

Flood Investigation Report

Location of Investigation: Yalding

Date of incident: 20 July 2021

This document has been prepared by Kent County Council Flood and Water Management Team as the Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010, with the assistance of:

- Kent County Council (KCC)
- Environment Agency
- Southern Water
- Kent Fire and Rescue Service (KFRS)
- Yalding Parish Council

The findings in this report are based on the information available to KCC at the time of preparing the report. KCC expressly disclaim responsibility for any error in or omission from this report. KCC does not accept any liability for the use of this report or its contents by any third party.

This report can be found [here](#) where more information can be found about the requirements and trigger for a Section 19 investigation and the roles and responsibilities of Risk Management Authorities.

For further information or to provide comments, please contact us at flood@kent.gov.uk

Summary of Flood Event

On the 20th July 2021 intense rainfall caused flooding to Yalding and the surrounding areas. The nearest rain gauge is located in Watlingbury, located approximately 2.5 km to the north of Yalding, and recorded approximately 44.29 mm between 14:45 and 16:30. Within this period of rainfall approximately 37.9 mm was recorded over 30 minutes between 15:00 and 15:30. The long-term monthly rainfall for July in Kent is approximately 50.4 mm¹. This resulted in surface water run-off from the surrounding land overwhelming the highway surface water and sewerage drainage infrastructure.

Approximately 15 properties throughout Yalding are reported to have been flooded on the 20th July 2021. Yalding Parish Council received reports of internal property flooding to 13 properties, with an additional 2 properties flooding externally. The Parish Council provided support to the affected properties and reported the flooding to KCC. The approximate locations of the reported flood incidents are shown in Annex 3 at the end of the report (please note: only the roads where the properties are located have been mapped, and not the individual properties).

KCC undertook a survey of affected residents in November 2021 collating information about the events of the flood to inform this Section 19 investigation. Table 1 provides a summary of the flooding issues and known flood extents, including the information collated from the flood survey. 35 surveys were sent out to the residents, with 6 responses received by KCC. As a result, the information detailed in Table 1 below may

¹ Source: <https://www.southernwater.co.uk/water-for-life/regional-rainfall>.

not provide an accurate reflection of the experience of all properties impacted by the flood event. Of the survey results collected, 4 properties reported internal flooding and an additional 2 properties reported external flooding. Appendix A provides a breakdown of the number of flood surveys that were sent to each road within Yalding.

Table 1 - Summary of the investigated flooding issues

Location	Details of Reported Flooding	Source of Report
Mount Avenue	1 property reported external flooding.	KCC / Flood Survey
Blunden Lane	1 property reported external flooding to a depth of approximately 10 cm.	KCC / Flood Survey
Vicarage Road	2 properties flooded internally. Flood depths were estimated up to approximately 15 cm. It was also reported that the road was closed due to carriageway flooding.	KCC / Flood Survey / Parish Council
High Street	10 properties reported internal flooding up to depths of approximately 17 cm.	KCC / Flood Survey / Yalding Parish Council
Oast Court	1 property severely flooded internally.	KCC / Yalding Parish Council

Site Location, Topography and Flood Risk

The village of Yalding is located approximately 7 km to the southwest of the town of Maidstone, near the confluence of the River Beult, River Teise and the River Medway, which are classified as main rivers, and are regulated by the Environment Agency.

Yalding lies at the base of the Maidstone greensand ridge and to the north of the village the land slopes steeply away from the River Beult in the south.

Several field drains and unnamed tributaries of the River Beult flow through Yalding in a mostly north to south direction, eventually discharging into the River Beult. A ditch flows south from the north of Lughorse Lane, it passes below Lughorse Lane near King's Cottages and flows into a culvert beneath Mount Avenue that flows under Blunden Lane and the Windmill Path onto Vicarage Road. Where it discharges into a Southern Water surface water sewer flowing south down the High Street (see Figure 1).

The fields drains and unnamed tributaries of the River Beult are classified as ordinary watercourses and are regulated by the LLFA or the Upper Medway Internal Drainage Board.

