# Hertfordshire County Council
# Section 19 Flood Investigation Report
## Chapel Lane, Long Marston

**Long Marston in 2010**

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# Revision Schedule
**Hertfordshire County Council**
**Chapel Lane, Long Marston Flood Investigation Report**

December 2018
Version 5

| Rev | Date | Details | Author | Checked and Approved by |
|---|---|---|---|---|
| **1** | 31/10/2018 | First Draft | Ryan Thomas, Partnership & Scheme Development Officer | John Rumble, Head of Environmental Resource Planning |
| **2** | 05/11/2018 | Draft | Ryan Thomas, Partnership & Scheme Development Officer | John Rumble, Head of Environmental Resource Planning |
| **3** | 29/11/2018 | Final Draft | Ryan Thomas, Partnership & Scheme Development Officer | John Rumble, Head of Environmental Resource Planning |
| **4** | 10/12/2018 | Final | Ryan Thomas, Partnership & Scheme Development Officer | John Rumble, Head of Environmental Resource Planning |
| **5** | 14/10/2018 | Final – Typo corrected | Ryan Thomas, Partnership & Scheme Development Officer | Andy Hardstaff, Team Leader, Flood Risk Management |

## Explanation of Acronyms and Terms

| Acronym / Term | Explanation |
|---|---|
| **Adopted Highway** | The term has been used in this report to include all highways maintainable at public expense. This includes historic highways as well as those formally adopted through section 38 of the Highways Act 1980 and preceding powers. |
| **Antecedent conditions** | Antecedent conditions is a term used to describe the relative wetness or dryness of a catchment, which changes continuously and can have a very significant effect on surface water flows during wet weather. Antecedent moisture conditions are high when there has been a lot of recent rainfall and the ground is moist. Antecedent moisture conditions are low when there has been little rainfall and the ground becomes dry. |
| **Attenuation** | The processes of water retention on site slowly being released to a surface water/combined drain or watercourse. |
| **EA** | Environment Agency |
| **HCC** | Hertfordshire County Council |
| **LLFA** | Lead Local Flood Authority – This is the role assigned to the unitary or county council for an area with a range of duties and powers to support the management of local flood risk. |
| **LDA 1991** | Land Drainage Act 1991 – Legislation that sets out a range of roles and responsibilities relating to flood risk management. It is also the legislation that gives powers to local authorities to manage flood risk and highlights the role of the landowner to manage watercourses on their land to maintain the flow of water. |
| **Riparian Owner** | A riparian owner refers to a person who owns land bounding upon a river, lake, or other watercourse. |
| **RMAs** | Risk Management Authorities – Bodies identified in the FWMA 2010 with roles and powers to manage flood risk. In Hertfordshire this includes the County Council as Lead Local Flood Authority and Highway Authority, district councils, Highways England, the Environment Agency, the Bedfordshire and River Ivel Internal Drainage Board, Thames Water Utilities Limited and Anglian Water Services Limited. |
| **Storage** | An area or structure where surface water flows are retained. |
| **TfL** | Transport for London |
| **TWUL** | Thames Water Utilities Limited |

## Executive Summary

During the evening of 27 May 2018, Station Road and Chapel Lane was affected by flooding. The cause was intense rainfall that quickly turned into surface water flooding. This caused a pooling of water in the highway and a near miss of internal flooding from a surcharging manhole at the rear of a property in Chapel Lane. After visiting the property, it transpired that this potential flood event was the result of intense rainfall event and a pipe (herewith referred to as the orphaned asset) carrying an unknown source of water that was unable to effectively drain away through the network.

There was also significant flooding from the foul water network that was caused when a lightning strike in Tring caused a power failure to the pumping station that is also situated on Chapel Lane. This failure, combined with additional surface water draining to the foul water sewer, led to the foul water network surcharging and combining with the surface water flooding already taking place in Chapel Lane.

Hertfordshire County Council (HCC) in its role as Lead Local Flood Authority, on becoming aware of a flooding issue, has the responsibility to begin an investigation due to the uncertainty of the source of flooding and the organisation with primary responsibility for resolving it.

The main findings of this investigation are:

- The rainfall event on the 27 May 2018 was intense and the most significant rainfall event to occur in Tring over the last four years.
- The orphaned asset historically served Long Marston as a sewage pipe, draining originally to a sewage farm north west of Long Marston. This is now not occurring; however surface water is still draining to this asset.
- The orphaned asset was blocked and broken in a number of places downstream of the surcharging manhole; reducing the ability to drain water away from properties in Chapel Lane.
- Upstream of the surcharging manhole, the source of the orphaned asset was linked in some way to two highway gullies and associated pipes in Station Road.

The recommendations from this investigation for reducing the risk of flooding from the orphaned asset are:

- Further investigations to be conducted by the Highway Authority to ascertain the catchment size of the orphaned asset and to map where all the highway drainage discharges.
- The LLFA to continue its investigation to establish ownership and subsequent responsibilities related to the maintenance of the asset.
- Thames Water to continue investigating the foul water sewage network and establish where rainwater is entering its network.
- A partnership approach to look at options of changing the drainage arrangements in Long Marston. This should include evaluating changing the discharge location of the orphaned asset as well as replacing broken sections and clearing it of all blockages.

# 1. Introduction

## 1.1 Background

Long Marston suffered from property, highway and agricultural flooding in February 2014. A flood investigation was conducted under Section 19 of the Flood and Water Management Act by Hertfordshire County Council (HCC) as the Lead Local Flood Authority (LLFA), and this was subsequently published on Hertfordshire County Council's website[1]. The investigation concluded that flooding occurred as a result of a heavily saturated catchment, which inhibited infiltration and increased run-off volumes when a relatively small rainfall event occurred on 14th February. The investigation also found that the Tring Bourne (main river), which is the main point of discharge for the urban drainage network, was hydraulically under capacity to be able to effectively drain water away from Long Marston due to a number of culverted sections along the reach.

As part of the original investigation it was reported that a manhole to the rear of a property that flooded internally surcharged during the February 2014 flood event. An attempt to conduct a pipe condition survey (CCTV crawler unit) took place on the 17 October 2014; however the survey was not able to be completed as of a result of blockages within the pipe (see Figure 1). In conjunction with this, a detailed hydraulic modelling study was taking place in the catchment, which was evidencing that overland flows were also contributing to flooding in Chapel Lane. A decision was taken by HCC not to resurvey the chamber and connecting pipes, but to concentrate on the pre-feasibility study and wider catchment issues.

**Figure 1: Images of failed CCTV Survey (25/11/2014). Root penetration visible in both images**


On the 27 May 2018, a flood event was reported to HCC on Chapel Lane following extremely heavy rain. Residents identified that the same manhole chamber, as identified in 2014, surcharged and was the source of the garden flooding and the near miss. It was also reported that there were flooding issues related to the sewage network, as a direct

[1] https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/water/flood-investigations.aspx

result of excess water entering the foul network. Both mechanisms led to the Fire & Rescue service being called to respond and pump water away from properties Figure 2.

**Figure 2 HCC Fire and Rescue attending flooding to Chapel Lane 30 May 2018**

## 1.2 Justification for further Investigation

Under Section 19 of the Flood and Water Management Act (FWMA) 2010 HCC LLFA, on becoming aware of a flood in its area, must, to the extent that it considers it necessary or appropriate:

- Investigate the incident;
- Identify the Risk Management Authorities (RMAs) with relevant flood risk management functions;
- Establish if the relevant RMAs have responded to the flood event or are proposing to respond;
- Publish its findings; and
- Inform the relevant RMAs of its findings.

