Kent County Council

Flood Investigation Report

Location of Investigation: Ulcombe

Date of incident: 01 August 2021

This document has been prepared by Kent County Council Flood and Water Management Team as the Lead Local Flood Authority (LLFA) 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)
- Ulcombe 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 1st August 2021 intense rainfall caused flooding to Ulcombe and the surrounding areas. The nearest rain gauge is located in Sutton Valence, located approximately 4 km to the west of Ulcombe, and recorded approximately 16.85 mm between 15:00 and 17:15, however the rain gauge indicates that the rain fell in short intense bursts. A review of rainfall radar data indicates that there were localised areas of intense rainfall across Ulcombe and the surrounding areas during the flood event which were not recorded by the rain gauge and that 41.73 mm rain fell between 16:00 and 19:00.

As a result, it is likely that the rain gauge did not accurately record the flood event at Ulcombe. This is supported by a local landowner owned rain gauge that recorded 42 mm of rainfall on the 1st August. The average monthly rainfall for August in Kent is approximately 49.5 mm[1]. Consequently, drainage ditches, local watercourses and parts of the local sewer network were unable to cope with the volume of rainfall.

Approximately 27 properties throughout Ulcombe and the surrounding area are reported to have flooded by Ulcombe Parish Council. The approximate locations of the reported flood incidents are shown in Annex 1 at the end of the report (please note: only the roads where the properties are located have been mapped, and not the individual properties).

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

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 investigated flooding issues and known flood extents, including the information collated from the flood survey. 26 surveys were sent out to residents, with 7 responses received by KCC. As a result, the information detailed in Table 1 below may not include all properties impacted by the flood event. Of the survey results collected, five properties reported internal flooding and an additional property reported external flooding. Appendix A provides a breakdown of the number of flood surveys that were sent to each road within Ulcombe.

Table 1 - Summary of the investigated flooding issues

Location	Details of Reported Flooding	Source of Report
The Street	The Parish Council reported 27 properties flooded during the flood event. Internal flooding was reported to be up to a depth of 15 cm.	KCC / Flood Survey / Parish Council
Pye Corner	3 properties reported flooding, but it is not known if they flooded internally.	KCC

Site Location, Topography and Flood Risk

The village of Ulcombe is located approximately 11 km to the southeast of the town of Maidstone, just to the south of the M20 between junctions eight and nine. The hillsides around Ulcombe form the upper most reaches of the tributaries and catchment area of the River Beult. The sub-catchment that Ulcombe is located in is approximately 2.7 km² with the upper reaches of the catchment extending just to the north of Ulcombe. The catchment slopes steeply in a north to south direction.

A tributary on the eastern edge of Ulcombe rises to the north east of Ulcombe Hill and flows in a southerly direction through agricultural land,

Figure 1 shows a map of Ulcombe, the water features around it and the surface water drainage systems.

There are a number of small ponds along the course of this stream that are reported to have partially filled up with silt and vegetation. As the watercourse continues south, the channel becomes shallower and narrower through the gardens of the properties to the east of The Street.

The watercourse splits into two channels at the rear of Heron Bank. The western watercourse flows through a culvert beneath The Street, alongside the School, in a 500mm culvert, which discharges into a small channel which gradually widens. The other channel of the watercourse flows through scrub land and towards Pye Corner. Both Channels discharge to the River Beult approximately 5km to the south at Headcorn

A ditch runs adjacent to the carriageway in the field on the western side of Ulcombe Hill. At Oak Tree Cottage the ditch flows southwest through the field to join another ditch and these ultimately discharge into the western channel of the watercourse to the west of Ulcombe.

On Ulcombe Hill at The Coach House, there is a grip on the highway that drains runoff from the highway into a watercourse that joins the unnamed tributary at one of the ponds. The highway surface water drainage system was improved in April 2021, with additional gullies installed on

Ulcombe Hill that are collected by a highway drainage system that discharges into the ditch on the west of Ulcombe Hill.

A review of the Cranfield University Soilscape database[2] indicates the majority of the underlying soils in Ulcombe are loamy and clayey soils with impeded drainage. This means that rainfall in this area is unlikely to significantly infiltrate into the ground and will runoff over land, especially in heavy rainfall events. The underlying soils located just to the north of Ulcombe are freely draining loamy soils.

