Section 19 Flood and Water Management Act 2010

Needham Market Flood Investigation – Storm Babet 2023

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Executive Summary

Storm Babet caused significant disruption to communities across Suffolk between 18th-21st October 2023. Needham Market was one of the most severely impacted locations. Over 45 residential and commercial properties were internally flooded, with infrastructure and services disrupted. Suffolk County Council, as Lead Local Flood Authority, have therefore undertaken a Section 19 Flood Investigation. The resulting report will:

- highlight the probable causes of flooding
- identify options to reduce future flood risk and increase property resilience
- make recommendations for actions by relevant responsible organisations, landowners or homeowners

Needham Market is located in an area at significant risk of both fluvial (river) and pluvial (surface water) flooding and the nature of the surrounding topography and geology contributes to the susceptibility of the town to flooding. Areas of the town are low-lying, surrounded by a reasonably steep rural catchment. There are multiple overland pluvial flow paths flowing into Needham Market from surrounding high ground, which flows through the urban centre in a combination of open and piped watercourses, before converging with the River Gipping. The local geology and soils are characterised as having low permeability and high run off, making a high number of properties in the town vulnerable to flooding due to intense rainfall events. Storm Babet delivered significant rainfall, following an extended period of above average rainfall.

Impacts within Needham Market were widespread and for the purposes of this report, the affected areas have been categorised into four distinct zones. The description of the flood events detailed in the report have been compiled using data submitted to Suffolk County Council, as well as information from Risk Management Authorities (e.g. Environment Agency, District Council) and the community.

A comprehensive summary for each zone is provided within the report, outlining the context of the event and the impact. Key findings are that Needham Market was severely impacted by flooding due to the intensity of rainfall, which overwhelmed the natural flow routes and the capacity of watercourses and drainage infrastructure. This situation was compounded when overland flow paths converged with the overtopped Main River channels and saw the resultant internal flooding of property, infrastructure, and services.

Short, medium and longer term recommendations have been published and each have a potential role to improve resilience and reduce the risk of flooding to Needham Market. For short term measures, key highlights include the implementation of community flood plans, maximising Property Flood Resilience (PFR) grants, removal of blockages within watercourses, both open and piped, as well as drainage infrastructure. For medium to longer term recommendations, there is emphasis on the investigation of potential improvements to drainage infrastructure, and the creation of new natural flood management features, to reduce flood risk within the catchment.

Justification for Investigation

Suffolk County Council, Lead Local Flood Authority (LLFA) has determined that in accordance with our criteria, it is considered necessary and appropriate to carry out an investigation into this flood event.

This is in accordance with Section 19 (1) of the Flood and Water Management Act 2010, and in accordance with Section 19 (2) of the Flood and Water Management Act 2010, to publish the results and notify the relevant risk management authorities (RMAs).

Section 19 Local authorities: investigations

(1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate -

> *(a) which risk management authorities have relevant flood risk management functions, and*
>
> *(b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*

(2) Where an authority carries out an investigation under subsection (1) it must -

> *(a) publish the results of its investigation, and*
>
> *(b) notify any relevant risk management authorities*

Criteria for an investigation (as per Appendix D of the Suffolk Flood Risk Management Strategy):	✓
There was a risk to life because of flooding?	
Internal flooding of one property (domestic or business) has been experienced on more than one occasion?	
Internal flooding of five properties has been experienced during one single flood incident	✓
Where a major transport route was closed for more than 10 hours because of flooding	
Critical infrastructure was affected by flooding	
There is ambiguity surrounding the source or responsibility of a flood incident	

Understanding the Flood Context

1. **What happened during Storm Babet?**

A succession of weather fronts between the 11th and 13th of October 2023 brought significant rainfall to the region. Readings indicate that between 30mm and 50mm of rain fell across Suffolk compared with an average of just less than 65mm across the whole month of October according to Met Office weather data (Met Office, 1991-2020). This significant rainfall occurred in a short space of time and resulted in saturated land and rivers reaching their capacity. Shortly after this, Storm Babet followed on the 18th to 21st of October 2023. The storm brought between 50 mm and 80 mm of rain to much of central and northern East Anglia, with some Suffolk weather stations recording the wettest October day on record.

The Environment Agency river level measuring stations indicated many flows close to or exceeding their highest on record, and the weather remained wetter than average for the rest of the month. October 2023 was the joint wettest on record in the east of England since 1871. During Storm Babet, Suffolk saw the heaviest rainfall across East Anglia causing significant flooding of roads and properties. The river systems rose rapidly across whole catchments due to the existing conditions, which was unusual as storms will often impact a small area and result in a steady progression of flood water downstream. A major incident was declared by the Suffolk Resilience Forum (SRF) in the afternoon of the 20th of October due to significant impacts on communities and disruption to the road and rail networks.

The following maps illustrate the extent to which the rainfall in the months preceding Storm Babet exceeded the average monthly rainfall for July to October in recent years in Suffolk.

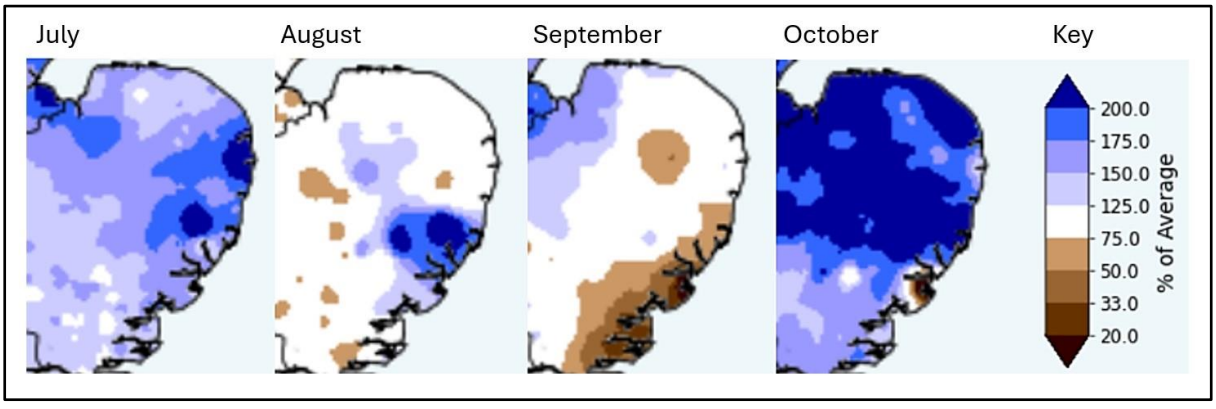

Figure 1- Average rainfall in East Anglia between July and October 2023 as a percentage of the historical average monthly rainfall

The following report acknowledges that October 2023, and in particular Storm Babet, was an extreme event and will assess the likely causes and impacts. The report will recommend measures to reduce the risk of flooding within the location, in line with best practice, ranging from large to small scale interventions and be targeted at a range of stakeholders. It should be noted that Storm Babet was a significant event, with a low probability of recurrence. The recommendations will provide advice about reducing flood risk; however, they should not be relied upon as a guaranteed failsafe to mitigate against all future flooding.

2. Location of Flooding

Needham Market is a small town in Suffolk, set in the River Gipping valley (see Figure 2). It is situated in the local government district of Mid Suffolk. The district is primarily a rural area. Needham Market is 9 miles north-west of the county town of Ipswich.

Figure 2 - Investigation Area Map

On the 20th of October 2023, Storm Babet resulted in significant rainfall across Suffolk on top of an already wet October. This caused internal flooding to properties, residential and commercial, across the county from various flooding sources. The following report is focused on Needham Market and will discuss the probable flooding sources, the observed flow paths through the community, and the receptors which have been affected.

Needham Market was one of the most significantly impacted communities during Storm Babet with over forty five properties reporting internal flooding. The town experienced major flooding on Friday 20th of October from fluvial (water from a river or watercourse), pluvial (surface water run-off) sources and both combined. For the purposes of this report, the term 'flood water' may be used to describe both fluvial and pluvial flooding. The majority of the flooding to properties included some fluvial element due to the Lion Barn drain and Orchard Gate watercourse exceeding their capacity and overtopping their banks (see Figure 3). Surface water run-off was the cause of the flooding experienced on Foxglove and Hargrave Avenue.

