

# Flood Investigation Report

Location of Investigation: Capel-le-Ferne

Date of incident: 04-05 November 2023

This document has been prepared by Herrington Consulting Ltd on behalf of the 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)
- Herrington Consulting Ltd

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This report can be found on our [Section 19 investigations website](#) 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](mailto:flood@kent.gov.uk)

## Summary of Flood Event

On the evening of 04 November 2023 and the early morning of 05 November, flooding was recorded in Capel-le-Ferne, Kent. Prior to the flood event there was a period of prolonged rainfall totalling 8 days and included winter storm Ciaran, this was followed by a short and intense period of rainfall (~2 hours) which coincided with the flood event.

The nearest rain gauge recorded 42mm of rainfall throughout the day on the 04 November. 13.2mm of rain fell in 1 hour 45 minutes, between the hours of 23:00 (04 November) and 00:45 (05 November)<sup>1</sup>. There had been numerous rainfall events of similar magnitude throughout the preceding week.

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<sup>1</sup> Source: [Rainfall Gauge Station](#)

At approximately 00:00 on the 05 November 2023, residents became aware of flooding to properties near to the junction of Lancaster Avenue and Capel Street. Both Kent Fire and Rescue and Kent Highways attended the scene.

Approximately six properties were affected by the flood event, with five properties known to have flooded internally. Damage was also reported to garages and gardens. Some of the flooded properties were evacuated. There were no reported injuries.

The approximate location of the reported flood incident is shown in Annex 1, (please note: only the roads where the properties are located have been mapped, and not the individual properties).

## Flood Survey

In November and December 2023, a resident's survey was conducted by KCC for the affected area. Information was collated with regard to the flooding and this information was used to inform this Section 19 investigation. 47 surveys were sent to residents and 6 responses were received. Appendix A provides a breakdown of the number of flood surveys that were sent to the affected post codes within Capel-le-Ferne.

Table 1 provides a summary of the survey responses, which detail the type of flooding, known flood extents, and other relevant information. The information detailed in Table 1 is not exhaustive and therefore, may not include all of the impacts.

*Table 1 - Summary of the investigated flooding issues*

Location	Details of Reported Flooding	Source of Report
Lancaster Avenue	<ul style="list-style-type: none"> <li>One resident reported runoff from arable fields and the highways gullies becoming blocked.</li> <li>One property flooded internally to 'approximately 200 to 300mm'.</li> </ul>	Flood Surveys
Capel Street	<ul style="list-style-type: none"> <li>Two residents noted runoff from the agricultural fields and blocked drains.</li> <li>One property reported internal flooding to approximately 300mm.</li> <li>One property reported external flooding in the driveway and garden.</li> </ul>	Flood Surveys

	Details of Reported Flooding	Source of Report
Elizabeth Drive	<ul style="list-style-type: none"> <li>One property reported external flooding to approximately 300mm.</li> </ul>	Flood Surveys

## Site Location, Topography and Flood Risk

The village of Capel-le-Ferne is located within Folkestone and Hythe district, approximately 3.5km northeast from the centre of Folkestone. The village is located at an elevated position atop the chalk cliffs, commonly known as “the White Cliffs of Dover”, with an elevation of ~135-175m above sea level (Ordnance Datum Newlyn). Capel-le-Ferne contains no mapped watercourses within its catchment.

The geology of the catchment is chalk bedrock overlain with superficial deposits from the Clay with Flints Formation, and Superficial Head (soil). A review of the Cranfield University Soilscales database<sup>2</sup> indicates that the underlying soils in Capel-le-Ferne are slightly acid loamy and clayey soils with impeded drainage. This means, that whilst the majority of the rain landing in the catchment is likely to infiltrate into the soils and underlying chalk (up to 75%), some rainfall in this area is still unlikely to infiltrate into the ground and will flow overland. Increased runoff is likely, as following prolonged rainfall soils can become saturated, increasing the flood risk.