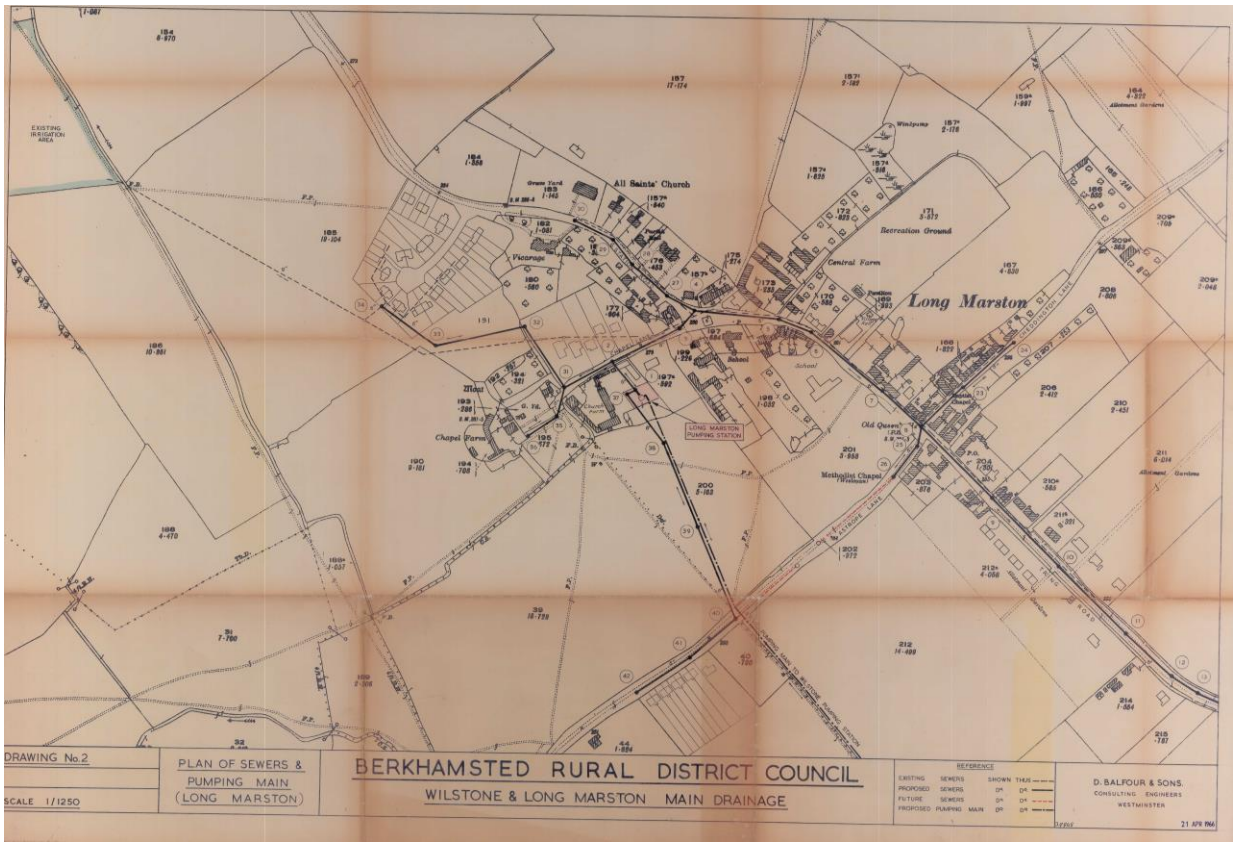
An RMA (as defined under Section 6, subsection 13 of the FWMA 2010), has certain powers to manage, regulate, assess and mitigate flood risk. The activities of the following RMAs have been examined as part of this Section 19 flood investigation for Long Marston:

- HCC as LLFA
- HCC as the Highway Authority
- Thames Water Utilities Limited (TWUL)
- Environment Agency (EA)
- Dacorum Borough Council

On receiving the report of the surcharging manhole chamber and that a property nearly flooded internally, it was determined that this incident met the criteria in Policy 2 of HCC's Local Flood Risk Management Strategy for an investigation to be undertaken due to the uncertainty of the source of flooding and the organisation with primary responsibility for resolving it.

For the purpose of clarity, during the investigation and after all survey work was completed, a map was provided by the Ting Rural Parish Council that detailed a historic sewage pipe that was in the same location as the pipe of this investigation (See Figure 3). The investigation has concluded that the unknown pipe and the focus of this investigation is the historic sewer pipe. It will be referred to as the 'orphaned asset' throughout this report as the status of the pipe is unknown.

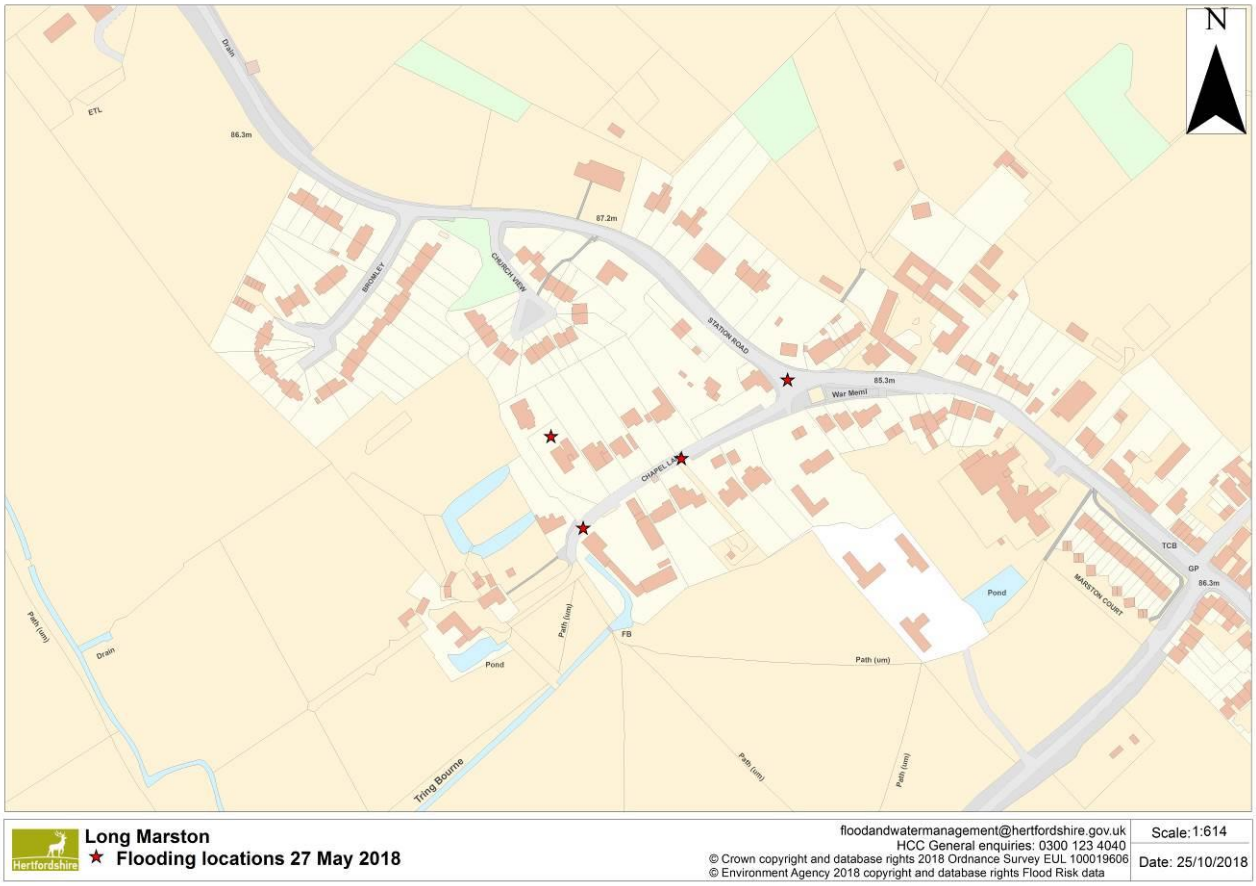
**Figure 3 Plan of sewers for Long Marston (1966)**