[2] Source: http://www.landis.org.uk/soilscapes/

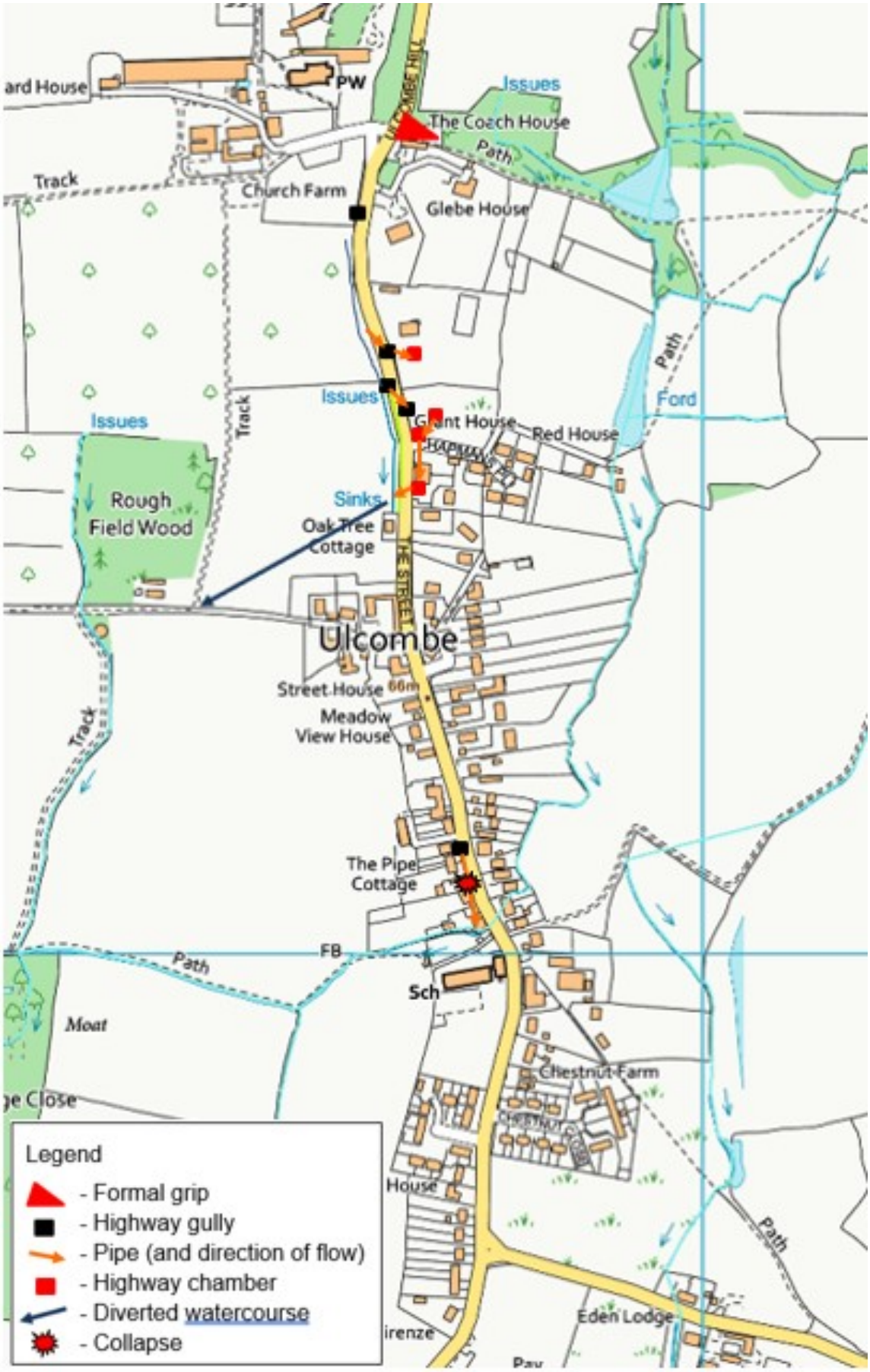

Figure 1 Map of Ulcombe and highway drainage

Annex 1 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 the areas at a high risk of flooding from surface water sources are associated with the unnamed tributaries of the River Beult, in particular the tributary that flows beneath The Street[3]. The areas indicated to be a high risk of flooding from surface water sources are consistent with the locations of reported properties affected by the flood event.