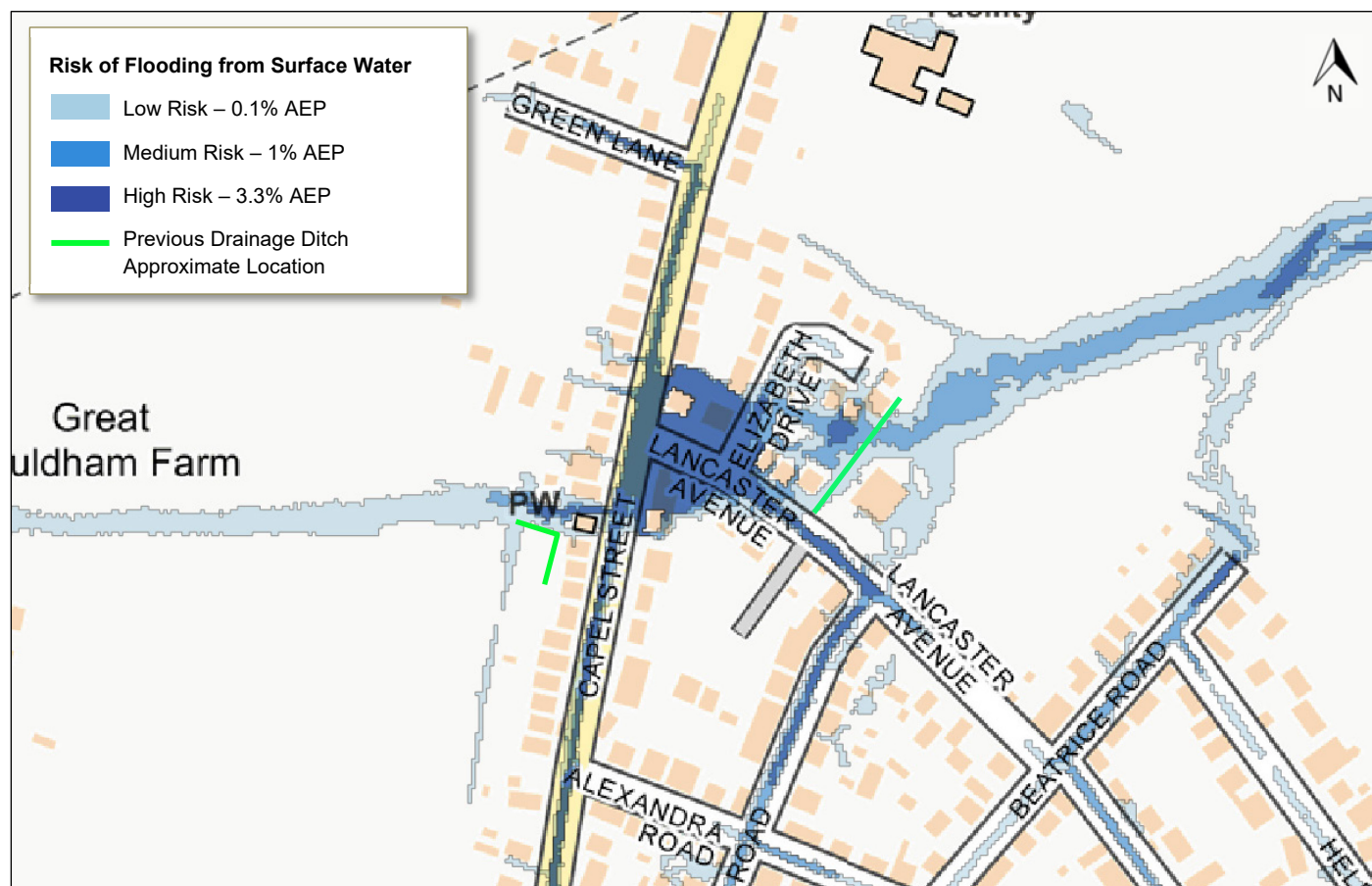
The primary source of flooding is considered to be surface water (overland flow). The Environment Agency’s (EA’s) ‘Flood Risk from Surface Water’ map (Figure 1) indicates there is a natural surface water overland flow path which flows in a predominantly west to east direction, from the direction of Great Cauldham Farm, across the agricultural field, to the junction at Capel Street and Lancaster Avenue. There is an additional, larger surface water overland flow path which flows predominantly northeast to southwest, from Dawkinge Wood towards the Junction between Capel Street and Lancaster Avenue, before continuing northeast towards Dover.

