Contents

3. Derwent Catchment

3.1 Derwent Catchment Event Hydrology

This section describes the hydrological conditions that were experienced across the Derwent sub-catchment during Storm Babet, including rainfall and river patterns and their rarity. The Hydrology Technical Appendix provides more details on the event hydrology within Derbyshire leading up to and during Storm Babet.

3.1.1 Catchment Characteristics

The Derwent sub-catchment spans through the centre of Derbyshire from east of Manchester near Glossop to south of Derby. The largest river in this sub-catchment is the River Derwent, which flows south-east from its source through Bamford, Grindleford, Baslow, Rowsley, Matlock, Belper, Duffield and Derby until it combines with the River Trent southwest of Long Eaton. The tributaries include the River Westend, River Ashop, River Noe, River Wye, River Ecclesbourne and Markeaton Brook on the right bank (right bank of the river when looking downstream), and Bar Brook, River Amber, Bentley Brook, and Bottle Brook on the left bank (left bank of the river when looking downstream).

Figure 3-1 indicates the Derwent sub-catchment extent in respect of the Derbyshire area, in addition to showing the location of the rainfall, river flow and level gauges within or near the sub-catchment.

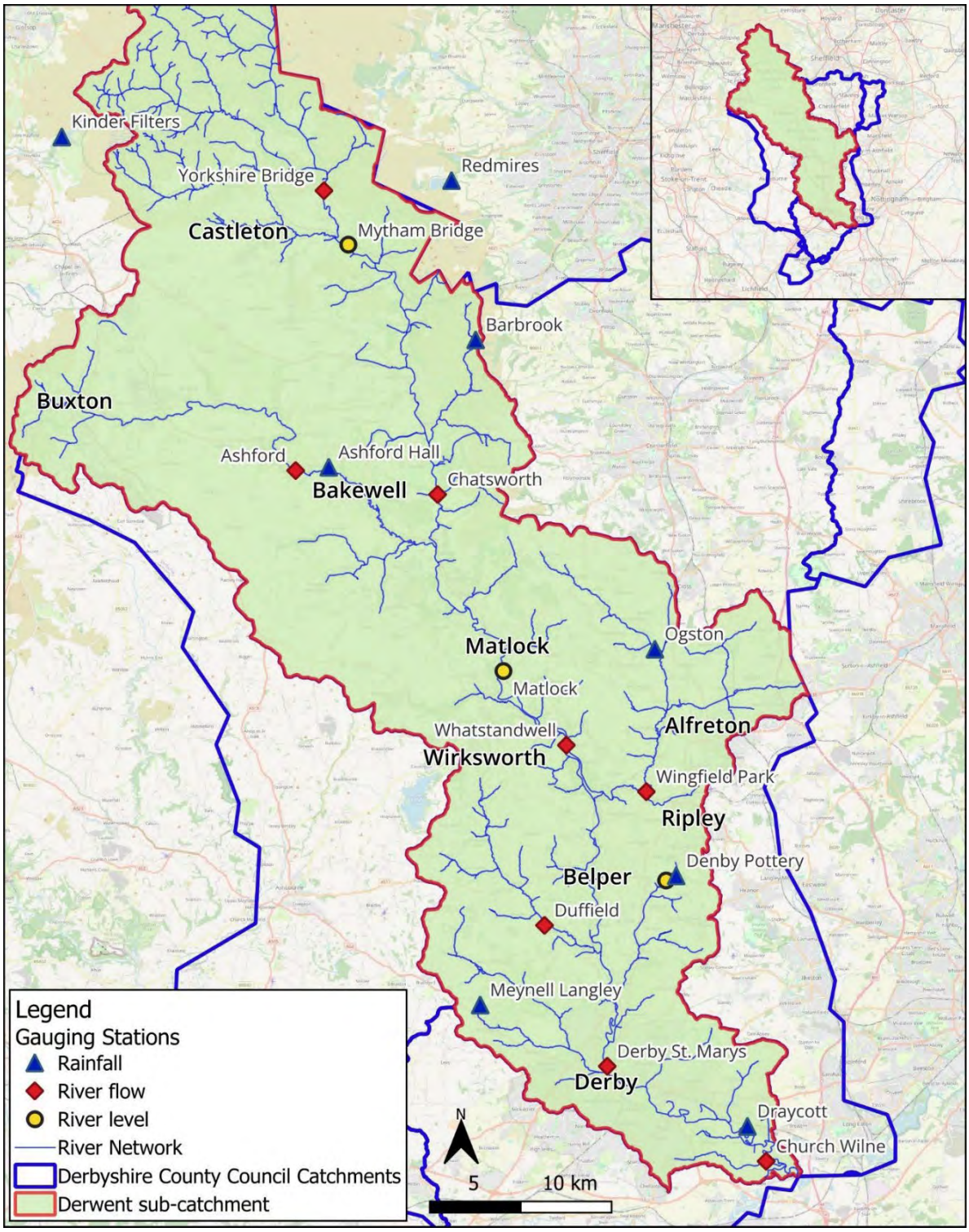

Figure 3-1: Extent of the Derwent sub-catchment and location of rainfall, river flow and river level gauges.

3.1.2 Hydrological Summary

3.1.2.1 A Reminder on Probability

The chance of something happening is often expressed as a probability. If something has a small probability of occurring it is a rare event, meaning that the chance of it happening within a certain timeframe is small. Within the context of this report, a rare event is also a more extreme event, for example a more extreme weather event. Conversely, if something has a higher probability of occurring, then the chance of it happening in a certain timeframe is higher. Again, within the context of this report, a more frequent event is also a less extreme event, for example a less extreme weather event.

More specifically, this section of the report refers to the probability of high rainfall and river flow events using the term "annual exceedance probability" (AEP). This indicates the severity or rarity of an event at a particular

location. AEP refers to the chance that a specific hydrological condition, for example 100mm of rain falling during a storm, is exceeded in a one-year period. In this context to exceed means a rarer, or extreme, weather event.

An example of a severe and rare event would be a 1% AEP event. This is an extreme weather condition that has only a one in a hundred chance of being exceeded in any given year. An example of a less extreme, but still intense, event would be a 25% AEP event. This has a one in four chance of being exceeded in any given year. As indicated by these examples, the smaller the percentage AEP stated, the more rare or extreme an event is.

3.1.2.2 Rainfall

During Storm Babet, heavy rainfall lasted from the 18th to the 21st of October 2023 across the Derwent sub-catchment with rainfall peaking early on the 20th of October from 4:15am to 10:00am. The most extreme rainfall occurred in the north-eastern part of the sub-catchment over Stoney Middleton, Baslow, and Thornhill. Recorded rainfall equated to 0.3% to 4% AEP events at all stations except Kinder Filters which recorded rainfall equating to a 25% AEP event. This station is located to the north-west, just outside the Derwent sub-catchment.

3.1.2.3 Rivers

Shorter and earlier river responses to heavy rainfall were recorded in the downstream tributaries of the River Derwent, at the River Ecclesbourne and Bottle Brook near the towns of Duffield and Rawson Green. Later and longer responses to heavy rainfall were recorded at stations on the River Derwent itself, nearer to Derby, and Whatstandwell. The shortest lag time between peak rainfall and peak flow was recorded at Duffield on the River Ecclesbourne (7 hours) while the longest was recorded at St. Mary's Bridge on the River Derwent in Derby (27 hours). The later peak is reflective of multiple tributaries feeding into the River Derwent.

St. Mary's Bridge on the River Derwent and gauging stations on the River Ecclesbourne, River Amber and Bottle Brook produced the highest ranked flows or levels on record in response to Storm Babet. These stations are in Derby, Rawson Green and Lower Hartshay.

Peak river flows and levels recorded during Storm Babet in the upstream regions of the River Derwent (Yorkshire Bridge, Mytham Bridge) did not record high ranking flows. This is because of intentional lowering, or 'draw-down', of water levels in Ladybower Reservoir by Severn Trent in the lead-up to the Storm Babet event. This is a role Severn Trent can play to create some capacity in their reservoirs at certain times of the year, to store flood water to help alleviate downstream flooding. To do this, Severn Trent is required to contact the Environment Agency and ask whether it is appropriate for them to operate the draw-down. The Environment Agency have access to information on environmental conditions (e.g., weather forecasts and saturation of the catchment) and relationships with downstream river users. This information can inform the Environment Agency on whether conditions downstream are suitable for additional water to be released and confirm with Severn Trent, who carry out the operation. Those who sign up to receive Flood Warnings (see 2.4.4) will receive an alert from the Environment Agency when a draw-down from Ladybower Reservoir will take place.

3.1.2.4 Communities

The rainfall conditions severity at each local community within the Derwent sub-catchment are listed below. Event rarity was estimated from the nearest rainfall gauging station to each community:

- 0.3% AEP: Bradwell
- 1.1% AEP: Baslow East, Stoney Middleton
- 1.4% AEP: Lilac Way, Ridgeway, Clay Cross
- 2.3% AEP: Breadsall, Ockbrook
- 2.6% AEP: Little Eaton, Duffield
- 3.8% AEP: Lower Kilburn, Denby Bottles
- 25% AEP: Castleton

For access to the nearest gauging station to each community, please see the Government's Check for Flooding Service: https://check-for-flooding.service.gov.uk/river-and-sea-levels.

3.2 Community Impacts - Lilac Way

3.2.1 Location Characteristics

Six residential properties suffered internal flooding as a result of Storm Babet in Lilac Way, located in the village of Shirland, north-east Derbyshire, as shown in Figure 3-2. The area flooded is next to a small, culverted ordinary watercourse which runs from north to south, parallel to Lilac Way. Lilac Way is near to the bottom of a shallow valley associated with the small watercourse, with ground levels rising to the east and west. The community is located within the catchment of the River Amber, a tributary of the River Derwent, Derbyshire.

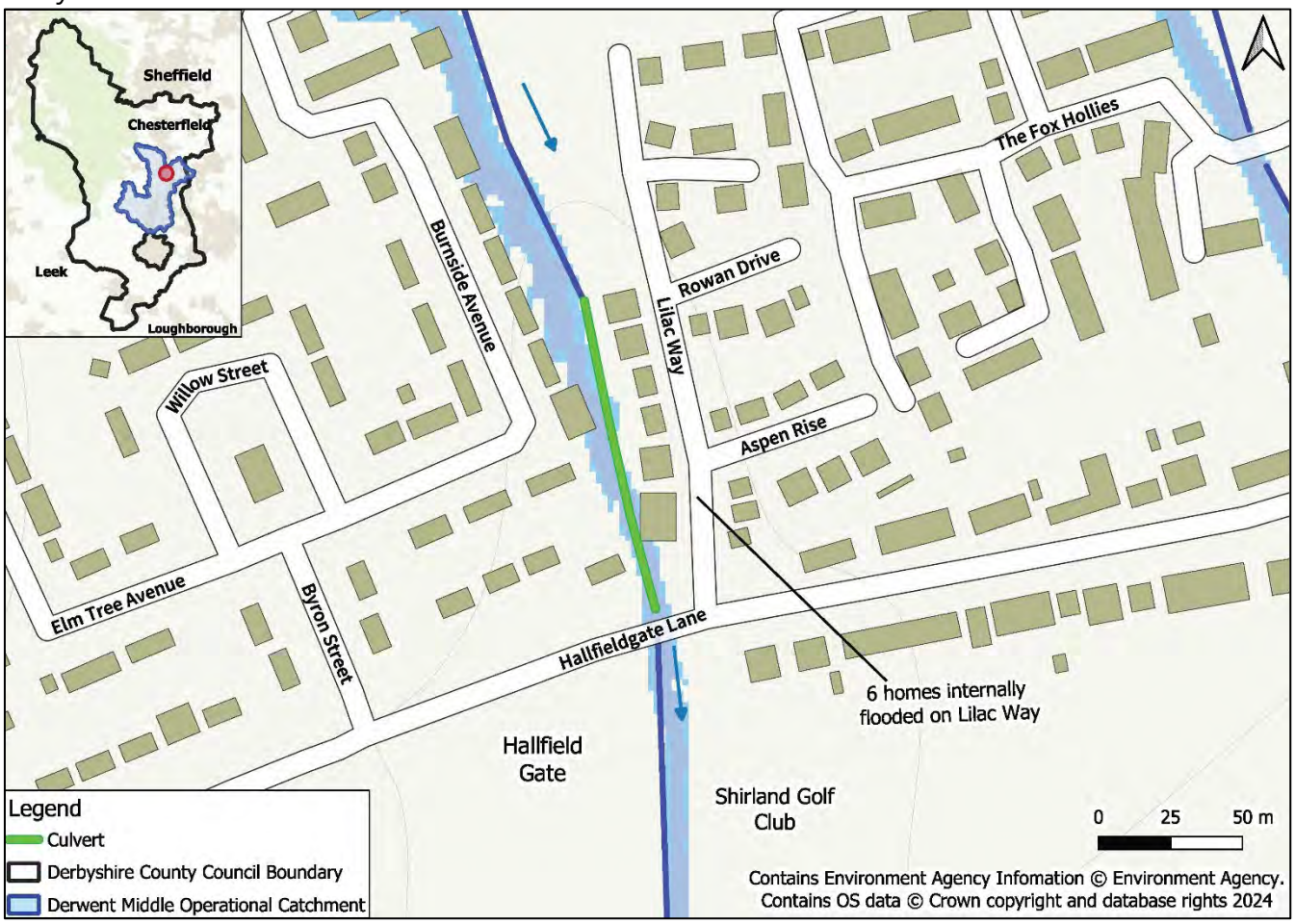

Figure 3-2: Overview Map of Lilac Way and surrounding area.

The community is mainly residential, with some businesses. Homes on Lilac Way are relatively modern, consisting of bungalows, semi-detached, and detached properties. Lilac Way connects onto Hallfieldgate Lane, which in turn provides access to the A61. There are no known vulnerable groups within the community.

The area is elevated above the River Amber floodplain, which is approximately 500m to the west. The local geology is a mixture of sedimentary sandstone and mudstone.

The Environment Agency Historic Flood Map indicates that there have been no previous flood events. However, it is understood that the area flooded in February 2020. The Long Term Flood Risk Map for Surface Water (https://check-long-term-flood-risk.service.gov.uk/postcode) shows the chance in any given year of flooding from surface water and is shown for Lilac Way and its surrounding area in Figure 3-3. The map indicates that there is some potential risk of surface water flooding associated with the natural drainage pathway next to Lilac Way, although the scale of the national mapping does not allow for detailed local assessment. The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows flood risk from larger rivers but is not relevant here given the minor nature of the local watercourse.

The community is not located within or near any nationally designated environmental sites.

Figure 3-3: Map showing the chance in any given year of flooding from surface water at Lilac Way.

3.2.2 Current Flood Risk Management Arrangements

The area is not serviced by Environment Agency Flood Alerts or Flood Warnings, and there are no existing flood defences present. There are no notable assets with a flood risk management purpose that are owned or maintained by other organisations. There are no records of property flood resilience at any of the properties in the community.

3.2.3 Storm Babet Incident Details

Internal flooding of residential properties occurred on the 20th of October 2023.

The six properties recorded as flooding internally are all residential homes on the west side of Lilac Way. All properties have gardens that back onto the ordinary watercourse which is partly culverted beneath the gardens of the properties on Lilac Way. Three properties were also flooded externally.

3.2.4 Flood Mechanisms, Extent and Impacts

Lilac Way lies along a small, natural surface water drainage pathway. Unfortunately, this drainage pathway has been built on, and the watercourse buried within a culvert has limited capacity. This increases the likelihood of the culvert becoming blocked. Together with the intensity of rainfall occurring during Storm Babet, these are the causes of the flooding.

The inlet to this culverted watercourse is small, poorly designed and in poor condition. It can be seen in Figure 3-4 below.

Figure 3-4: The culvert inlet of the watercourse which flows southwards parallel to Lilac Way.

North East Derbyshire District Council investigated the flood event which included discussions with residents. They suggested that water could not sufficiently pass through the culvert inlet, and this resulted in water bypassing the culvert and flowing into gardens. This is understandable given the very small size of the culvert inlet. Flood water then continued to flow through the gardens to the rear of the properties, and subsequently entered the properties through doorways where flood water reached depths of 0.6m. The flood water continued to flow south and finally into a large chamber that connects the watercourse and surface water gullies from Lilac Way to the watercourse continuing south of Lilac Way Lane. This chamber is shown in Figure 3-5. North East Derbyshire District Council also noted that many of the residents were unaware of the risk of flooding from the ordinary watercourse and their riparian ownership responsibilities to maintain the watercourse. However, it is acknowledged that a single culvert runs through several properties making coordination essential, and this can be difficult for a group of riparian owners to achieve.

Initial investigations into flooding issues were also undertaken by Derbyshire County Council on the 27th of October 2023. They were made aware that water flowed to a low point and pooled somewhere between no. 1 and 7 Lilac Way, then encroached around the properties and then water entered through the doorways. The initial findings were that the culvert capacity was exceeded.

Restrictions within the culvert impeded flow which exacerbated the impacts of flooding. Siltation of a chamber near the downstream end of the culvert was reported, which has subsequently been removed by North East Derbyshire District Council. During the flooding, residents attempted to remove debris from the culvert. The chamber, before and after silt removal, is shown in Figure 3-5 below. It is noted that the siltation is only partial and that the size of the culvert here appears to be much greater than that at the inlet.

Figure 3-5: The picture on the left shows the chamber before cleaning and after de-silting on the right.

3.2.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- North East Derbyshire District Council
- Severn Trent Water
- Emergency services

Derbyshire County Council reported that there were over 100 requests for sandbags in Shirland and that 15 of those requests were responded to, some of which were in the Lilac Way community. North East Derbyshire District Council were not able to respond to all requests for sandbags in time due to the quick onset of the flooding and the distance from the council depot where sandbags were stored.

During the event the community was attended by the Fire and Rescue Service and water and silt was pumped from the Lilac Way.

North East Derbyshire District Council visited the community after the flooding and removed silt and blockages from the chamber, with senior officers having visited on the 22nd of October 2024 to start coordinating clean-up operations and next steps. They carried out this maintenance as a one-off activity in response to the flooding, but they state that they are not responsible for the ongoing maintenance of the chamber. At the time of the event, the responsibility for the access chamber was unclear. Severn Trent have now taken responsibility of the chamber and will be adding it to their maintenance programme.

North East Derbyshire District Council and Derbyshire County Council investigated responsibility and informed residents of their findings. They are working with residents and developers to resolve longstanding issues.

3.3 Community Impacts - Ridgeway

3.3.1 Location Characteristics

Sixteen residential properties in Ridgeway, a hamlet close to Ambergate in the Amber Valley, suffered internal flooding as a result of Storm Babet. The area with internally flooded properties is focused along the A610, locally called Riversdale and Ripley Road, which is the main road between Ambergate and Ripley. The community is located within the River Amber catchment, which is a tributary of the River Derwent in Derbyshire. The section of River Amber that flows through Lower Kilburn is designated as a main river. Figure 3-6 shows the location of the Ridgeway community. Three homes were also flooded on Drover's Way, located

to about 400m to the north east of the homes flooded in Ridgeway.