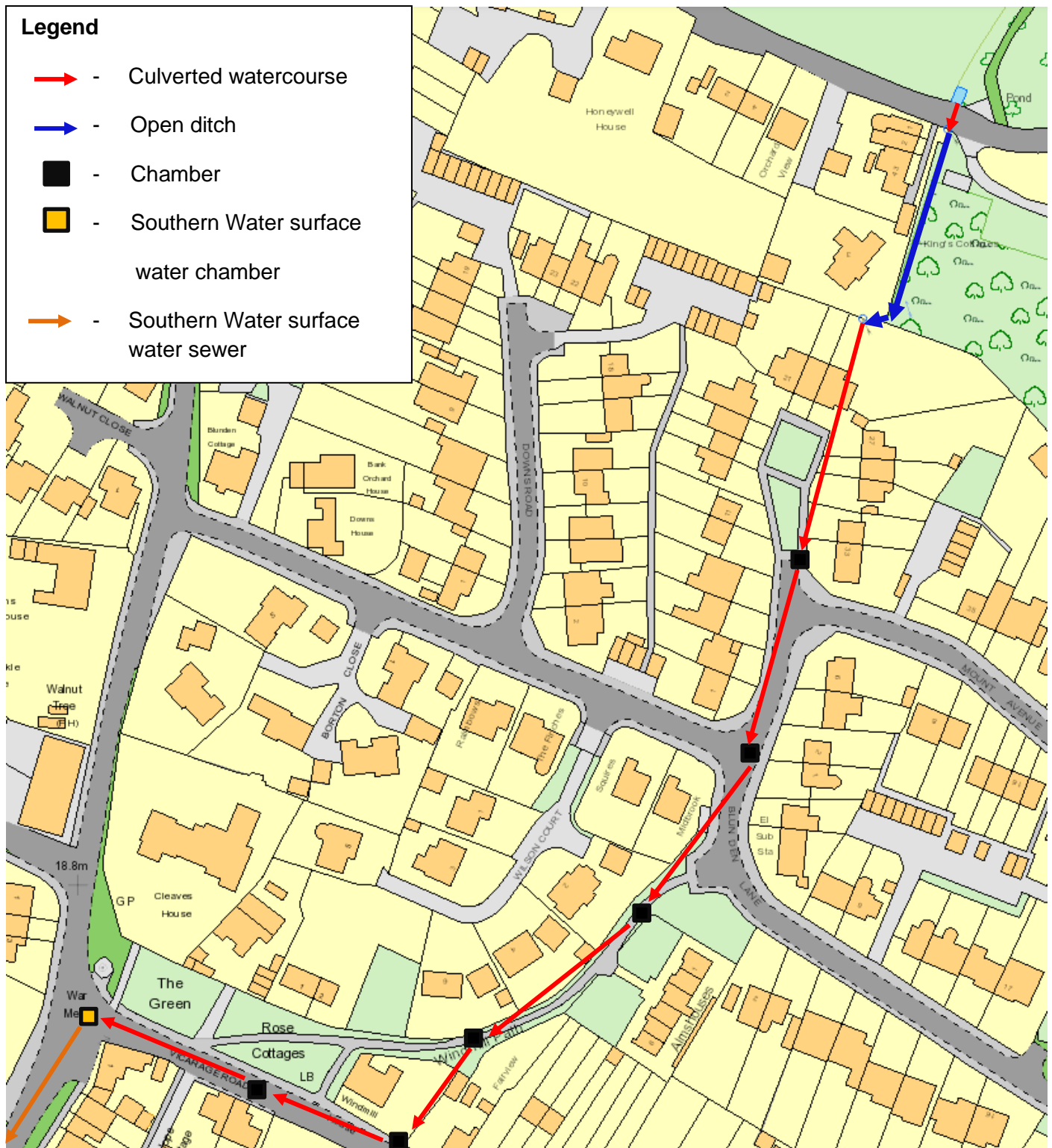


Figure 1 Map showing the ditch flowing south from Lughorse Lane.

The surface water drainage system within the village of Yalding consists of public sewers which are owned and maintained by Southern Water and highway drainage owned and maintained by KCC as the Highway Authority. The majority of the surface water drainage discharges into the River Beult. Southern Water data does not indicate that there are any combined sewers within Yalding.

A review of the Cranfield University Soilscape database² indicates that the northern area of Yalding is underlain by slowly permeable, loamy and clayey soils. The south of Yalding is underlain by loamy and clayey floodplain soils with naturally high groundwater. This means that rainfall in this area is unlikely to significantly infiltrate into the ground and will runoff over land, especially in heavy rainfall.