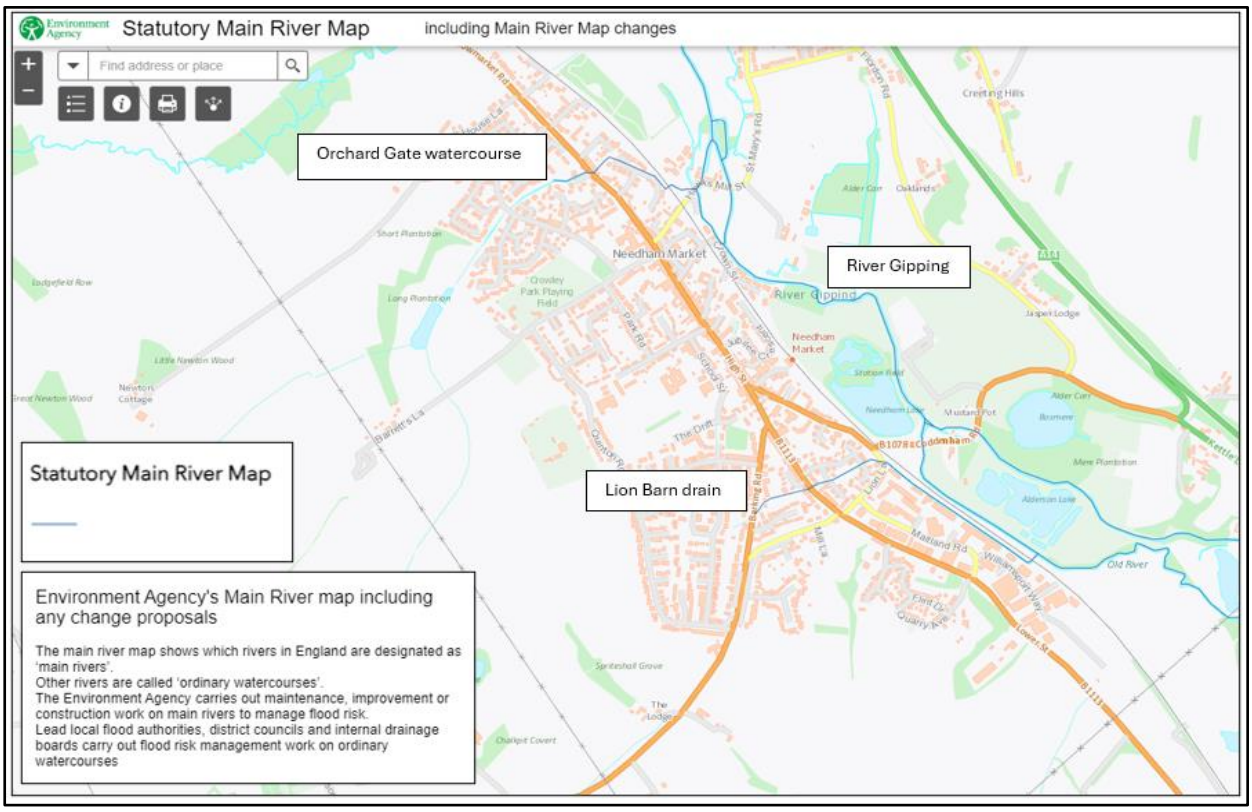

Figure 3 - Main River map

Anecdotal evidence indicates that the first signs of flooding occurred on Pinecroft Way on the morning of 20th October. This was caused by water from the Lion Barn Drain, rather than from the River Gipping itself. The water flows from the rural catchment southwest of the town and is susceptible to rapid increases in flood levels following intense rainfall. Data from river level gauges on the River Gipping show a peak water level at Stowmarket at 22:58 GMT on 20th October (surpassing the previous recorded maximum from Feb 1979). The peak level at Bramford further downstream on the River Gipping was at 14:40 GMT on Saturday 21st October (surpassing the previous recorded maximum from Feb 1979), reflecting the time taken for the flood peak to travel down the River Gipping. The following flood alerts/warnings were issued on the 20 October 2023:

- 20/10/2023 03:28 Flood Alert: 054WAFSF4DE - The Rattlesden River and River Gipping, through and including Stowmarket and Needham Market.
- 20/10/2023 17:12 Flood Warning: 054FWFSF4F - The River Gipping through Needham Market.
- Flood Alert – Flooding is possible. Be prepared.
- Flood Warning - Flooding is expected. Immediate action required.

For the purposes of this investigation the various areas affected by flooding have been separated into four distinct zones (see Figure 4). The zones are as follows:

1. Barking Road, Foxglove Avenue, Hargrave Avenue, School Street.
2. Pinecroft Way, Lime Tree Close, Lion Lane, Maitland Road, Coddenham Road.
3. High Street, Hawks Mill Street, Crown Street, St Mary's Road.

4. Highlands Close, John Swain Close.

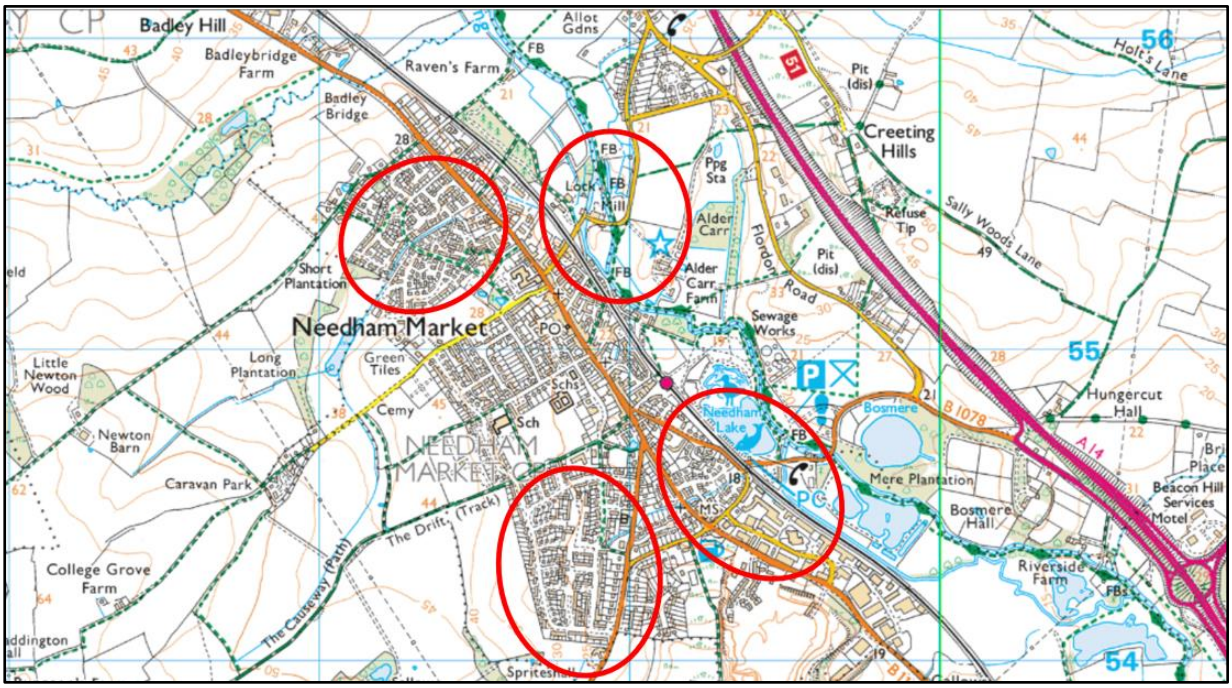

Figure 4 - Investigation Area Map with Zones

3. Records of any historical flooding

A review of Suffolk County Council's highway reporting tool, local media reports, social media sources and Environment Agency records indicates that Needham Market has been impacted by flooding to varying extents in the past.

SCC Highways are aware of frequent issues at the Coddenham Road railway bridge. During heavy prolonged rainfall periods the road under the bridge is flooded and inundated by water.

Environment Agency records show that flooding events were reported in Needham Market in August 1987, January 1988, October 1993, October 2000 and May 2012. All of which resulted in internal property flooding.

In May 2012, 9 properties recorded internal flooding. Flooding was from a combination of sources from the River Gipping and surface water run-off. Local residential roads, particularly at Crown Street and Hawks Mill Street were flooded, causing local disruption. The B1078 road was also flooded, which links with the A14 dual carriageway, disrupting emergency services and local transport.

There has been multiple historic external floodings reported to Anglian Water. The root cause of these was a build-up of fat, oils and grease or other obstructions in the network.

4. Predicted Flood Risk

Parts of Needham Market show significant flood risk from pluvial and fluvial sources.

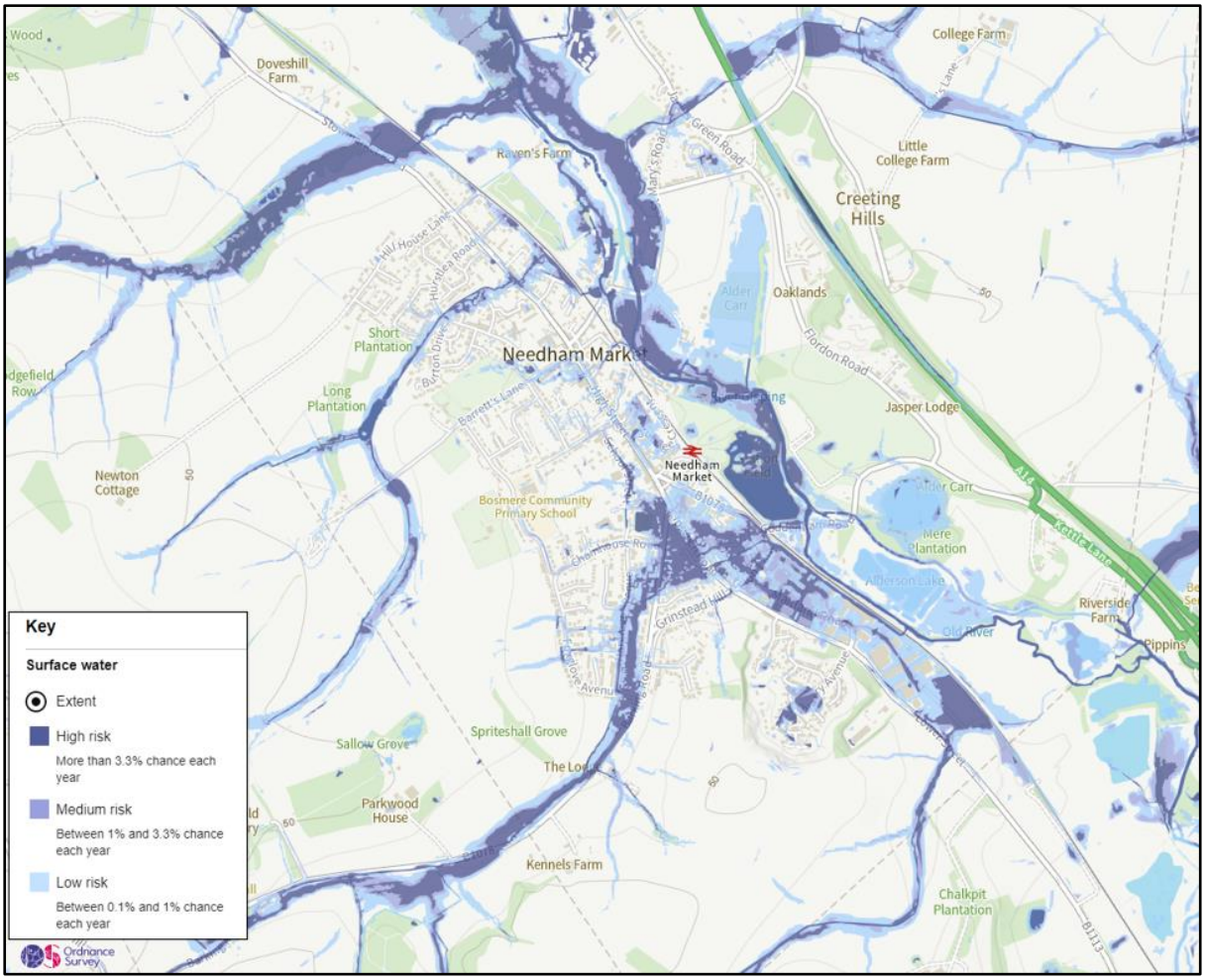

Figure 5 - Predicted Pluvial Flood Risk

Figure 5 highlights the predicted pluvial (surface water run-off from surrounding land and ditches) flood risk within Needham Market, with five main flow paths coming into the town. This indicates that there is significant risk of surface water flooding on Barking Road, Foxglove Avenue, Hargrave Avenue, Pinecroft Way, Limetree Close, Hawks Mill Street, Crown Street and Highland Close. These areas were all affected by flooding during Storm Babet.