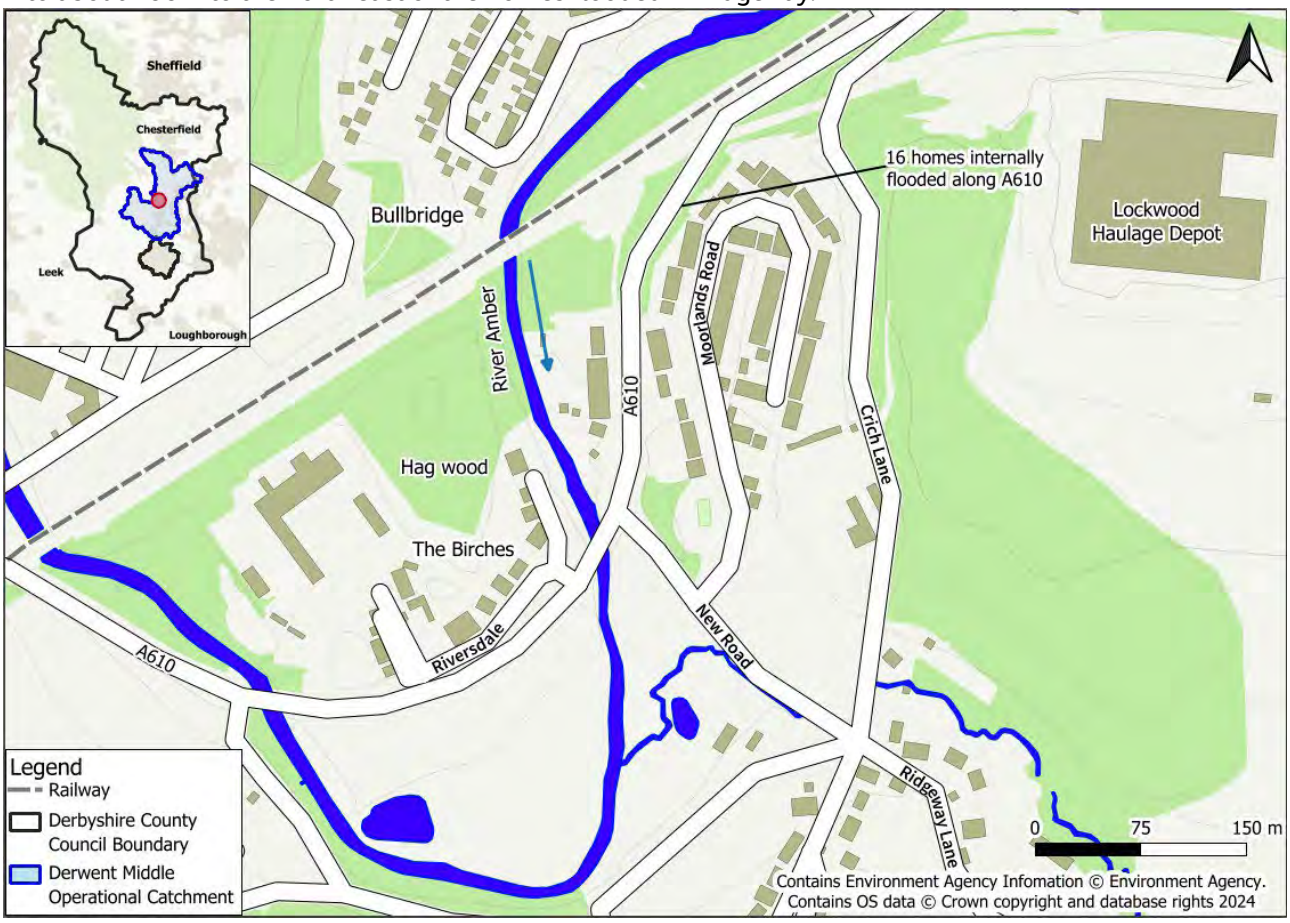

Figure 3-6: Overview Map of Ridgeway affected community.

The community affected by flooding is entirely residential, with terraced, semi-detached and detached properties. The Midlands Main Line Railway is a major railway line running between London and Sheffield and crosses the River Amber twice close to the community. There are no known vulnerable groups within the community.

The community is on the floodplain of the River Amber, which flows westwards to join the River Derwent, approximately 1km west of the community. The flooded homes are to the east of the River Amber. Topographic data shows that the community is low lying relative to the River Amber. The local superficial geology is alluvium, i.e., gravel, sand, silt and clay.

An event in 2007 caused flooding of six properties on Drovers Way and Riversdale within the locality of Bullbridge. One property experienced internal flooding in July 2005 and another two in February 2020. Residents who have gardens backing onto the River Amber report that the water levels came very close to flooding properties in January 2021.

The Environment Agency Historic Flood Map shows that flooding also occurred in 1947 and 1977 which were of similar extents to Storm Babet. These floods were also caused by overflowing of the River Amber, however it is unknown if the same properties were internally flooded.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 3. Flood Zone 3 means the properties are within the floodplain and have a greater than 1% AEP of flooding from rivers. Figure 3-7 shows the extent of Zone 2 and Flood Zone 3 at Ridgeway.

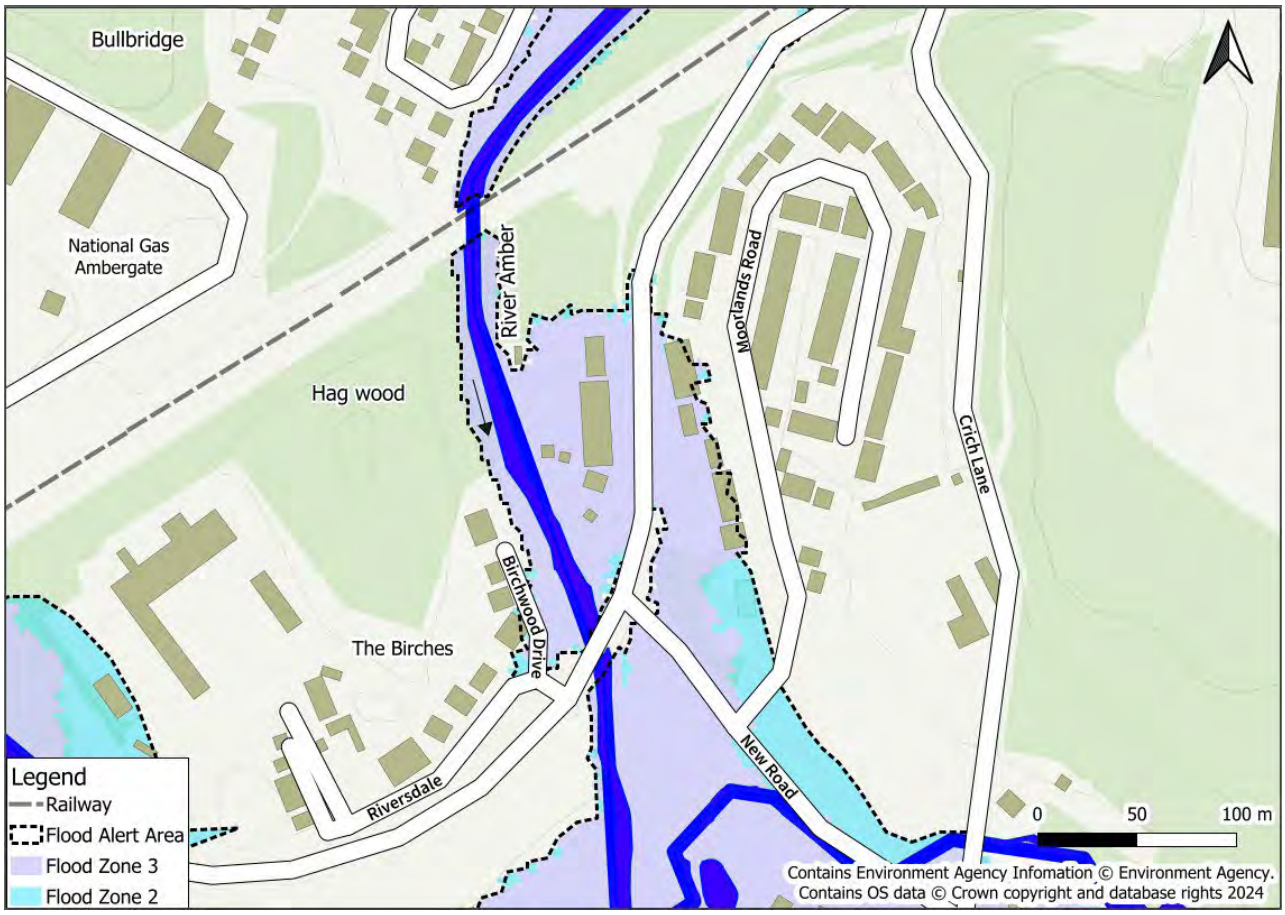

Figure 3-7: Flood zones and Flood Alert area at Ridgeway.

Some homes on both sides of Riversdale have low risk of surface water flooding based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode). Low risk is defined as between a 1% and 0.1% AEP of flooding. Figure 3-8 shows the chance in any given year of flooding from surface water at Ridgeway.

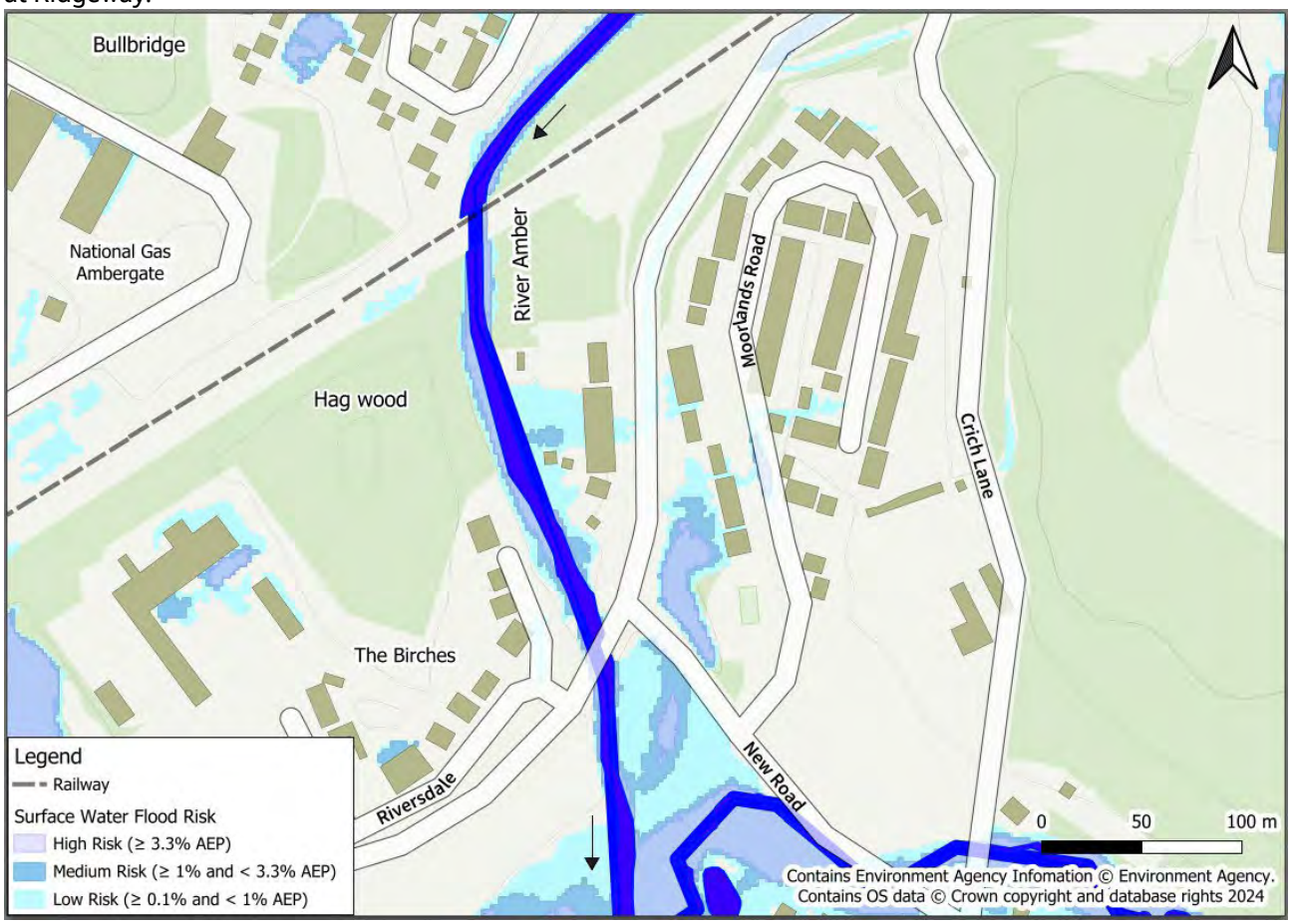

Figure 3-8: Map showing the chance in any given year of flooding from surface water at Ridgeway (Source: Long Term Flood Risk Map)

The community is less than 500m away from the Derwent Valley Mills UNESCO World Heritage Site and two Sites of Special Scientific Interest: Crich Chase and Ambergate & Ridgeway Quarries.

3.3.2 Current Flood Risk Management Arrangements

The community lies adjacent to the River Amber, which has artificial banks but no formal flood defences.

All flooded properties in this community are within the 'River Amber in Derbyshire' EA Flood Alert Area, and the 'River Amber at Ambergate' Flood Warning Area. Therefore, in anticipation of a potential flood event, residents who are signed up to alerts and warnings are informed when flooding is expected. There is a sewage pumping station to the west of the A610 Riversdale that is owned by Severn Trent Water.

Some homes have property flood resilience measures in place (e.g. external flood barriers).

3.3.3 Storm Babet Incident Details

A Flood Alert was issued to the River Amber in Derbyshire on the 19th of October 2023 at 7:13pm, and a Flood Warning was issued on to the River Amber at Ambergate on 20th of October 2023 at 1:46pm. Internal flooding of residential properties is understood to have taken place on the afternoon and evening of the 20th of October 2023.

The sixteen homes which flooded internally are all located on Riversdale on the east side of the River Amber. In addition to the internally flooded homes, four more homes flooded externally.

3.3.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting all of the homes within this community was from the River Amber. This was also the case for the three homes flooded upstream of Ridgeway on Drovers Way.
The River Amber and River Derwent have a confluence downstream, approximately 1km to the west of the community. Both rivers had high volumes of water in them during Storm Babet. The high volume of water in the River Amber led to the river exceeding its channel capacity. The high volume of water in the River Derwent also hindered the River Amber from being able to discharge into the River Derwent. This caused water in the River Amber to back up and levels to rise, contributing to the River Amber overtopping its banks. Hydrology data shows that on the 20th of October 2023, the peak level recorded at the River Amber at Wingfield Park gauge, which is upstream of the community, reached 2.97m; the highest level ever recorded.

The reported depths of internal flooding reached 0.9m and entered homes via doorways. Figure 3-9 shows the water line on the door of one of the properties, indicating the depth of flooding.

Figure 3-9: Flood water line on property door.

The pumping station continued to operate during the event. However, it was overwhelmed by flows during the storm and had no free outlet to pump the flows to. The network backed up as a result. The Environment Agency reported that residents experienced foul flooding overflowing from the drains around their properties.

Surface water also contributed to the flooding. Surface water flowed downhill from the railway/Bullbridge area to the north of Riversdale.

3.3.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Amber Valley Borough Council
- Severn Trent Water
- Emergency Services

The Environment Agency issued a Flood Alert to the River Amber in Derbyshire on the 19th of October 2023 at 7:13pm, and a Flood Warning on to the River Amber at Ambergate on 20th of October 2023 at 1:46pm. This Flood Warning was issued approximately 20 minutes before the flooding began.

Amber Valley Borough Council provided sandbags to residents to help reduce the flooding to their homes.

Residents who were at home and already had flood resilience measures installed, were able to deploy them.

Severn Trent Water visited the area to clear drains and to notify locals that the sewage pumping stations

despite continuing to pump, had been overwhelmed by flows.

The Police and Fire and Rescue Service were called to shut the A610. However, prior to the road being shut, HGVs had continued to drive through the flood water creating waves which increased the flooding into people's homes.

A public drop in was held on the 15th of January 2024 in Belper for residents and businesses affected by flooding. The event was attended by the Environment Agency, Derbyshire County Council, Amber Valley Borough Council and Severn Trent Water.

3.4 Community Impacts – Baslow East

3.4.1 Location Characteristics

Baslow is a village in Derbyshire in the Peak District National Park near Bakewell. In the community nine residential properties and eleven non-residential properties were internally flooded because of Storm Babet. The area with the most internally flooded residential properties is focused on the east of Baslow village in the Nether End area. The community is located close to Bar Brook which is a tributary of the River Derwent.

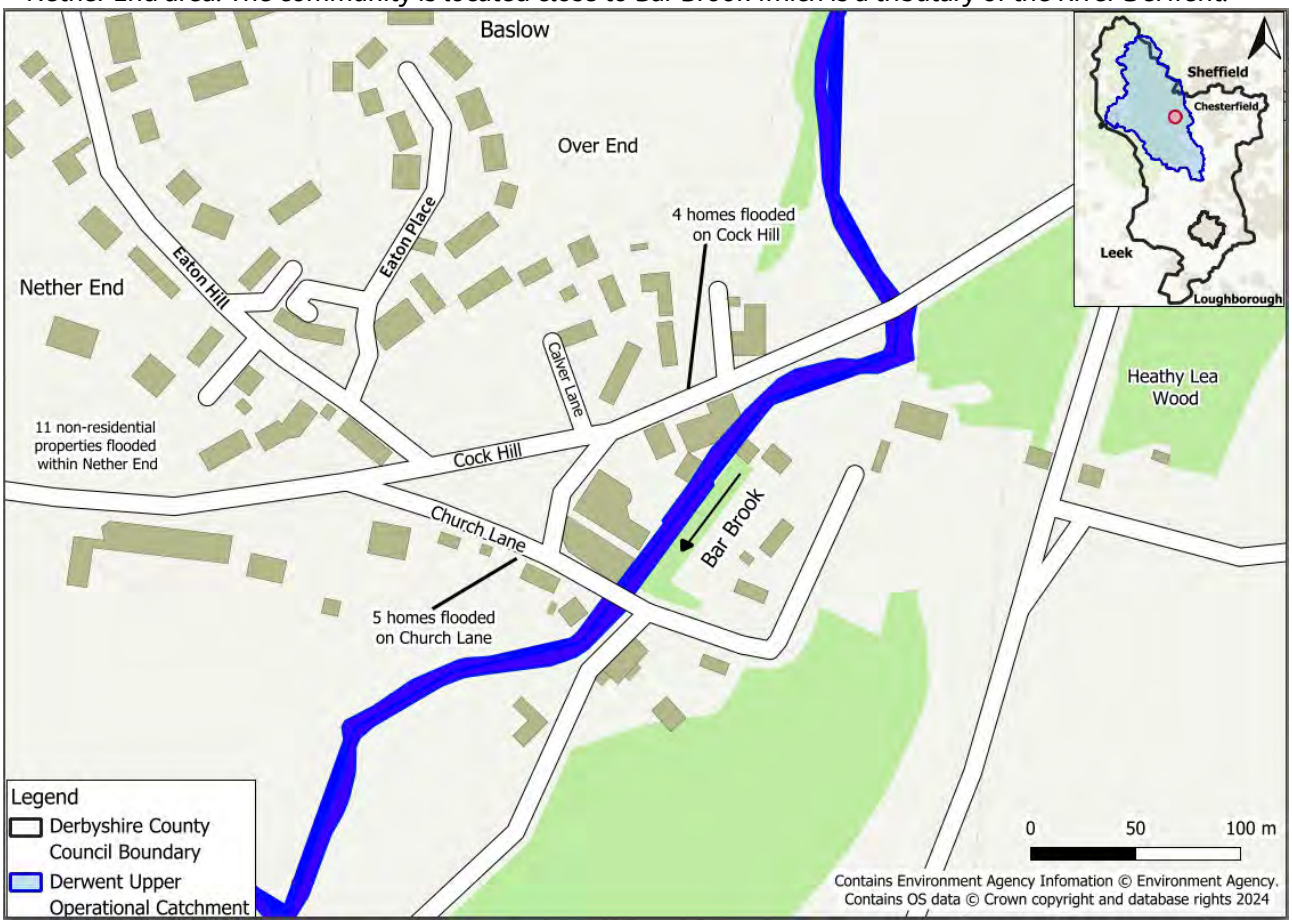

Figure 3-10: Overview map of the Baslow East community.

The community is a mixture of residential and non-residential properties, such as pubs, cafes, restaurants, and public buildings. Homes in the community are predominantly older, consisting of terraced, semi-detached and detached properties. The age profile of the population is relatively older and therefore more vulnerable in a flood event. Baslow is located on the A619 (Cock Hill) between Bakewell and Chesterfield.

The properties that suffered flooding are located on the floodplain of Bar Brook, which flows southwards where it joins the River Derwent approximately 1km downstream of the community.

The area of Nether End has a low point on Cock Hill and topographic data shows the community to sit at the bottom of a valley. The local superficial geology is alluvium (i.e., gravel, sand, silt, and clay) and river terrace deposits (i.e., sand and gravel).

The Environment Agency's Historic Flood Map indicates that most of the properties that flooded as a result of Storm Babet were also flooded previously from Bar Brook.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 2 or Flood Zone 3, with the majority in Flood Zone 3. Flood Zone 3 means the properties are within the floodplain and have a greater than 1% AEP of flooding from rivers. Flood Zone 2 means the properties have a lower probability of flooding from rivers of between a 1% and 0.1% AEP. The extents of Flood Zone 2 and Flood Zone 3 at Baslow East are shown in Figure 3-11.