Annex 1 at the end of the report shows an extract from the Environment Agency’s Flood Map for Planning (Rivers and Sea). The map indicates that the areas in the south of Yalding are located within the high-risk Flood Zone 3³. There is also a small strip located within the medium risk Flood Zone 2 just to the north of Yalding Bridge. The area in the north of Yalding, where the elevation is higher, is located within the low-risk Flood Zone 1. The fluvial flood risk is associated with the River Beult, River Teise and the River Medway. In response to the high flood risk and previous fluvial flood events, the Environment Agency have recently fitted Property Flood Resilience (PFR) measures to a number of properties in Yalding, with the majority of the properties located along the southern bank of the River Beult and the southern end of the High Street.

Annex 2 at the end of the report shows an extract from the Environment Agency’s Flood Risk from Surface Water map. Flooding from surface water is typically associated with natural overland flow paths (including the unnamed tributaries of the River Beult) and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events. The Environment Agency’s map indicates that there are areas within Yalding at a high risk of flooding from surface water sources such as High Street, Kenward Road and Vicarage Road, which aligns with where the fields drains and ordinary watercourses are shown in Figure 1. The areas at high risk of flooding corresponds with the location of the properties affected in the 20th July 2021 flood event.

Rainfall	
Rain Gauge	Wateringbury (station number. 297775)
Rainfall	Whole event: 44.29 mm (14:45 – 16:30) 30 minutes: 37.9 mm (15:00 – 15:30)
Annual Exceedance Probability	Whole event: 2% 30 minutes: 0.9%
	Whole event: 1 in 49-year return period 30 minutes: 1 in 108-year return period

Rainfall Analysis

Rainfall around the country is recorded by a series of rain gauges operated by the Environment Agency. Reports received regarding the flood event indicate that the intense rainfall started at approximately 15:00 on the 20th July 2021 and lasted for approximately 105 minutes. The closest Environment Agency rainfall gauge is located in Wateringbury, approximately 2.5 km to the north of Yalding. Annex 4 at the end of the report shows the location of the Wateringbury rain gauge. The rainfall gauge at Wateringbury recorded

² Source: <http://www.landis.org.uk/soilscales/>

³ Flood Zone 1 is defined as having a less than 1 in 1000 (0.1%) chance of flooding from fluvial sources. Flood Zone 2 is defined as having between 1 in 100 year (1%) and 1 in 1000 year (0.1%) chance of flooding from fluvial sources.

Flood Zone 3 is defined as having a greater than 1 in 100 year (1%) chance of flooding from fluvial sources.

42.29 mm between 14:45 and 16:30, and a daily total of 44.9 mm of rainfall on the 20th July. The majority of the rainfall fell during a 30-minute period between 15:00 and 15:30 with the Watlingbury rain gauge recording 37.9 mm of rainfall within this period. Yalding Parish Council reported 45 mm of intense rainfall which is very similar to the amount of rainfall recorded by the Watlingbury rainfall gauge, and as such it is likely that the gauge recorded the peak of the rainfall.

The Flood Estimation Handbook⁴ (FEH) web service Event Rarity Calculator assesses the Annual Exceedance Probability (AEP) of the recorded rainfall. This is the likelihood of rainfall of this depth or more falling in a year in that location when compared with the FEH rainfall probability model. For instance, a rainfall event with an AEP of 1% means that rainfall of this depth or greater would only have a 1% chance of occurring in any one year in that location. This is also known as a '1 in 100 year' event.

The Event Rarity Calculator assessed the July flood event as an approximate 1 in 49-year event at Yalding when assessing the whole flood event (between 14:45 and 16:30). The Event Rarity Calculator also assessed the intense rainfall between 15:00 and 15:30 when the majority of the rainfall was recorded. It was assessed as an approximate 1 in 108-year event at Yalding.

Radar data from the Met Office is shown in Figure 2 below for the 20th July 2021 for 15:00. The radar data shows large areas of intense rainfall across Kent during the flood event and indicates that the nearest rainfall gauge is likely to have recorded the flood event relatively accurately.