## 1.3 Location

Long Marston is a rural village surrounded by agriculture and a network of watercourses and artificial waterbodies. The flood incident occurred in a small concentrated area in Long Marston, which includes Chapel Lane and Station Road (See Figure 4

**Figure 4 Long Marston map, with flood locations 27 May 2018**




# 2 Assessment of the 27 May 2018 Flood Event

## 2.1 Rainfall Analysis

On the 27 May 2018, torrential storms caused flash flooding across the East of England and impacted many counties, with reports that an average month's rainfall fell within a one hour window in Birmingham[2]. In Hertfordshire, heavy rainfall was experienced throughout the county over a three day period, with a number of reports of flooding logged with the Highway Authority.

A severe rainfall event occurred in the most western part of the county; which is where Long Marston is situated (see Figure 5). The LLFA has access to rainfall event data to be able to track weather patterns and provide flood estimation to flood events. The area of Long Marston (circled in red) experienced the highest intensity of the storm, which can be seen in Figure 6 and distinguished by the grey colours of the radar. The intensity of the storm was also great, which peaked at just over 75 mm/hour (3 inches/hour) (see Figure 7).

[2] Source; https://www.birmingham.gov.uk/news/article/278/flooding_update_%E2%80%93_28_may_2018

**Figure 5 Rainfall Radar of rainfall 27 May 2018 with Hertfordshire shaded in light blue**

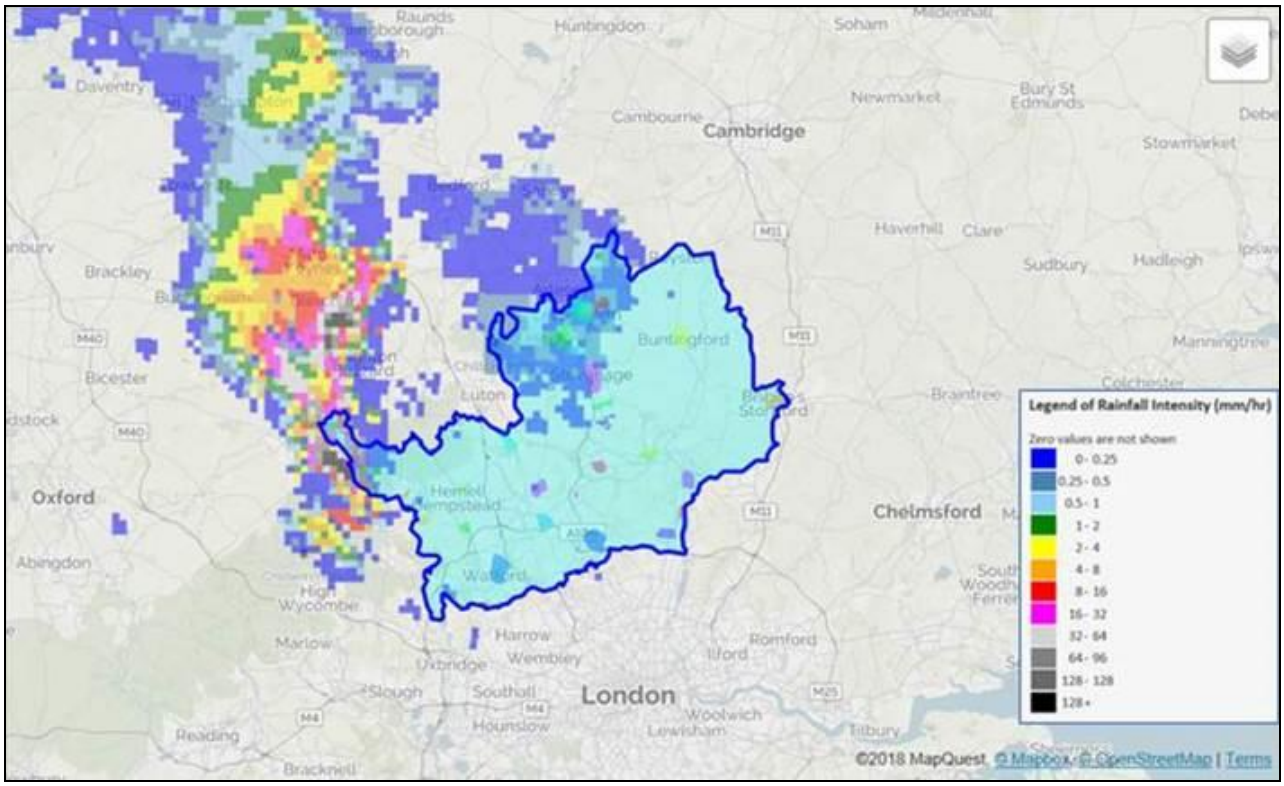



**Figure 6 Radar map at 21:35 on 27 May 2018**

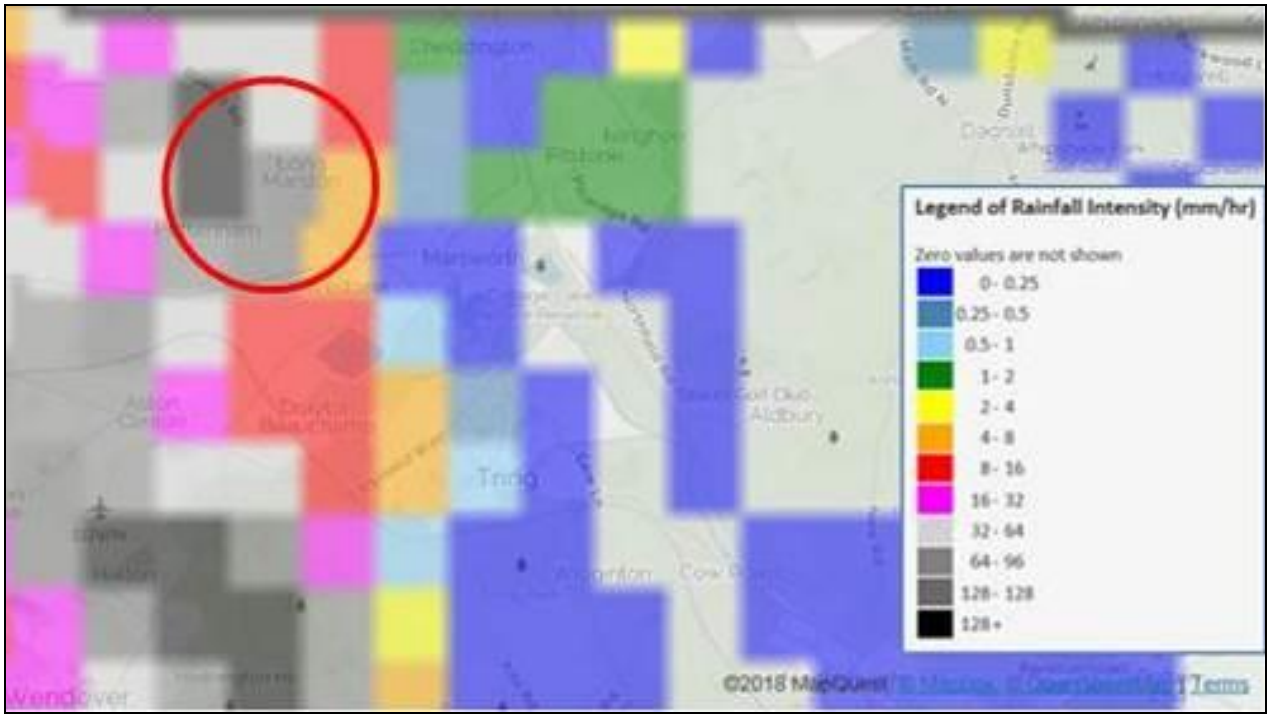
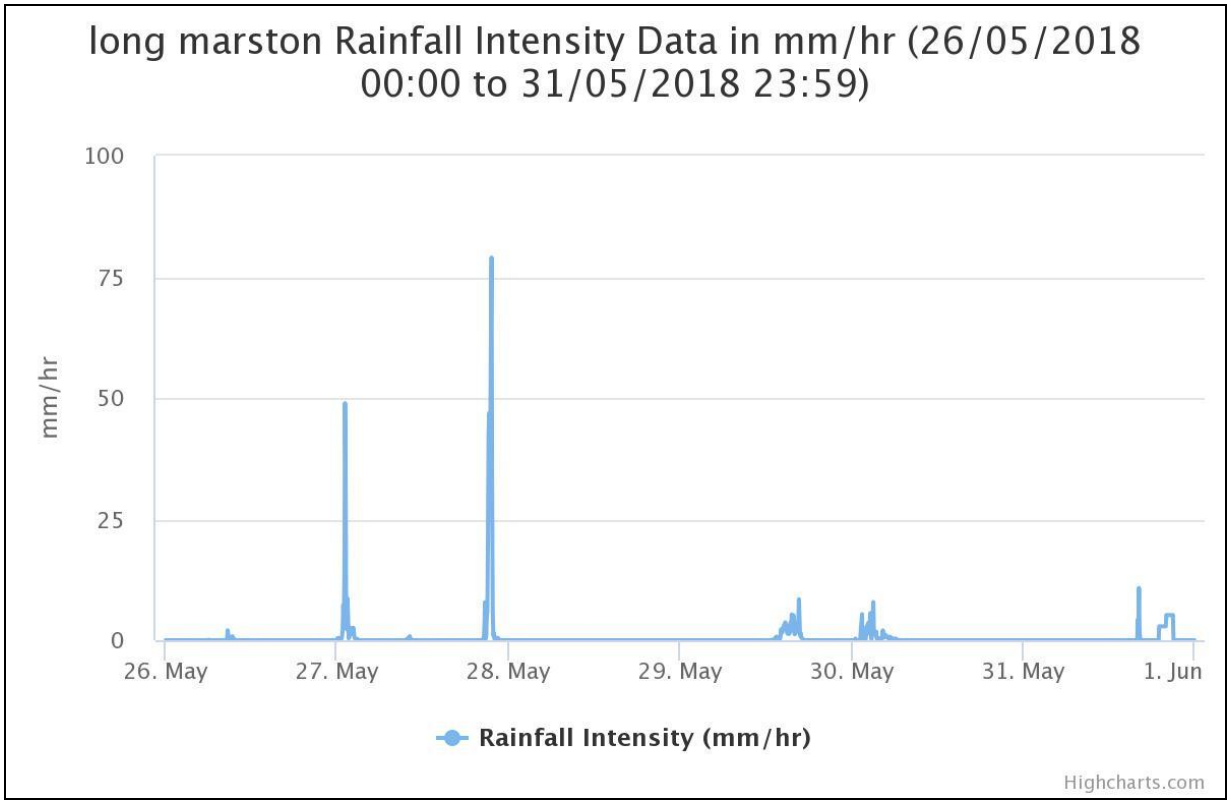


**Figure 7 Rainfall intensity for 26 to 31 May 2018**




Rainfall can be further defined as a return period or likelihood of occurring in a given year, which is an industry standard of attempting to rank flood events, known as the Flood Estimation Handbook (FEH). We have two sources of data to compile that information and rank the event:

- Rain gauge located south of Tring (TP261602)
- Weather radar.

There is a discrepancy between the two sources of data when applying the FEH to provide a return period. The rain gauge estimates a 1 in 5 year return period, whereas radar estimates that it was closer to a 1 in 24 year return period. These can be further expressed as a percentage, known as Annual Exceedance Probability (AEP). For this flood event, it is likely that the probability of this rainfall occurring in a given year, as measured from these two sources, would be 20% and 4.2% respectively.

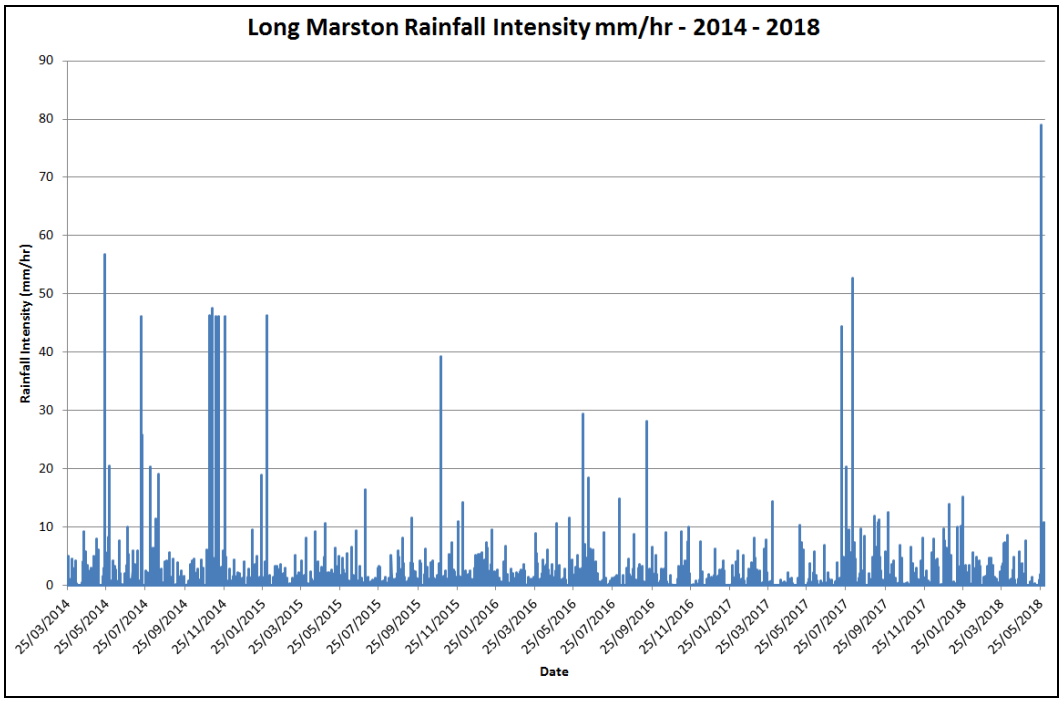
Discrepancies between radar and rain gauge data are not uncommon, and can be for a number of individual or a combination of factors linked to the way they capture data, including:

- Accuracy of weather radar and grid size used,
- Rain gauge location in proximity to the flood investigation site,
- Rain gauge free from malfunctioning.