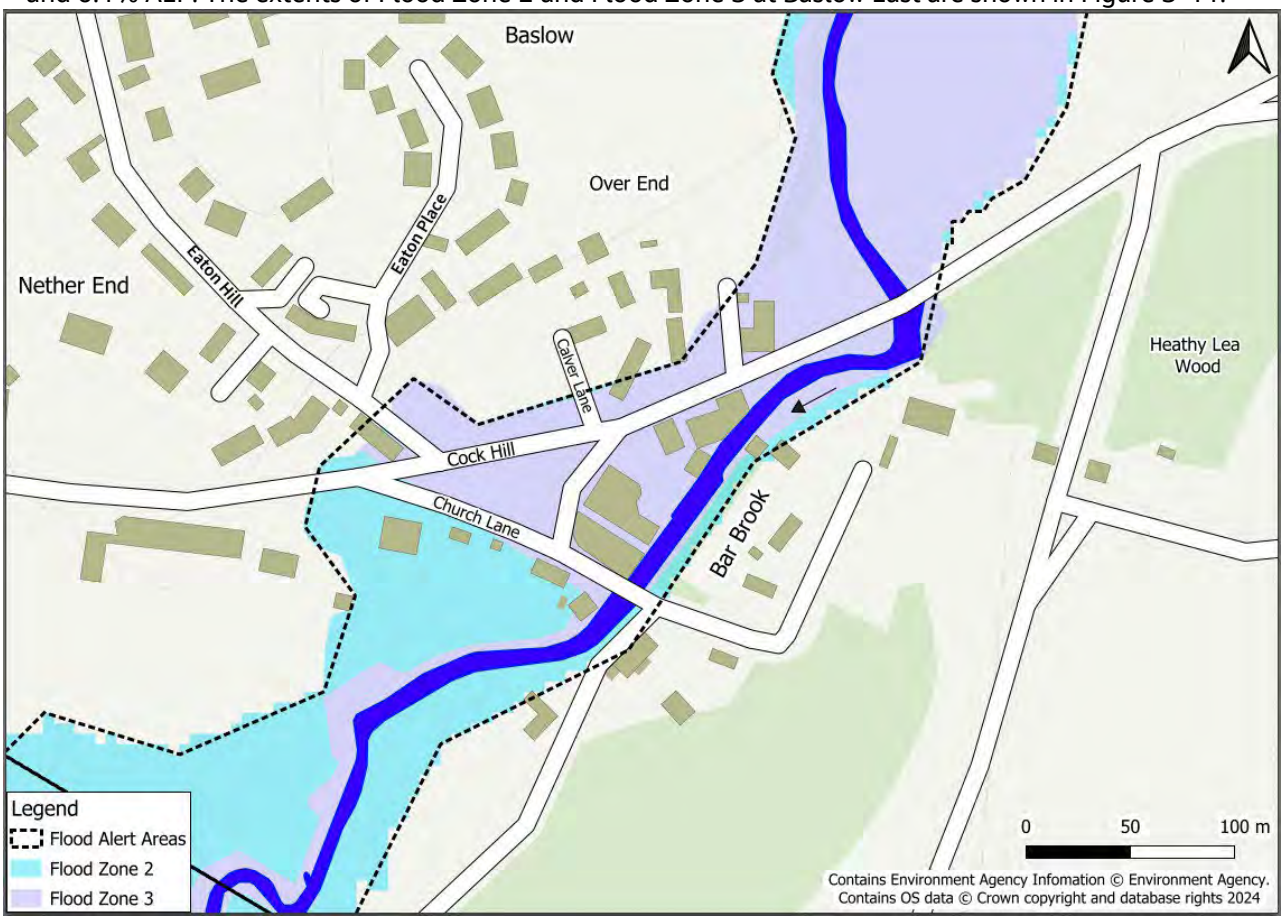

Figure 3-11: Flood zones and Flood Alert area coverage at the Baslow East community.

Additionally, based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode), all the residential properties have at least a low risk of surface water flooding (between a 1% and 0.1% AEP), with many of the properties in the community having a high risk of surface water flooding (more than 3.3% AEP). The chance in any given year of flooding from surface water at the Baslow east community is shown inn Figure 3-12.

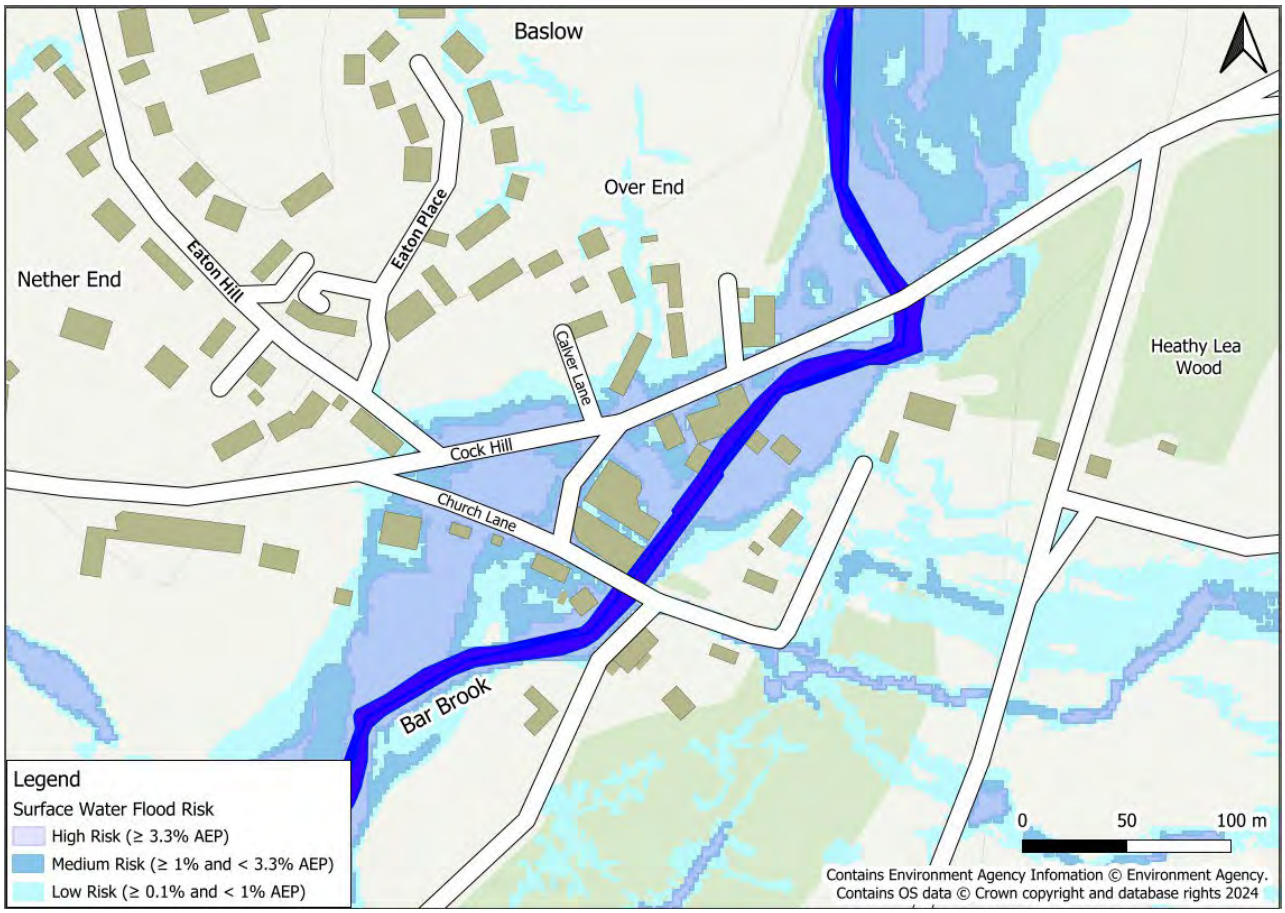

Figure 3-12: Map showing the chance in any given year of flooding from surface water at the Baslow east community (Source: Long Term Flood Risk Map)

The community is not located within or near any nationally designated environmental sites. However, the community does sit just outside the boundary of Chatsworth House Estate, and the Baslow Old Bridge is a Scheduled Monument.

3.4.2 Current Flood Risk Management Arrangements

All the residential properties that suffered flooding within this community are located within the Environment Agency's 'Tributaries in North Derbyshire' Flood Alert Area. The residential properties that flooded are not within a flood warning area. Three of the non-residential properties that suffered flooding are located in the 'Upper Derwent in Derbyshire' Flood Alert Area, and the 'River Derwent at Baslow and Bubnell' Flood Warning Area.

The Environment Agency's Asset Information and Maintenance Programme (data.gov.uk) (https://environment.data.gov.uk/asset-management/) shows there to be an asset 190 metre in length along the western bank of Bar Brook, to the east of The Wheatsheaf Pub, north of the A619 bridge over Bar Brook. The defence is listed as engineered high ground which was constructed in 1969. Aerial imagery shows the engineered high ground to appear to be a heavily wooded embankment which could be classed as a raised flood defence.

3.4.3 Storm Babet Incident Details

A flood alert was issued to the 'Tributaries in North Derbyshire' Flood Alert Area on the 19th of October at 7:13pm. A flood alert was also issued to the 'Upper River Derwent in Derbyshire' Flood Alert Area on the 20th of October at 9:26am, and a Flood Warning was issued to the 'River Derwent at Baslow and Bubnell' on the 20th of October at 3:44pm.

Internal flooding of residential properties is understood to have taken place on the afternoon and evening of the 20th of October.
The nine homes which flooded internally include four on Cock Hill (A619) and five properties on Church Lane. Eleven non-residential (commercial/businesses) properties flooded internally are located around the Nether

End area to the east of Baslow.

3.4.4 Flood Mechanisms, Extent and Impacts

The main source of flooding to the residential properties in the community was Bar Brook which exceeded its capacity and overflowed its banks.

It was also reported that there was flooding due to the volume of surface water on the highway. There are anecdotal reports that this was exacerbated by a burst water main on Cock Hill (A619); however, Severn Trent received no reports of a burst in this area during Storm Babet. It is understood that the water main burst due to erosion of the road surface caused by flooding. It was also reported there was a large volume of surface water flowing towards the community from the north of Cock Hill, where springs related to old mine workings have appeared. This surface water flowed southwards down the hill towards the low point on Cock Hill (A619), where there is a triangle of grass and trees between Church Lane and Cock Hill. All these flooding mechanisms combined to flood the Nether End car park, Baslow Village Hall and the properties identified. Figure 3-13 shows the local ground level and arrows indicate the direction of surface water runoff and direction of flooding from Bar Brook.

Figure 3-13: Ground level and Storm Babet flow routes at the Baslow East community.

3.4.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Derbyshire Dales District Council
- Severn Trent Water
- Emergency Services

The Environment Agency issued a flood alert to the tributaries in North Derbyshire on the 19th of October at 7:13pm and to the Upper River Derwent in Derbyshire on the 20th of October at 9:26am. A Flood Warning was issued to the River Derwent at Baslow and Bubnell on the 20th of October at 3:44pm.

A public drop in was held at Baslow Village Hall on the 19th of February 2024 at Baslow Village Hall attended by the Environment Agency, Derbyshire County Council, Derbyshire Dales District Council and Severn Trent Water.

Derbyshire Dales District Council set up a sandbag hub in the area to provide residents with access to sandbags throughout the event. In the days following the event, Derbyshire Dales District Council carried out welfare checks on effected properties.

The Environment Agency removed gravel which had accumulated around the Park side area located downstream of bridge at Church Lane.

3.5 Community Impacts – Little Eaton

3.5.1 Location Characteristics

Storm Babet resulted in eight residential properties suffering internal flooding in Little Eaton, a village in the borough of Erewash approximately 5km north of Derby city centre. Figure 3-14 below shows the area where the main group of residential properties flooded, around Croft End on the west side of Bottle Brook. One property also flooded on the east side of Bottle Brook, off Alfreton Road. Bottle Brook flows from north to south through the community and is a tributary of the River Derwent. The section of Bottle Brook that flows through Little Eaton is designated as a main river.

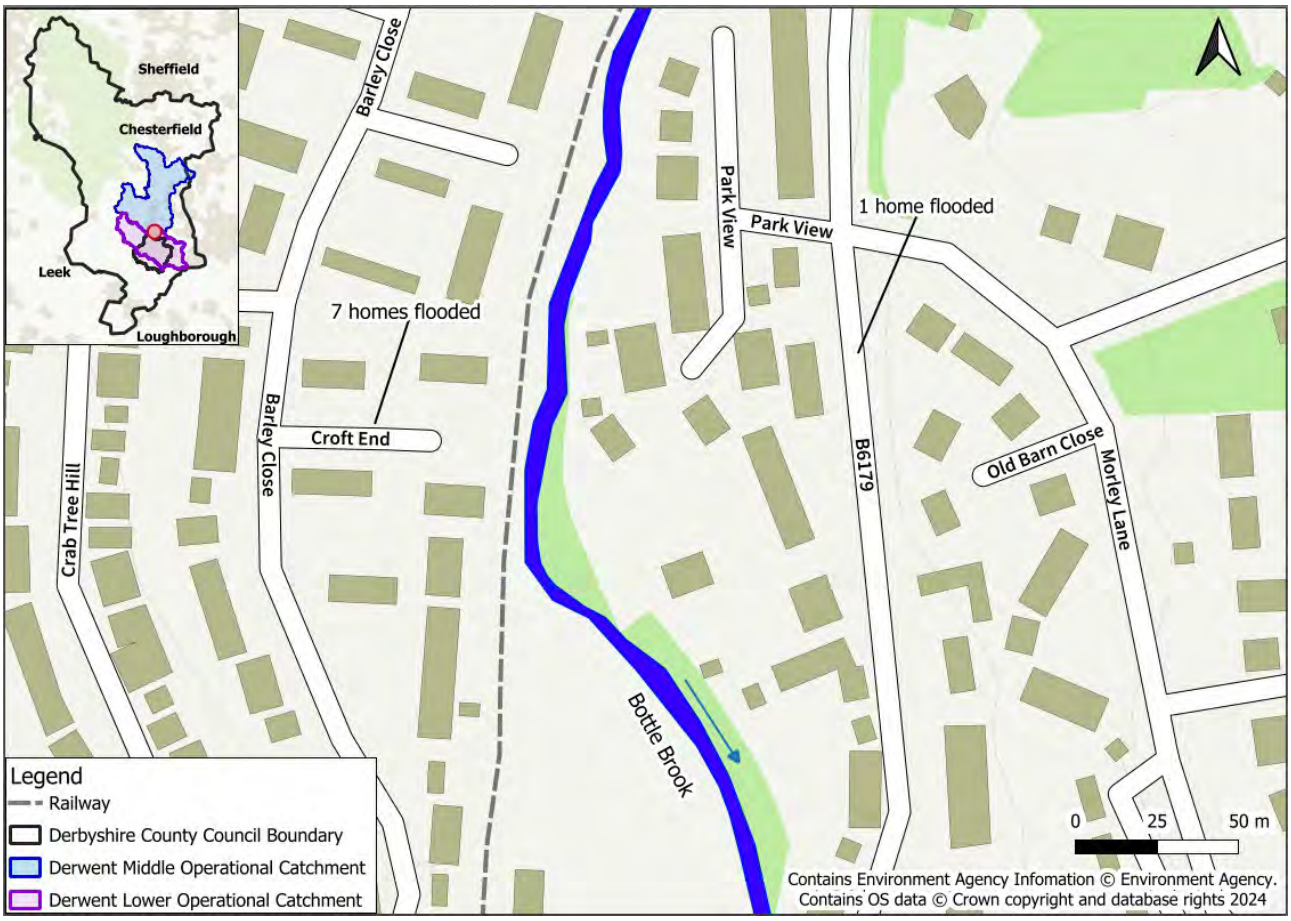

Figure 3-14: Overview Map of Little Eaton community.

The community is predominantly residential with some non-residential properties. Homes in the community are terraced, semi-detached and detached properties. Little Eaton is located on the B6179 (Alfreton Road), which is the old route of the A61. Little Eaton Primary School is near to Bottle Brook and the affected properties although it did not experience flooding during Storm Babet.

Topographic data shows that the flooded properties sit at a similar elevation to the top bank level of Bottle

Brook. The local superficial geology is alluvium (i.e., gravel, sand, silt, and clay).

The Environment Agency Historic Flood Map indicates that recorded flooding from the river has occurred in the area before, although not all the properties flooded during Storm Babet have been flooded previously.

The community is located on the floodplain of Bottle Brook which flows southwards to join the River Derwent approximately 1km downstream from the affected properties.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 2. Areas in Flood Zone 2 have between a 1% and 0.1% AEP of river flooding. Figure 3-15 shows the extents of Flood Zone 2 and Flood Zone 3 at Little Eaton.

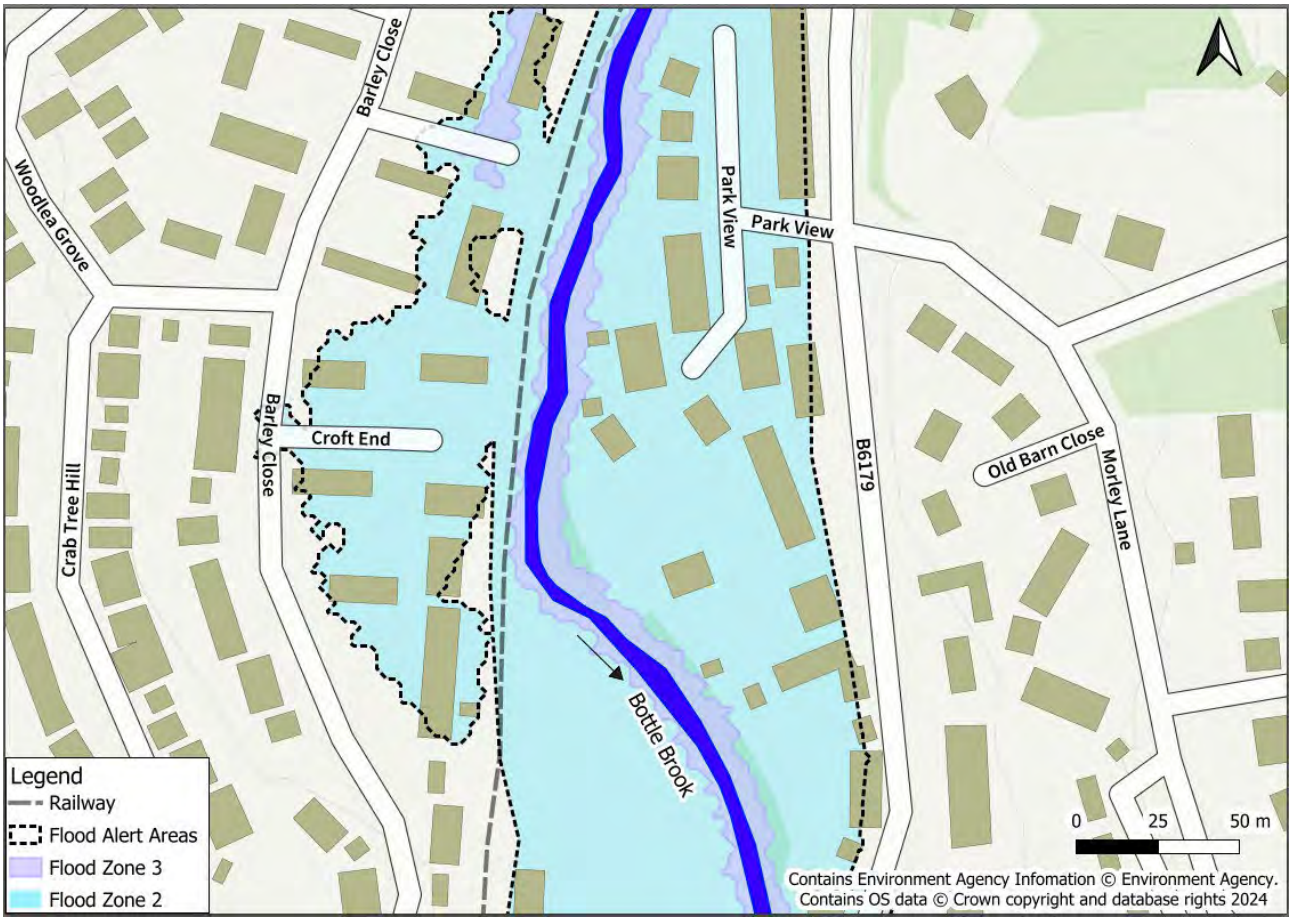

Figure 3-15: Flood zones and Flood Alert area coverage at Little Eaton.