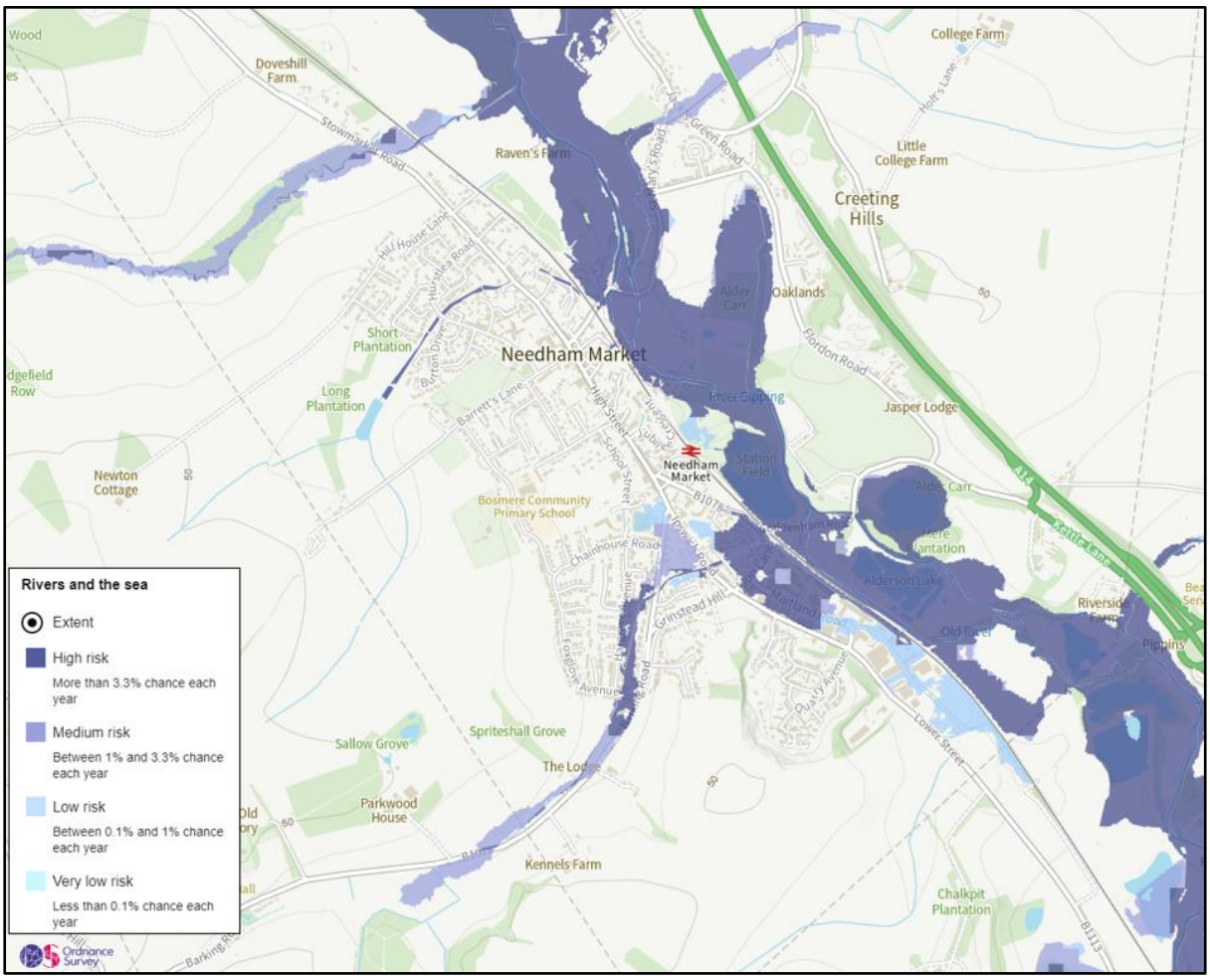

Figure 6 - Predicted Fluvial Flood Risk

Figure 6 highlights the predicted fluvial (from designated main river) flood risk within Needham Market. The main fluvial influences consist of the main river Gipping, the Lion Barn drain and the Orchard Gate watercourse. The Hawks Mill area, Crown Street, Pinecroft Way, Maitland Road, Barking Road and some areas of Foxglove Avenue are shown as being at risk for fluvial flooding. These areas were affected by flooding during Storm Babet.

5. Catchment characteristics

Needham Market is surrounded by rural, predominantly arable land. It is situated in the River Gipping valley. There are multiple overland pluvial flow paths flowing into Needham Market from the higher ground Northwest, West (Orchard Gate) and Southwest (Barking Road) of the town, before converging in the areas of the town where the topography is noticeably lower (Pinecroft Way, Lion Lane). The low-lying land where Needham Market is situated can act as a flood water storage area during intense rainfall events, retaining excess flood water as it slowly discharges into the river and down the catchment. Overwhelmed infrastructure and watercourses may be observed during these intense rainfall events.

Figure 7 shows the topography surrounding Needham Market and the gradient changes across the town. Hawks Mill, Pinecroft Way, Limetree Close, Maitland Road and Lion Lane are among the lowest lying locations in Needham Market. These were identified as being some of the worst affected areas following Storm Babet.

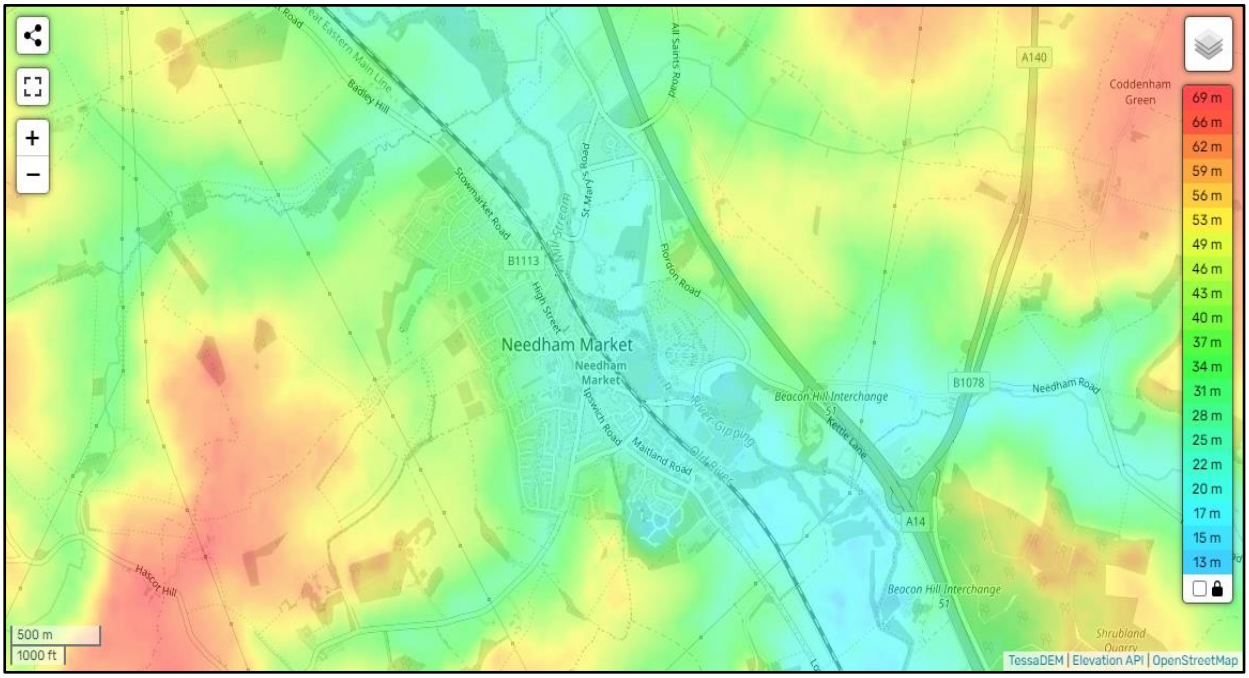

Figure 7 - Needham Market and surrounding topography

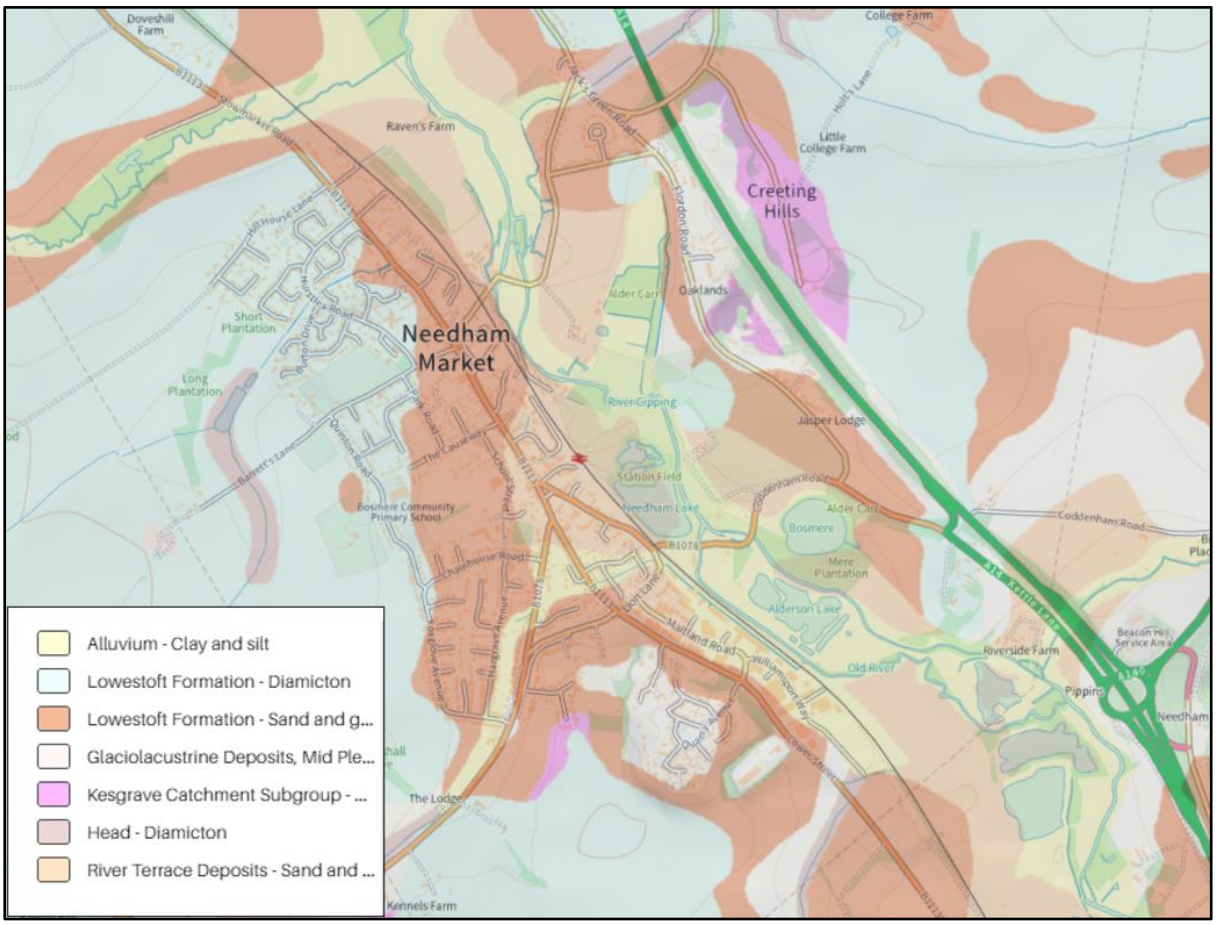

Figure 8 - Needham Market town centre and underlying superficial geology (British Geological Survey, 2024)

Needham Market itself sits mostly on Lowestoft Formation - sand and gravel and alluvium which is described by the British Geological Survey as a mixture of clay and silts. These alluvium floodplain soils usually have naturally high groundwater and tend to be wet.