Rainfall

This section assesses the annual exceedance probability (AEP) of the flood event on 1st August 2021 across Ulcombe using observed rainfall from the Sutton Valence rain gauge (see Annex 2), the closest in proximity to the affected properties, and radar data across the estimated Ulcombe catchment.

It is important to note that this rainfall analysis and the AEP estimates are approximates based off observed rainfall data which comes with a degree of uncertainty. Other factors such as catchment characteristics and antecedent rainfall conditions have not been considered for this analysis. Assessment of AEP based solely on rainfall data can only ever provide an approximation of the resultant flood event. Other local factors, such as asset condition and blockage, may also have an effect on flooding seen, rather than simply the magnitude of the event.

Methodology

Rainfall around the country is recorded by a series of rain gauges operated by the Environment Agency. The Flood Estimation Handbook[4] (FEH) web service Event Rarity Calculator has been used to assess the AEP of the recorded rainfall. This is the likelihood of rainfall of this depth (for a specified length of storm) being exceeded in a typical 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 has a 1% chance of occurring in any one year in that location. This is also known as a '1 in 100 year' event. The assessment has been undertaken using the FEH13 rainfall model.

There are two sources of data for rainfall, rain gauges and radar that detect rainfall remotely. The closest rain gauge to Ulcombe is at Sutton Valence located 4 km to the west (see Annex 2) and radar data has been purchased form the Met Office for the catchment area.

Error! Reference source not found.2 compares rain gauge data with the with rainfall radar data for 1st August 2021. As can be seen, both data sources measure broadly comparable rainfall occurring between 15:00 and 17:00. However, the radar also measures a significant later burst of rainfall occurring between 18:00 to 19:00. Considering the timing of the reported flood event, between 19:00 and 21:00, it seems likely that this later rainfall was the main cause and indicates that this later storm was highly localised and not experienced at the rain gauge location.

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[3] High risk of flooding from surface water is defined as having a greater than 1 in 30 (3.3%) chance of flooding.
Medium risk of flooding from surface water is defined as having between 1 in 100 (1%) and 1 in 30 (3.3%) chance of flooding.
Low risk of flooding from surface water is defined as having between 1 in 1000 (0.1%) and 1 in 100 (1%) chance of flooding.

[4] FEH is the standard tool in the UK for flood estimation. It is used by the Environment Agency and professional hydrologists.

Due to the significant distance of the rain gauge from Ulcombe and the localised nature of intense rainfall events, it appears the rain gauge data does not accurately represent the rainfall in this event. For this assessment rainfall estimates have been derived from the radar data only.