Additionally, based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode), the homes on Croft End have a high risk of surface water flooding (more than 3.3% AEP). Figure 3-16 shows the surface water flood risk for the community based on the national mapping referred to above.

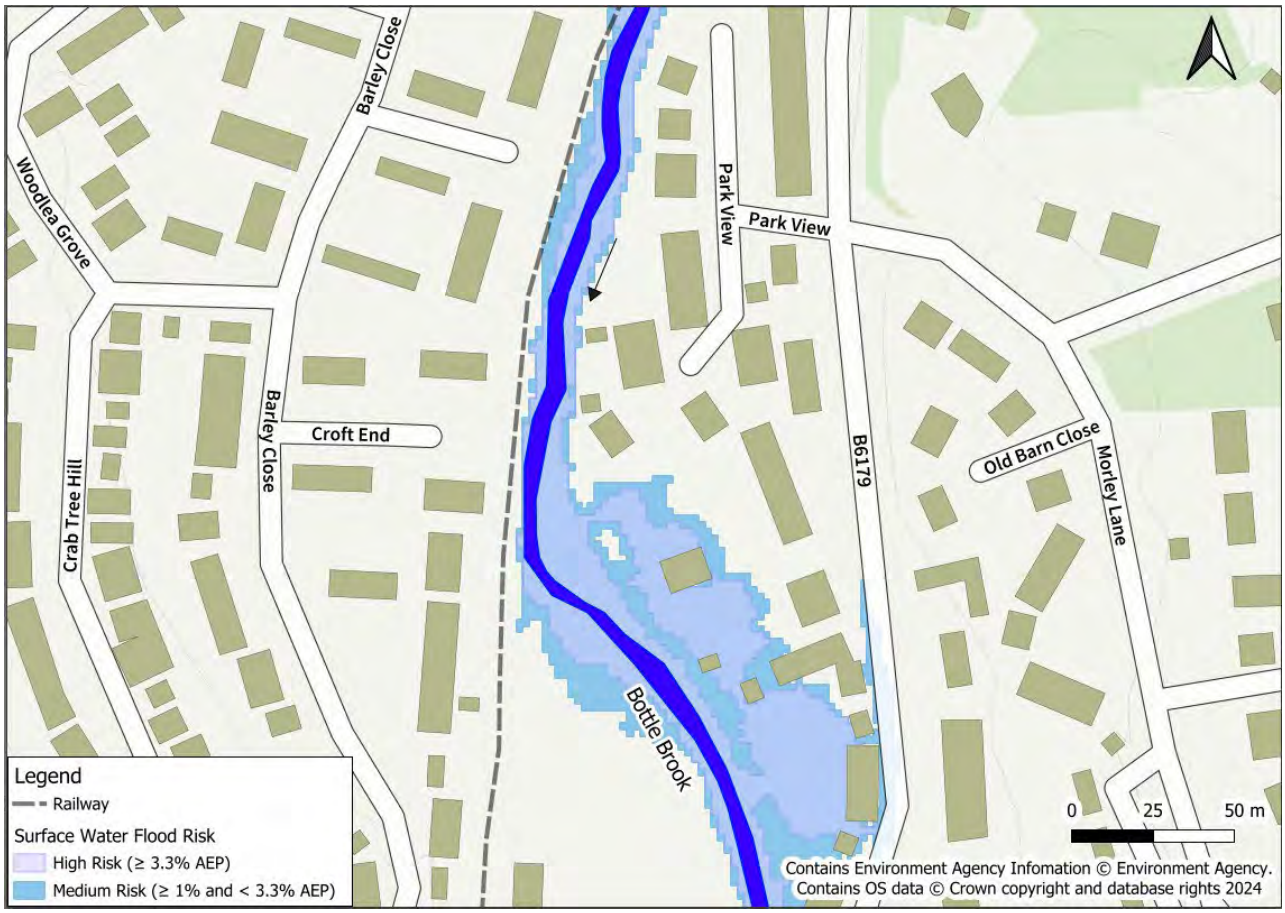

Figure 3-16: Map showing the chance in any given year of flooding from surface water at Little Eaton (Source: Long Term Flood Risk Map)

The community is not located within or near any nationally designated environmental sites.

3.5.2 Current Flood Risk Management Arrangements

The seven properties in Croft End and the one on Alfreton Road are within the 'Bottle Brook in Derbyshire' Flood Alert Area. The affected community is covered by two Environment Agency flood warning systems: one for 'Bottle Brook at Little Eaton' and one for the 'River Derwent at Little Eaton'. On anticipation of a potential flood event, residents who are signed up to receive alerts are warned of the possibility of flooding.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show various formal flood defences being present in the community. Assessment completed as part of this investigation indicates that this may not be the case where engineered high ground has been identified.

3.5.3 Storm Babet Incident Details

A flood alert was issued to the 'Bottle Brook in Derbyshire' Flood Alert Area on the 19th of October at 2:27am. A flood warning for the River Derwent was issued to Little Eaton on the 21st of October at 05:33. No flood warning was issued for Bottle Brook as the level at the Smithy Houses river gauge peaked below the threshold for issuing a flood warning.

Internal flooding of residential properties is understood to have taken place on the afternoon and evening of the 20th of October 2023.

The eight homes which flooded internally include seven properties on Croft End, on the west side of Bottle Brook and one on Alfreton Road (B6179), to the east of Bottle Brook.

3.5.4 Flood Mechanisms, Extent and Impacts

Surface water flooding was the primary source of flooding affecting the properties on Croft End during Storm Babet. The high river levels meant surface water could not discharge into the watercourse. This caused

manhole covers in Croft End to surcharge. The cause of the flooding at Alfreton Road is not fully understood. Erewash Borough Council think that a foul pumping station may have failed.

The Little Eaton pumping station continued to pump throughout the event but was overwhelmed by flows. Surveys and investigations into Severn Trent's surface water system identified a watercourse connected to the system. Severn Trent therefore believe that this would have impacted the network during the event. The system outfalls into the brook and has a flap valve installed on the outlet. It was reported the Bottle Brook river levels were high during the event and subsequently would have closed the flap valve to prevent flow ingress into surface water network.

3.5.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Erewash Borough Council
- Severn Trent Water
- Emergency services

The Environment Agency issued a flood alert on the 19th of October to the 'Bottle Brook in Derbyshire' Flood Alert Area in anticipation of the flooding which occurred the following day. Following the flood event, the Environment Agency completed inspections of their assets at this community and confirmed that they operated as normal but that the volume of water would have exceeded their capacity.

On the 15th of January 2024, a public drop in was held at the community to provide support and guidance to those affected.

Following their initial survey work, Severn Trent are continuing investigations into the ordinary watercourse connected to its network to understand the impact of this connection and the flap valve.

3.6 Community Impacts – Lower Kilburn

3.6.1 Location Characteristics

Lower Kilburn is within the Amber Valley and the Derwent catchment. Seventeen residential properties suffered internal flooding during Storm Babet. Figure 3-17 shows the general extent of the community. Bottle Brook is a tributary to the River Derwent and flows south through the community. The section of Bottle Brook that flows through Lower Kilburn is designated as a main river. All the flooded properties are east of Bottle Brook.

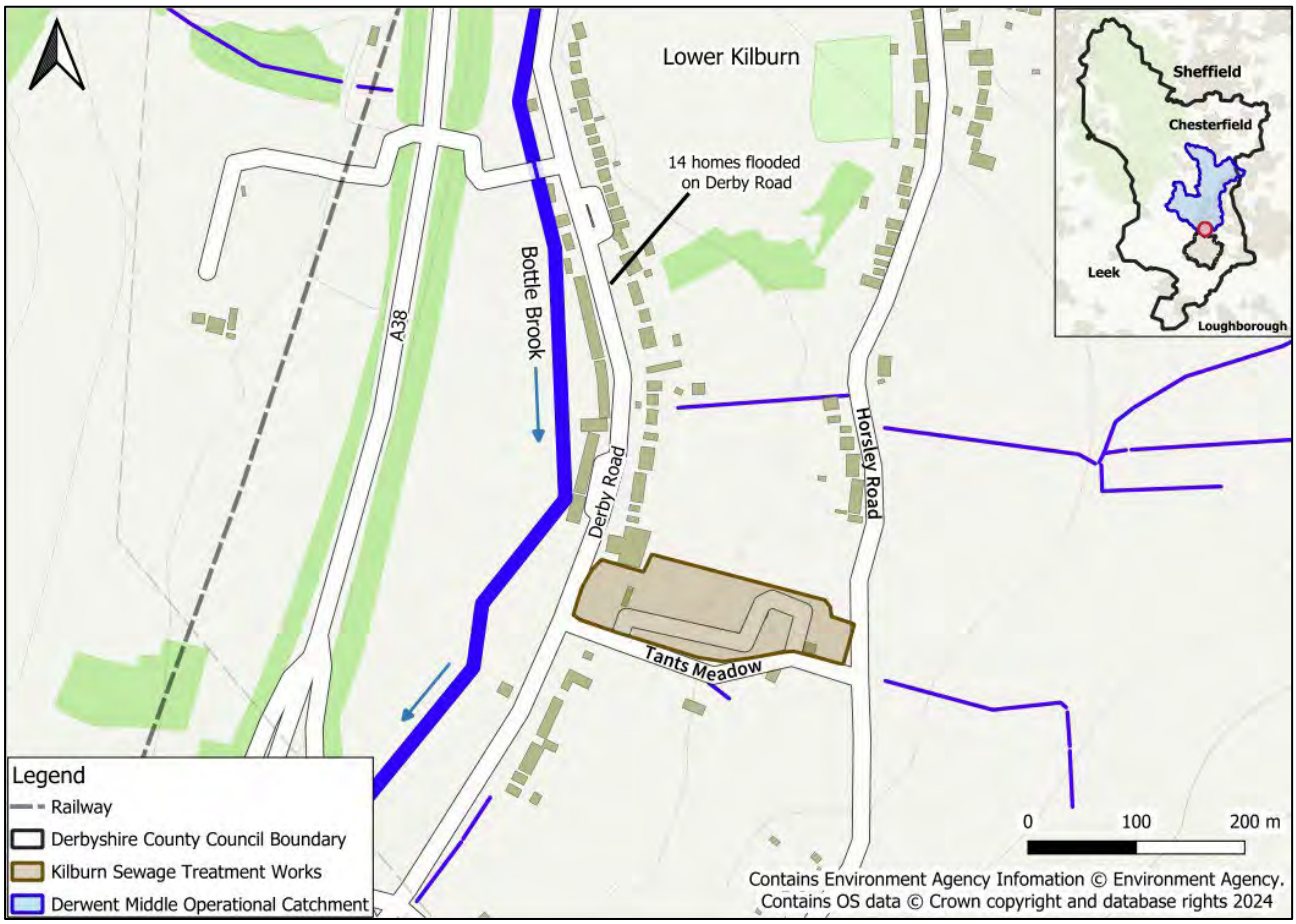

Figure 3-17: A map showing Bottle Brook, and an overview of Lower Kilburn.The community is mainly residential, extending along Derby Road, B6178. Properties in the area are mainly a mixture of 20th century housing.

The A38 runs to the west of Bottle Brook and is a major road connecting Derby and Ripley and the M1 beyond. Derby Road (B6178) runs to the east of Bottle Brook and is the main road through Lower Kilburn and connects to the A38 south of the community. The Kilburn Sewage Treatment Works also sits within the community and is operated by Severn Trent Water.

The local topography shows that the immediate area surrounding Bottle Brook is low lying, and gradually increases in elevation eastwards and westwards. The local superficial geology is alluvium gravel, sand, silt, and clay.

The community is located on the floodplain of Bottle Brook which flows southwards to join the River Derwent approximately 5km downstream.

The Environment Agency Historic Flood Map indicates that the community area has flooded previously. An Environment Agency assessment was conducted following Storm Babet and suggests that while the Amber Valley Flood Risk Assessment had recorded two previous incidents of flooding at Bottle Brook, in 1977 and 2007, residents in the surrounding areas have reported far more recent and frequent flooding events in the past five years. Within a previous Section 19 report, properties were reported as being flooded within Lower Kilburn during November 2019.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 2. Areas in Flood Zone 2 have between a 1% and 0.1% AEP of river flooding. Figure 3-18 shows the extents of Flood Zones 2 and 3 at Lower Kilburn.

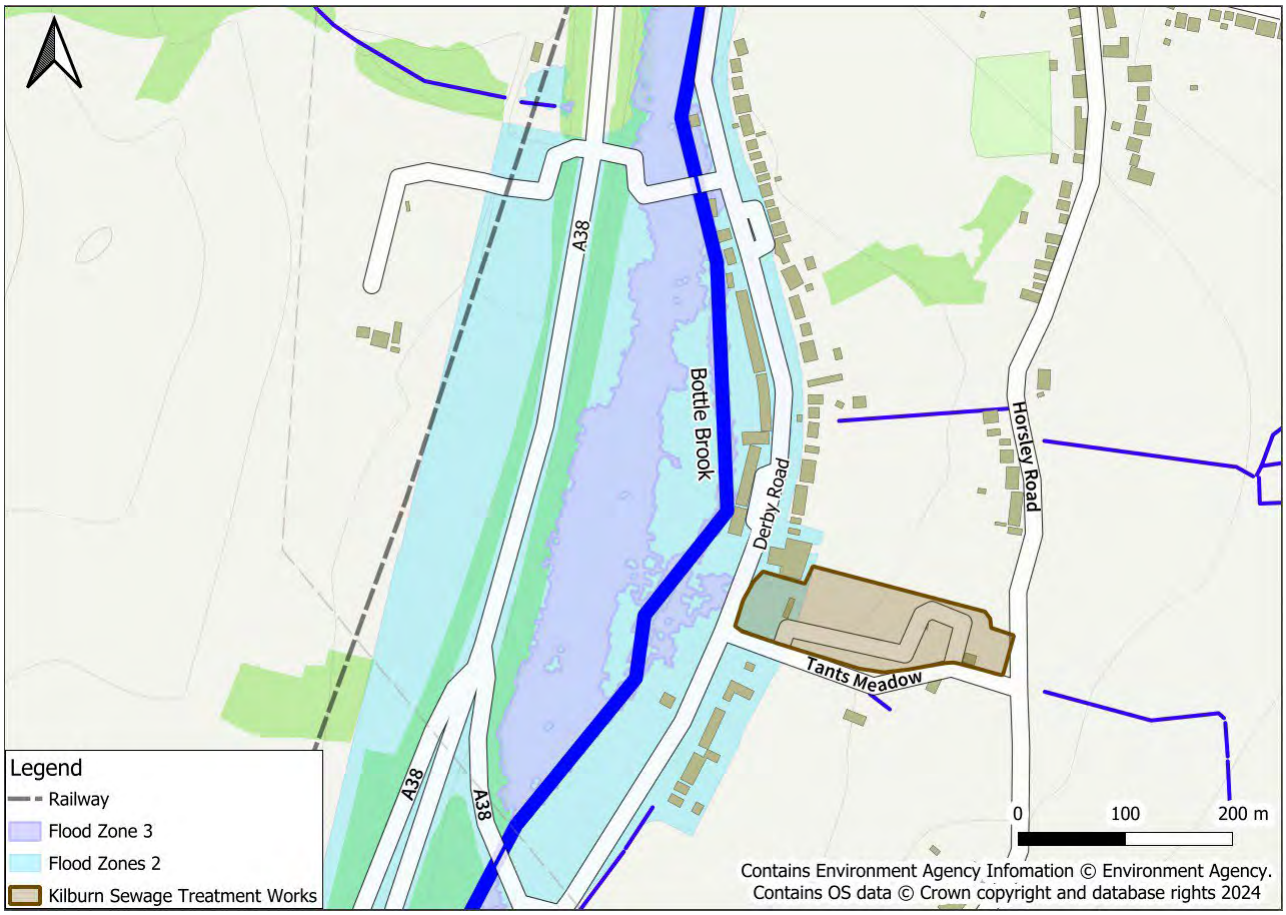

Figure 3-18: Map showing current flood risk management strategies within Lower Kilburn.

Additionally, based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode), surface water flood risk is extensive for Lower Kilburn, including areas having a high risk of surface water flooding (more than 3.3% AEP). Figure 3-19 shows the surface water flood risk for the community.

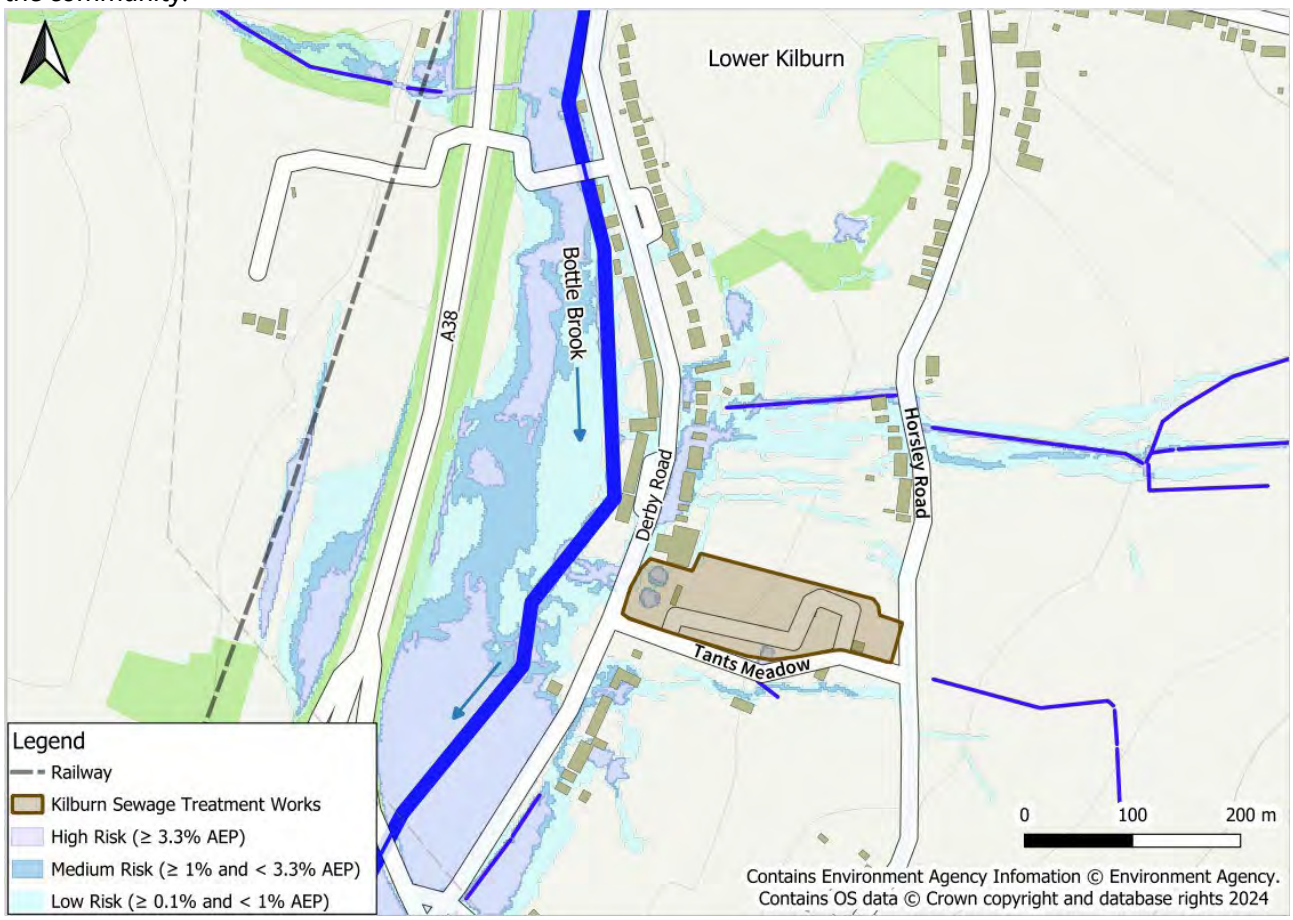

Figure 3-19: Map showing the chance in any given year of flooding from surface water at Lower Kilburn (Source: Long Term Flood Risk Map)

The community is not located within or near any nationally designated environmental sites.