Post the 2007 flood event two drainage ditches in the area have been removed. One drainage ditch ran along the border of the agricultural field and adjacent to the residential properties, delineated in green in Figure 1 below, this is believed to have been a blind ditch at the boundary of the field, this ditch has become infilled with material including concrete blocks and sediment. A second drainage ditch adjacent to the footpath by the village hall, is also delineated in green in Figure 1 below was infilled and replaced with soakaways and a perforated pipe (installed as a solid length of pipe) during the works carried out to improve the drainage system in the area post the 2007 flood event.

<sup>2</sup> Source: [Cranfield University Soilscales](https://www.cranfield.ac.uk/research/soilscales/)

Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events. The EA's 'Flood Risk from Surface Water' map and aerial height data shows a topographic depression at the junction of Capel Street and Lancaster Avenue, resulting in a 'high' risk area. The areas indicated to be at high risk of flooding from surface water sources are relatively consistent with the locations of reported properties affected by the flood event.

Figure 1 – EA's 'Flood Risk from Surface Water' map (© Environment Agency. Contains Ordnance Survey data © Crown copyright and database right 2024). An extract of this mapping for the wider area is included within Annex 2.



## Flood History

There are no recorded incidents of flooding in the area contained within the Strategic Flood Risk Assessment (SFRA 2019) and Surface Water Management Plan (SWMP 2011). Residents recall a number of historic flood events that have occurred in Capel-le-Ferne prior to the event on the 04-05 November 2023. This information has been supplemented by testimony gathered during a meeting with residents held in Capel-le-Ferne Village Hall on the 05 December 2023.

Information on historic flooding, provided by the residents have been collated and summarised in Table 2 (below).

Table 2 - Summary of the historic flood records

Location	Date of Flooding	Details of Flooding	Source of Information
Lancaster Avenue and Capel Street	2007	Surface water runoff from blocked gully and agricultural field caused road and property flooding	Local Residents testimony KCC Highways testimony Newspaper articles shown to investigators. Member of Parliament (MP) Involvement
Capel-le-Ferne	1996	Surface water	Local Residents testimony
Capel-le-Ferne	1976	Surface water	Local Residents testimony
Capel-le-Ferne	1974	Surface water	Local Residents testimony
Capel-le-Ferne	Unknown	Details not provided. Statement made by local resident that the area had been subject to “5, now 6 flood events”.	Local Residents testimony

Following the 2007 flood event, and involvement from the local member of parliament, a KCC Highways flood alleviation scheme was implemented with the aim of reducing flood risk in this location.

This scheme included the proposed installation of 4 additional high-capacity road gullies on the northern site of Lancaster Avenue. A new drainage pipe was also added, connecting these gullies to a new 750mm perforated pipe and chamber running south to north alongside the village hall and footpath. This new network was designed to connect into the existing highways network north of the village. Design drawings show that the existing network was to be retained (with the exception of the removal of a small length of pipe connecting the existing network to the ditch adjacent to the village hall).

## Rainfall

The nearest public rain gauge is “The Lower Standen rain gauge”, located approximately 1.84km to the northwest of the flood incident at Caple-le-Ferne. This gauge recorded 42mm of rainfall throughout the day on 04 November, with 13.2mm of rainfall in 1 hour 45 minutes during the flood incident<sup>3</sup> between 23:00 (04 November) – 00:45 (05 November).

Private rainfall data was also obtained from a rain gauge very close to the flood location and controlled by a local resident. This data closely matches the Lower Standen Rain Gauge over the period preceding the flood event and suggests rainfall at Capel-le-Ferne was not significantly different from that observed at the Lower Standen Rain Gauge site.

To assess the rarity of the rainfall that fell during this period, the Flood Estimation Handbook<sup>4</sup> (FEH) Event Rarity Calculator has been used to obtain an Annual Exceedance Probability (AEP), which is the likelihood of rainfall of this depth (or more) falling within one year. For instance, a rainfall event with an AEP of 1% means that rainfall of this depth, or greater, would only be expected to occur on average once in 100 years, or on average 10 times in 1,000 years.

It is important to note that this rainfall analysis and the AEP estimates are approximates only, based on the observed rainfall data, which come with a degree of uncertainty. Other factors such as catchment characteristics and antecedent rainfall conditions have not been considered for this analysis. An 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 influenced the flooding witnessed, rather than simply the magnitude of the rainfall event in isolation.