Lowestoft Formation 'Diamicton' surrounds the town more generally which is described by the British geological survey as a diverse mixture of clay, sand, gravel, and boulders varying widely in size and shape This generally has a low permeability meaning water will tend to flow off it before it can be infiltrated, which reflects reports from the event.

With reference to soils in the wider catchment, immediately around Needham Market, they are described as loamy and clayey soils with slightly reduced infiltration. This is sometimes known as boulder clay. At the higher levels surrounding the town, the soil is described as slowly permeable, seasonally wet, loamy and clayey soils with reduced infiltration (LandIS, Cranfield University, 2024). Lower rates of infiltration to ground means that more surface water will stay on the surface and not be absorbed, potentially contributing to flood water (see Figure 9).

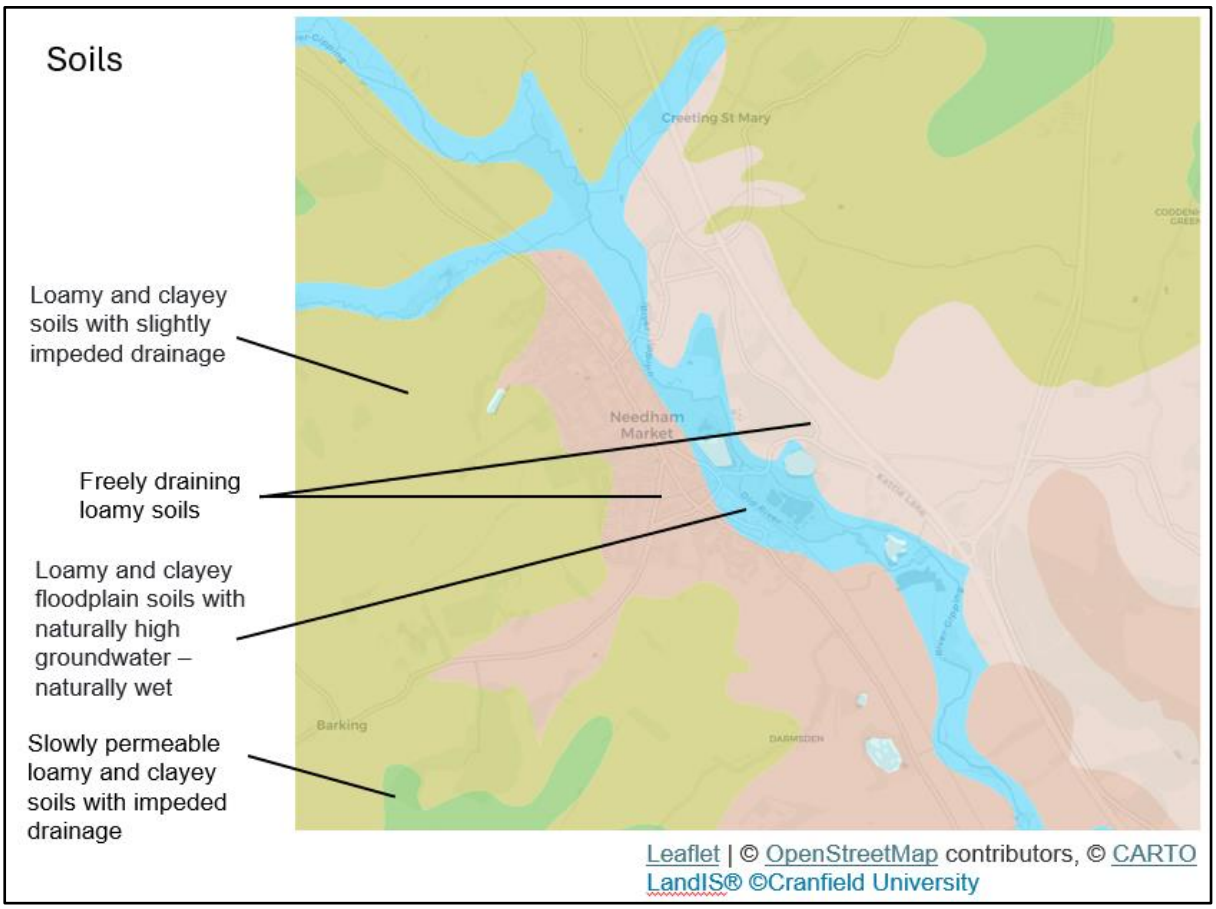

Figure 9 - Needham Market and surrounding soils

Flooding Source(s), Pathway(s) & Receptor(s)

The low-lying nature of areas of Needham Market, with its several flow paths and low permeability of some surrounding soils and superficial geology make it susceptible to flooding events in extreme rainfall. Storm Babet was an extreme event which came at a time when Suffolk had experienced a significant amount of rainfall in the preceding week.

Storm Babet delivered significant rainfall in the River Gipping catchment between 19 and 22 October. At Needham Market rainfall gauge there was 58.6mm of rain in 24hrs between 19 Oct 19:45 and 20 Oct 19:30. 28mm of rainfall was received in 5hrs from 07:00 to 11:45 on the morning of 20 October. River levels recorded on the gauges at Stowmarket and Creeting were the highest on record.

The description of the flood events described below has been prepared using reports submitted to Suffolk County Council via the online Highways Reporting Tool and information gathered by Risk Management Authorities (RMAs) and the community. Some on-site images and measurements were recorded by Environment Agency Community Information Officers (CIO's) during site visits on 25, 27 October, 23 November 2023, and 8 January 2024 in the aftermath of Storms Babet, Ciaran and Henk. Detailed descriptions of each investigation area can be found below.

1. **Barking Road, Foxglove Avenue, Hargrave Avenue, School Street**

On the morning of 20 October 2023, a number of tributaries in the rural upper catchment directed water into the town. Floodwater flowed along Barking Road towards Foxglove Avenue originating from fields to the east around Grinstead Barn, before emerging onto the carriageway. There were additional overland (surface water run-off) flow paths merging onto Barking Road from fields to the south either side of Priestly Wood close to Barking. Outside the pharmacy entrance on Barking Road, water was starting to pool from 09:00am onwards and by 11:00am water was observed to be coming into the car park from the road (Image 1).

Water was also arising from a surcharging manhole at the entrance to the Grinstead Barn turnoff. Additionally, an inspection chamber in the field to the west of Barking Road was blocked and added to the floodwater flowing along the road. Since Storm Babet, there have been additional reports that water is still surcharging from the area near the entranceway to Grinstead Barn and flowing north-eastwards along the Barking Road and towards Foxglove Avenue. Suffolk Highways are aware of the issues at this location. Jetting and initial investigations have already happened, and further actions are planned to be carried out.

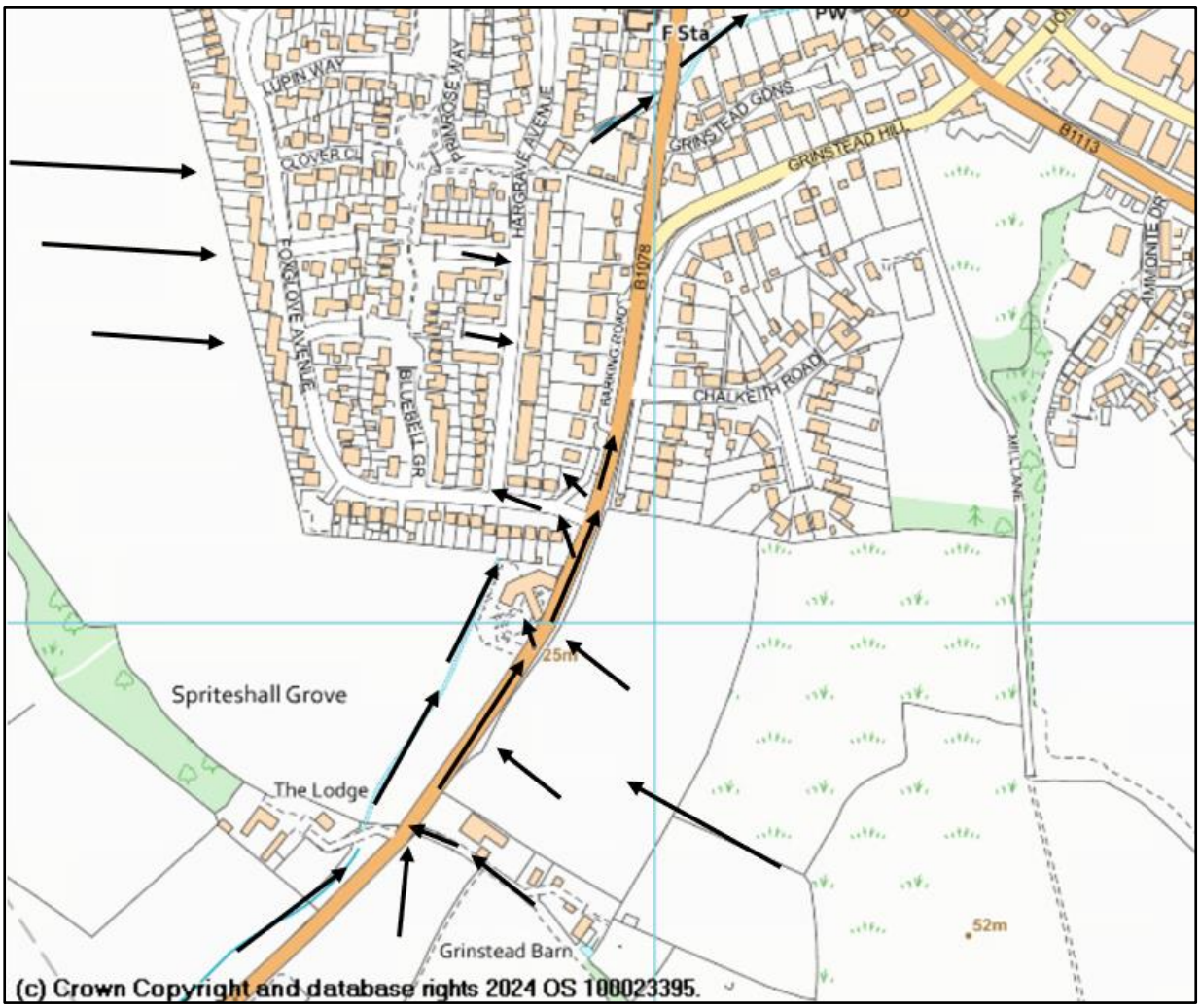

Figure 10 - Approximate floodwater flow routes on Barking Road, Foxglove Avenue, Hargrave Avenue and School Street