3.6.2 Current Flood Risk Management Arrangements

Most of the internally flooded properties within this community were located within the 'Bottle Brook in Derbyshire' Environment Agency Flood Alert Area, and the 'Bottle Brook at Lower Kilburn and Coxbench' Flood Warning Area. On anticipation of a potential flood event, residents who are signed up to receive alerts are warned of the possibility of flooding.

Lower Kilburn has two flood wardens, and many properties benefit from property flood resilience measures.

There are no river flood defences in the area.

3.6.3 Storm Babet Incident Details

A flood alert was issued for the 'Bottle Brook in Derbyshire' Flood Alert Area on the 19th of October at 2:27am and a flood warning was issued for the 'Bottle Brook at Lower Kilburn and Coxbench' Flood Warning Area on the 20th of October at 11:46am.

The Smithy Houses River Gauge is located approximately 2km northeast of the community and records the upstream water levels for Bottle Brook. The gauge data shows that water levels began to rise on the 20th of October at around 4:00am and peaked at a height of 1.5m at midday.

The 17 properties that flooded internally are all located on Derby Road.

3.6.4 Flood Mechanisms, Extent and Impacts

It is likely that there was a combination of fluvial and surface water flooding in the community. An Environment Agency assessment suggests that flooding started to the north of the community, at Gypsy Bridge, where river flows inundated the bridge. Flooding then spread southwards combining with surface water flooding from the east. Figure 3-20 shows ground level at Lower Kilburn.

As Derby Road is the main road through Lower Kilburn, flooding would have caused travel disruption.

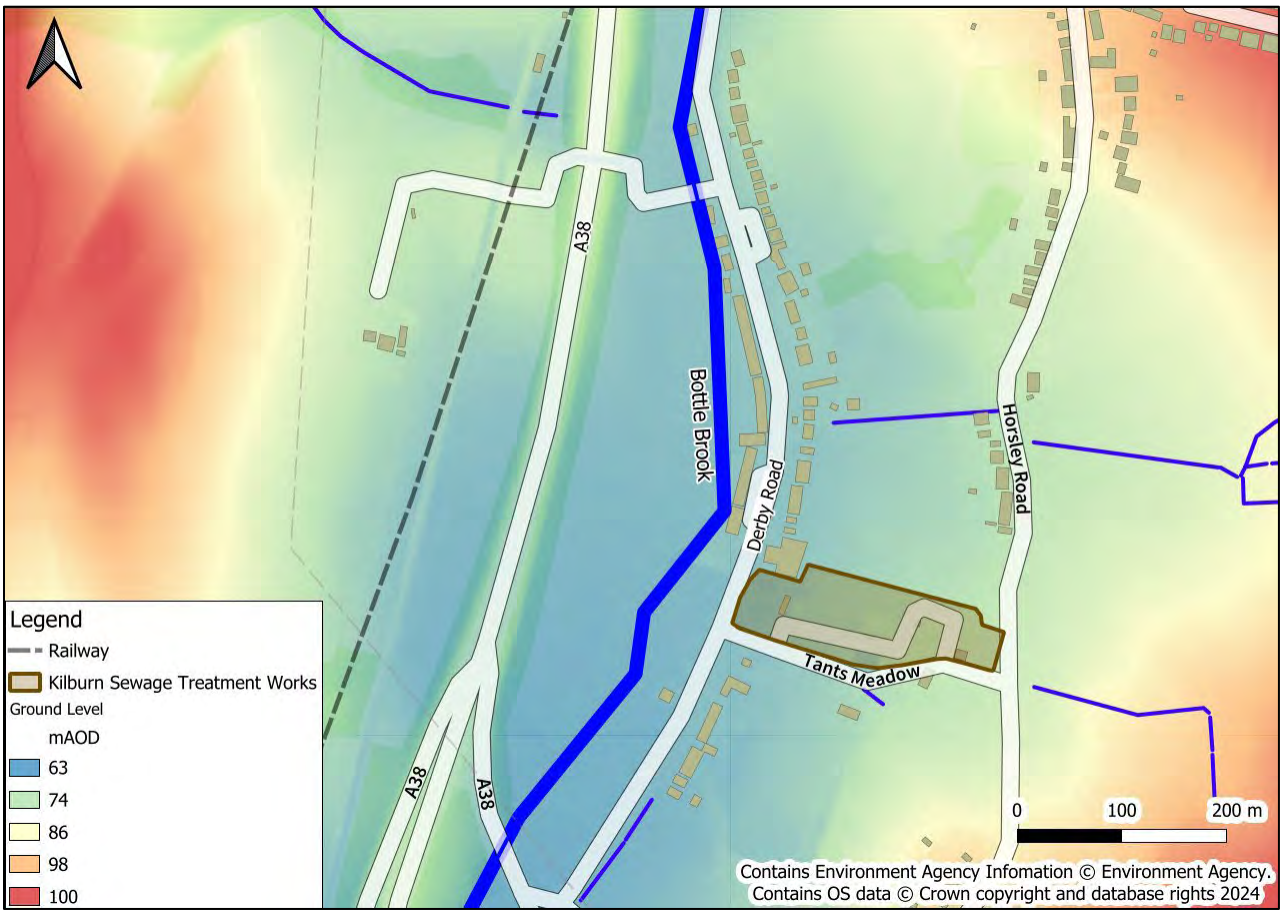

Figure 3-20: Ground Level at Lower Kilburn.

3.6.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Amber Valley Borough Council
- Severn Trent Water
- Emergency Services

The Environment Agency issued a Flood Alert for the Bottle Brook in Derbyshire on the 19th of October at 2:27am and a Flood Warning for the 'Bottle Brook at Lower Kilburn and Coxbench' Flood Warning Area on the 20th of October at 11:46am.

On the 15th of January 2024, a public drop in was held at the community to provide support and guidance to those affected.

3.7 Community Impacts – Denby Bottles

3.7.1 Location Characteristics

Denby Bottles is a settlement located in Amber Valley, about 1km north of Kilburn. Thirty-five properties suffered internal flooding during Storm Babet, of which 30 were homes and 5 were non-residential including businesses.

Denby Bottles is located alongside Bottle Brook, which is a tributary of the Derwent. Two designated main rivers both named Bottle Brook pass through Denby Bottles. From here onwards, the river that flows from the north-east shall be referred to as Bottle Brook North and the river that flows through Denby Bottles from the east shall be referred to as Bottle Brook East. The confluence of the rivers is located downstream of Denby

Bottles, approximately 50m to the southwest of the A609 and B6179 junction. Denby Bottles is separated from Rawson Green to its west by Bottle Brook North. Figure 3-21 below shows Denby Bottles with the regions in which properties were flooded internally during Storm Babet labelled.

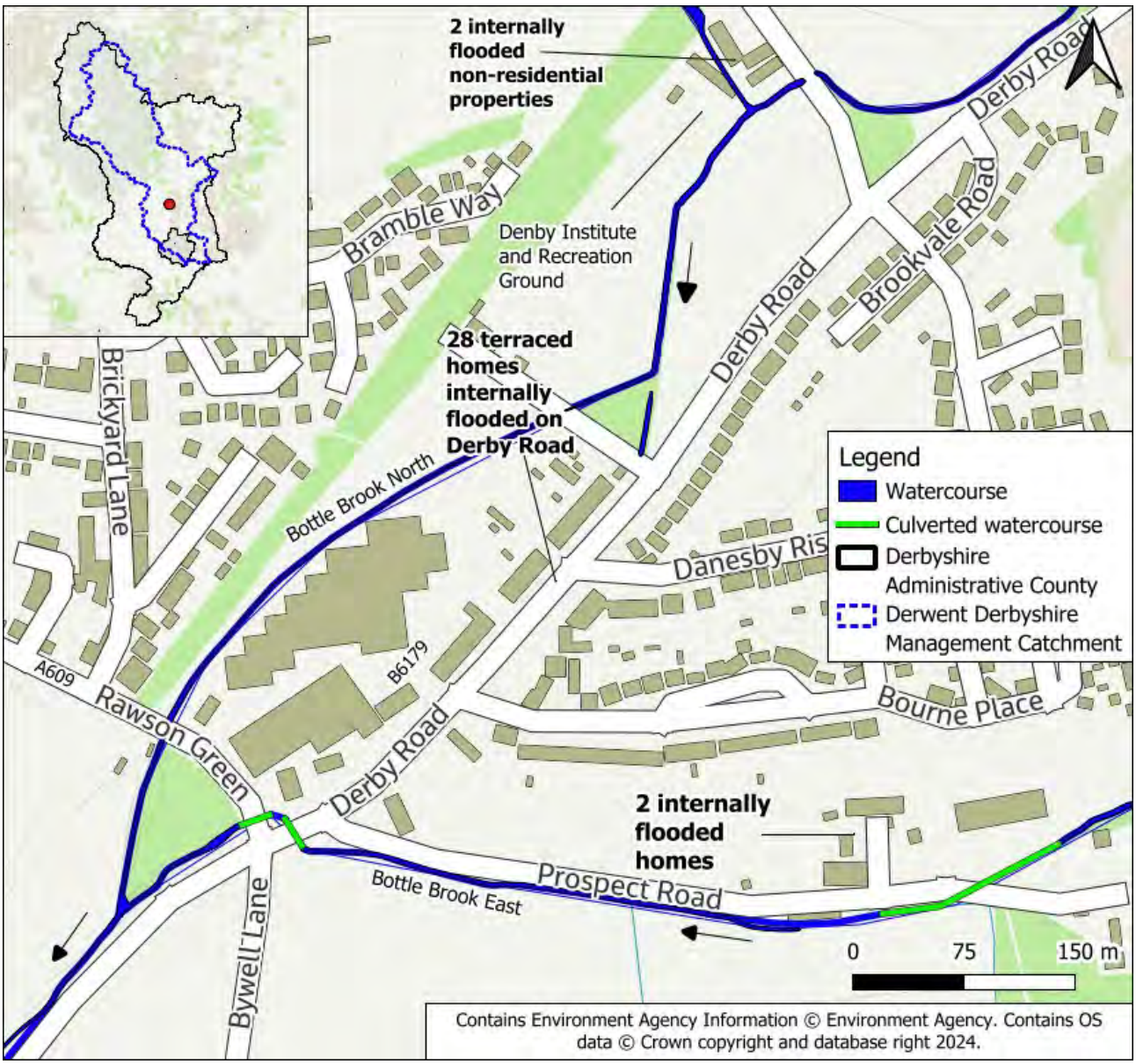

Figure 3-21: Overview map of Denby Bottles and the areas affected by flooding.

Although the majority of Denby Bottles consists of detached residential homes, most residential properties which suffered internal flooding are terraced homes.
Superficial geology near to the rivers are alluvium (i.e., clay, silt, sand and gravel), while bedrock in the area consists of mudstone, siltstone and sandstone.

The Environment Agency's Historic Flood Map indicates that Bottle Brook has flooded Denby Bottles in the past. However, not all properties that were flooded during Storm Babet are showing as having flooded previously.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 3. Areas in Flood Zone 3 have more than a 1% AEP of river flooding. Figure 3-22 shows the Flood Zones and other flood risk management features relevant to the next section of the report.

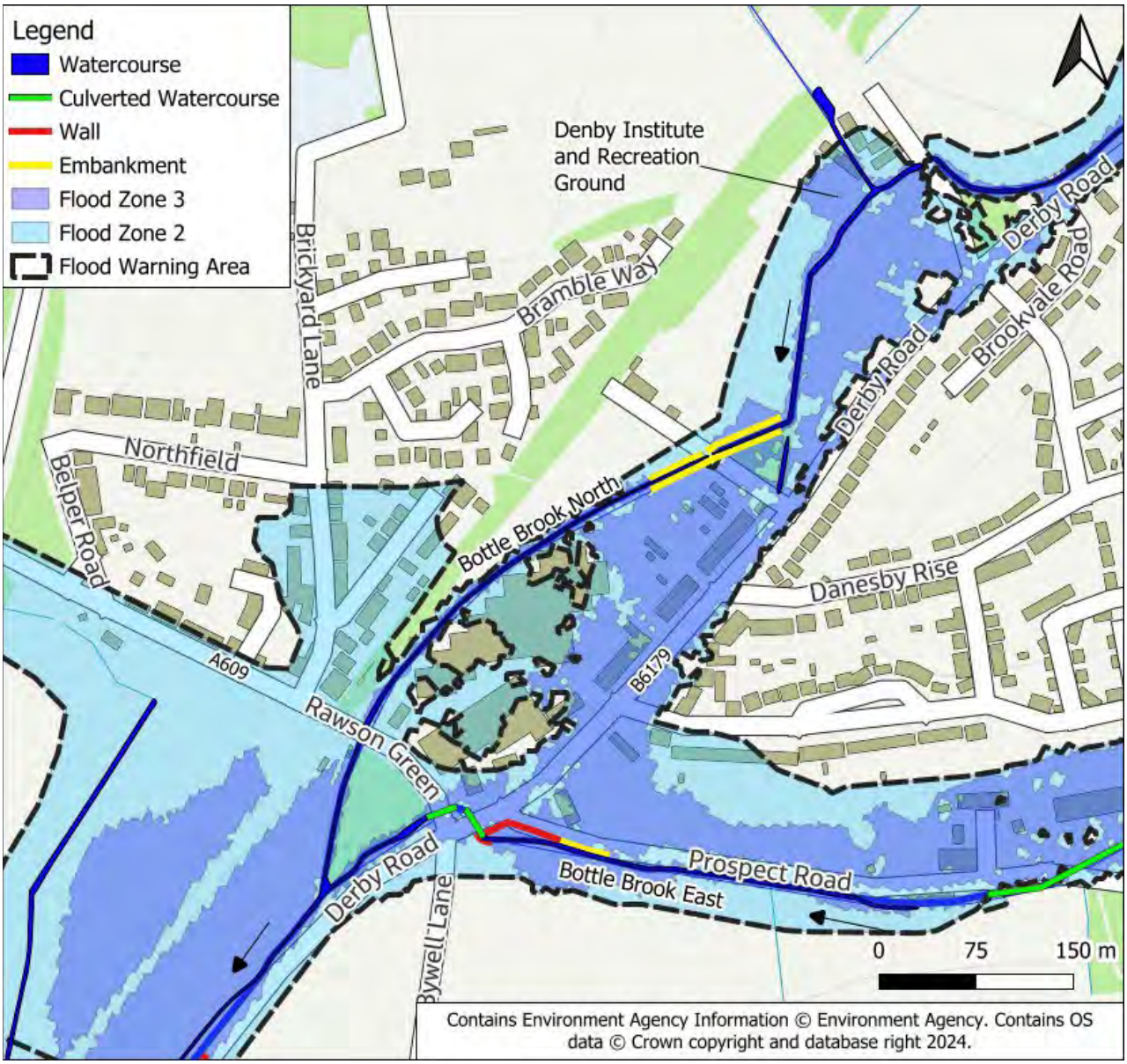

Figure 3-22: Flood map for Planning Flood Zones and Flood Risk Management Assets in the vicinity of Denby Bottles

Additionally, based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode), much of Denby Bottles and Rawson Green is at a high risk of surface water flooding, meaning more than a 3.3% AEP. This surface water map includes all properties that suffered internal flooding during Storm Babet. Figure 3-23 shows the chance in any given year of flooding from surface water at Denby Bottles.

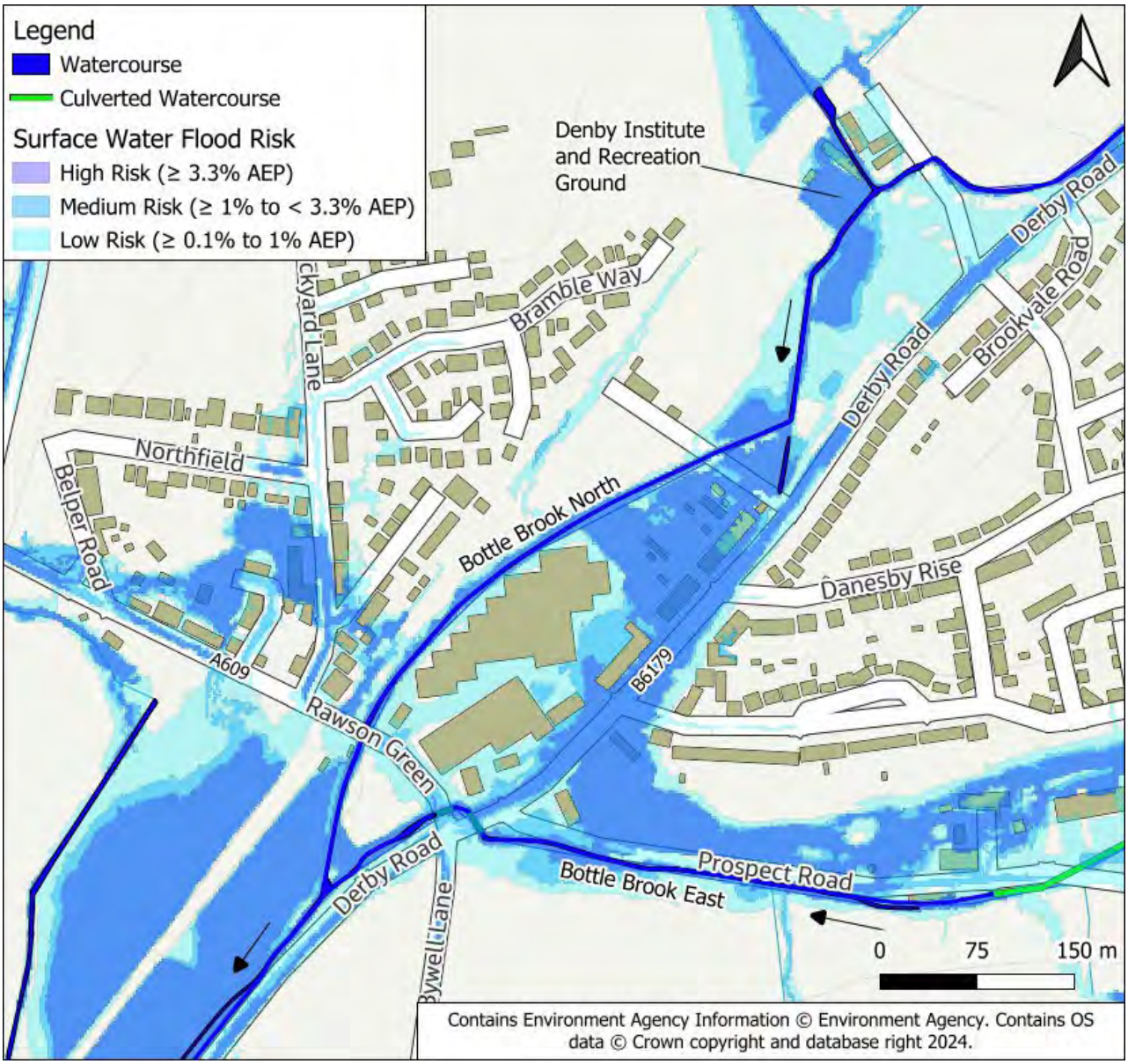

Figure 3-23: Map showing the chance in any given year of flooding from surface water at Denby Bottles. (Source: Long Term Flood Risk Map)

The community is not located within or near any nationally designated environmental sites.

3.7.2 Current Flood Risk Management Arrangements

Figure 3-22 also shows the current flood risk management arrangements within the area, including existing flood defences and flood warning areas.

Note that the flood warning area and flood alert area at this community cover the same extent and align with the Flood Zone 2 extent. All properties that suffered internal flooding within this community are within the 'Bottle Brook Derbyshire' Flood Alert Area and the 'Bottle Brook at Rawson Green' Flood Warning Area.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) show several Environment Agency flood risk management assets in the community. There are embankments on both banks of Bottle Brook North approximately 100m in length. They are located 400m upstream of where Bottle Brook North passes beneath the A609. There is also a length of embankment on the right bank of Bottle Brook East adjacent to Prospect Road which is approximately 40m in length. Immediately downstream of the embankment and on the same bank, there is a length of flood wall approximately 65m long. Both assets are relatively small in height and form a continuous defence.

3.7.3 Storm Babet Incident Details

A flood alert was issued to Bottle Brook on the19th of October at 2:27am and a flood warning was issued to

'Bottle Brook at Rawson Green' Flood Warning Area on the 20th of October at 12:13pm. Both of these warnings covered all of the flooded properties.