The assessment has been undertaken using the FEH22 rainfall model.

## Rain Gauge Analysis

Rainfall data from Lower Standen (Station Number: E5170. Grid Reference: TR237402) on 04-05 November 2023:

Rainfall: Daily total of 42.00mm, with 13.2mm falling during the flood incident (1 hour 45 minutes: 23:00 – 00:45)

Estimated Annual Exceedance Probability (23:00 – 00:45): 1 in 1.4-year return period, 69.44% occurrence in any given year.

Antecedent Rainfall: 8 days prior to the rainfall event a total of 155.2mm of rain fell.

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<sup>3</sup> Source: [Rainfall Gauge Station](#)

<sup>4</sup> 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.

Estimated Annual Exceedance Probability (8 days): 1 in 60 year return period, 1.60% occurrence in any given year.

The closest rainfall gauge is located in Lower Standen. There are two other rainfall gauges located at Dover, approximately 8km to the east of the catchment, and at Cherry Gardens (Folkestone), approximately 4km to the west of the catchment. However, at the time of the analysis, rainfall data for the time of interest is either unchecked or missing. Therefore, rainfall data at these locations has not been referenced further.

The total daily rainfall for 04 November was 42.0mm, approximately a 1 in 1.8 year return period. The flood incident on 04-05 November at 23:00 – 00:45, recorded 13mm of rainfall, a 1 in 1.4 year return period. In both cases this is a relatively small rainfall event, however, it is also important to consider the weather conditions leading up to the flood incident.

A rainfall event of similar magnitude (41.0mm total daily rainfall) occurred approximately 1 week prior (28 October 2023) to the flood incident at Capel-le-Ferne.

When considering the antecedent weather conditions from 27 October 2023, up to and including the flood incident, the total rainfall recorded at Lower Standen was 155.2mm. This equates to a 1 in 60 year return period event, resulting in an estimated 1.6% AEP.

Based on historic rainfall records for this location, which start in 1998, the event observed in 2023 that resulted in the flooding witnessed at Capel Street, is unlikely to have caused the flooding in isolation. It is therefore concluded that additional factors separate from the prolonged and high intensity rainfall are likely to have contributed to the flooding on the 04-05 of November 2023.

## Flooding Description and Mechanism

The short period of intense rainfall alongside the antecedent weather conditions is likely to have resulted in a significant volume of runoff from the agricultural land. This runoff followed the natural topography of the land flowing southeast towards Capel-Le-Ferne. Water entered the village flowing past the Baptist Church which fronts onto Capel Street. From here water travelled onto and across the carriageway (Capel Street).

Drains along the southern part of Capel Street were overwhelmed, water continued to flow overland past the junction of Capel Street and Lancaster Avenue, and accumulated in the topographic depression between Capel Street and Elizabeth Drive. The accumulation of floodwater was exacerbated by a blocked drain to the north of Lancaster Avenue, hence forth referred to as the “Northern Capel Street Drain” (due to the fact that it drains the northern half of Capel Street in addition to parts of Lancaster Avenue).

Additional drainage gullies, also located within Lancaster Avenue, are connected to a separate network (referred to as the “Flood Alleviation Drain”), failed to drain runoff at a sufficient rate to prevent flood water from accumulating. This was due to the high volume of water which meant the drains were unable to convey water further downstream, this may have been exacerbated by obstructions in the ‘Flood Alleviation Drain’ network. (Figure 3).

With drainage overwhelmed, runoff accumulated within the topographic depression and water levels continued to rise. Based on eyewitness reports (Kent Highways and Local Residents) flood water levels began to recede once the manhole cover at the junction of Capel Street and Lancaster Avenue was lifted. This manhole provided a new pathway for floodwater to bypass the Northern Capel Street Drain and Flood Alleviation Drain by allowing water to drain into the Southern Capel Street Drain.

The factors which are likely to have contributed to the magnitude of the flooding witnessed are described in further detail below:

**1. Topographic Depression** – The affected properties and highway are located within a shallow topographic depression. As such, there is no natural mechanism for water accumulating within this low area to freely drain away. The area is therefore solely reliant on urban drainage systems to prevent flooding.