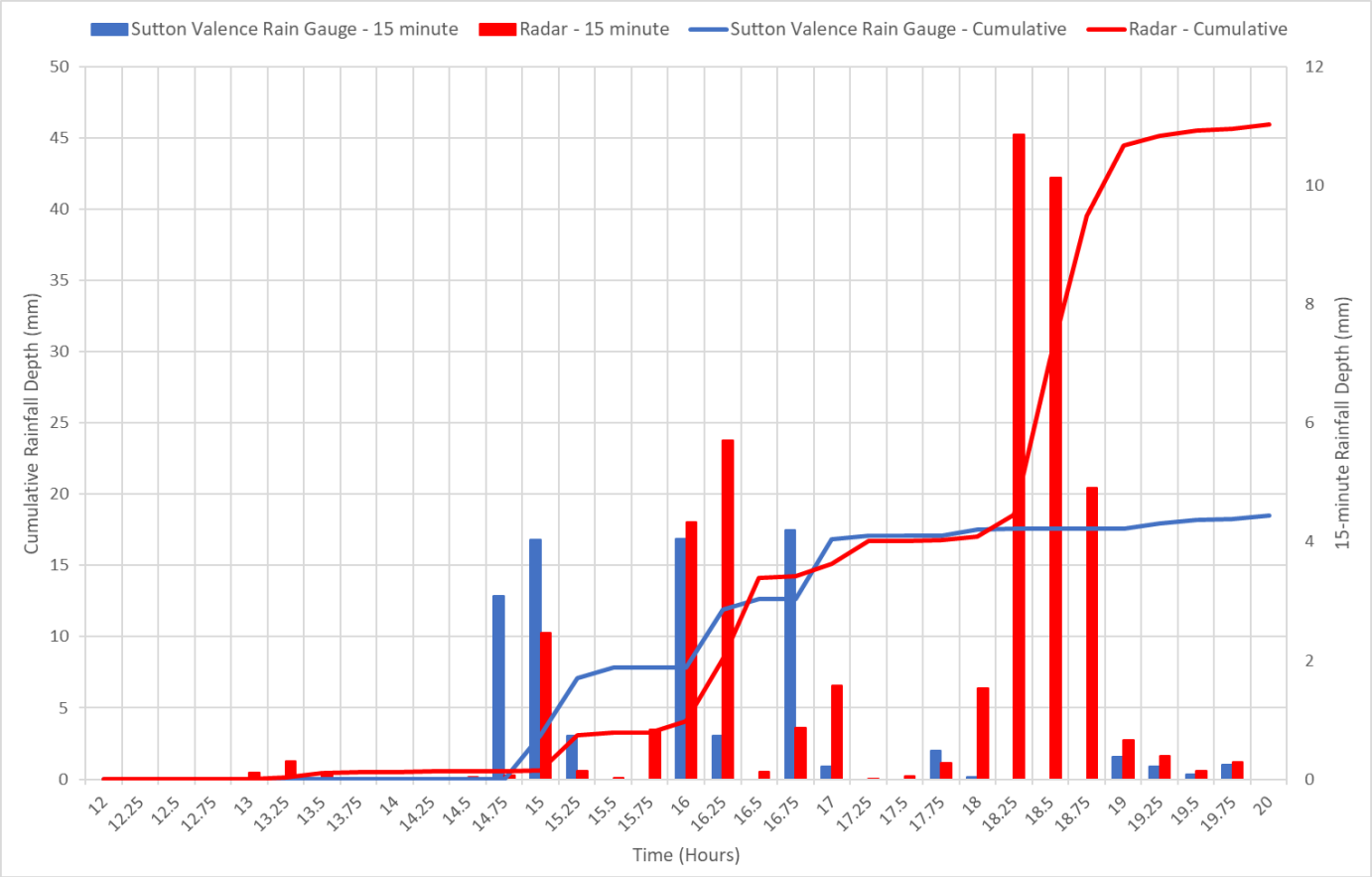


Figure 2 Comparison of measured rainfall between the Sutton Valence rain gauge data (blue) and the radar data (red).

Radar Rainfall Analysis for the flood event that took place on 1st August 2021:

Daily total rainfall: 46.49mm

3 hours rainfall (16:00 – 19:00): 41.73mm
Estimated Annual Exceedance Probability (16:00 – 19:00): 1 in 18-year return period, 6% occurrence in any given year.

1 hours rainfall (18:00 – 19:00): 29.66mm
Estimated Annual Exceedance Probability (18:00 – 19:00): 1 in 29-year return period, 3.4% occurrence in any given year.

The radar data was purchased for four 1x1 km grid squares across Ulcombe, this covered all the recorded flooded properties from the flood event and the majority of the area of the main catchment which has affected Ulcombe and Pye Corner. The rainfall distribution was extrapolated to encompass the estimated Ulcombe catchment area and then averaged, producing hourly rainfall values for the catchment.

The majority of the rainfall occurred between 16:00 and 19:00 with 41.73mm falling, this corresponds to local reports and a privately owned rain gauge which recorded 42mm of rainfall during the event and was located at the top of the Ulcombe catchment. During the event a more

intensive period of rainfall occurred with 29.66mm falling in an hour, the return period for this intensive burst of rain is a 1in 29-years and is likely to have generated the most significant volumes of surface water runoff.

The rainfall radar data below clearly shows the period of intense rainfall between 18:00 and 19:00 and that it fell to the north-east of the Ulcombe directly over the watercourse catchment area.