## 2.2 Catchment response to rainfall

What can be concluded from both sets of information is that this was a considerable storm, with volumes of water that would have exceeded urban drainage networks in Long Marston. Over the past four years, this event was clearly the biggest in terms of intensity (see Figure 8 and the last bar on the chart), and considerably bigger than the rainfall event in February 2014 which triggered the winter flood event.

**Figure 8 Long Marston Rainfall Intensity Data over a four year period**




This data further evidences that saturation levels in the catchment are a critical component to understanding the flood risks to Long Marston. Saturation levels would have been very high due to a very wet winter in the February 2014 flood event; however the rainfall intensity was relatively small. In contrast, the rainfall event in May 2018 was much greater, however due to a very long spell of dry weather and the soil moisture deficit effect; there would have been considerable storage available in the catchment for infiltration to take place. It is therefore likely that the high intensity rainfall would have generated some runoff; however the catchment would have also intercepted and infiltrated as well.

# 3 Lead Local Flood Authority Investigation

There was limited information available to the LLFA ahead of the investigation; however we now know that the orphaned asset was originally serving the community as a sewage waste pipe (see Figure 3). Table 1 will provide the chronological events completed as part of the investigation.

## Table 1: Chronological breakdown of Investigation

| Stage | Dates | Section within report | Summary of actions completed |
|---|---|---|---|
| Initial Investigation (site visit) | 22 June 2018 | 3.1 | • Meeting with residents on Chapel Lane impacted by flood event<br>• Catchment walked to ascertain what could be established above ground |
| Desktop Study | 25 June – 5 July 2018 | 3.2 | • No maps could be located that identify the orphaned asset<br>• Land registry search has drainage identified for properties on Chapel Lane but no plan provided |
| CCTV survey and initial results | 2 July to 7 September 2018 | 3.3 | • CCTV only partially successful due to the poor condition of the drainage network and large volumes of silt<br>• Some sections areas of drainage pipe completely collapsed and restricting flow<br>• Upstream source only identifiable through dye testing |
| Discussions with RMAs | 29 July 2018 | 3.4 | • Initial discussions with RMAs following some of the results from the CCTV survey.<br>• Source of water was still unidentified at this time |
| Parish Council Meeting and site visit TWUL | 30 July 2018 | 3.4.1 | • Parish Council called a meeting with TWUL to discuss failure of Pumping station during 27 May flood event<br>• HCC as the LLFA invited due to historic background of the area<br>• Agreed a partnership approach to investigate the causes of flooding<br>• Catchment walked with TWUL colleagues<br>• Identification of sealed sewer manholes on Station Road |
| Site visit with identified RMAs Highway Authority | 18 September 2018 | 3.4.2 | • Catchment walked with Highway Authority drainage colleagues<br>• Key catchment characteristics discussed |
| Parish Council Meeting | 25 October 2018 | 3.4.1 | • CCTV survey information presented to the Parish Council<br>• TWUL also presented findings from their investigation<br>• LLFA asked the Parish for any additional information that would aid understanding of the orphaned asset |
| Historic sewage plan received from the Parish Council | 26 October 2018 | 3.5 | • A historic sewage plan identified the orphaned asset<br>• Plan was shared with the Highway Authority and TWUL |
| End of Section 19 Investigation | 29 October 2018 | N/A | • Enough data captured to complete and publish draft flood investigation |

## 3.1 Initial Investigation

On being notified of the flood event, a site visit took place with the impacted property owners and the LLFA on the 22 June 2018. The manhole chamber to the rear of their garden was lifted and was 30% full of clear water. This manhole cover was also lifted in 2014 and connections in the chamber were all visible (see Figure 10). This indicated that there has been a change in circumstances, either more water was draining to the orphaned asset or water could now not drain away.

After talking with other local residents, it was identified that the downstream route discharged to the Tring Bourne, as it used to carry sewage to a defined sewage farm. This is later confirmed and evidenced on the 3rd edition Ordnance Survey map (see Figure 11). This meant that the pipe crossed a farm to the north-west of the properties on Chapel Lane. After visiting the farm, a number of raised manholes were located (See Figure 12 for an example). It was noted during this site visit that the manholes were not benched in properly; allowing silt and debris able to easily enter the chamber and block flow through the orphaned asset (see Figure 13).

## 3.2 Desktop Study

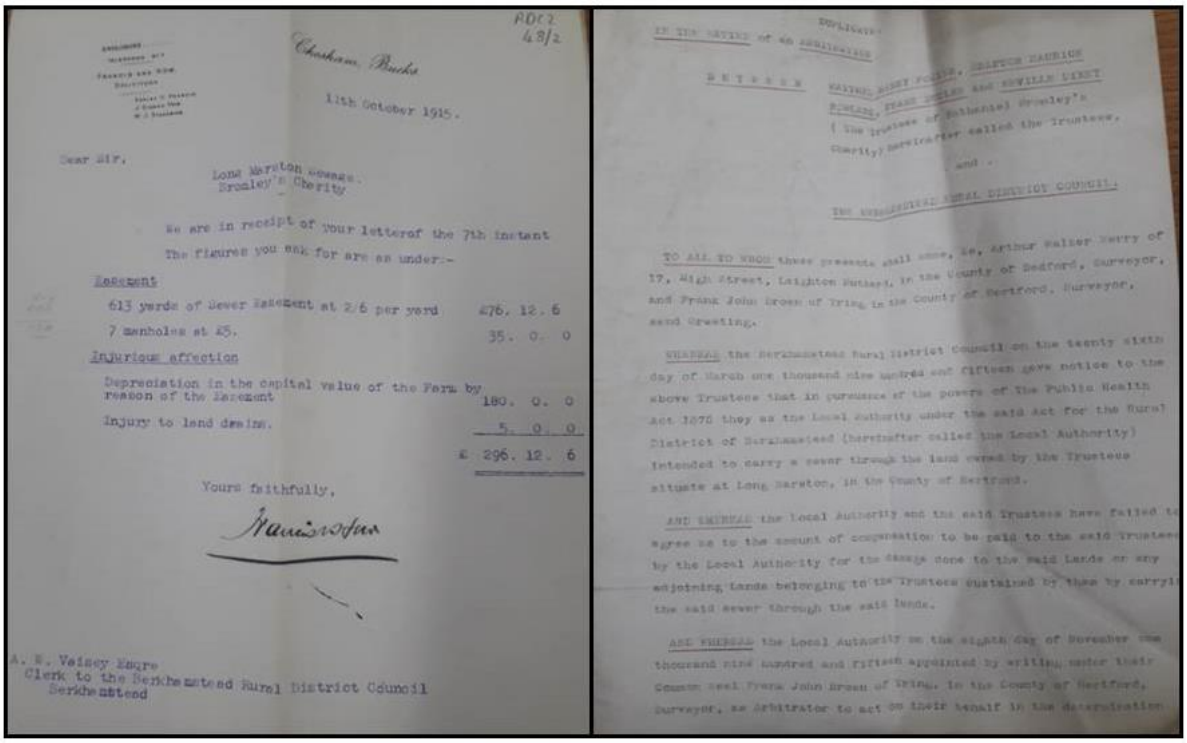
Initial desk studies tried to ascertain ownership of the orphaned asset to establish the upstream and downstream extents; however it was not plotted on the TWUL asset register and was not previously known to HCC. After searching through historic HCC records, only correspondence from the local land owners and the serving of Notice by Berkhamsted Rural District Council under the powers of the Public Health Act (1875) proposing to lay the sewer through their land could be found (see Figure 9).