**2. Limited Capacity of Highway Drainage Network due to obstructions** – There are three highway drains located within the affected area and each system is discussed further below:

**3a. Southern Capel Street Drain** - This drain passes under the pavement south of Lancaster Avenue and connects the gullies along the southern part of Capel Street, with drains near the village hall. A local resident suggested the gullies along Capel Street (south) were not draining during the flood event, as water flowed around the church and into the road. This suggests the capacity of this drain may have been exceeded by the high volume of water flowing across the road.

There are no gullies connecting into this drain between the junction of Capel Street and east of Elizabeth Drive (close). As a result, floodwater accumulating within the topographic depression did not drain into this part of the network until a manhole at the southern corner of Lancaster Avenue and Capel Street was lifted. Several residents suggested that this activity resulted in a reduction in flood level, as water began to drain away (or drained away faster) from the area. Lifting of the manhole cover was also reported to have been accompanied by a sucking “vacuum” sound, as water began draining into this drainage system.

There is no natural overland pathway for floodwater to flow from the topographic depression into the valley to the northeast, and as such, any floodwater that does accumulate in this low area cannot drain away. As a direct consequence, there is a reliance on the condition of the drainage networks to manage the risk of flooding at this location.

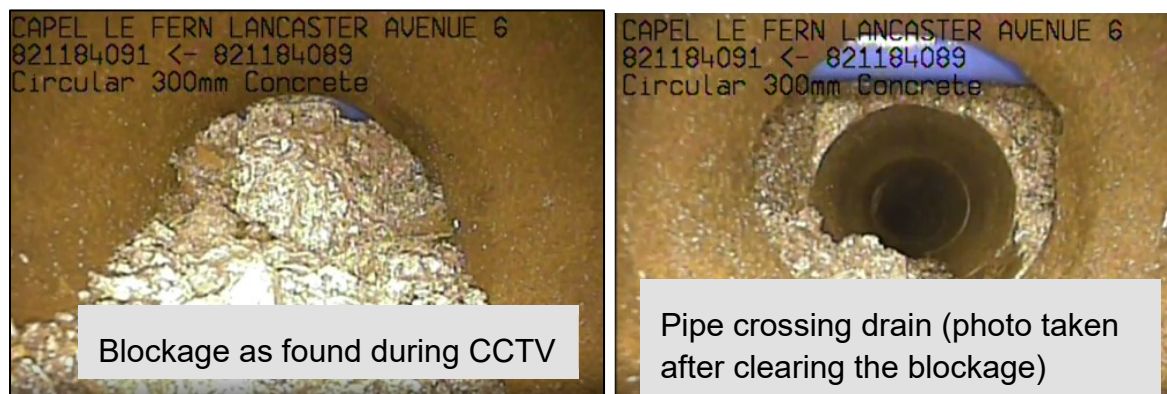
**3b. Northern Capel Street Drain** – This drain passes underneath the pavement and private land north of Lancaster Avenue and connects with gullies along the northern part of Capel Street. At a manhole near the junction of Capel Street and Lancaster Avenue (north of the road), there is an overflow from the drainage network into a flood alleviation system (installed following the 2007 flooding). The drain continues before connecting with two of the four high-capacity gullies. This drain was installed following the 2007 flooding, along with several smaller gullies that predate the 2007 scheme.



During the flood event, it is likely that this network was blocked due to a combination of factors, such as, a water main which crosses the pipe (third party damage due to subsequent installation of water main) and general debris. The location of this blockage was downstream of the flooding at the junction between Capel Street and Elizabeth Drive.

The blockage is shown in Figure 2 below.