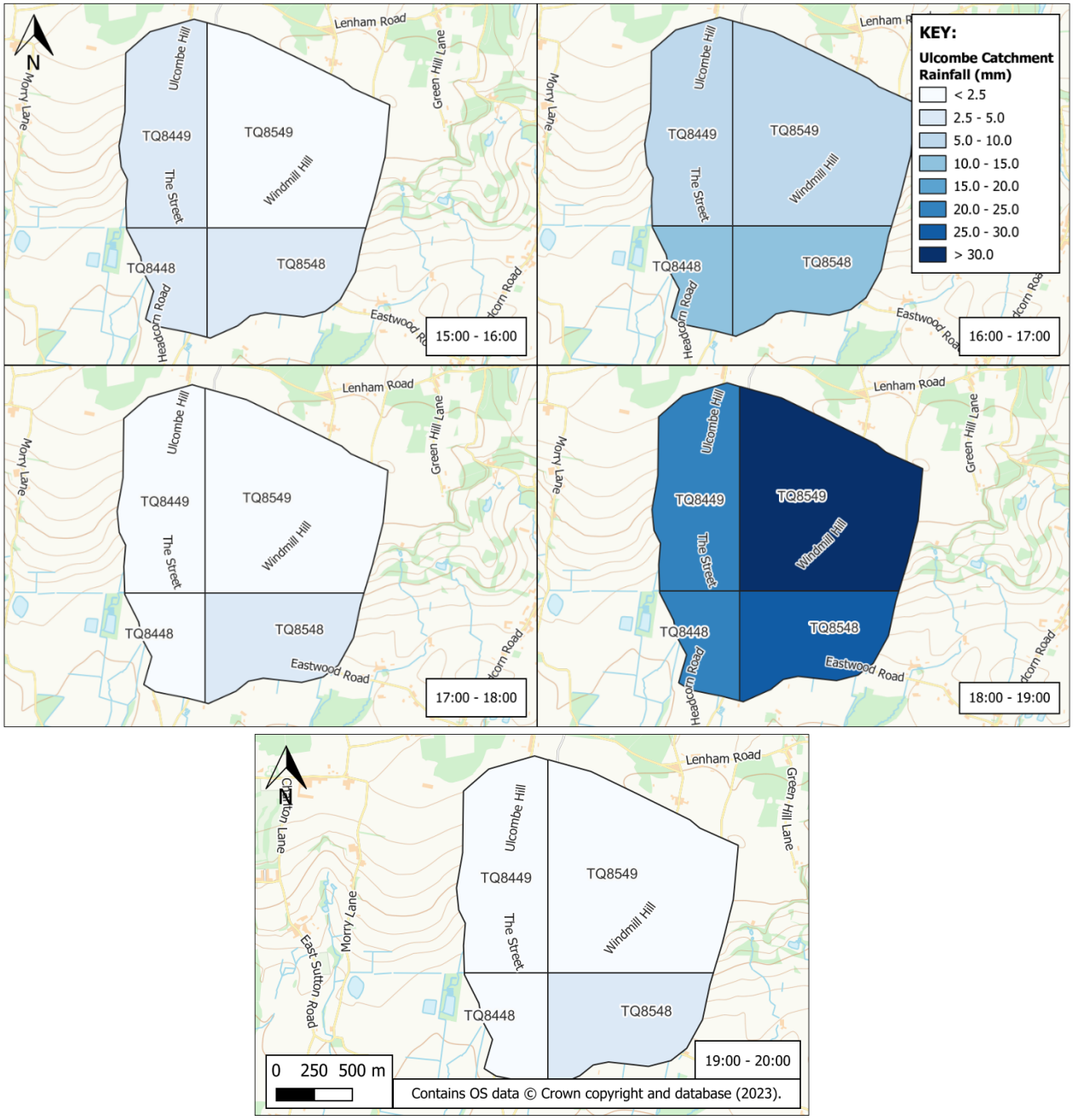


Figure 3 Hourly rainfall radar data from the Met Office from 15:00 - 20:00 across the approximate Ulcombe catchment.

Flood History

There are a number of historic flood events that have occurred in Ulcombe prior to the event on the 1st August 2021.