Smithy Houses River Level Gauge is located 700m upstream of Denby Bottles on Bottle Brook North. Gauge records indicate that Bottle Brook levels began to rise on the 20th of October at 12:30am and peaked at a height of 1.51m at 12:15pm. This was the highest peak water level recorded at this station since it began recording in May 2004. The previous highest water level recorded here was 1.45m on the 25th of June 2007.

Thirty-five properties suffered internal flooding across three areas at Denby Bottles:

- 2 non-residential properties in the Denby Institute and Recreation Ground
- 28 homes and 3 non-residential properties in Derby Road
- 2 homes in Prospect Road

3.7.4 Flood Mechanisms, Extent and Impacts

The source of flooding was from Bottle Brook North and Bottle Brook East. Figure 3-24 shows the Storm Babet flood flow routes and ground level at Denby Bottles.

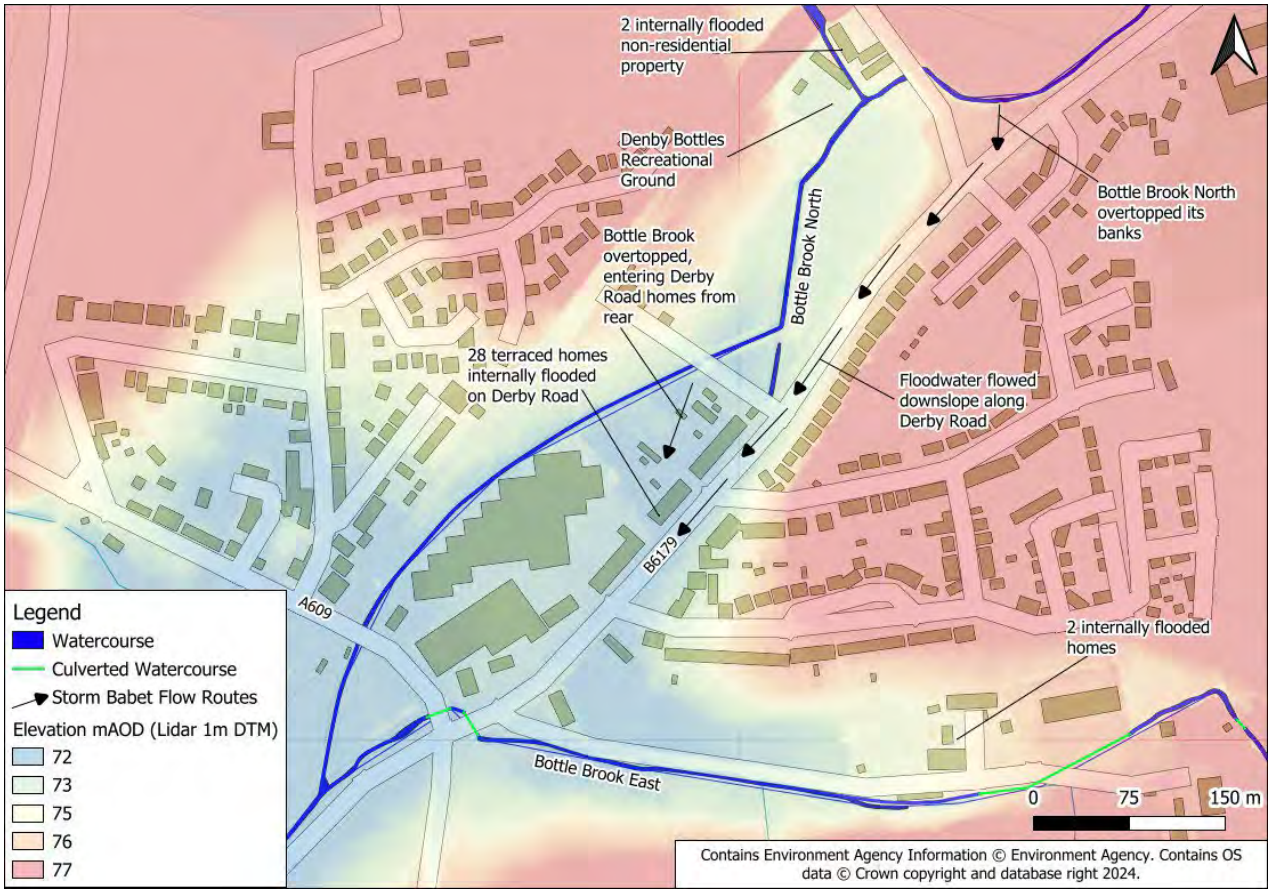

Figure 3-24: Ground level and flow routes at Denby Bottles

An Environment Agency Flood Risk Officer undertook a survey at Denby Bottles after the event. They determined that Bottle Brook North exceeded its channel at two locations upstream of Denby Bottles football field, before spilling onto Derby Road. Floodwater flowed southwards along Derby Road, which acted as a secondary flow route for Bottle Brook North. As a result, twenty-eight homes and three businesses located on Derby Road were internally flooded via their fronts. Simultaneously, Bottle Brook North exceeded its channel further downstream, causing floodwater to also enter these properties from the rear. Flood depths at homes on Derby Road varied between 0.1m and 1m, with flooded properties located further south along Derby Road typically flooded to the greater depths.
Channel exceedance of Bottle Brook North, on its right bank at Denby Institute and Recreation Ground, resulted in the internal flooding of The Bowling Green Sports Pavilion and the Denby Institute and Recreation Ground building.

The cause of flooding to the two internally flooded homes on Prospect Road is not clear, although it is likely

to be from Bottle Brook East given the location of these homes and their proximity to the river.

3.7.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Amber Valley Borough Council
- Emergency Services

The Environment Agency issued a Flood Alert to Bottle Brook on the19th of October at 2:27am and a Flood Warning to Bottle Brook at Rawson Green Flood on the 20th of October at 12:13pm.

Following the flood event, the Environment Agency completed inspections of their assets at this community and confirmed that they operated as normal but that the volume of water would have exceeded their capacity.

On the 15th of January 2024, a public drop in was held at the community to provide support and guidance to those affected.

3.8 Community Impacts – Breadsall

3.8.1 Location Characteristics

Breadsall is a village and civil parish in the Borough of Erewash in Derbyshire, England. Six residential properties suffered internal flooding across the village in Storm Babet. Figure 3-25 shows an overview of the Breadsall community.

The area flooded is close to Dam Brook and Boosemoor Brook, which are ordinary watercourses and tributaries of the River Derwent. Dam Brook and Boosemoor Brook both flow through Breadsall in a westward direction towards the River Derwent. Dam Brook is south of Boosemoor Brook. The River Derwent is approximately 1km to the west of Breadsall. Flooding was a result of Dam Brook and Boosemoor Brook reaching capacity and overflowing their banks during Storm Babet.

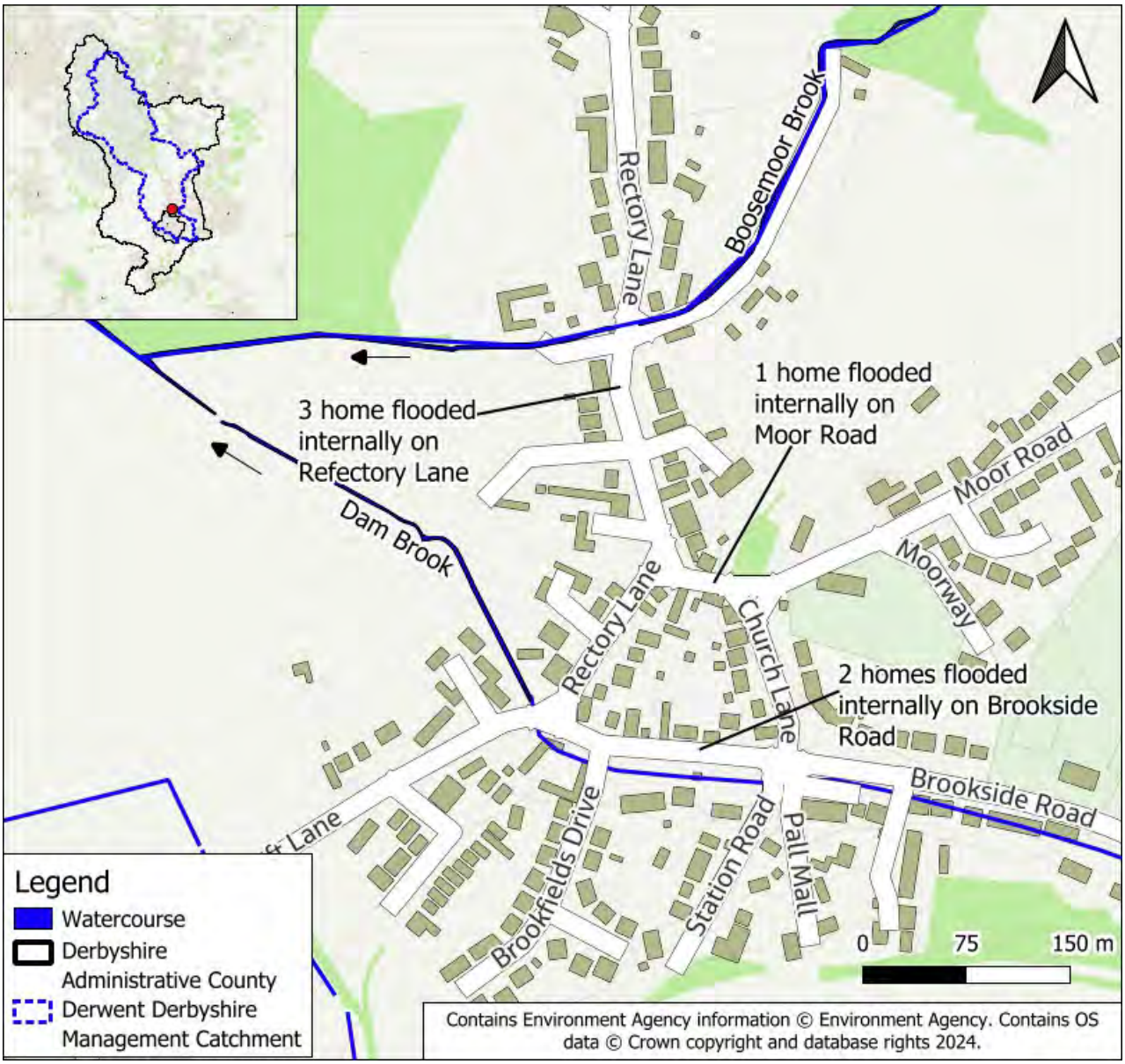

Figure 3-25: Overview Map of Breadsall community.

The community is mainly residential, with some businesses and public buildings across the village. The village is a mixture of older and more modern properties. There are two main roads that pass through the village, Moor Road and Brookside Road, which merge into Croft Lane to the southwest of Breadsall. Croft Lane connects Breadsall to the A61, which is critical local infrastructure. The East Midlands Mainline Railway is also located approximately 0.7km to the west.

There are no known vulnerable groups in the community that suffered flooding as a result of Storm Babet. Breadsall Pre-School and C of E Primary School are located to the east but are not known to have flooded.

The local superficial geology is alluvium, including gravel, sand, silt, and clay.

The community is partly located within the floodplain of the River Derwent. The community affected is slightly elevated compared to the River Derwent floodplain, with topographic data showing Breadsall to be approximately 56mAOD, whilst the floodplain to the west is approximately 51mAOD.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 2 extending into the village. Properties in Flood Zone 2 have between a 1% and 0.1% Annual Exceedance Probability (AEP) of river flooding. Figure 3-26 shows the extent of Flood Zone to at Breadsall.

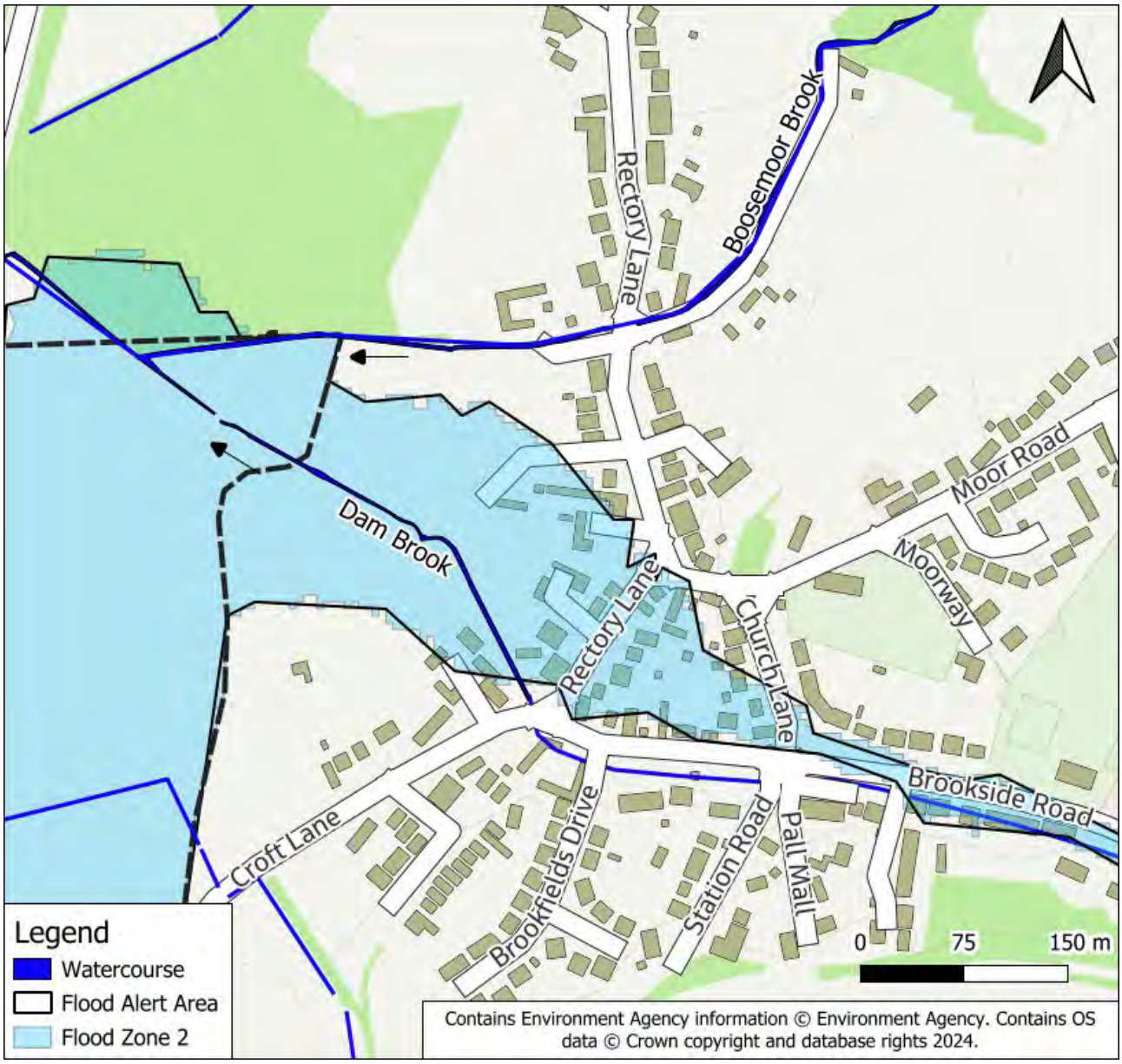

Figure 3-26: Flood Zone 2 and Flood Alert area coverage at Breadsall.

All the properties that were internally flooded are at high risk (more than 3.3%) chance of surface water flooding based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode). The main source of surface water risk is likely to be related to local topography and drainage networks being unable to discharge to Dam Brook and Boosemoor Brook during heavy rainfall events. Figure 3-27 shows the chance in any given year of flooding from surface water at Breadsall.

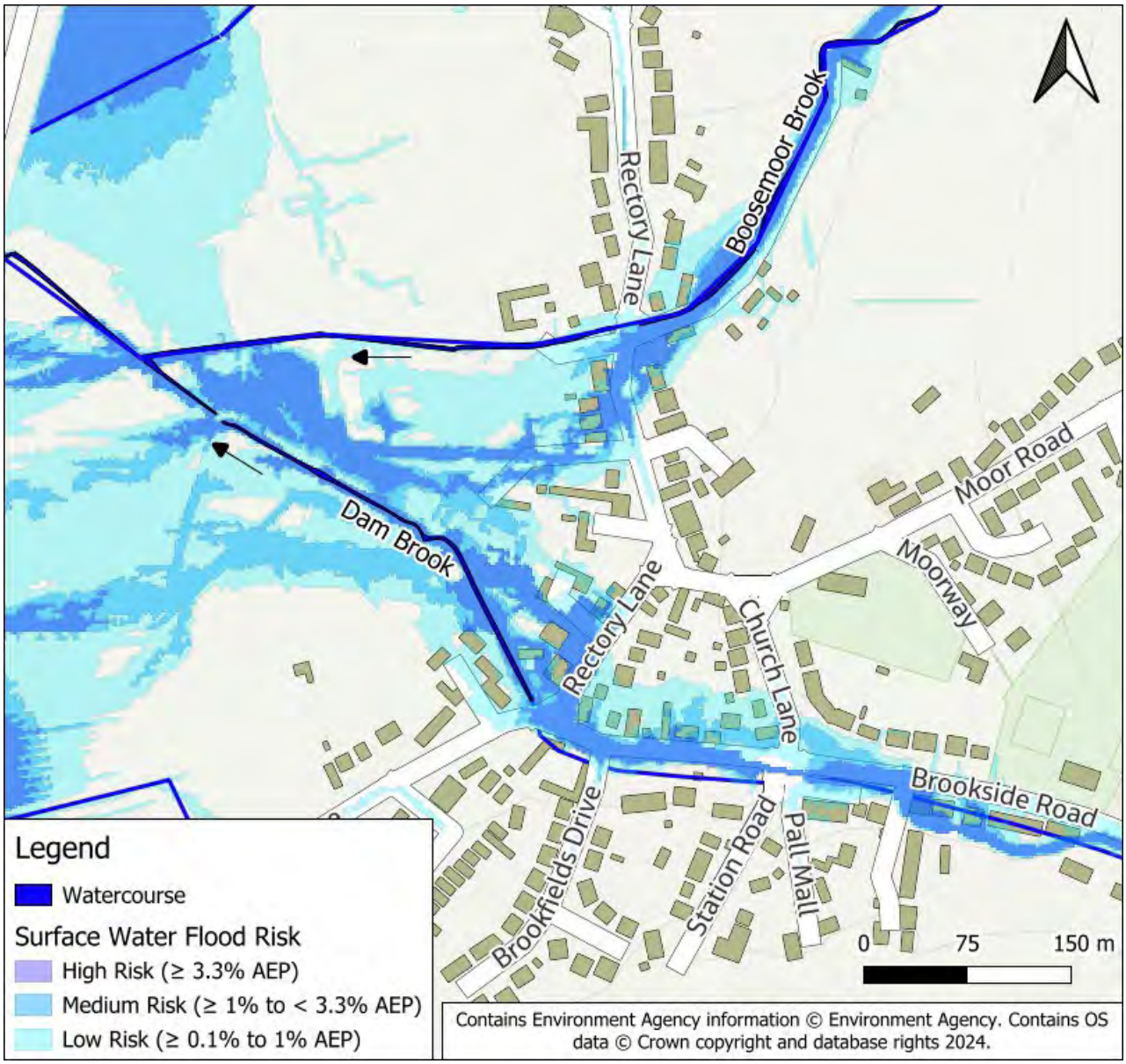

Figure 3-27: Map showing the chance in any given year of flooding from surface water at Breadsall (Source: Long Term Flood Risk Map)

The Environment Agency Historic Flooding Map indicates that there is no record of the community previously flooding. However, the community is known to Derbyshire County Council to have suffered flooding from the ordinary watercourses previously with independent records showing the floodplain to the west of Breadsall flooded from the River Derwent in 1965.

The community is not located within or near any nationally designated environmental sites.

3.8.2 Current Flood Risk Management Arrangements

Some of the community is located within the 'Lower Derwent in Derbyshire' Flood Alert Area, which provides an alert for the River Derwent but not for Dam Brook and Boosemoor Brook. Properties that are located within Flood Zone 2 are within the Flood Alert area. Therefore, on anticipation of a potential flood event, residents who are signed up the service are informed when flooding is expected. The community is not in a flood warning area. Figure 3-27 shows Flood Zone 2 and the Flood Alert Area.

There are currently no notable assets with a flood risk management purpose in the community.