*Figure 2 – Blockage at the junction of Capel Street and Elizabeth Drive.*

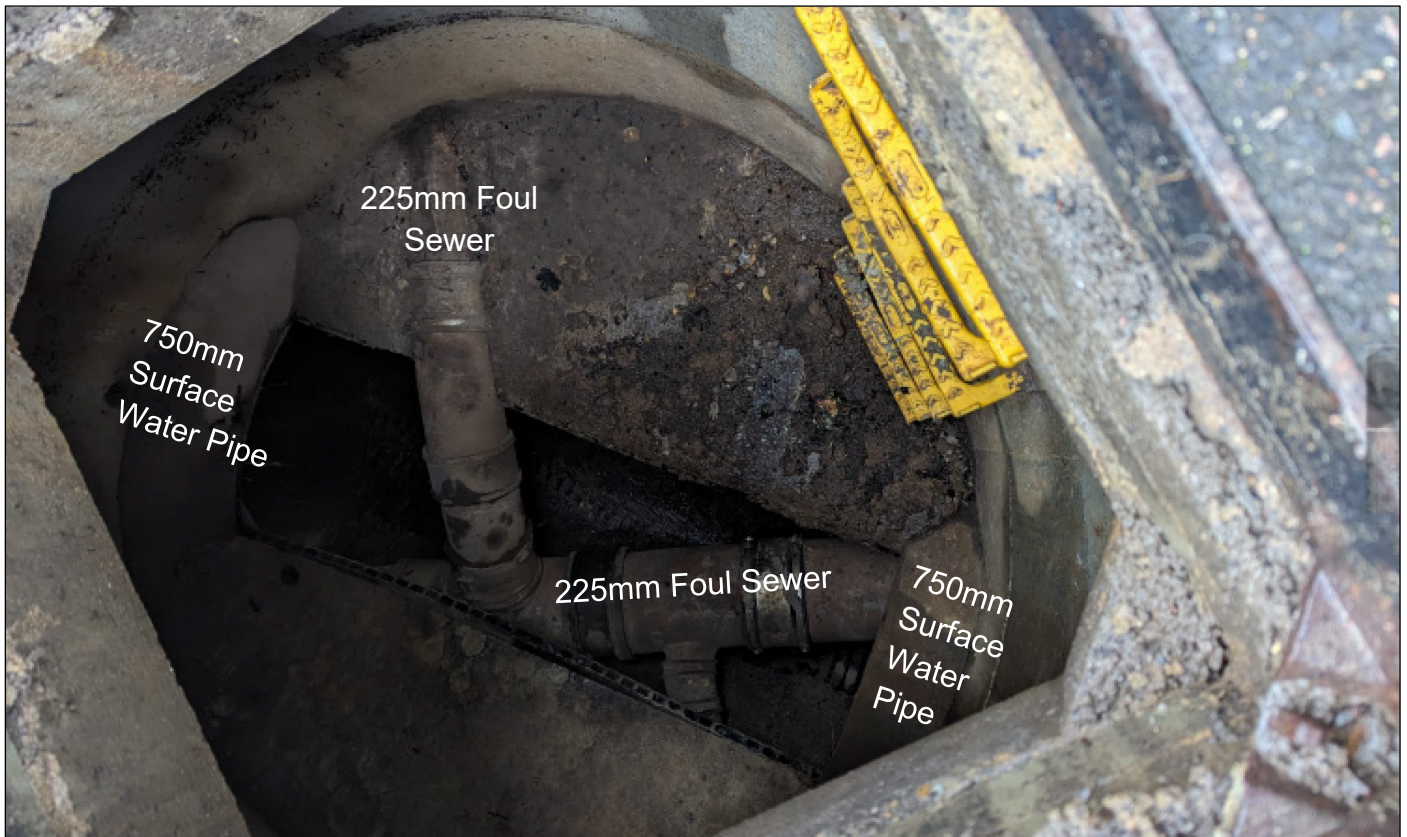


The blockage in this network prevented the connected gullies from draining floodwater away from the area during the flood event. Gullies to the east of the blockage, at the entrance to Elizabeth Drive, would have been located beyond this blockage and consequently, may have allowed water to drain away from the area. The presence of the gullies located beyond the blockage potentially limited the depth and extent of the flooding witnessed, i.e., once the flood extent/depth had reached a point where water could enter the unblocked drainage network.

**3c. Flood Alleviation Drain** – An additional drain was constructed under Lancaster Avenue following the 2007 flooding. This pipe connects two of the high-capacity gullies in Lancaster Avenue and drains water from the area that was affected to a 750mm diameter pipe, west of the village hall. This 750mm pipe drains into a soakaway which has a 225mm diameter overflow into the wider drainage network.

The hydraulic performance of the 750mm diameter pipe is impacted by an obstruction, (a foul sewer which passes through and blocks a significant part of the surface water pipe). This obstruction is shown in Figure 3 below.

Figure 3 – Significant obstruction to flow and area considered likely to be prone to blockages.