Data of events from 2008 from the KCC's flood incident database, Surface Water Management Plans and the Environment Agency have been collated into Table 2.

Table 2 - Summary of the historic flood records.

Location	Date of Flooding	Details of Flooding
Eastwood Road	April 2008	Blocked gully caused road flooding.
Eastwood Road	September 2009	Carriageway flooded.
The Street	May 2012	Collapsed drain caused road flooding.
Ulcombe Hill	October 2012	Carriageway flooded.
London Road	January 2015	Carriageway flooded.
Headcorn Road	December 2020	Blocked drainage ditch caused road flooding and one property flooded internally.

Flooding Description and Flood Mechanism

Following heavy rainfall between 16:00 and 19:00 on the 1st August local residents reported flooding between 19:00 and 21:00 which reached depths of up to 40 cm externally and 15 cm internally of their properties.

The ponds along the course of the watercourse, to the east of Ulcombe Hill and The Street (see Figure1), were reported by KCC as being silted and therefore the capacity of both ponds to slow water was reduced.

Where the watercourse flows through the gardens of properties to the east of The Street, it was unable to cope with the volume of water and burst its banks, with water flowing to the west towards the properties. Video footage during the flood event shows a large volume of water flowing from the back gardens of these properties, down the driveways and onto the carriageway. The watercourse narrows and varies in level of maintenance with some highly vegetated sections.

The 500mm culvert, under The Street was overwhelmed by the volume of water and surcharged, causing flooding in the vicinity of the culvert, this may have contributed to an increasein the flooding upstream.

The highway drainage system on Ulcombe Hill was overwhelmed during this event and the outfall was ineffective. KCC reported that on the 1st of August the grip alongside The Coach House, was full of mud, which likely accumulated during the event, the highway runoff would have continued to flow down the carriageway once this was blocked.

Prior to the event, the ditch on the west of Ulcombe Hill, discharged into a pipe under Oak Tree Cottage however this had collapsed. This collapse caused surface water to flow back onto the highway rather than continuing south to ultimately discharge into The Street watercourse.

KCC highways reported that Southeast Water assets had caused multiple breakages within the 150mm outfall of a gully at the bottom of Ulcombe Hill therefore this gully was ineffective and would have impacted the flooding at this location.

There is evidence of overland flow paths, soil erosion and scour in the orchard to the east of Ulcombe. The rain fell during summer months when the soils are more likely to be highly compacted and dry causing increased run-off. Local reports suggested that orchards in the upper catchment had been recently planted, with bare ground and small trees reducing the interception of surface water. In addition, during the summer polytunnels are more likely to be covered which may further increase the area of impermeable surfaces across the catchment. To the northeast of Ulcombe fruit orchards and polytunnels make up the majority of landcover and present a potential source of overland runoff in intense rainfall and may have contributed to higher runoff than in previous events.

Flood Response

KFRS attended an incident at Pye Corner as a result of a flooded garden. KFRS also received two calls regarding flooding along The Street but did not attend.

Since the flood incident on the 1st August 2021, the drainage ditches that were blocked during the flood event have been cleared by local residents. The landowner west of Ulcombe Hill was given land drainage consent to undertake works to divert the watercourse, running parallel to Ulcombe Hill, to cross the field and ultimately outfall further downstream in the watercourse to the west of Ulcombe.

KCC Highways have undertaken a number of works since the flood event including cleansing the gullies located on Streetfield. KCC Highways and South East Water have rectified the breakages in the 150mm pipe at the bottom of Ulcombe Hill.