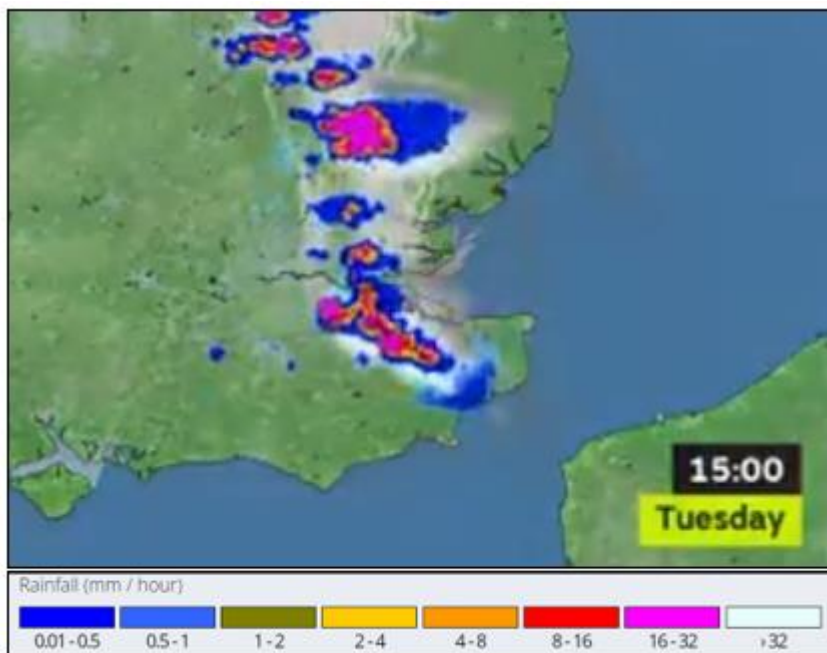


Figure 2 Met Office's rainfall radar on the 20th July

Flood History

There are a number of historic surface water flood events that have occurred in Yalding prior to the event on the 20th July 2021. Yalding and the surrounding area have flooded on a number of occasions, data for recent events from the KCC's flood incident database, Surface Water Management Plans and the Environment Agency have been collated into Table 2. Yalding has a long history of flooding from the main

⁴ FEH is the standard tool in the UK to estimate rainfall return periods. It is used by the Environment Agency and all professional hydrologists to estimate rainfall and rainfall return periods.

rivers, lying at the confluence of three large rivers there is a substantial floodplain here, as a result fluvial flooding has not been included in Table 2 below due to the different source of flooding in comparison to the July 2021 flood event.

Table 2 - Summary of the historic flood records

Location	Date of Flooding	Details of Flooding
Darman Oast	October 2000	1 property affected.
Symonds Lane	November 2000	1 property affected.
Vicarage Road	December 2000 April 2001 February 2004 September 2012 April 2018 January 2019 January 2021	3 properties affected. Carriageway flooding. Carriageway flooding. Carriageway flooding. Carriageway flooding.
Benover Road	March 2001 October 2001 December 2001 May 2006	4 properties affected.
Hampstead Lane	March 2001	1 property affected.
Mill Lane	April 2001 September 2001 October 2001 January 2003 July 2005	5 properties affected.
Lees Road	October 2001	1 property affected.
Gravelly Way	October 2001	1 property affected.
Claygate Road	February 2002 March 2007 May 2018	3 properties affected.
Lughorse Lane	March 2002 September 2005 January 2010 October 2014 December 2019 June 2020	3 properties affected. Carriageway flooding. Carriageway flooding. Carriageway flooding. 1 property affected.
Kenward Road	November 2002 September 2012 November 2012	1 property affected. Carriageway flooding. Carriageway flooding.
Yalding Hill	November 2002 February 2003 February 2009	3 properties affected.

Location	Date of Flooding	Details of Flooding
Emmet Hill Lane	May 2005 June 2005	2 properties affected.
Hunt Street	February 2008	1 property affected.
Bow Hill	February 2008	1 property affected.

Flooding Description, Flooding Mechanism and Flood Response

The flood event on the 20th July was reported to have occurred between 15:00 and 16:00. During the flood event KFRS attended two flooding incidents in the High Street to pump floodwater from the properties. The police also attended the flood event and put in place a road closure along Vicarage Road.

Yalding Parish Council and the local flood wardens assisted during the flood event and pumps from properties located within the floodplain of the River Beult were used to pump floodwater from affected properties.

The main cause of the flood event on the 20th July was the short intense burst of rainfall that began at approximately 15:00. The highway surface water system is designed to accommodate 1 in 30-year rainfall event therefore it was unable to effectively manage the 1 in 108 year event. As a result, the highway surface water system was overwhelmed and the additional volume of water, above a 1 in 30 event, continued as overland flow. Surface water runoff was reported to have flowed from the adjacent fields to the north of Yalding onto the High Street, Vicarage Road and Yalding Hill.

A CCTV survey was undertaken in March 2023 of the culverts under Mount Avenue, Blunden Lane and Windmill Path and the surface water sewer up to the junction of Vicarage Road and the High Street. The results of the survey indicate that the culvert downstream of Blunden Lane was in a very good condition. The section surface water sewer along Vicarage Road, was shown to contain tap roots and silt, equating to an approximate 20% loss of capacity within the pipe. KCC have reported the issues to Southern Water.