This section of the drainage network would be extremely prone to blockages, as mud or other debris could get lodged on the underside of the pipe. A blockage at this location may have contributed to the flooding on the 04 and 05 November 2023, by preventing floodwater from draining away via the high-capacity gullies.

A blockage at this location could have also prevented water from draining away via the overflow connection that exists between the northern Caple Street network and the flood alleviation network.

This mechanism of flooding (via a blockage) is supported by observations made by residents, who stated that the road gullies were not draining the water away. Notwithstanding these accounts, even in the absence of a blockage, the obstruction in the pipe is likely to have been sufficient to restrict the flow of water away from the area, which could have contributed to the flooding witnessed.

**Infilling of the Existing Ditch** – The historic ditch that used to be located behind the properties along Caple Street was infilled sometime after the 2007 flooding. If this ditch was still present and maintained, it would have provided some storage for the runoff from the field. This ditch would have the potential to reduce the volume of water that would eventually be discharged into the road. Notwithstanding this, as the historic ditch was not connected to the wider drainage network, its benefits are likely to be limited, and its removal alone is unlikely to be a significant factor in the flood event.

## Flood Response

During the flood event, a total of 6 properties were affected. KCC Highways attended the flood incident and Kent Fire Rescue Service (KFRS) also assisted with 3 fire engines/vehicles. It is understood from residents that KFRS assisted by pumping floodwater out of affected properties and gardens into the wider highway drainage network.

A volunteer flood warden attended the flood event.

Since the flood incident, following the standard procedure for KCC Highways in the aftermath of a flood event, an inspection and cleaning operation of highway drains and gullies in the immediate area affected was undertaken on 09 November 2023. Direct discussions with highways officers confirmed that this included the jetting of the road gullies and mainlines, including the drainage installed as part of flood alleviation works following the 2007 flood.

KCC has adopted a new risk-based maintenance appropriate to highway drains, which is now entering its third year. This has resulted in a significant increase in preventative maintenance by cleaning highway drains on an annual, biennial or triennial basis, depending on the assessed level of risk. Capel Street and Lancaster Avenue now receive biennial routine maintenance visits and Elizabeth Drive triennial routine maintenance visits in accordance with this recent policy. Previously minor roads had received reactive maintenance in response to flood incidents and reports of blocked gullies. All drains in the village are due for their next maintenance visit around July 2024 and will undergo future maintenance in line with this policy.

## Conclusions and Recommendations

On the 04 and 05 November 2023, a short rainfall event occurred which overwhelmed the drainage systems in Capel-le-Ferne. The nearest rain gauge recorded 42mm of rainfall throughout the day on 04 November and 13.2mm of rainfall was recorded between the hours of 23:00 (04 November 2023) – 00:45 (05 November 2023).

A rainfall event of similar magnitude (41.0mm total daily rainfall) occurred approximately one week prior to the flood incident at Capel-le-Ferne (on 28 October 2023). Rainfall was constant throughout the week, which resulted in the ground in the surrounding area and agricultural field becoming saturated. Consequently, the antecedent weather conditions *in combination* with the rainfall on 04-05 November is believed to have resulted in surface water running off the adjacent agricultural fields. This runoff accumulated in a localised depression with no natural drainage route. The location of this topographic depression is between the junction of Capel Street and Lancaster Avenue, and the junction of Lancaster Avenue and Elizabeth Drive. The highway drainage system could not convey this runoff away due to a combination of obstructions and the significant volume of the intense rainfall.

The result was at least six properties were affected by flooding, five of which are known to have flooded internally, as well as flooding within the road.