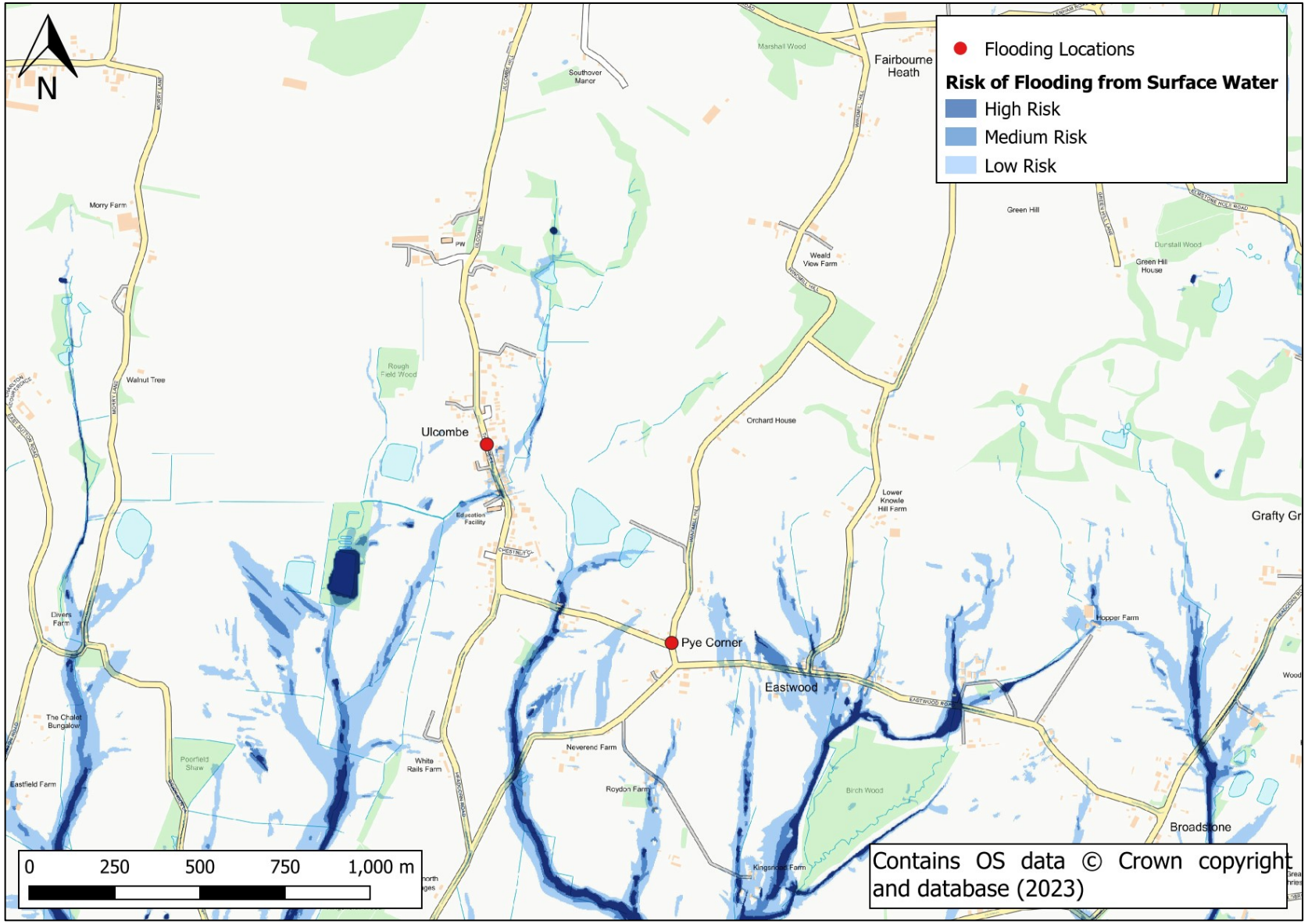
Conclusions and Recommendations

On the 1st August 2021 the village of Ulcombe experienced an intensive rainfall event which resulted in 41.73mm of rain falling between 16:00 and 19:00 with 29.66mm of this rain fall occurring between 18:00 and 19:00. The intense nature of the rainfall during the summer months, when the ground is more likely to be dry and compacted will have increased the impermeable surface area that the rain fell on.