Properties near to the junction of Foxglove Avenue and Barking Road were impacted by water entering Foxglove Avenue from Barking Road later in the morning. A drop kerb immediately south of the junction created a low entry point from the road (Image 2). This low point allowed water to pass onto Foxglove Avenue at a quicker rate and bypass a raised traffic calming road bump on Foxglove Avenue close to the junction with Barking Road. Properties at this location were also flooded internally in early January 2024 during Storm Henk.

Floodwater did not overtop from the Lion Barn drain south of Foxglove Avenue. The water was observed to be in-channel, with vegetation in the meadows upstream of the Health Centre flattened in a direction towards the watercourse as surface water flows went into the watercourse. However, maintenance by private homeowners on the 20th of October was required to clear debris from the culvert entrance screen to allow water conveyance.

Several properties along Foxglove Avenue were reported to have flooded from the fields to the west, at the rear of the properties. Local reports coupled with LIDAR imagery of the field, indicate the field slopes to the east funnel the surface water runoff towards the affected properties. This happened in the early hours of 20 October from around 03:00 am onwards. This closely matches the flow paths and extents shown in the predicted surface water flood risk mapping (Figure 11).

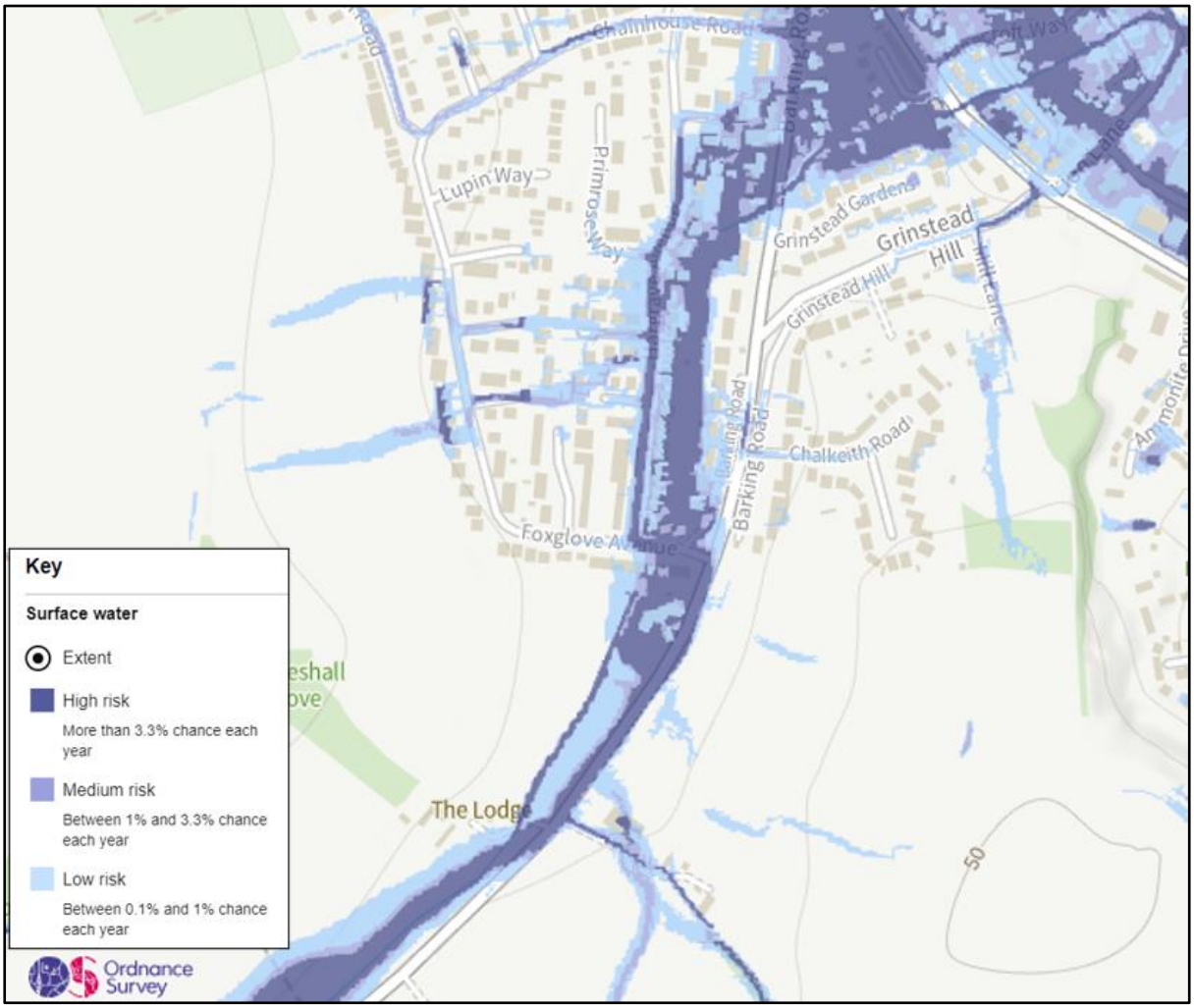

Figure 11 - Predicted Pluvial Flood Risk, Barking Road and Foxglove Avenue

This continued to be an issue throughout the winter with internal flooding also occurring on at least two other occasions between Storm Babet and Storm Ciaran (2nd November 2023) and again during Storm Henk (4th January 2024).

Floodwater originating from the fields to the west flowed through Foxglove Avenue, impacting properties in the flow path, before flowing onto Hargrave Avenue in several directions. Properties located to the east of the estate, were flooded from the surface water on the highway as water from the field was funnelled along the road travelling downhill. The drainage gullies were overwhelmed and the convergence with flood water from Barking Road, caused further flooding to properties. Further north, School

Street suffered some surface water flooding when the highway drainage and adjacent watercourses exceeded their capacity.

In summary:

- Intense and prolonged rainfall resulted in excess surface water runoff flowing off the fields and surrounding catchment to the west and south of Needham Market.
- Floodwaters flowed onto Foxglove Avenue from fields to the rear and also from Barking Road originating from fields to the south and east.
- Floodwater from multiple surface water pathways merged and impacted Hargrave Avenue.
- Some ordinary watercourses and drainage assets on the highway were overwhelmed beyond their design capacity.

LLFA recommended action(s):

- Investigate potential NFM projects to 'slow the flow' and attenuate water on overland flow paths (leaky dams, restoration of watercourses, etc.) to the west and south of Needham Market.
- Explore options to reduce the field run off from the west of Foxglove Avenue. Possible use of a vegetation strip / break, bund or ditch between field and properties.
- Investigate the potential to raise the dropped kerb on Barking Road.
- Investigate the drainage problems below Barking Road near Grinstead Barn
- Ensure a maintenance regime is in place for the entrance to the Anglian Water culvert upstream Hargrave Avenue. A CCTV survey to be conducted.
- Investigate highway drainage infrastructure to ensure capacity and condition are sufficient.

2. **Pinecroft Way, Lime Tree Close, Lion Lane, Maitland Road, Coddenham Road.**

During the morning of 20 October 2023, large amounts of floodwater flowed down the Lion Barn drain which passes through the Pinecroft estate on its way to the River Gipping (designated main river). Pinecroft Way and Lime Tree Close were some of the worst affected areas for internal flooding in Needham Market.

Maintenance of assets and infrastructure was undertaken by Risk Management Authorities prior to Storm Babet under cyclical maintenance regimes. The gullies located on Lime Tree Close and Pinecroft Way were inspected and cleaned in September 2023 by Suffolk Highways. The Environment Agency had completed their annual routine in-channel maintenance works in October 2023 prior to Storm Babet.

During Storm Babet, water initially came up through the road gullies on Pinecroft Way. These gullies outfall into the Lion Barn drain and the majority of the outfall pipes do not have non-return flaps, which could have mitigated the volume of water returning up the drains from the watercourse.

Puddles began to form on the highway from 10am onwards and water levels continued to rise throughout the morning. Eyewitness testimony and photographic evidence indicate that some of the water from Lion Barn drain was surcharging back out of the road gullies as the water level within the watercourse rose higher than the relative level of the road gully prior to any overtopping of the watercourse banks (Image 3). The floodwater began to accumulate on the roadway and by early afternoon the water was impacting houses.

There were multiple flow pathways for the floodwater to travel across Pinecroft Way once water levels in the channel rose above the banks, resulting in water leaving the channel. Some of the floodwater flow paths followed the course of historic ditches and ponds that existed on the land prior to the housing estate. The channels and ponds have historically been infilled to aid the construction of the estate in the early 1980's. Historic maps that precede the development of Pinecroft Way show the alignment of a ditch and associated pond. It is this pathway that flooded properties on Lime Tree Close before flowing onto Lion Lane. Over time the ditch infill material has settled and created low spots in the landscape over which the floodwater could flow.