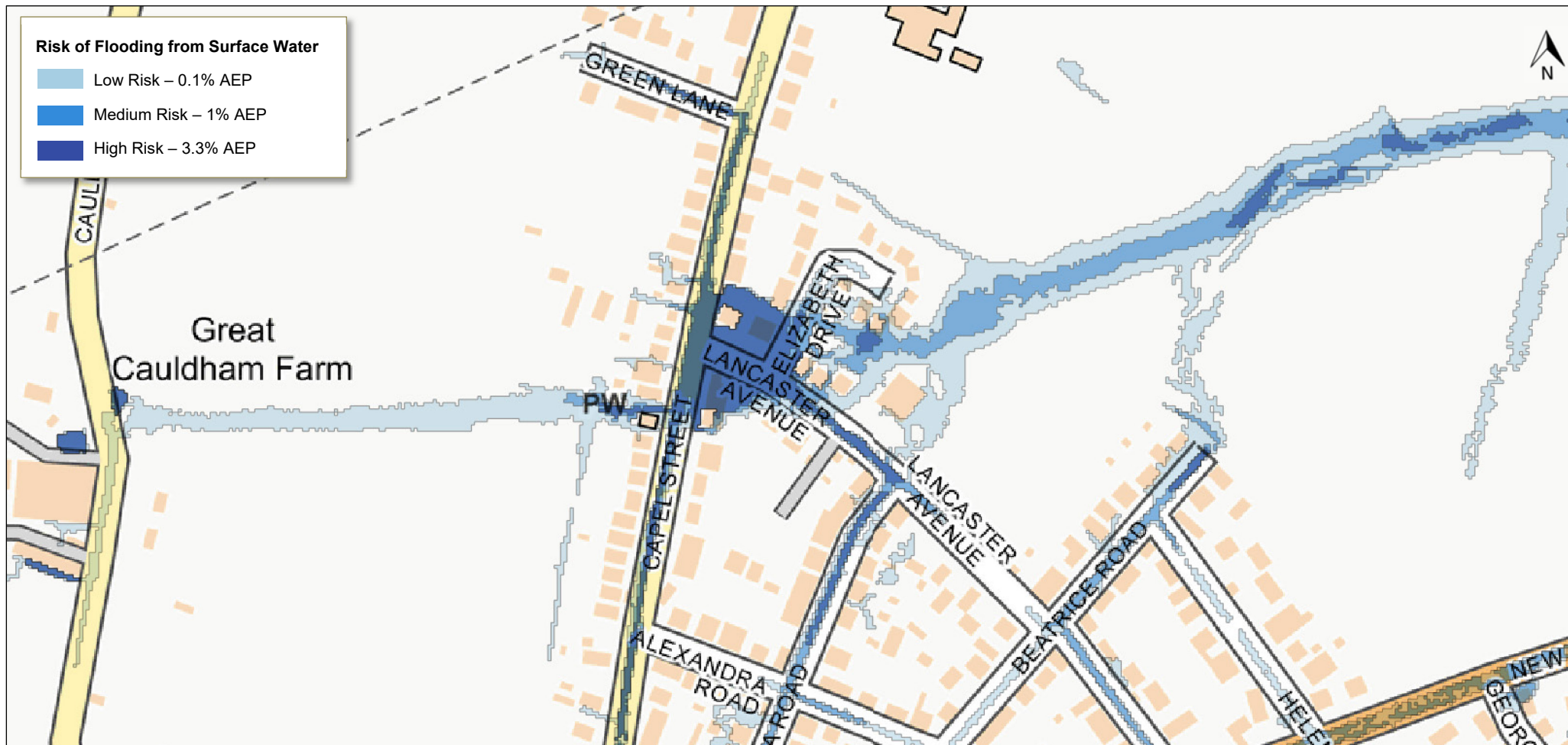
A number of options could be considered following the results of the flood investigation:

- An assessment of the existing drainage system should be carried out .,where defects are found in the existing drainage system these should be repaired, or if necessary, parts of the existing drainage network replaced.
- An assessment should be carried out to determine the potential for property level flood protection (PLP) measures to be used in this area. Whilst PLP measures will not reduce the likelihood of a flood occurring, they can potentially reduce the impact by preventing floodwater entering homes or other buildings, or making those buildings more resilient to flooding should it occur in the future.
- Local residents should be contacted regarding local flood risks, which should include consultation in regard to the actions the community could take in future flood events. It is noted that an Environment Agency Volunteer Flood Warden attended the site during the flood event, however, other measures should be implemented if this one volunteer is unavailable.

Annex 1 – Estimated flood extent of reported flood incident in Capel-le-Ferne. The estimated flood extent covers the roads only and not the properties which experienced flooding.



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



## Appendix A: Flood Surveys

Table 3 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 3 - Summary of flood surveys*

Location	No. of flood surveys sent	No. of flood surveys received
Capel Street	23	3
Lancaster Avenue	14	2
Elizabeth Drive	7	1
Cauldham Lane	3	0
Total	47	6