It is likely that the culvert was at full capacity during the flood event due to the significant amount of rainfall over a short period. As a result, the adjacent highway drainage infrastructure could not discharge into the watercourse and led to localised flooding.

There are also public sewers throughout the village, operated by Southern Water, however these serve as 'foul only' for most connections from residential and commercial premises. As such it is not likely that there will be widespread inflows of surface water to the sewers in normal circumstances. It was reported that the sewers and gullies located along the High Street surcharged with foul debris reported.

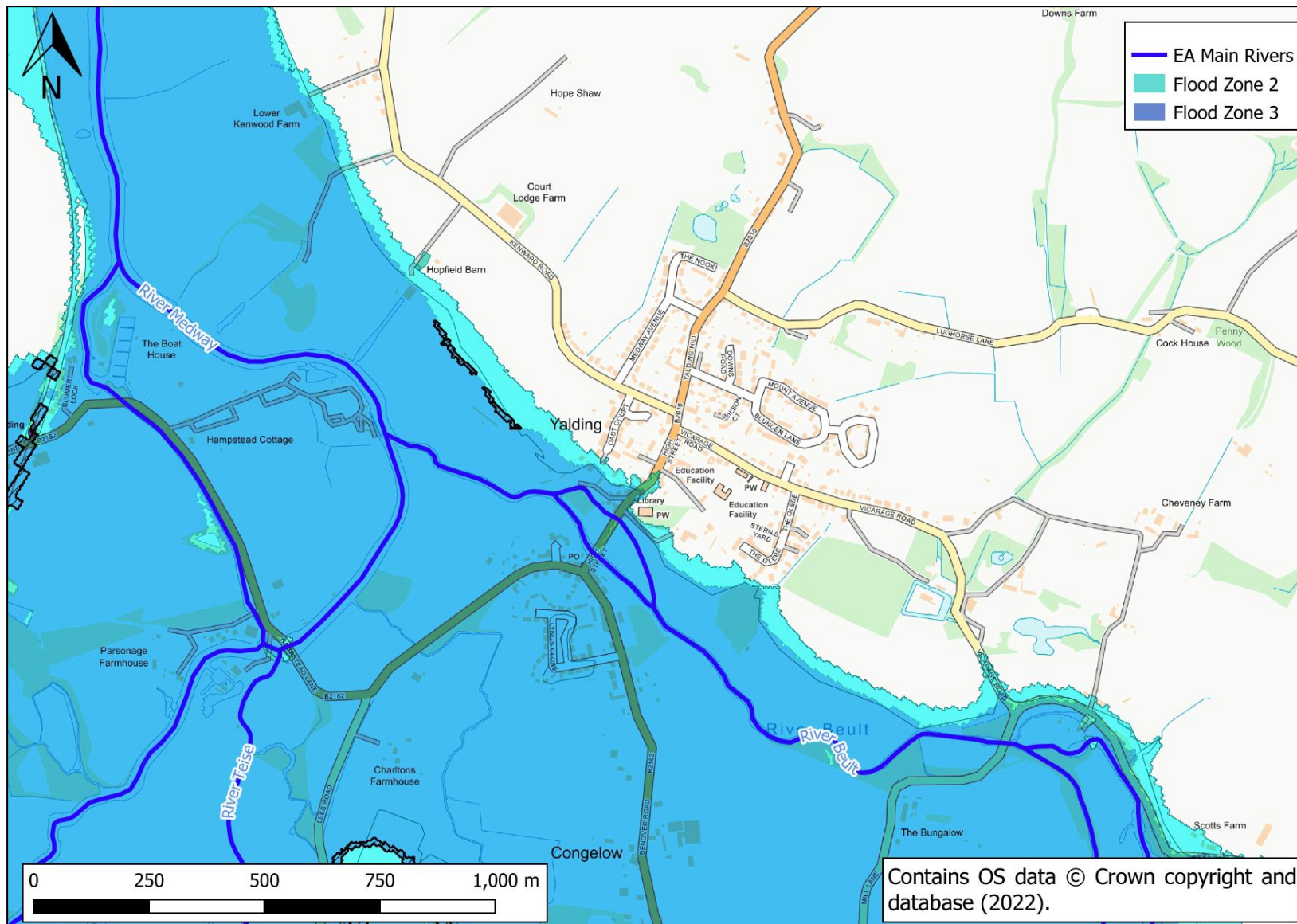
Since the flood incident on the 20th July 2021, KCC have attended to replace gully covers and clear any gullies that had become blocked.