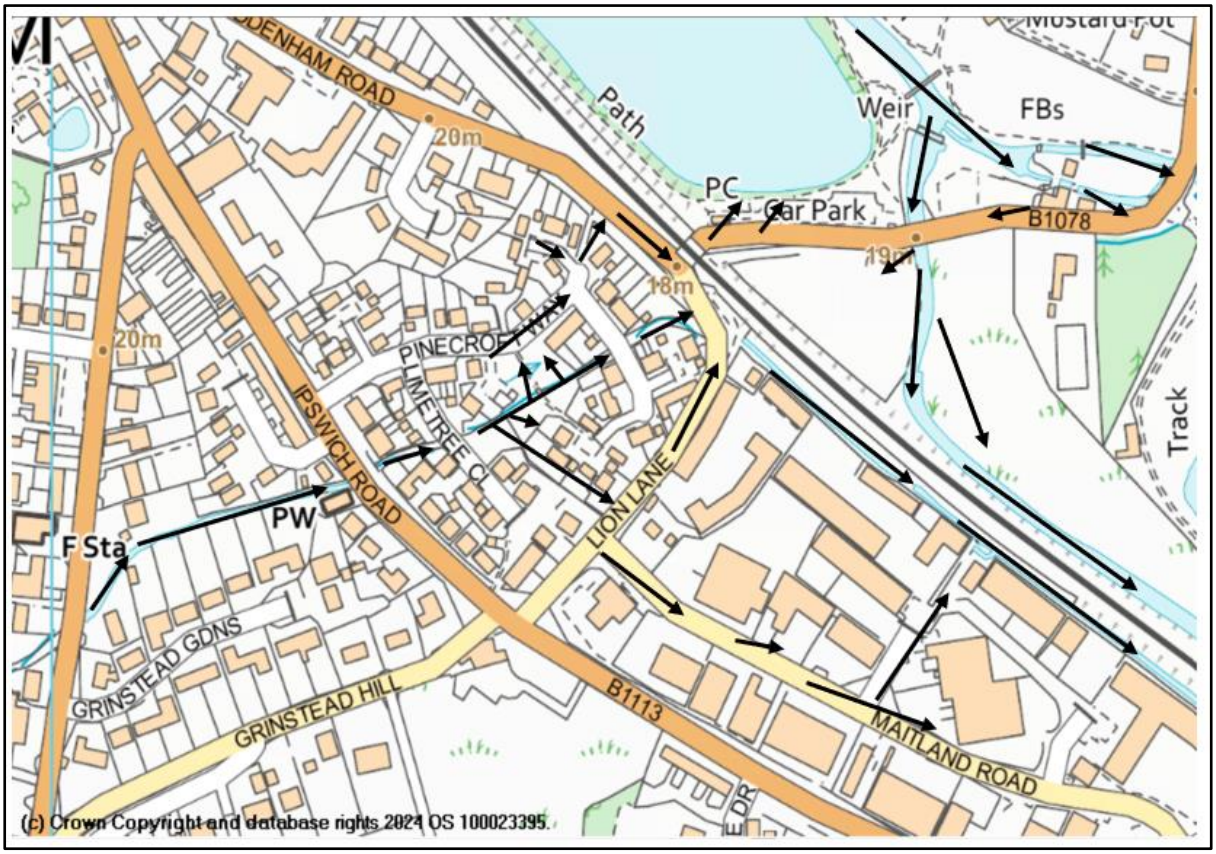

Figure 12 - Approximate floodwater flow routes on Pinecroft Way, Lime Tree Close, Lion Lane, Maitland Road and Coddenham Road

Floodwater overtopped the northern bank of the watercourse flooding properties on the northern side of Pinecroft Way and overtopped the southern bank flooding properties on the southern side of Pinecroft Way and Limetree Close (Images 4 & 5). It also backed up onto Lion Lane through another unflapped outfall, merging with floodwater on the corner with Coddenham Road from the railway bridge direction and then into Maitland Road, affecting buildings on the Lion Barn industrial estate (Image 6).

Water from the Lion Barn Drain was able to flood onto Coddenham Road, north of Pinecroft Way via a number of routes. Primarily, floodwater flowed through the pedestrian lane from the north of Pinecroft Way onto Coddenham Road. It was also backing up and surcharging at the road culvert under Lion Lane, where the volume of water exceeded the capacity of the culvert (the latest general inspection of this culvert by the Highways Structures Team records the drainage as “Mostly Functional”, with less than 25% of the cross section blocked). This resulted in water exiting the channel and flowing along the verge onto Coddenham Road. Floodwater also flowed through gardens and over driveways before entering Lion Lane, ultimately spilling into Maitland Road and the Lion Barn industrial estate.

There were reports of regular ponding of surface water outside of some of the units on Maitland Road, however Suffolk Highways have since completed their cyclic maintenance and cleansing of the drainage assets here and reported that no specific issues were found. There were various reports from business owners on the Lion Barn/Maitland Road Industrial Estate, that surface water collecting on a partially developed housing estate was being tankered off the site and discharged into the surface water sewer or overland. This may have added to the flooding experienced on the industrial estate. The issue was investigated by the relevant authorities at the time and there are currently no further actions required.

Makeshift channels were cut by residents and the Fire Service into the raised roadside bank located behind Pinecroft Way properties adjacent to Coddenham Road and around the elevated ramp in the footpath. This was to allow impeded floodwater to escape from the Pinecroft Way estate on to Coddenham Road before flowing into Needham Lake (Image 7). Properties on Pinecroft Way and Limetree Close have suffered repeated internal flooding over the winter months between Storm Babet and Storm Henk.

Further east along Coddenham Road properties were also flooded when the main River Gipping overtopped its banks with reports indicating the floodwater was between 2 -3 ft deep on the road. The observed floodwater extents and pathways from the watercourse match closely with the flood extents shown on the national surface water flood risk mapping (Figure 6).

In summary:

- Intense and prolonged rainfall resulted in greater than usual amounts of water flowing into the Lion Barn drain which passes through Limetree Close and Pinecroft Way.
- Unflapped outfalls created a pathway and route for the floodwater to travel onto the road surface and impact property.
- The Lion Barn drain exceeded its capacity, floodwater exited the channel and flowed overland resulted in flood properties.
- The culvert beneath Lion Lane constricted the water flow, resulting in excess floodwater coming out of channel.
- The raised bund between the Pinecroft estate and Coddenham Road impeded the flow of the floodwater and resulted in an area which was inundated and unable to drain.
- Floodwater merged from the various pathways, accumulated further and flowed onto Maitland Road flooding numerous businesses.
- Highway drainage assets were overwhelmed beyond their design capacity.

LLFA recommended action(s):

- Investigate potential NFM projects to 'slow the flow' and attenuate water on overland flow paths (leaky dams, restoration of watercourses, etc.) to the west and south of Needham Market.
- Fit non-return flaps on the outfalls along the Lion Barn drain through Pinecroft Way.
- Investigate capacity of the culvert under Lion Lane / Coddenham road corner. Carry out a de-silt / cleanse if required.
- Investigate options to enhance the flood risk benefit of the bund between Pinecroft and Coddenham way to allow drainage from the estate and defence from flooding from the main river Gipping.
- Investigate highway drainage infrastructure to ensure capacity and condition are sufficient.

3. **High Street, Hawks Mill Street, St Mary's Road, Crown Street**

A small number of properties were internally flooded on the High Street and close to the junction with Hawks Mill Street. Reports suggested blocked highway drains and low property thresholds contributed to the impact from the floodwater accumulating on the roads.

The primary source of flooding in the Hawks Mill and St Mary's Road area was fluvial flooding, with flood water from the river merging with overland flows already on the fields and roads. The banks of the River Gipping overtopped upstream of Hawks Mill and combined with surface water flows and river tributaries coming across the fields from the Northwest. This meant much of the River Gipping flood plain was inundated and remained in flood for a considerable period of time (Image 8). The sluice gate

upstream of Hawks Mill which is operated and maintained by the Environment Agency was opened fully and functioned correctly throughout Storm Babet. The privately owned and operated gate below the mill was opened and operated at full capacity also (Image 9).

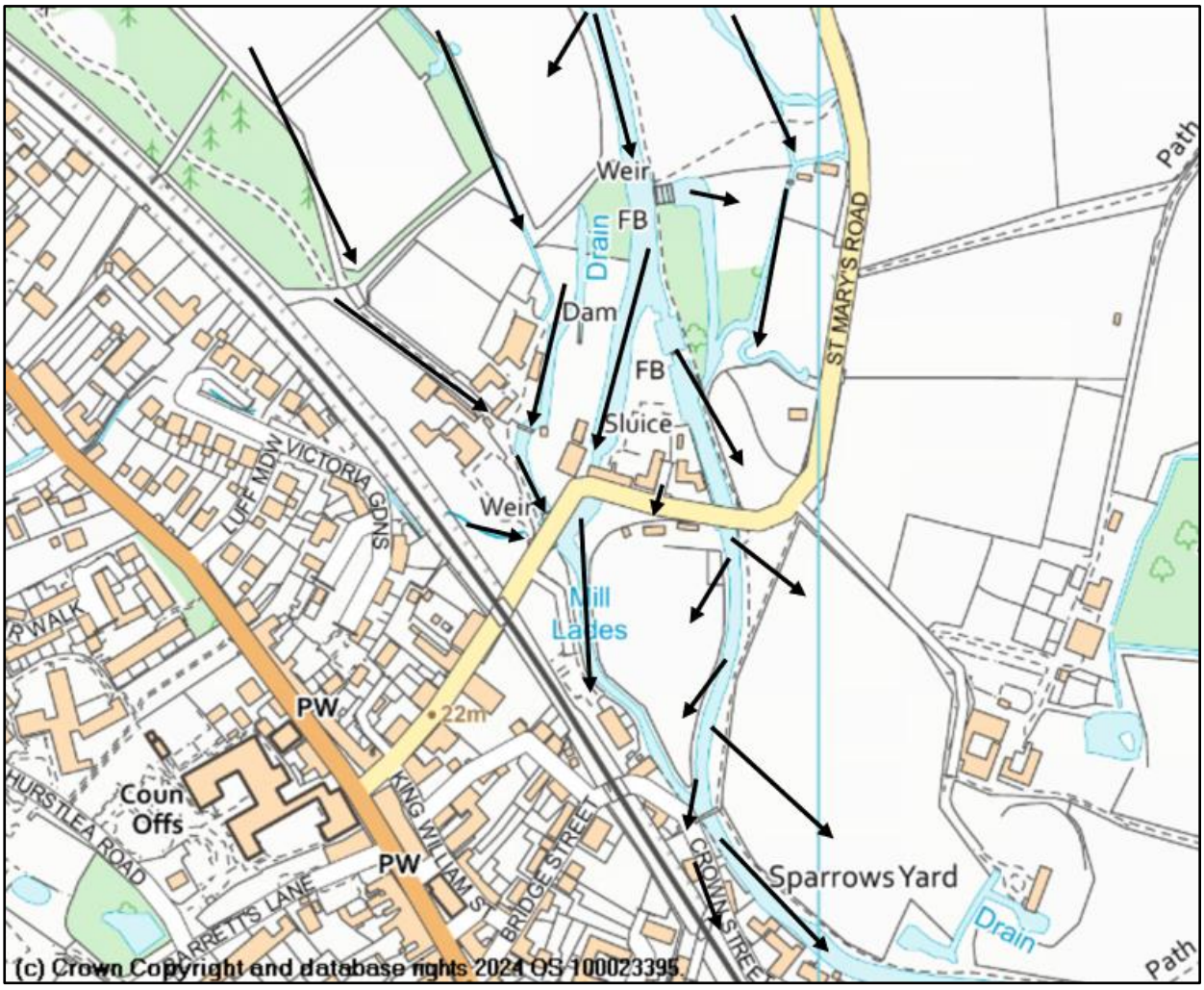

Figure 13 - Approximate floodwater flow routes on High Street, Hawks Mill Street, St Mary's Road and Crown Street