A drainage asset was documented on Land Registry property registers for a number of properties on Chapel Lane, yet the route was not clarified or provided.

It's our considered opinion from the available evidence that the orphaned asset was constructed by the Berkhamsted Rural District Council to provide a positive sewerage network to remove property foul water from the village, instead of the use of property level septic tanks circa 1916. As Berkhamstead Rural District Council would have been responsible for all drainage functions, it is likely that the function of the pipe was to drain surface water as well as foul water away from Long Marston. The surface water occurring periodically would have provided a 'flushing effect'; regularly pushing solids through the network and acting as a means to clean the pipe.

At the time of our investigation however, there was no known route of the pipe, no identified owner and no responsibilities designated to previous and future management and maintenance. Upstream from the flooded property, a manhole on the same line was located to the rear of a property (see Figure 14). With no other manholes identifiable upstream, an underground survey (CCTV) was required to establish the source upstream of this location and also the condition the pipe throughout its length.

**Figure 9 Correspondence circa 1915 held at the County Council**



Chesham, Bucks.

11th October 1915.

Dear Sir,

Long Marston Manors.
Bromley's Charity

We are in receipt of your letter of the 7th instant

The figures you ask for are as under:-

Easement

613 yards of Sewer Easement at 2/6 per yard 476. 12. 6

7 manholes at £5. 35. 0. 0

Injurious affection

Depreciation in the capital value of the Farm by reason of the Easement 180. 0. 0

Injury to land drains. 5. 0. 0

£ 296. 12. 6

Yours faithfully,

A. E. Vesey Esqre
Clerk to the Berkhamsted Rural District Council
Berkhamsted

IN THE MATTER of an ARBITRATION

BETWEEN

THE BERKHAMSTEAD RURAL DISTRICT COUNCIL

TO ALL TO WHOM these presents shall come, We, Arthur Walter Berry of 17, High Street, Leighton Buzzard, in the County of Bedford, Surveyor, and Frank John Brown of Tring in the County of Hertford, Surveyor, send Greeting.

WHEREAS the Berkhamsteas Rural District Council on the twenty sixth day of March one thousand nine hundred and fifteen gave notice to the above Trustees that in pursuance of the powers of The Public Health Act 1875 they as the Local Authority under the said Act for the Rural District of Berkhamstead (hereinafter called the Local Authority) intended to carry a sewer through the land owned by the Trustees situate at Long Marston, in the County of Hertford.

AND WHEREAS the Local Authority and the said Trustees have failed to agree as to the amount of compensation to be paid to the said trustees by the Local Authority for the damage done to the said Lands or any adjoining Lands belonging to the Trustees sustained by them by carrying the said sewer through the said lands.

AND WHEREAS the Local Authority on the eighth day of November one thousand nine hundred and fifteen appointed by writing under their Common Seal Frank John Brown of Tring, in the County of Hertford, Surveyor, as Arbitrator to act on their behalf in the determination

**Figure 10 Standing water in the manhole chamber of the flooded property (Left image 2018, Right image 2014)**

**Figure 11 1926 OS map identifying Sewage Farm in red circle**

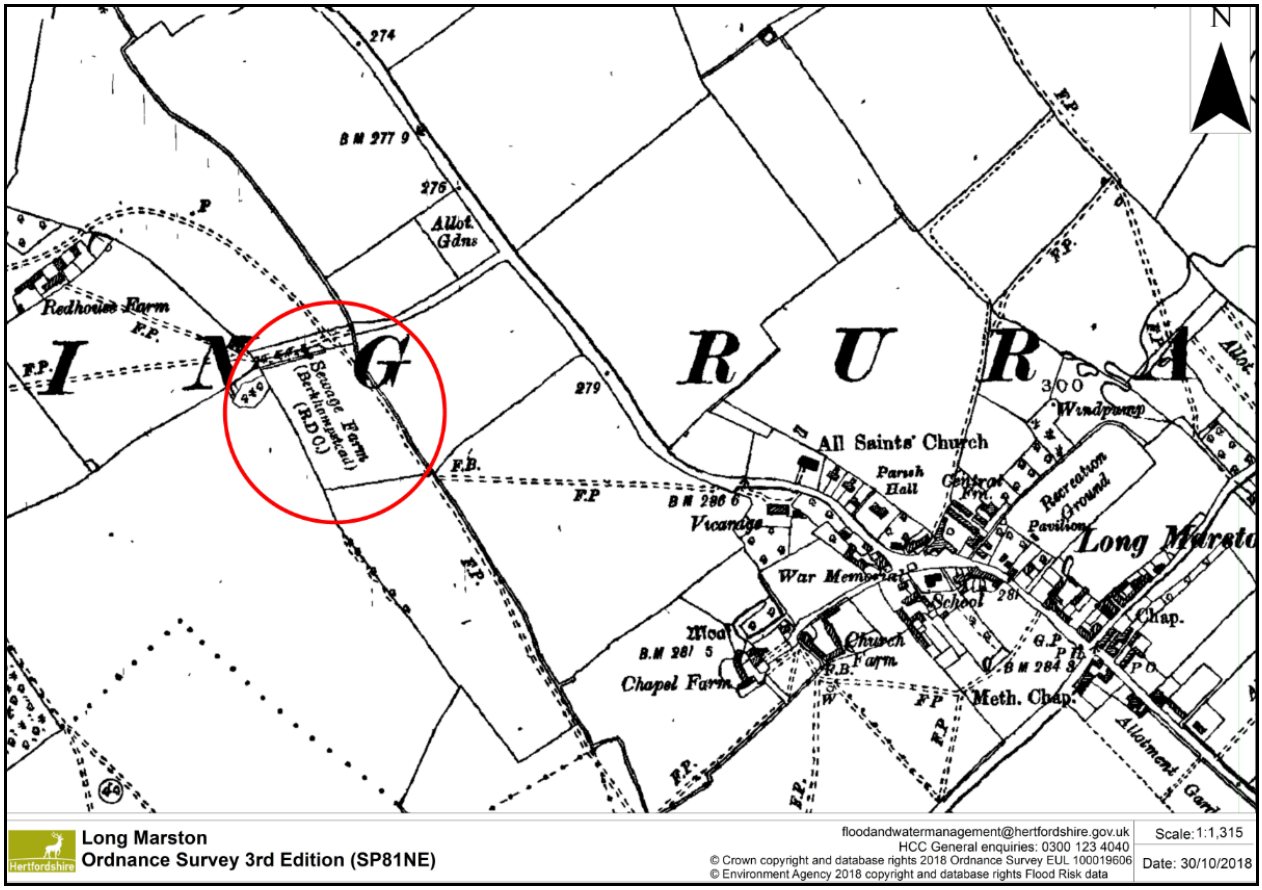



**Figure 12 An example of a raised manhole through the farm near the pipe outlet**

**Figure 13 Silt and debris entering a chamber within the farmers field near the outlet**

**Figure 14 Manhole found upstream of flooded property**

### 3.3 CCTV survey and initial results

The connectivity of the pipe was established through a combination of CCTV surveys, dye testing and electronic location equipment to establish the route of the pipe. See Figure 15 for a connectivity map establishing what could be ascertained from the survey.