A property on Brookside Road that suffered internal flooding had previously installed a demountable flood gate across the driveway following previous flood events.
The responsibility for the maintenance of the watercourses that pass through the community, Dam Brook and Boosemoor Brook, falls with the riparian owners, including where the watercourses are culverted.

3.8.3 Storm Babet Incident Details

A flood alert was issued to the 'Lower Derwent in Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm.

Internal flooding of residential properties in the community is understood to have taken place on the afternoon and evening of the 20th of October 2023. The six homes which flooded internally were two properties on Brookside Road, a property on Moor Road and three properties on Rectory Lane.

3.8.4 Flood Mechanisms, Extent and Impacts

The primary sources of flooding affecting the properties within the community were from Dam Brook and Boosemoor Brook.

Correspondence from a resident at one of the properties that internally flooded on Brookside Road, received by Erewash Borough Council, suggests that Dam Brook first overtopped its banks at around 8:30am on the 20th of October 2023 before receding at 9:30am. Water levels rose again at 10:20am, leading to the flooding of Brookside Road flooded to a reported 0.5m depth in low spots. The road remained flooded until 3:00pm, at which point the Dam Brook flood levels started to recede. The exact flow routes of flood water reaching other affected properties is unknown.

As can be seen in Figure 3-28 the property on Brookside Road that had a demountable flood barrier initially successfully prevented floodwater from Dam Brook from entering the property. On the 20th of October 2023 Dam Brook overtopped and flooded Brookside Road which subsequently resulted in the sewer network being overwhelmed and surcharging. This led to the internal flooding of the property. Figure 3-29 below shows the internal flood water damage.

Figure 3-28: Demountable flood barrier across a driveway prevents flood water reaching a property in Breadsall.

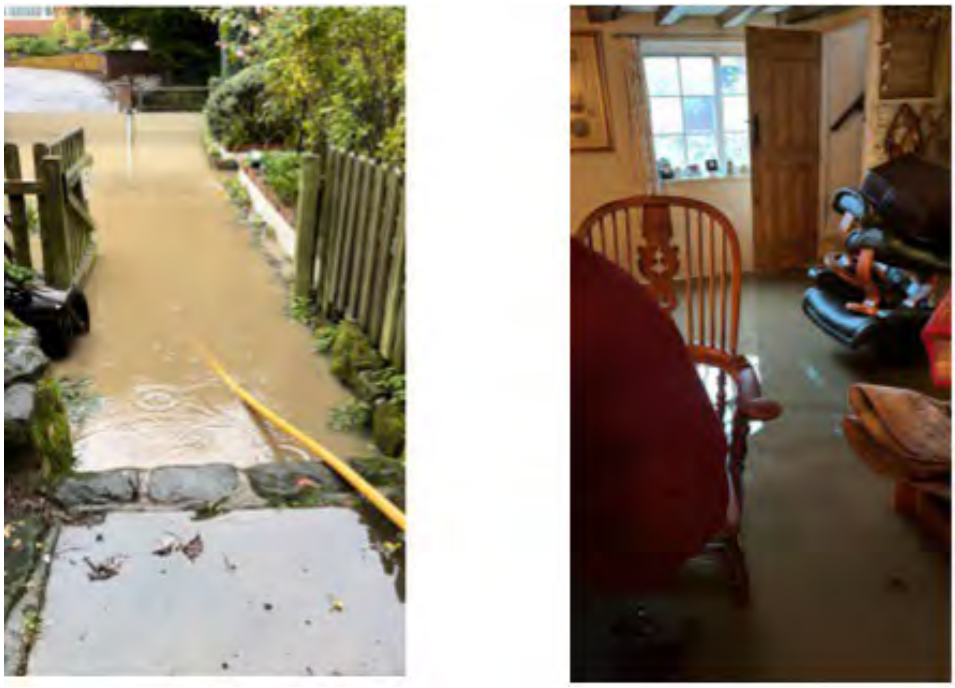

Figure 3-29: Flood water from drainage surcharge (left) and flood water within a property (right).

There were also reports of internal flooding to a property on Moor Road in Breadsall, where water came up through the floor.

3.8.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Severn Trent
- Erewash Borough Council
- Emergency Services

The Environment Agency issued a Flood Alert in advance of the flooding.

Severn Trent attended the area on the 20th and 21st of October 2023 and checked the connections of the property drainage to the main sewer beneath Brookside Road. They are completing ongoing investigation work following the flood event. Derbyshire County Council are currently in the process of studies exploring the feasibility of natural flood management measures to reduce flood risk associated with Dam Brook. The Dam Brook Flood Alleviation Scheme aims to consider possible interventions in the area such as, leaky dams, flood plain reconnection, bunding and woodland creation.

On the 15th of January 2024, a public drop in was held at the community to provide support and guidance to those affected.

3.9 Community Impacts – Ockbrook

3.9.1 Location Characteristics

Ockbrook is a village approximately 8km east of Derby, England. Eight residential properties flooded internally during Storm Babet within the community.
The flooded homes are close to Ock Brook, an ordinary watercourse which flows through the village, passing under Cole Lane and to the south of Collier Lane. Ock Brook flows southwards and becomes main river south of the A52 Borrowash by-pass. It joins the River Derwent approximately 1.4km south of Ockbrook.

Figure 3-30 below shows the community affected by flooding.

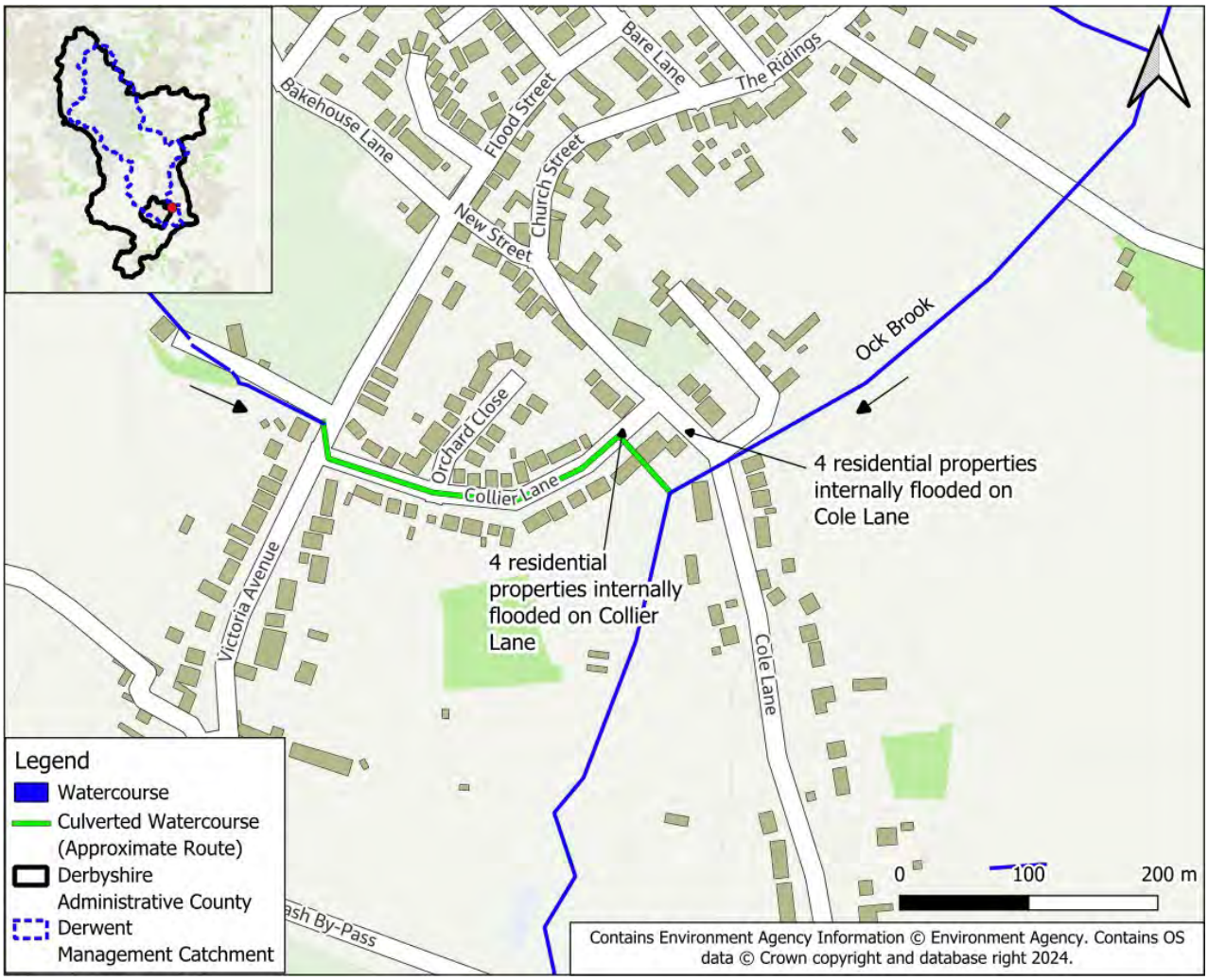

Figure 3-30: Map of the Ockbrook community where internal property flooding occurred.

The community affected by flooding is entirely residential properties. There are no known vulnerable groups within the community that have been affected by flooding, for example schools, hospitals and residential care homes.

The flooded properties in the community lie within, or are close to, the floodplain of Ock Brook. The community sits in a natural low point in the local topography. The local superficial geology is alluvium, including gravel, sand, silt, and clay.

The Environment Agency Historic Flood Map has no prior record of flooding to the properties affected by Storm Babet. However, according to Erewash Borough Council and Derbyshire County Council, Ock Brook is known to have flooded properties in the area previously.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 1. Areas in Flood Zone 1 have a very low chance of flooding from a river, less than 0.1% AEP.

Based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode), the homes on Cole Lane and Collier Lane both have a mix of high (more than 3.3% AEP) and medium (between 1% and 3.3% AEP) chance of surface water flooding. Figure 3-31 shows the surface water flood risk described.

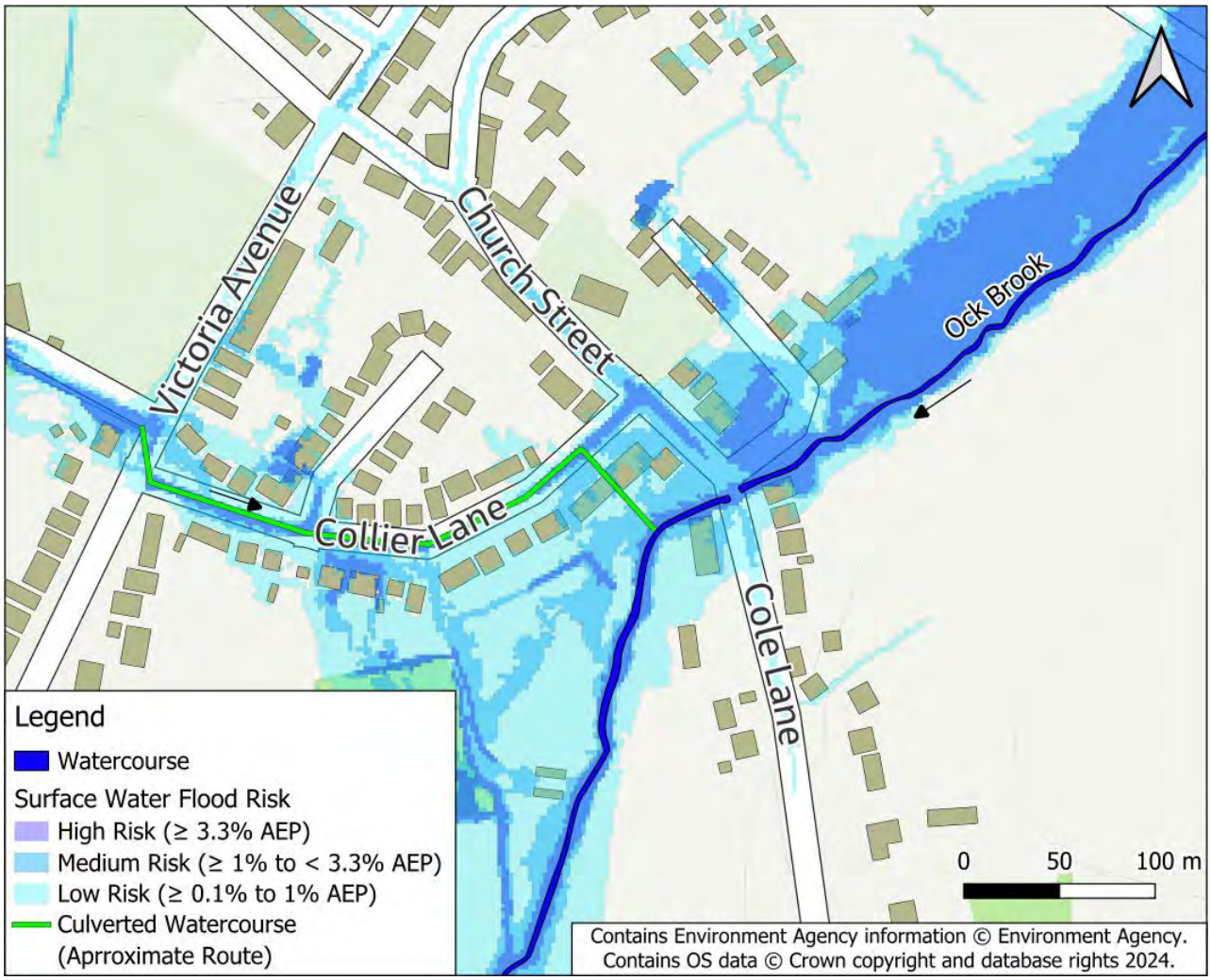

Figure 3-31: Map showing the chance in any given year of flooding from surface water at Ockbrook (Source: Long Term Flood Risk Map)

The community is not located within or near any nationally important designated environmental sites.

3.9.2 Current Flood Risk Management Arrangements

The Ockbrook community is not within a flood alert or a flood warning area. 'South Derbyshire' Flood Alert Area and 'River Derwent at Elvaston Castle Country Park'' Flood Warning Area are both south of Borrowash and the closest to the community.

Ockbrook and Borrowash Parish Council have an appointed a Flood Warden.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show no formal flood defences being present in this community.

The responsibility for the maintenance of Ock Brook falls with the riparian owners, including where the watercourse is culverted.

3.9.3 Storm Babet Incident Details

The eight homes which flooded internally include four properties on Cole Lane, which runs perpendicular to Ock Brook, and four properties on Collier Lane which runs adjacent to Ock Brook. The exact timings of the flooding that occurred during Storm Babet are unknown.

3.9.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting all the properties in the community was Ock Brook.
Ock Brook is culverted as it passes under Cole Lane. Communication from residents in the community

indicates that the culvert under Cole Lane was partially blocked, leading to the water level in Ock Brook to rise upstream (north) of Cole Lane. The Ock Brook then overflowed its banks, with flood water flowing westward along Cole Lane and Collier Lane. Figure 3-32 shows the flooding to Collier Lane.

Figure 3-32: Flooding to Collier Lane

Another unnamed watercourse flows from Victoria Avenue towards Cole Lane and is culverted eastwards from Victoria Avenue until it joins Ock Brook. This watercourse exceeded the culvert capacity at its inlet, causing exceedance flow down Collier Lane, which then contributed to the out-of-bank flows from Ock Brook.

3.9.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented to all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Erewash Borough Council
- Emergency Services

There is a Derbyshire County Council project ongoing to investigate the feasibility of flood alleviation options in the area.

3.10 Community Impacts – Stoney Middleton

3.10.1 Location Characteristics

Stoney Middleton is a village in the Derbyshire Dales, England. A group of ten properties suffered internal flooding as a result of Storm Babet. Seven of the properties were residential and the other three were non-residential. The area flooded is close to Dale Brook, which flows from west to east through the village. Dale Brook flows into Stoke Brook, which is a tributary of the River Derwent to the east. All watercourses listed are designated main rivers. Figure 3-33 below shows the location of the affected community.

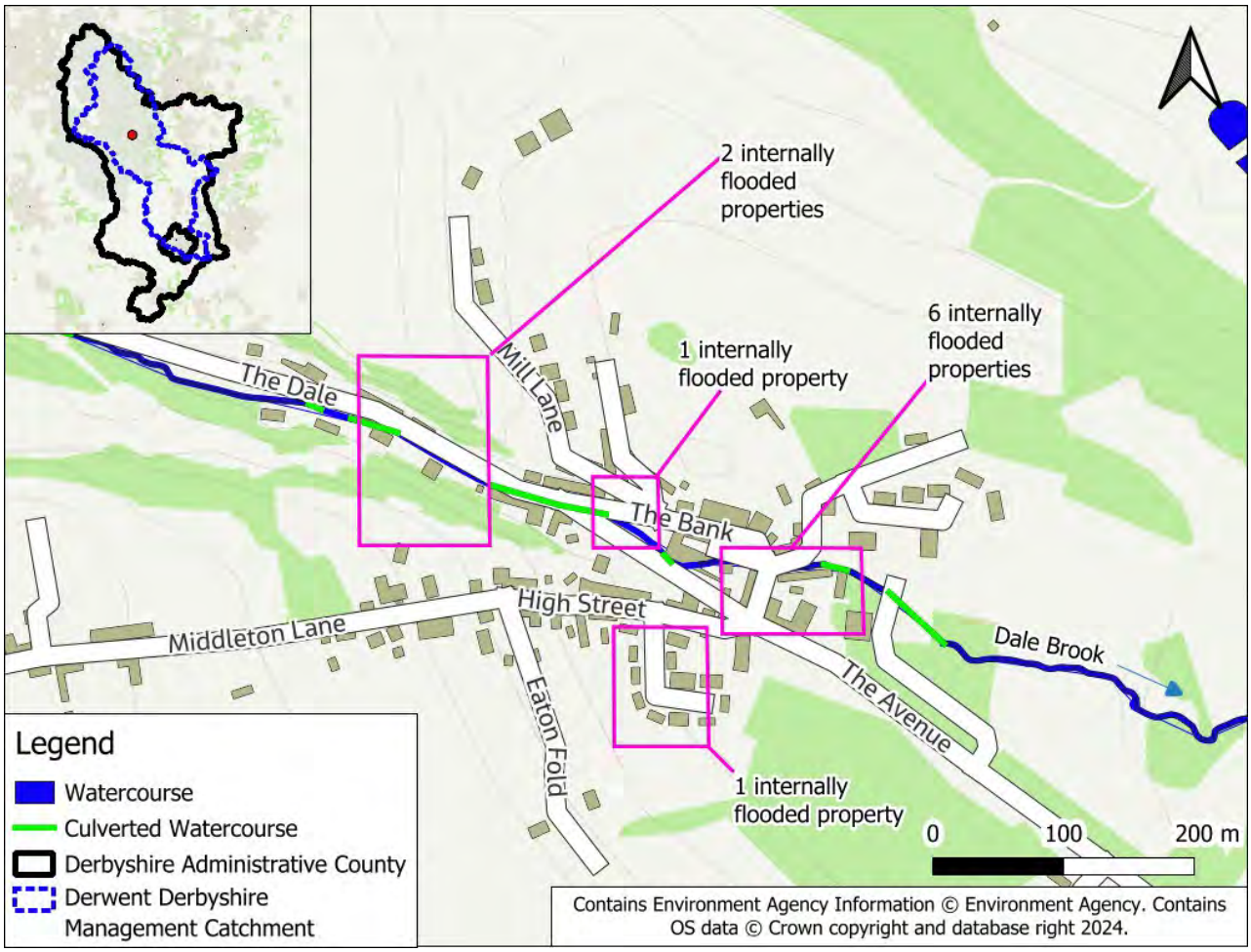

Figure 3-33: Overview of Stoney Middleton

Stoney Middleton is a historic area, with most properties 100 years old or more. The community affected is a mix of terraced, semi-detached and detached properties. There are no known vulnerable groups within the community, for example schools, hospitals and residential care homes.

The community is within the floodplain of Dale Brook, which flows eastwards to join the River Derwent, approximately 1.5km east of the community. Properties are located along the valley bottom are at a low elevation, similar to the natural top-of-bank level for Dale Brook. The local superficial geology is alluvium, including gravel, sand, silt, and clay.