The Orchard Gate watercourse travels from Victoria Gardens and discharges into the Hawks Mill millpond via a highways culvert. The culvert, feeding into Hawks Mill millpond (marked Mill Lades in Figure 14) was found to be blocked with building material and watercourse debris. This restricted the flow and backed up water towards the railway embankment and the bottom of Victoria Gardens. Witness reports highlighted significant flows coming through the culvert below the railway embankment

On Crown Street residential and commercial properties were internally affected by flooding. Environment Agency data suggests the peak level on the River Gipping was reached in the early hours of 21 October, and the Flood Alert for the area was issued on 18:20GMT on 20 October. Floodwater from the river did not overtop the floodwall

but, at its peak it was close to overtopping. Fluvial flows may have bypassed the northern end of the flood wall upstream of the garage on Crown Street.

Floodwater was accumulating on the road during the afternoon and appeared to be coming from the north end of Crown Street. It was not able to enter the River Gipping due to the presence of the flood wall and resulted in the formation of a pond behind the wall. The river was reportedly flowing over the top of the public footbridge. Outfalls for highway drainage were quickly submerged as they fell below the raising river level. This resulted in floodwater ponding on the road as it was unable to discharge into the river.

The Environment Agency during their site visits following the event, identified two unflapped outfalls on the right bank immediately downstream of the footbridge. These outfalls may have contributed to the flooding on Crown Street, similar to the situation seen on Pinecroft Way, acting as a pathway for the floodwater from the river, emerging on the road surface. There is also a highways drainage outfall in this location which does have a flap valve fitted.

Immediately upstream of the Crown Street garage at the northern end of Crown Street, two more highway drainage outfalls were recorded beyond the end of the floodwall. These had flap valves installed by Suffolk County Council in 2015. One of the outfall pipes could not be viewed as the lower half of its structure is completely covered by sediment and waste materials. This would inhibit the ability for surface water to drain off the road. The other outfall has a very lightweight plastic flap and this could potentially have become unseated by high flow velocities in the River Gipping and allowed river water to enter the surface water/highway drainage system.

There is the likelihood that the river flooded onto Crown Street via the surface water drainage system, and that the surface water could not get into the river in combination with the river capacity being exceeded and the general widespread flooding on the river flood plain.

In summary:

- Intense and prolonged rainfall resulted in ordinary watercourses and drainage assets on the highway being overwhelmed beyond their design capacity.
- The river Gipping overtopped its bank in multiple locations, inundating the flood plain. The huge fluvial flows impacted properties close to the river.
- Multiple constrictions: bridges and blocked culverts hindered the conveyance of the flood water away from the Hawks Mill area.
- Unflapped drainage outfall pipes on the riverbank may have created a pathway for the floodwater to rise onto Crown Street.

LLFA recommended action(s):

- Investigate potential NFM projects to ‘slow the flow’ and attenuate water on overland flow paths (leaky dams, restoration of watercourses, etc.) to the west and north of Needham Market.

- Ensure main river maintenance is delivered where there is flood risk benefit and investigate potential to Increase the extent and frequency of main river maintenance across the town, based on hydraulic modelling.
- Carry out CCTV survey and any required maintenance of culverts below the railway embankment and under Hawks Mill Street.
- Identify ownership of existing outfalls in the main river channel on Crown Street and investigate the feasibility of installing non-return flap valves.

4. **Highlands Close, John Swain Close**

Several properties on Highlands Close and John Swain Close suffered internal flooding from the Orchard Gate watercourse. On the morning of Friday 20 October, floodwater levels peaked at about midday and had started to drain away by the early evening.

The footbridge over the watercourse at Highlands Close marks the upstream limit of the main river, which falls under Environment Agency jurisdiction. Upstream of the footbridge is classified as an ordinary watercourse. This section is maintained by Mid-Suffolk District Council. The footbridge over the watercourse at Highlands Close marks the point at which the upstream ordinary watercourse network becomes classified as main river and is thus under the jurisdiction of the Environment Agency. There is a culvert under the footbridge which has a limiting effect on the capacity of the watercourse. It is set in a very tall brick headwall that forms the footbridge. The Environment Agency received a report of a blockage to this culvert via their NIRS (National Incident Reporting System) on 20 October. When visiting the site after Storm Babet, Environment Agency officers noted a possible access prevention or trash screen on the downstream face of the culvert. It is highly likely that during Storm Babet with the culvert running at full capacity, this screen caught debris and presented a major obstruction to the water flow. The screen on the culvert exit has since been removed.

There is evidence to show the channel was overgrown with thick vegetation prior to Babet, this may also have impeded the water flow and added to the debris washed into the culvert. Council workers visited the site and cleared the vegetation in and around the watercourse a short time after the flooding.

Upstream of the footbridge, the watercourse sits in a deep channel. The northern bank with the public footpath, is much higher than the southern bank. During site visits, Environment Agency officers noted an apparent low spot on the southern bank, potentially providing a flow pathway for the floodwater into the rear gardens on Highlands Close. There is also a low section of the southern bank to the rear of John Swain Close. At this location residents had created makeshift barriers to try to prevent water overtopping from the watercourse into their gardens post Storm Babet (Image 10).

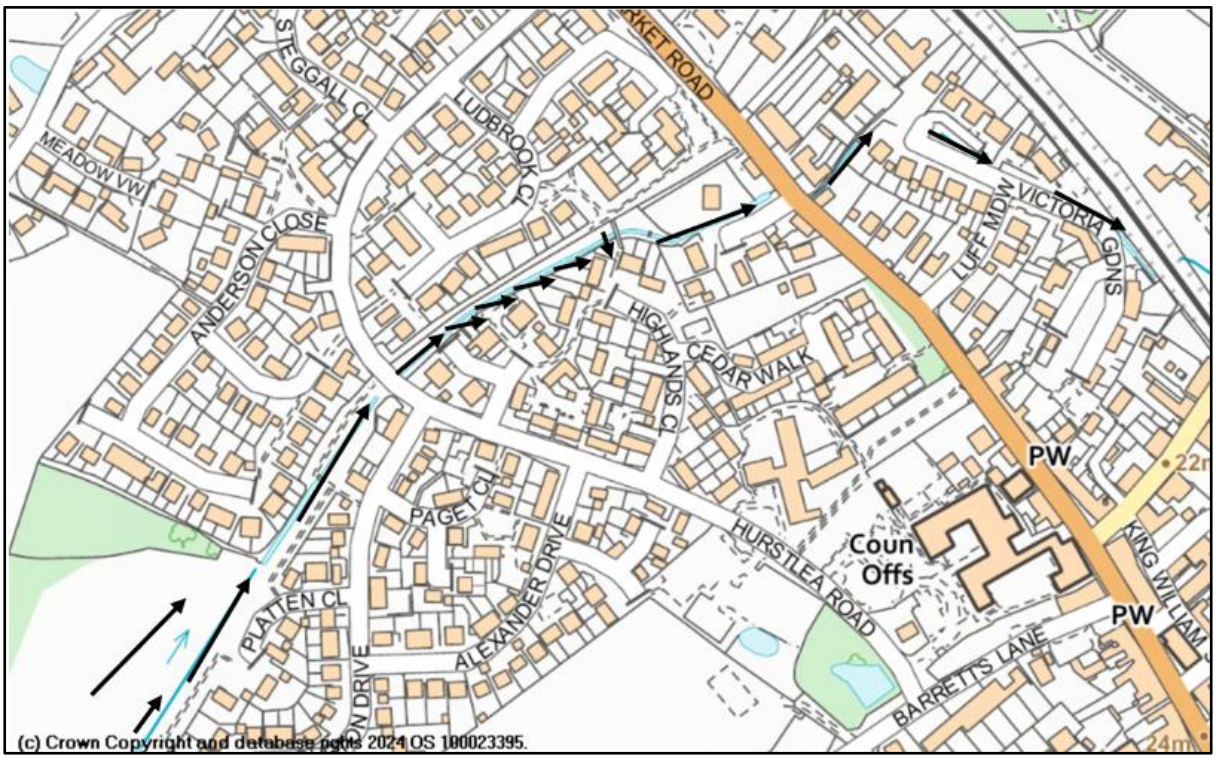

Figure 14 - Approximate floodwater flow routes on Highlands Close and John Swain Close

Flooding was likely caused by a combination of factors; a blockage in the culvert, the tall brick headwall of the footbridge blocking any flow downstream and the elevated height of the watercourse's northern bank. The observed floodwater extents and pathways from the watercourse match closely with the flood extents shown on the national surface water flood risk mapping (Figure 6).

In summary:

- Intense and prolonged rainfall resulted in excess floodwaters flowing off the fields and surrounding catchment to the west of Needham Market, resulting in significant flows of floodwater in the Orchard Gate watercourse.
- Multiple constrictions: road bridges, footbridges, blocked culverts and overgrown in-channel vegetation hindered the conveyance of the flood water away from the Highlands Close and John Swain Close areas.

LLFA recommended action(s):

- Investigate potential NFM projects to 'slow the flow' and attenuate water on overland flow paths (leaky dams, restoration of watercourses, etc.) to the west of Needham Market before entering the Orchard Gate watercourse.
- Ensure there is a channel maintenance regime in place for the upper section of the Orchard Gate watercourse (ordinary watercourse) in the urban areas.
- Ensure any observed blockages to bridges or culverts are reported to the relevant authority and removed.