#### 3.3.1 Upstream (source)

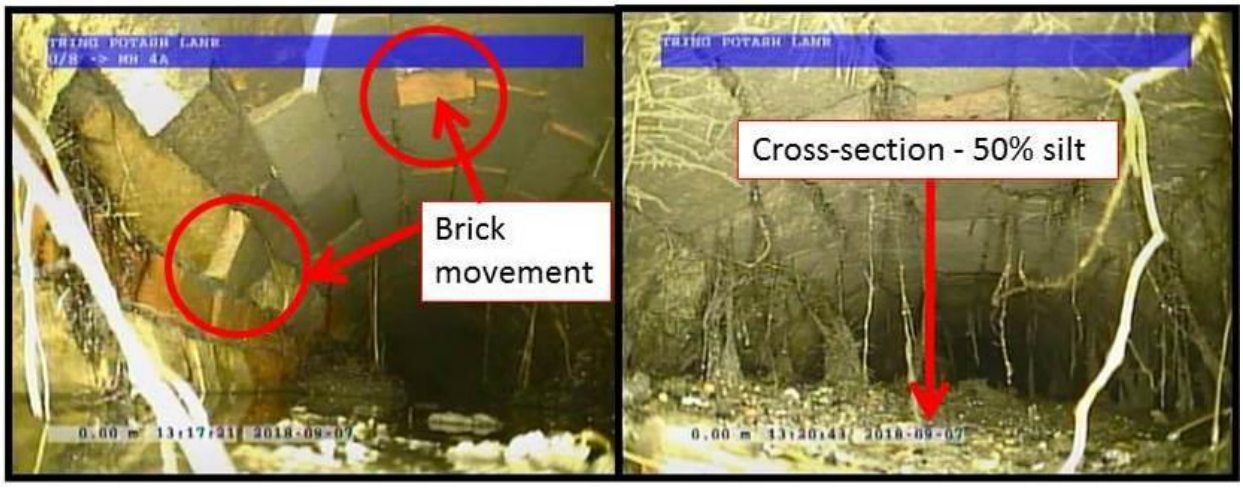
Upstream of the flooded house was traced to a manhole within the verge along Chapel Lane (see Figure 16). This manhole chamber had very old brick arches on the incoming and outgoing connections, therefore establishing that the orphaned asset was likely to be retrofitted at some point due to the change in construction (to a clay pipe).

Both of the brick arch culverts were heavily silted with root penetration visible from the inlet and it appeared the culvert in poor condition (see Figure 17). The pressure generated from cleaning culverts can cause older culverts to collapse, therefore it was decided that the risk was too great for these culverts and the survey was abandoned.

## Figure 15 Results from the Connectivity Survey

**Figure 16 Manhole chamber where the source of the orphaned asset originates with internal photograph**


**Figure 17 Silt and issues of structural integrity in culvert**




### 3.3.2 Downstream

From the flooded property, the culvert goes a considerable distance before it discharges to the Tring Bourne. The clay pipe was in poor condition throughout, with many areas totally submerged due to root penetration and collapses in the pipe (see Figure 18). The pipe was attempted to be cleaned to be able to complete the survey; however as the pipe was

lying very close to the surface (See Figure 19), the pressure of the jetting unit caused the pipe to break when it was attempted. The survey was once again abandoned due to the risks that this posed to the integrity of the pipe.

It was noted during the investigation that there were a number of manhole chambers in the field which had varying depths that didn't align with one another. This couldn't be investigated as part of this survey however there would be a benefit in understanding the full connectivity in the farm in the future when considering options.

**Figure 18 Pipe totally submerged and 100% blocked**

**Figure 19 Collapse of soffit during the investigation**

### 3.3.3 Dye Test upstream of the source

As the CCTV unit was unable to travel upstream of the manhole located on Chapel Lane, a dye test was performed in all drainage assets within Station Road to establish if any drained to the manhole chamber identified in Figure 16. This resulted in two roadside gullies being confirmed to drain into a separate pipe network that in some form is connected to the brick arch culvert (see Figure 20 for route and photographs). The dye test could not identify how the pipes were connected, so further investigations are still required.

**Figure 20 Dye testing locations**


## 3.4 RMA and key stakeholder engagement

### 3.4.1 Tring Rural Parish Council and TWUL consultation

In response to the flood event of the 27 May 2018, the Parish council contacted TWUL to discuss the failure of the pumping station on Chapel Lane and subsequent foul water surcharging in Chapel Lane and Station Road. TWUL provided evidence that the pumping station failed on the 27 May due to the storm disrupting a power station in Tring. This caused a loss of power to the pumps, resulting in water unable to discharge away from the pumping station. Water therefore started to back up and surcharge in close proximity of the pumping station. This would have been exacerbated with additional surface water flows draining to the foul network.

Historically, there have been incidents where additional surface water draining to the pumping station has caused the pumping station to have to discharge additional water that it is not designed to do, resulting in problems across the network.

A depth logger has been installed upstream of the pumping station within the foul network to monitor diurnal flow and any abnormal flow changes. Initial results indicate sudden increases in water level within the foul network after periods of prolonged rainfall, but the station is still operational and pumping flows out of the catchment. Water levels reduce very quickly, suggesting that the source of the additional flows has stopped rapidly. There are a number of possibilities as to how and why this might be happening, for example property roof drainage draining to private foul water sewers that are discharging to the public sewer, instead of individual soakaways. At an individual property level, it would not cause concern; however if there are many properties misconnected this can put a significant strain on the foul water network.

On attending a specially arranged Tring Rural Parish Council meeting on the 30 July 2018, there was a need to combine this investigation being conducted by the LLFA with investigations proposed by TWUL. To achieve this, the following actions took place:

- A joint site meeting, that included walking through the findings gathered from the LLFA survey (Figure 15).
- An agreement of sharing of all data between TWUL and HCC
- Attending of a second Parish Council meeting to provide feedback of progress made to date (24 October 2018).

The partnership with TWUL is significant due to their theory of how rain water could be draining to the foul pumping station. There are foul water manhole covers situated within the highway, on Station Road and at the Chapel Lane Junction, which have been identified as leaking as of a result of standing water in Station Road (this pooling of water is evidenced, see Figure 21). This standing water is likely to be the result of the water attempting to enter the gully network but can't as the gully's are connected to the orphaned asset that has been proved, through the recently conducted survey, as being blocked and collapsed in a number of places.

Since the flood event that took place in May, TWUL have now sealed these at risk manhole covers to stop pooling water draining to the foul water sewer; and are intending on sealing more in Station Road where the pooling of surface water is known to be taking place. This, if it is the cause for the foul water network to surcharge, will help reduce foul water flood risk, however may inadvertently increase flood risk to the road and subsequent surrounding properties from what the situation is now. The flow monitor in the sewer will allow TWUL to monitor if this has made a difference during future rainfall events.

### 3.4.2 Highway Authority

Highway flooding has only been reported after heavier rainfall events and not on each rainfall occurrence. A site visit was conducted with the Highway Authority to discuss the findings of the dye test survey (see Figure 20). After walking the catchment, it was clear that further investigation would need to take place to ascertain the following:

- Ownership/maintenance responsibilities of the pipes draining the highway gully network on Station Road and how big the catchment is (as identified in Figure 20).
- The connectivity of these pipes under Station Road and how they connect to the brick culvert in Chapel Lane

The historic sewage plan, which we did not have during this site visit, has now identified that the pipes receiving highway drainage could extend much further than just the junction of Station Road and Chapel Lane (see Figure 3). A survey is now required to confirm this connectivity to establish how much water is draining to the orphaned asset.