Conclusion and Recommendations

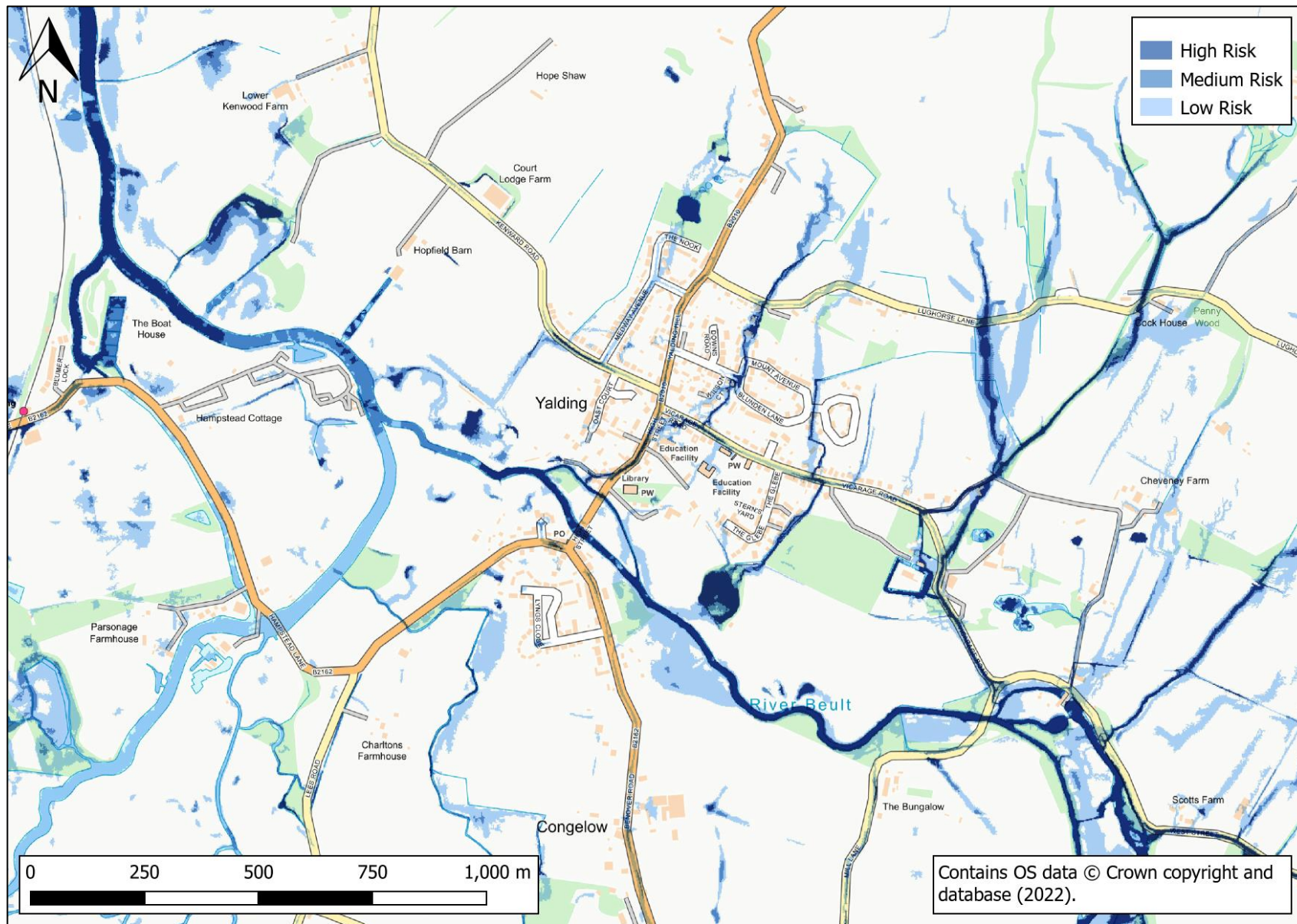
On the 20th July 2021 a short and very intense period of rainfall caused flooding to 15 properties and disruption to local roads. The rainfall analysis was undertaken for the Wateringbury rainfall gauge located approximately 2.5 km to the north of Yalding. The Event Rarity Calculator assessed the flood event as an approximate 1 in 108-year event for the 30 minutes when the majority of the rainfall (37.9 mm) was recorded. The local surface water infrastructure is not designed to accommodate rainfall of this magnitude and as a result was overwhelmed.