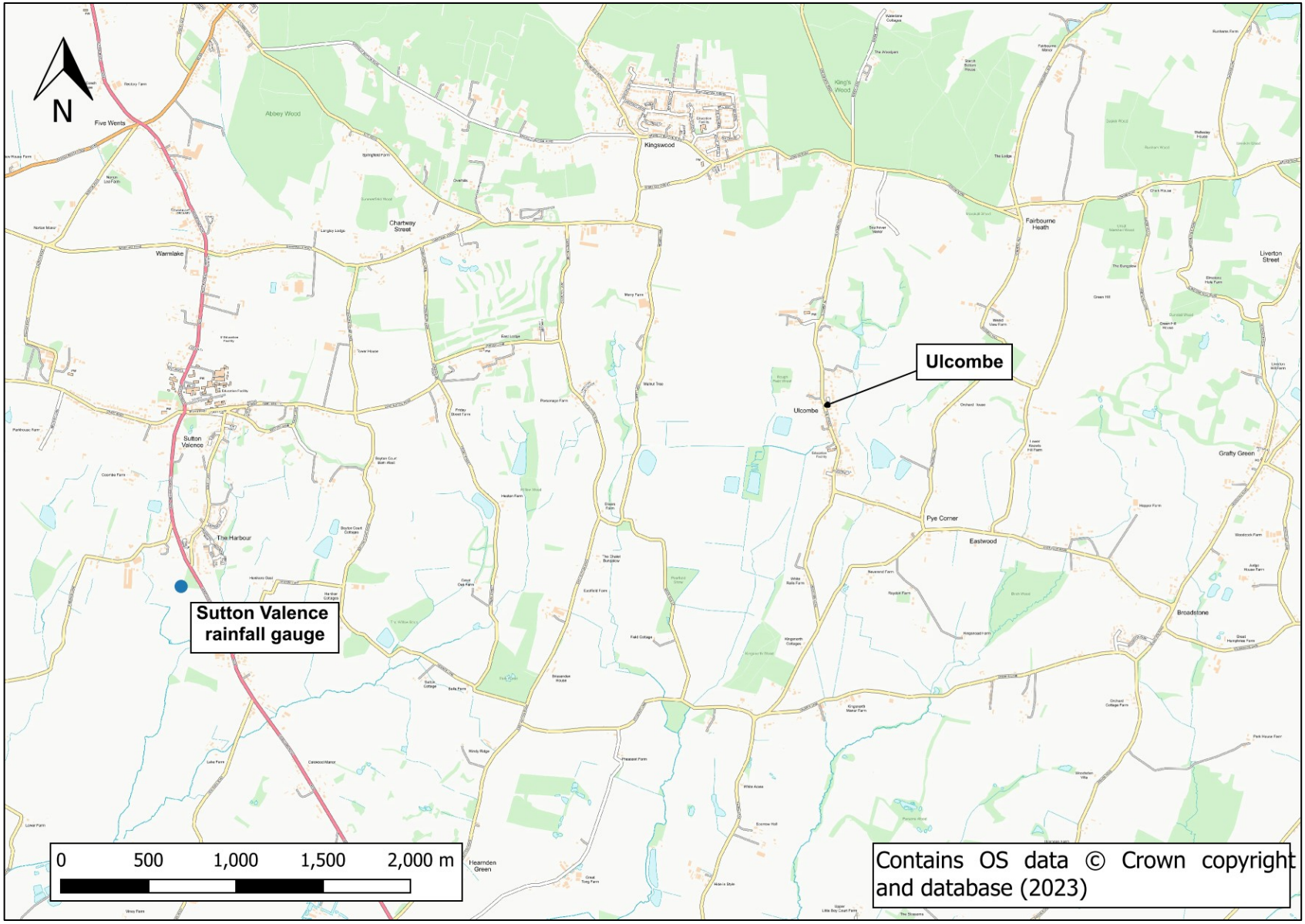
The increased surface water run-off quickly overwhelmed the watercourses, highway drainage and culverts in Ulcombe resulting in 27 properties flooding, as reported by the Parish Council. In addition to the system being overwhelmed it is likely that the breakages and collapse in two of the drainage network pipes would have increased the volume of water which built up as the water would have been slower to drain away.

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 Ulcombe to understand if it is appropriate.
- Communication with local residents regarding local flood risks and consultation regarding actions that the community could undertake in future flood events.
- Consultation with local landowners outlining their riparian responsibilities and best practices regarding land management.



Annex 1 - Extract from the Environment Agency's Flood Risk from Surface Water map



Annex 2 – The Sutton Valence rainfall gauge used in the rainfall analysis for Ulcombe.

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
The Street	22	7
Pye Corner	4	0