**Figure 21 Standing water on Station Road on 27 May 2018**

### 3.5 Berkhamsted Rural District Council sewer records

When the LLFA reported back to the Parish Council (24 October 2018) the findings to date (see Figure 15), members of the parish identified that they had seen a historical drawing that identified a pipe that may be the same pipe that the LLFA were investigating. Following the meeting, the plan was found and sent to the LLFA (See Figure 3).

This plan identifies the old sewage network for the Long Marston circa 1966, as well as a proposed sewage network. The old sewage network aligns with the findings that the LLFA established (Figure 15), therefore it can be concluded that the pipework is the old sewage line that the LLFA has investigated.

Berkhamsted Rural District Council has now been replaced by Dacorum Borough Council, who have identified that they have no drainage assets that they are responsible for in Long Marston and hold no records that may be of interest to the project

## 5 Role and Responsibilities

### 5.1 Responsible authorities and landowners

Part of the role of HCC as the LLFA in accordance with Section 19 of the FWMA 2010 is to identify the risk management authorities (RMAs) that have flood risk management functions relevant to the flooding in Long Marston. Those RMAs and their relevant powers and functions are set out below.

### 5.2 Hertfordshire County Council as Lead Local Flood Authority

HCC as the LLFA for Hertfordshire has fulfilled its responsibility to carry out a flood investigation under Section 19 of the FWMA 2010, to;

1. Identify the relevant RMAs and;
2. Establish if those authorities intend to utilise their own powers and to what extent.

The actions that the relevant RMAs have agreed to take are set out in Section 6.

In order to achieve the responsibilities under Section 19, HCC as LLFA must first establish the cause and impacts of the flooding and then, where possible, identify actions to reduce flood risk.

HCC as the LLFA for Hertfordshire has powers to carry out flood risk management works, in accordance with the Local Flood Risk Management Strategy for Hertfordshire, for flooding from surface runoff and groundwater. The LLFA is also required to maintain a register of structures and features that have a significant effect on local flood risk.

This flood investigation has been commissioned by HCC as the areas reported as being affected by flooding are fully within their jurisdiction as Lead Local Flood Authority (LLFA).

## 5.3 Hertfordshire County Council as the Highway Authority

HCC are the responsible authority to maintain and manage adopted highways including associated drainage infrastructure such as gullies, drainage pipes, and soakaways etc. which have been provided for the sole purpose of draining the public highway.

Station Road and Chapel Lane is highway maintainable at public expense. They were both impacted by the flood event.

HCC as the Highway Authority have powers to manage water falling on the public highway under the Highways Act 1980, however where this water originates from third party land and not from runoff from the highway these powers are limited.

HCC as the Highway Authority is required, as far as is reasonably practicable, to keep highways open and usable by the public.

In extreme flood events the majority of excess surface water from adjoining private land will eventually flow onto the highway as the roads act as manmade conduits for such water. This is the main reason for flood event as this excess water overwhelms the highway due to the extreme volumes of water that the drainage system isn't designed for.

## 5.4 Thames Water Utilities Limited

TWUL manages the public foul water sewer networks in Long Marston; it therefore has been identified as a relevant RMA. TWUL manages flooding from their network in line with their business plan approved by OfWAT. In this flood event, a power failure caused the pumping station to fail; however there is a clear relationship between surface water and increases in flow within foul sewer network, which is impacting the performance of the pumping station on Chapel Lane.

TWUL, like all Water and Sewage companies, are required to keep a register of all instances of internal and external flooding of properties, this is referred to as the Flood Risk Registers. This register is used as the evidence to justify improvements to the foul and surface water sewage network.

Only TWUL has the authority to alter the foul and surface water sewer and to manage the flood risk associated with it.

## 5.5 Environment Agency

The EA holds discretionary powers to manage flood risk from watercourses, which are designated as a main river. It is also the regulatory body for approval of work within 8m of the centreline of such watercourses, which includes any structures that cross a main river. The Tring Bourne is designated a main river on the Main River map.

Although in this case there were no properties which flooded internally as a direct result of water leaving the river, there are many issues surrounding the main river, including but not limited to:

- Hydraulic challenges due to the number of man-made structures in the river with current drainage discharging to the Tring Bourne
- Water quality issues as of a result of:
    - The highway drainage connecting directly into the main river with no pollution control
    - The foul sewer network surcharging and being pumped by the emergency services into the main river to protect property. This led to waste being left on the banks of the Tring Bourne.

### 5.6 Dacorum Borough Council

Dacorum Borough Council was the responsible drainage board until powers and responsibilities were transferred to other bodies following changes in Legislation; such as the Land Drainage Act (1991) and Water Industry Act (1991). They have been identified as a responsible authority; however during this investigation they have confirmed they hold no records or conduct any inspections of drainage features in Long Marston.

## 6 Conclusion and Recommendations

### 6.1 Conclusion of the Flood Investigation

At some point in time, possibly through the transferring of powers between authorities, a drainage asset that used to discharge foul water has been lost from current drainage records. This drainage asset, even though not functioning for its original purpose, was still receiving water from the highway gully network from Station Road, and therefore needs to drain without obstruction to the Tring Bourne.

Through a series of collapses and blockages, this pipe is now unable to discharge water efficiently and is potentially increasing the risk of flooding to property and local highways, and may have contributed to the foul water sewer network discharging. There is a need to continue investigations to ascertain if the catchment is as large as Figure 3 details, as well as proposing a series of options to remove the risks posed from the failing drainage asset.

### 6.2 Recommendations

There are a range of issues when considering recommendations for RMAs to improve the overall flood risk in the area, however there is still an overriding issue of identifying ownership of the current drainage network – as this investigation has failed to ascertain ownership. Therefore there is still a need to work together with all the identified RMAs to continue this investigation. The following recommendations for each RMA may have already commenced at the time of publishing the report.

### 6.2.1 HCC as the LLFA

- The LLFA to continue project managing the investigation of the orphaned asset, and continue to work with HCC as the Highway Authority and TWUL to conduct and help analyse new data
- Evaluate the significance of the findings against the hydraulic model that was produced as part of the feasibility study. This will involve procuring additional services to update the model to apply its impact (if any)
- Reconsider alleviations options at Long Marston as new survey information is submitted

### 6.2.2 HCC as the Highway Authority

- Following evidence provided by the parish Council, there is a need to confirm the connectivity of the highway gully network on the north side of Station Road, to confirm if it is the entire length of the redundant sewer as drawn on Figure 3. This also includes how the north and south drainage networks merge under the junction of Station Road/Chapel Lane
- Following the findings of the above and the evidence gathered from this investigation, there is a need to evaluate the current drainage connectivity and consider the following:

    - Divert highway drainage away from the orphaned asset
    - Repair the orphaned asset to allow water to flow freely
    - Upgrade sections of the orphaned asset but create a new connection to the Tring Bourne, which is closer than the current outfall

- Any work carried out to restore the drainage network to a functioning condition may also present an opportunity to enhance the legacy drainage to safeguard water quality; this may also open up access to funding possibilities under the Water Framework Directive as there have been sightings of fish and white-clawed cray fish. Any mitigation measures will need to be discussed with the EA to seek approval as the conditions for discharge may change.

### 6.2.3 Environment Agency

- To provide assistance with the identified RMAs to find a sustainable way to discharge water from the orphaned asset
- To identify if there are any funding opportunities related to the Water Framework Directive and water quality that could help partnership fund any mitigation measures.