A number of options to be considered as a result of the flood event are detailed below:

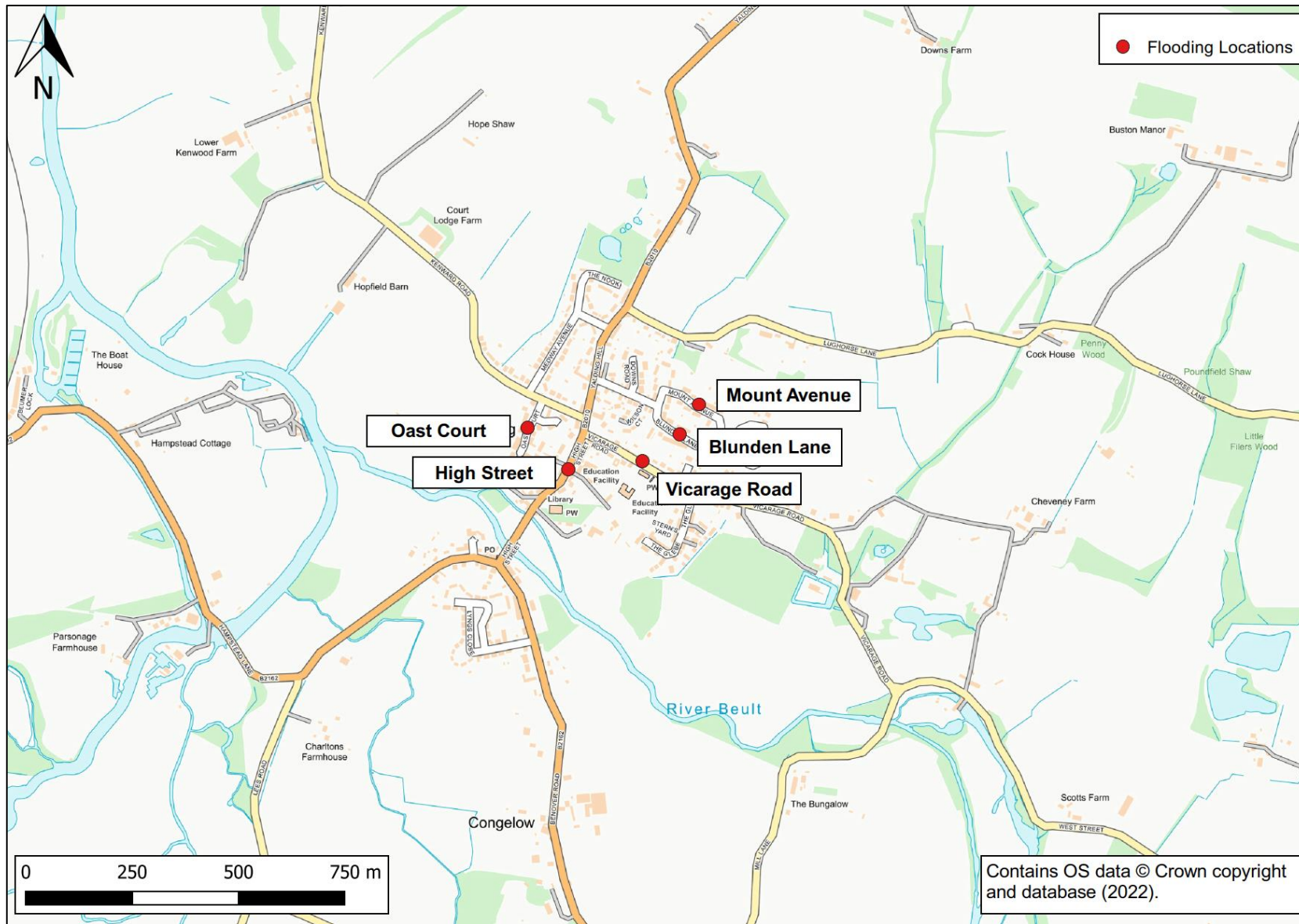
- Evaluation of the current highway drainage maintenance undertaken in Yalding to understand if it is appropriate.
- Consultation with local landowners outlining their riparian responsibilities and best practices regarding land management.
- Investigate opportunities to slow runoff from the north of Yalding
- Communication with local flood wardens and local residents regarding local flood risks and consultation regarding actions that the community could undertake in future flood events.