Images of Flooding

Image 1 - Flooding along Barking Road

Image 2 - Barking Road floodwater showing flowpath over the dropped kerb

Image 3 - Sequence of flooding from a drainage gully on Pinecroft Way

Image 4 - Flooding on Limetree Close next to the Lion Barn drain

Image 5 - Flooding on Pinecroft Way from the Lion Barn drain

Image 6 - Flooding on Lion Lane

Image 7 - Flooding under Coddenham Road railway bridge

Image 8 - Flooding on Hawks Mill meadow

Image 9 - High river level in the Mill Pond on Hawks Mill Street

Image 10 - Makeshift defences against floodwater overtopping from Orchard Gate watercourse

Risk Management Authorities, Non-Risk Management Authority and flood risk function(s)

The following section acknowledges both RMA's and Non-RMA's relevant to Needham Market and provide an overview of their flood risk functions. The table has been compiled from information collated as part of the investigation. It is not exhaustive and it should be acknowledged additional organisations and groups may be active within the community.

Risk Management Authority	**Relevant Flood Risk Function(s)**
Suffolk County Council	Lead local Flood Authority (LLFA), Highways Authority & Asset Owner
The Environment Agency (EA)	Lead organisation for providing flood risk management under its permissive powers and issuing warnings of flooding from main river
Anglian Water	Asset Owner
Mid Suffolk District Council (MSDC)	Local Planning Authority (LPA) & Asset Owner
Non-Risk Management Authority	**Relevant Flood Risk Function(s)**
Private Landowners	Riparian Responsibilities and management of water from land or watercourses
Private Homeowners	Riparian Responsibilities and improving flood resilience to property
Needham Market Town Council	Manage flood risk at a community level, prepare and produce flood action plans and maintain watercourses where present on land they own

Action(s) completed to date:

The following section acknowledges actions that RMA's and Non-RMAs have implemented or are currently in progress since Storm Babet and prior to publishing of this report.

Action	Responsible Party	Progress
Targeted reactive jetting of gullies and drains on Barking Road in the months since Storm Babet	Suffolk County Council Highways Authority	Complete
Carry out the scheduled cyclic cleanse of highway drainage assets across Needham Market	Suffolk County Council Highways Authority	Complete
The trash screen at the downstream end of the footbridge culvert on the Orchard gate watercourse has been removed by the owner after enforcement intervention by the EA	The Environment Agency	Complete
A fallen tree was cleared from the mill pond at Hawks Mill by the EA field team on 19 February 2024	The Environment Agency	Complete
Removal of blockages in main river channels, following reports from the public	The Environment Agency	Complete (also ongoing to respond to future reports)
The EA have engaged with the landowner to clear the fallen tree at the road bridge by Bosmere Mill, as this falls under riparian landowner responsibility	The Environment Agency	Ongoing
Offer of Property Flood Resilience (PFR) measures to the properties that flooded during Storms Babet and Henk	The Environment Agency & Suffolk County Council Lead Local Flood Authority	Ongoing
The Needham Market Flood Group was formed in May 2024. They can be contacted via the	Needham Market Town Council	Ongoing

Town Council. The group have met with the Environment Agency and SCC and obtained mapping documents of all tributaries into and within Needham Market. Some surveying by members has been completed		
Orchard Gate Watercourse and Lion Barn Drain both have maintenance completed on full extent of main river excluding concrete channel NE of High Street into Luff Meadow and excluding Network Rail land. Current maintenance is completed in line with Government guidance: "In-channel weed cutting should ideally take place late in the summer or autumn (weather and flow levels permitting), to ensure the most benefit for winter conveyance and to avoid the bird nesting and fish spawning seasons. Also, cutting in warm weather can increase the risk of seriously affecting the water quality and wildlife, especially for fish"	The Environment Agency	Completed during winter 2023 pre and post Storm Babet

LLFA Recommended Action(s):

The following section provides a range of flood mitigation measures that could be implemented to reduce the risk of flooding in Needham Market. They have been derived from data and evidence collated as part of the report and have been included having been considered realistic in their implementation. The implementation of actions falls to the responsible party. Progress on the action will be monitored by Suffolk County Council but it should be acknowledged that the council has limited powers to enforce the implementation of recommended actions.

Action	Responsible Party	Timescale for response	Latest Progress Update for Actions
Short Term Actions (e.g. standard maintenance activity and initial investigation of options that can be undertaken with limited need for forward planning)			
Establish a Community Emergency Plan that includes plans to manage future flood events –Liaison with Suffolk Joint Emergency Planning Unit	Needham Market Town Council	6 months	EA also happy to support the Town Council in this, providing guidance and advice on our flood warning service
Maximise the take up of the £5k PFR Grant currently available to residents before the April 2025 deadline	SCC LLFA / Residents	7 months	Ongoing
Understand the annual event probability of the rainfall & river flow across the region and specifically Needham Market	EA	6 months	Ongoing
Ensure main river	EA	Annually	Ongoing

maintenance is delivered where there is flood risk benefit and investigate potential to Increase the extent and frequency of main river maintenance across the town			
Ensure riparian landowner responsibilities are understood with the potential to increase the extent and frequency of watercourse maintenance across the town	EA and SCC LLFA	6 -12 months	Ongoing
Ensure the completion of highway drainage asset cyclic maintenance across Needham Market. Ensure observed blockages are removed. Key areas include Barking Road, Pinecroft way, Lion lane, Maitland Road	SCC Highways Authority	Annually	Ongoing
Investigate highway drainage infrastructure to ensure capacity and condition are sufficient in worst affected areas. Key areas include Barking Road, Pinecroft	SCC Highways Authority	6 - 12 months	

way, Lion lane, Maitland Road & Crown Street			
Fit non-return flaps on the outfalls along the Lion Barn drain through Pinecroft Way	SCC Highways Authority	6 months	Installation of the non-return valves at Pinecroft scheduled for late August / early September
Investigate the existing outfalls in the main river channel on Crown Street	SCC Highways Authority	6 - 12 months	
Ensure there is a channel maintenance regime in place for the upper section of the Orchard Gate watercourse. MSDC shown as landowner	Mid Suffolk District Council	6 - 12 months	
Medium Term Actions (e.g. longer planning timescales and potential need to source funding but potential for greater impact)			
Investigate potential NFM projects to 'slow the flow' and attenuate water on overland flow paths affecting Barking Road, Foxglove Avenue, Long & Short Plantation, Stowmarket Road). E.g. leaky dams, restoration of watercourses	SCC LLFA, EA, landowners	12 - 24 months	
Investigate capacity of the culvert under Lion Lane / Coddenham road	SCC Highways & Structures	12 months	

corner. Carry out a de-silt / cleanse if required			
Fit non-return flaps on the existing outfalls in the main river channel on Crown Street if determined to be a viable option	SCC Highways Authority	12 months	
Investigate the potential to raise the dropped kerb on Barking Road or move to another location	SCC Highways Authority	12 months	
Investigate the drainage problems below Barking Road near Grinstead Barn	SCC Highways Authority	12 months	
Carry out CCTV survey and any required maintenance of culvert under Hawks Mill Street	SCC Highways Structures	12 months	
Ensure a maintenance regime in place for the entrance to the Anglian Water culvert below Hargrave Avenue. CCTV survey to be done to assess drainage functionality of the asset	Anglian Water	12 months	
Through hydraulic modelling Investigate the flood risk implications of	EA	2025	Ongoing

varying amounts of silt in the Main River channel			
Explore options to reduce the field run off from the west of Foxglove Avenue. Possible vegetation strip / break, bund or ditch between field and properties	SCC LLFA and Landowners	12 - 24 months	
Installation of Property Flood Resilience (PFR) measures via grant funded schemes	Residents/businesses/Environment Agency/SCC LLFA	2025-2026	Properties have been contacted regarding initial survey. Installation of PFR measures to follow
Investigate potential viability and seek funding for projects which aim to attenuate water in the upper catchments e.g. storage ponds, wetland areas.	SCC LLFA, EA, Landowners	12 - 24 months	
Undertake topographic survey of Lion Barn drain & Orchard gate watercourse and update hydraulic modelling to improve understanding of flood risk through Pinecroft Way, Highlands Close & John Swain Close.	EA	9 months+	Ongoing

Improved understanding and modelling of fluvial and pluvial flooding within the town to inform bids for potential future works.	SCC LLFA and EA	12 - 24 months	
Investigate options for the bund between Pinecroft and Coddenham Road to allow drainage from the estate and maintain defence from flooding from the main river Gipping.	SCC LLFA and EA	12 - 24 months	
Investigate the surface water sewer network and associated Anglian Water assets on Maitland Road industrial estate to check condition and ensure effectiveness	Anglian Water	12 months	
Investigate opportunities to update development plan policy in Neighbourhood Plans or any potential Joint Local Plan site allocation(s) which identify risks and opportunities to mitigate flood risk issues as development comes forward	LPA, SCC LLFA	12 months+	Ongoing

Long Term actions (significantly longer timescale and budget required with potentially greater positive impact)			
Improvements to highway drainage network to manage surface water flows if investigation works suggest it is beneficial and viable.	Highways Authority	TBC	
Investigations into the feasibility of potential improvements to the flood warning service; to determine whether improvements to the spatial extent of the area which can currently receive flood warnings, as well as the accuracy and timeliness of warnings can be made.	EA	18 months+	
Installation of NFM features within upper catchments to attenuate and slow flood water if investigation works suggest it is viable.	SCC LLFA, EA and landowners	TBC	
Investigate further community-wide options for managing flood risk from the Lion Barn Drain,	SCC LLFA and EA	TBC	

Orchard gate Watercourse, and surface water sources.			

Approval

This report will be reviewed and updated every 6 months until actions are marked as complete.

Reviewer	Date of Review

Disclaimer

This report has been prepared and published as part of Suffolk County Council's responsibilities under Section 19 of the Flood and Water Management Act 2010. It is intended to provide context and information to support the delivery of the local flood risk management strategy and should not be used for any other purpose.

The findings of the report are based on a subjective assessment of the information available by those undertaking the investigation and therefore while all reasonable efforts have been made to gather and verify such information may not include all relevant information. As such it should not be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event. Should there be additional information available to develop the report, please email to floodinvestigations@suffolk.gov.uk

The opinions, conclusions and recommendations in this Report are based on assumptions made by Suffolk County Council when preparing this report, including, but not limited to those key assumptions noted in the Report, including reliance on information provided by third parties.

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The implications for producing Flood Investigation Reports and any consequences of blight have been considered. The process of gaining insurance for a property and/or purchasing/selling a property and any flooding issues identified are considered a separate and legally binding process placed upon property owners and this is independent of and does not relate to Suffolk County Council highlighting flooding to properties at a street level. Property owners and prospective purchasers or occupiers of property are advised to seek and rely on their own surveys and reports regarding any specific risk to any identified area of land.

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