surfaces localised ground conditions caused run-off to be directed quickly from where it fell as to the areas of flooding.

Rainfall was directed into the foul system causing it to surcharge elsewhere. This surcharging contributed to the flooding at the affected property.

Station Road, Cromer - Internal flooding experienced on the 16 September 2016 and 8th August 2017

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.

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.

Amendments should be made to neighbouring properties to ensure water is not directed to other properties.

Legend

-  Bridges
-  Watercourses
-  Main Rivers
-  Water bodies

Flood incidents within Swanton Abbott

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

Date of Incident	Incident as reported	What was the response to the flood incident
23/06/2016	On the 23/06/2016 - 1 property was internally flooded on The Street, Swanton Abbott. This incident was reported by Anglian Water Services Ltd via an electronic report on the 30 June 2016, (FWF/16/1/4521)	Anglian Water Services Ltd carried out measures to minimise the impact of flooding e.g. installation of a Non Return Valve. The resident pumped out water from the soakaways into a nearby land drain.

Recent rainfall within Swanton Abbott

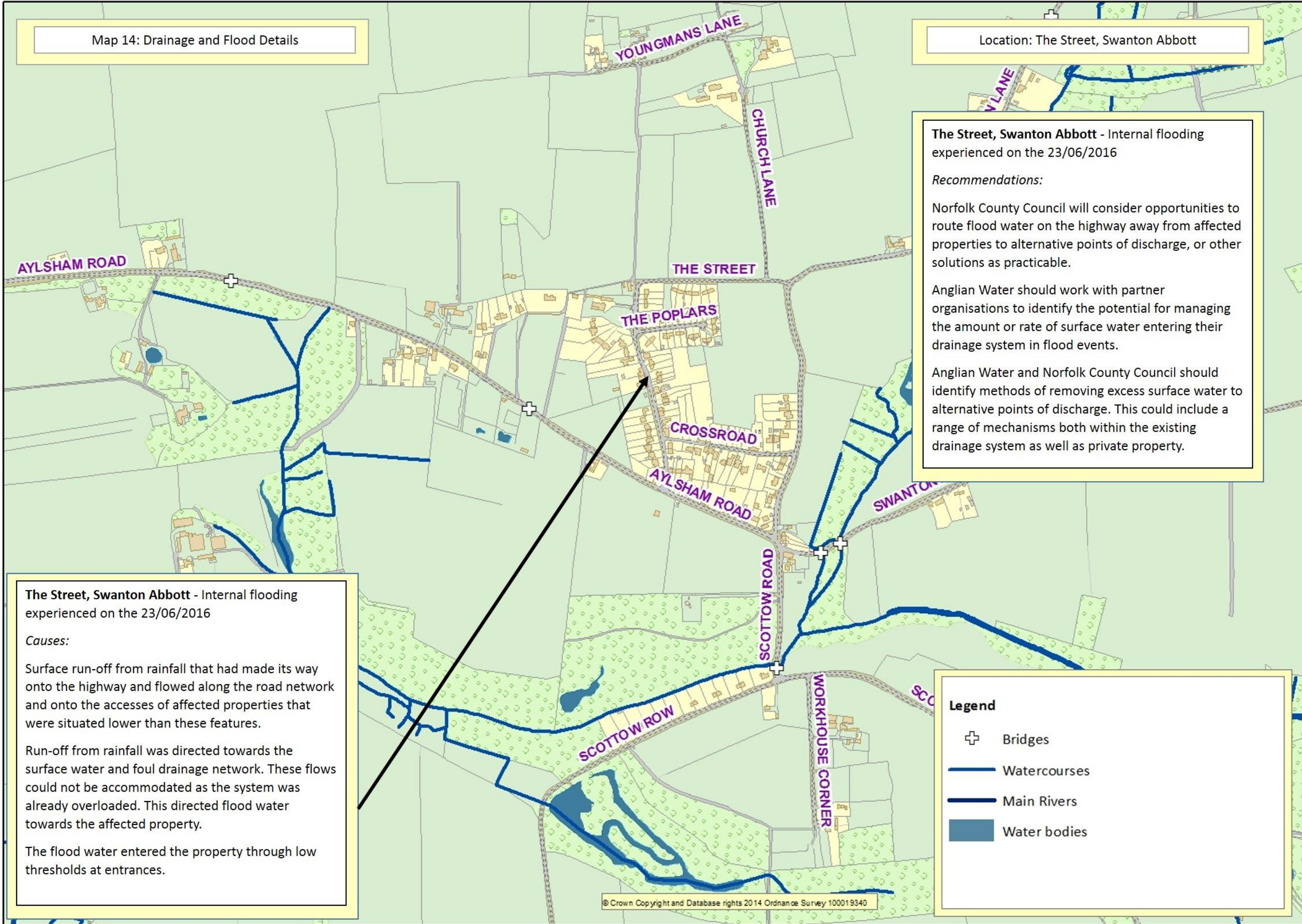
There were no rain gauges within 2.5km of the incidents of flooding within this catchment.

Causes of flooding at 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.

Causes of flooding at 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.



The Street, Swanton Abbott - Internal flooding experienced on the 23/06/2016

Recommendations:

Norfolk County Council will consider opportunities to route flood water on the highway away from affected properties to alternative points of discharge, or other solutions as practicable.

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.

Anglian Water and Norfolk County Council should identify methods of removing excess surface water to alternative points of discharge. This could include a range of mechanisms both within the existing drainage system as well as private property.

The Street, Swanton Abbott - Internal flooding experienced on the 23/06/2016

Causes:

Surface run-off from rainfall that had made its way onto the highway and flowed along the road network and onto the accesses of affected properties that were situated lower than these features.

Run-off from rainfall was directed towards the surface water and foul 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.

Legend

- ⊕ Bridges
- Watercourses
- Main Rivers
- Water bodies

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.

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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.