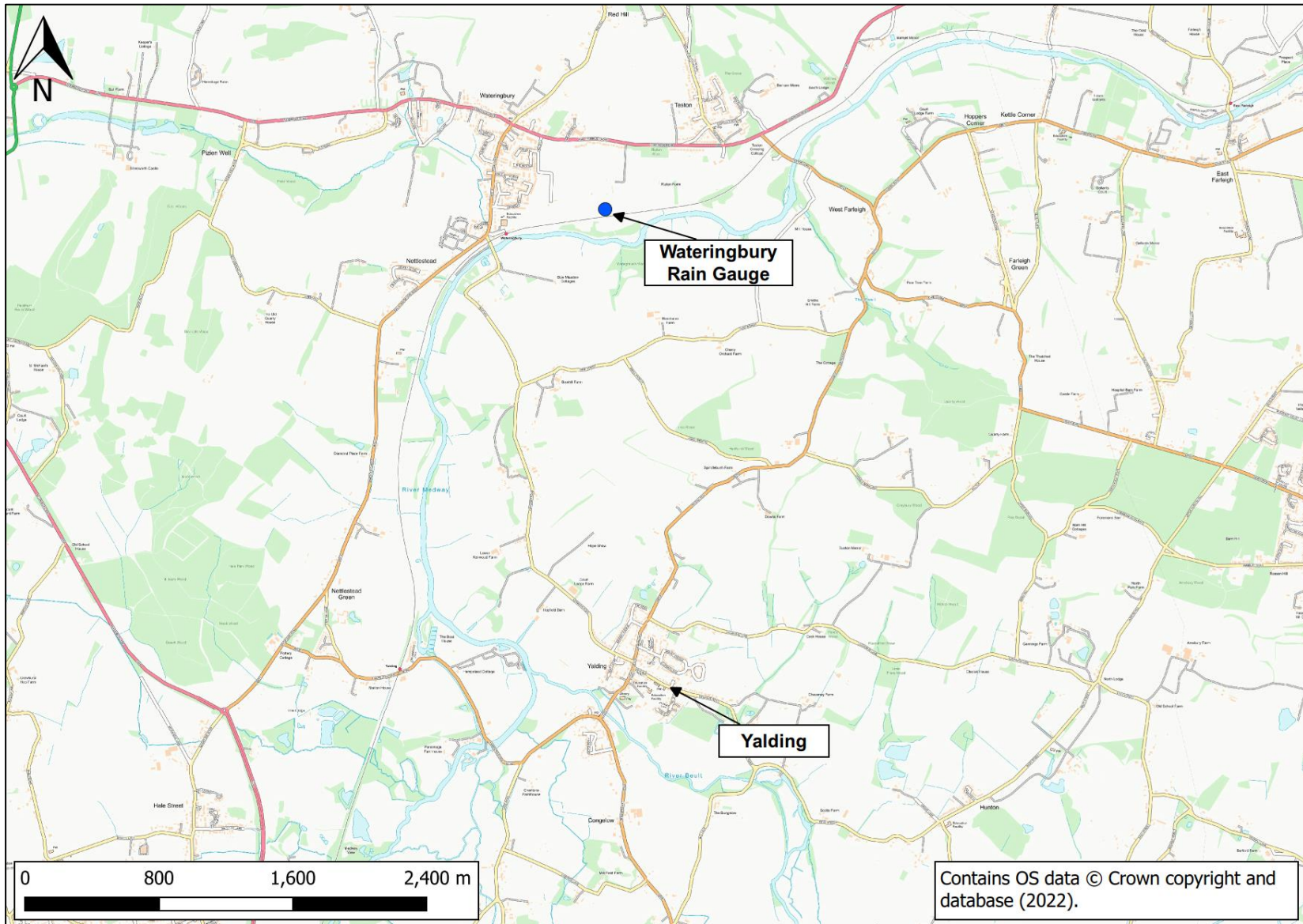
Annex 1 - Extract for the Environment Agency's Flood Map for Planning



Annex 2 - Extract from the Environment Agency's Flood Risk from Surface Water map.



Annex 3 – Location of reported flood incidents across Yalding.



Annex 4 – Rainfall gauges used to estimate rainfall for Yalding.

Appendix A: Flood Surveys

Table 1 below provides a breakdown of all of the roads that flood surveys were sent to and compares the number of flood surveys per road with the number of responses received.

Table 1 Summary of flood surveys

Location	No. of flood surveys sent	No. of flood surveys received
Mount Avenue	21	1
Blunden Lane	3	1
High Street	5	3
Church Cottage	5	0
Vicarage Road	1	1