A flood event occurred in January 2007 as a result of a dam failure at Glebe Mine. Derbyshire County Council also have records of frequent flooding associated with the old mine drainage in the area. These old mine drains are known as soughs.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all the flooded homes within this community are in Flood Zone 3 and Flood Zone 2, except one at Denman Crescent. Flood Zone 3 means the properties have a greater than 1% AEP of flooding from rivers. Flood Zone 2 means the properties have between a 1% and 0.1% AEP of flooding from rivers. The flooded property on Denman Crescent is higher up the hillside and is in Flood Zone 1 which means it has less than a 0.1% AEP of river flooding. Figure 3-34 demonstrates the Flood Zone extents.

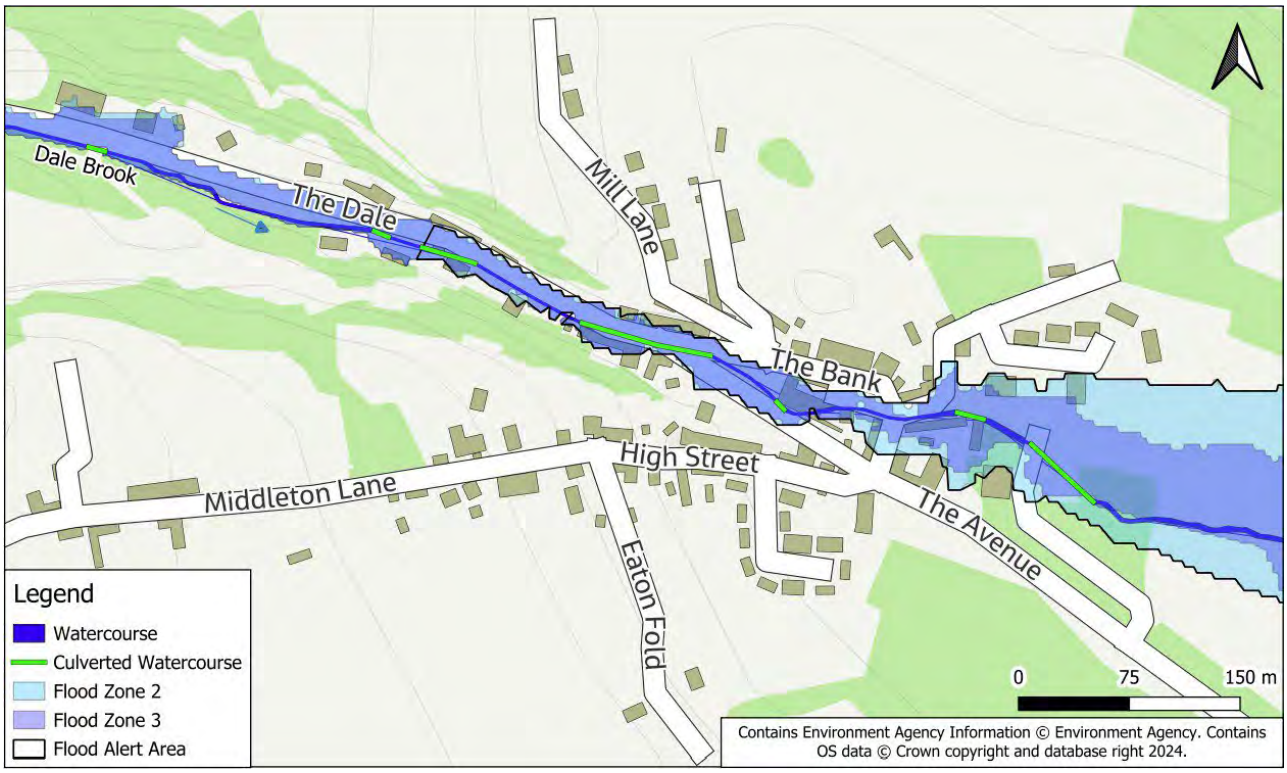

Figure 3-34: Extent of Flood Zones at Stoney Middleton

Additionally, some homes are at risk of surface water flooding based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode). The properties that are located close to Dale Brook have a medium (between 1% and 3.3% AEP) to high (more than 3.3% AEP) risk of surface water flooding. This includes all the properties apart from the one on Denman Crescent. There are local accounts of a significant surface water flow route that flows from the northwest side of Castle Hill down to The Nook. Figure 3-35 shows the risk of surface water flooding based on the Long-Term Flood Risk Map.

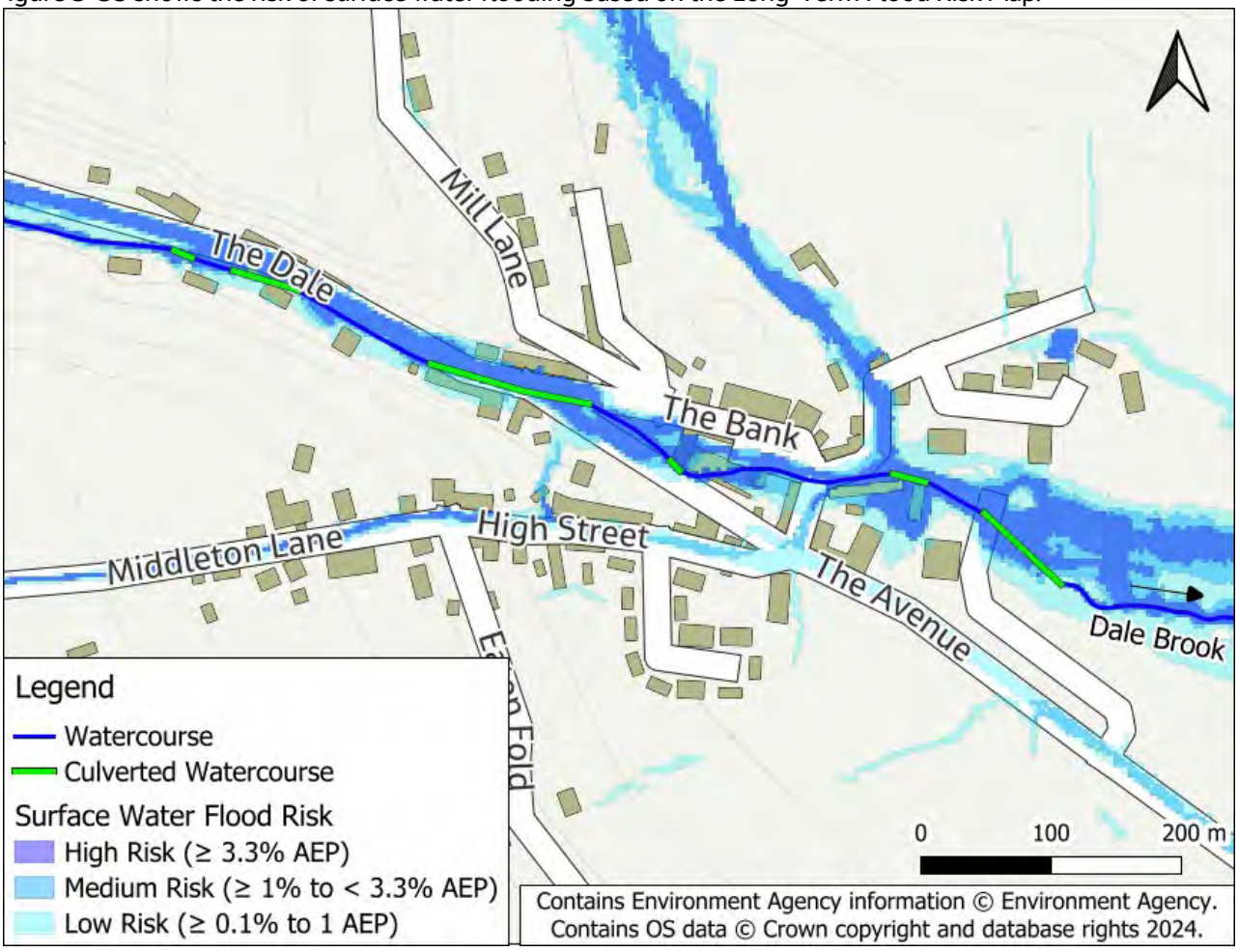

Figure 3-35: Map showing the chance in any given year of flooding from surface water at Stoney Middleton (Source: Long Term Flood Risk Map)

The community is located within 500m of Stoney Middleton Dale Site of Special Scientific Interest to the west and Coombs Dale SSSI and Peak District Dales Special Area of Conservation to the south.

3.10.2 Current Flood Risk Management Arrangements

The majority of properties flooded in this community are within the 'Tributaries in North Derbyshire' Flood Alert Area. There is no Flood Warning Area for this community.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show no formal flood defences being present in this community. However, four debris screen, and culverted sections of watercourse, do exist within the catchment. Three of the debris screens are maintained by the Environment Agency and the fourth by a private third party.

The responsibility for the maintenance of Dale Brook falls with the riparian owners, including where the watercourse is culverted.

The Stoney Middleton Flood Warden was noted as being very proactive in monitoring local watercourses and acting as a communication channel between residents and RMAs.

3.10.3 Storm Babet Incident Details

A flood alert was issued to the 'Tributaries in North Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm. Internal flooding of the properties is reported to have taken place on the afternoon of the 20th of October.
The seven homes that flooded internally include properties to the west of Stoney Middleton along the A623 (The Dale), around The Nook and one property on Denman Crescent. The three non-residential properties that flooded are located off The Bank and The Nook.

3.10.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting properties was from the Dale Brook. Dale Brook is a shallow watercourse that passes through the village via a mixture of open and culverted channels. There are four culverted sections in the vicinity of the properties affected which have a trash screen on the upstream end. This limits debris from entering the culvert and then potentially becoming lodged within the culvert and causing blockage. Environment Agency CCTV of the second trash screen on Dale Brook at Old Woodyard demonstrated that the channel was not blocked but water did exceed the capacity of the culvert during the event. It is probable that the volume of water during Storm Babet was too great for the relatively shallow watercourse and capacity of the culverts, causing it to flow out of bank and flood properties.

Derbyshire County Council observed flood damage to properties surrounding The Nook and determined that flooding was also related to old mine drainage (soughs) surcharging and flooding properties and the Nook road. Figure 3-36 shows the extent and damage of flooding along The Nook.

Figure 3-36: Flooding to properties on The Nook (left) and damage caused by flooding to The Nook (right)

Due to the nature of the steep hillside to the north of the community, surface water runoff is another likely cause of flooding, especially as The Nook is in a low-lying area adjacent to the watercourse. Surface water runoff from the field behind Denman Crescent is reported to be the source of internal flooding to the home which flooded in this location.

3.10.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Derbyshire Dales District Council
- Emergency Services

The Environment Agency issued a Flood Alert on 19th of October 2023 at 7:13pm.

Actions undertaken by Derbyshire County Council include:

- a site visit of Stoney Middleton to assess-flood damage and to gather information for further investigation.

- initial feasibility studies into delivery of natural Flood Risk Management in this area,

There will be a small scheme delivered by Derbyshire County Council to mitigate the flood risk both on the highway and existing properties in the Edge View/Meadow Close area.

On the 19th of January 2024, a public drop in was held at the community to provide support and guidance to those affected.

3.11 Community Impacts – Duffield

3.11.1 Location Characteristics

Duffield is a village in the Amber Valley district of Derbyshire, five miles north of Derby and south of the Peak District National Park. Thirty-four properties were internally flooded during Storm Babet. Thirty-one were residential and three were non-residential properties including Duffield Meadows Primary School. Figure 3-37 shows the open and culverted watercourses within Duffield.

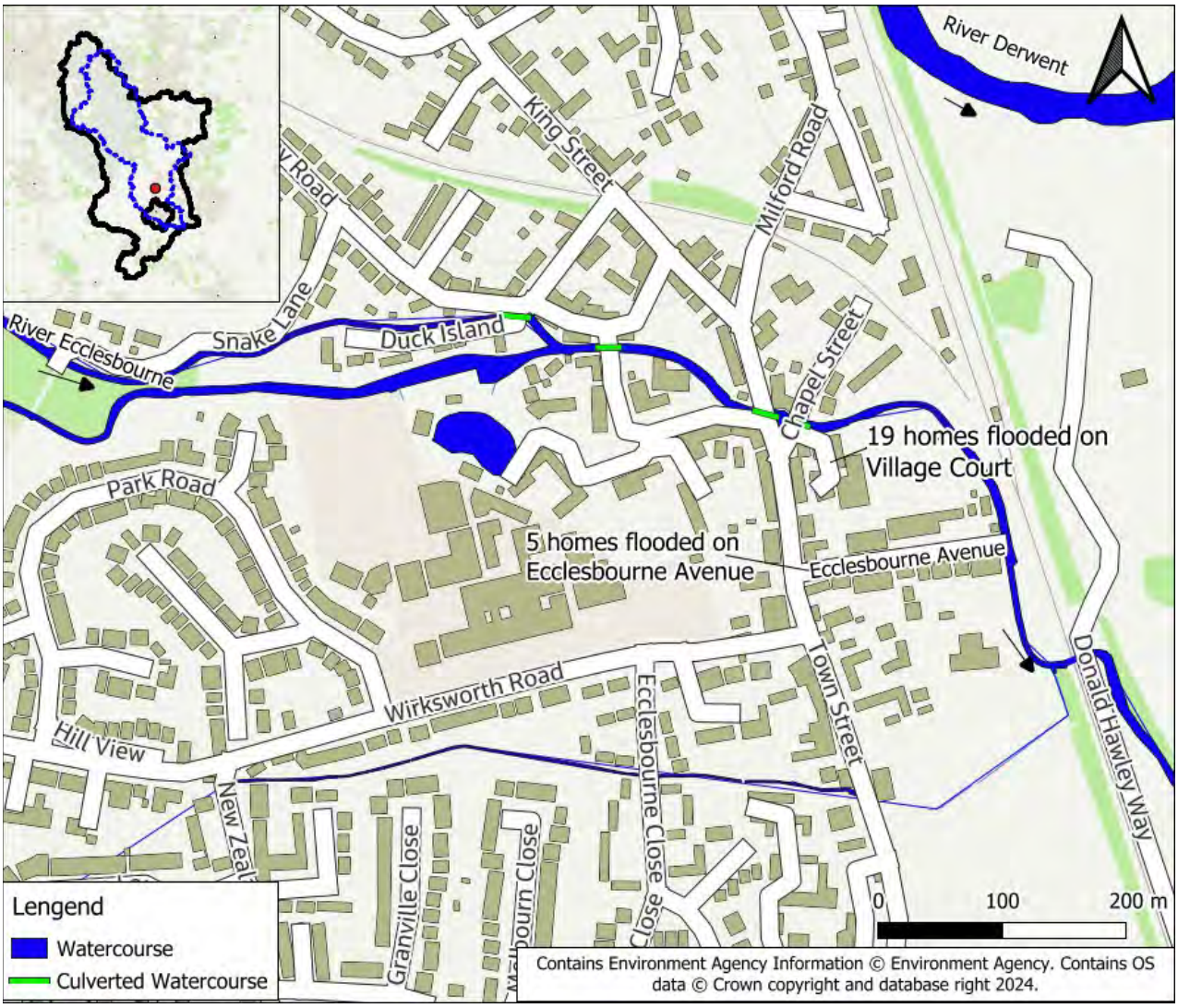

Figure 3-37: Overview map of Duffield.

The properties that were flooded in Duffield are a mix of terraced, semi-detached and detached homes and businesses. Nine potentially vulnerable groups have been identified in the community, including four schools, two care homes and one retirement complex.

Critical infrastructure within the area includes Town Street (A61) which connects Duffield with Derby to the south, and Belper to the north. Duffield railway station and the Midlands Main Line Railway runs to the east of Duffield. Duffield fire station is also located in the area.

The community is located on the floodplain of the River Ecclesbourne, which flows eastward to join the River Derwent at Duffield Millenium Meadow about 1km downstream of Duffield. Both watercourses are designated as main river. The area is on the southern foothills of the Pennines. The local topography is relatively low lying when compared to the surrounding countryside. The local superficial geology is alluvium, including gravel, sand, silt, and clay.

The Environment Agency Historic Flood Map, and records from the Environment Agency and Derbyshire County Council, confirm that flooding has previously occurred multiple times in Duffield.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that thirty properties are located in Flood Zone 3, three properties are located in Flood Zone 2 and one property is located in Flood Zone 1. Flood Zone 3 means the properties have a greater than 1% AEP of flooding from rivers. Flood Zone 2 means the properties have between a 1% and 0.1% AEP of flooding from rivers. Flood Zone 1 means that properties have a very low chance of river flooding. Figure 3-38 demonstrates the Flood Zone extents.

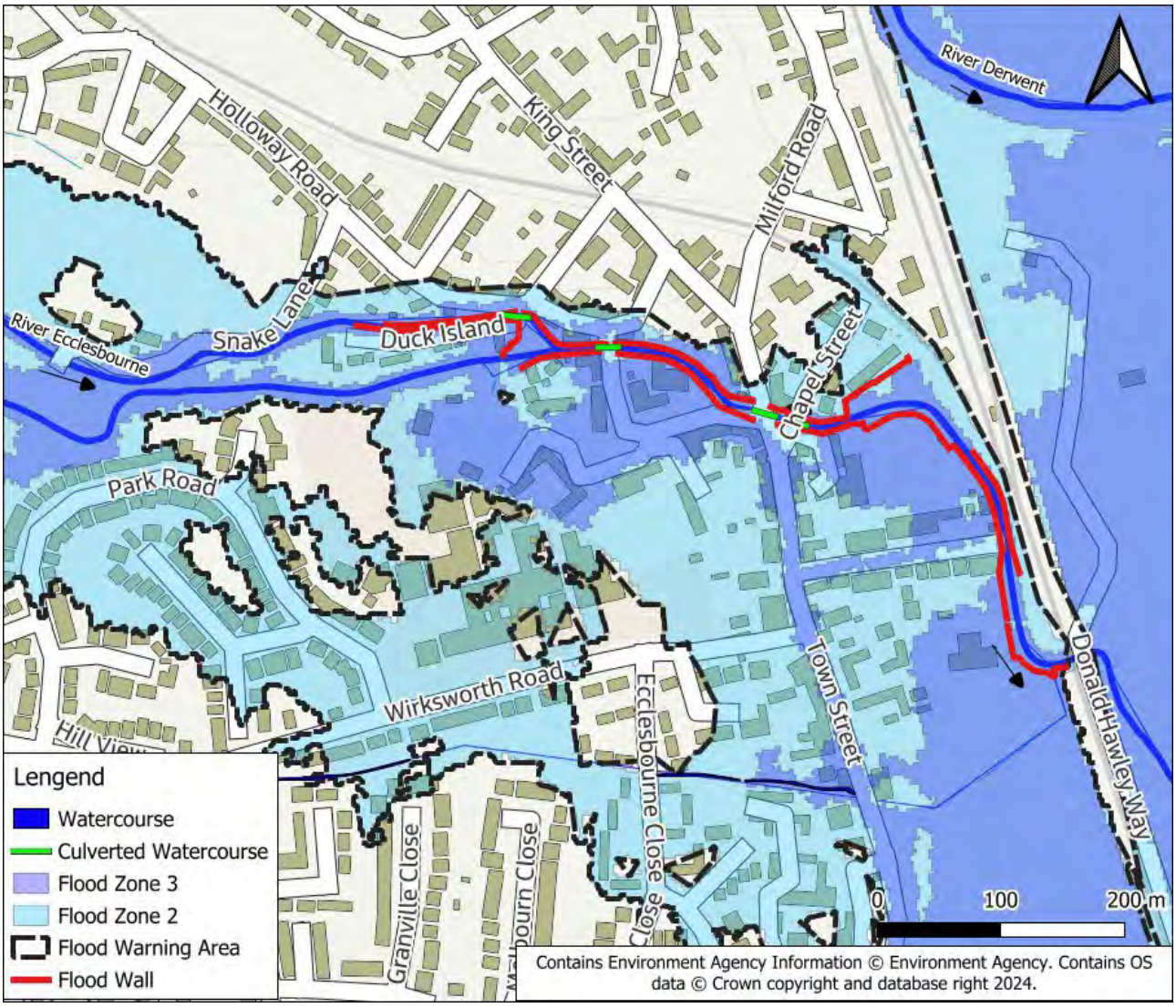

Figure 3-38: Flood zones and flood risk management arrangements at Duffield.

Additionally, some properties which flooded have a risk of surface water flooding based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode) See Figure 3-39. Properties on Village Court and Ecclesbourne Avenue having a medium chance (between 1% and 3.3% AEP) of surface water flooding. Many local roads, for example Town Street (A6), also have a high chance (more than 3.3% AEP) of surface water flooding.

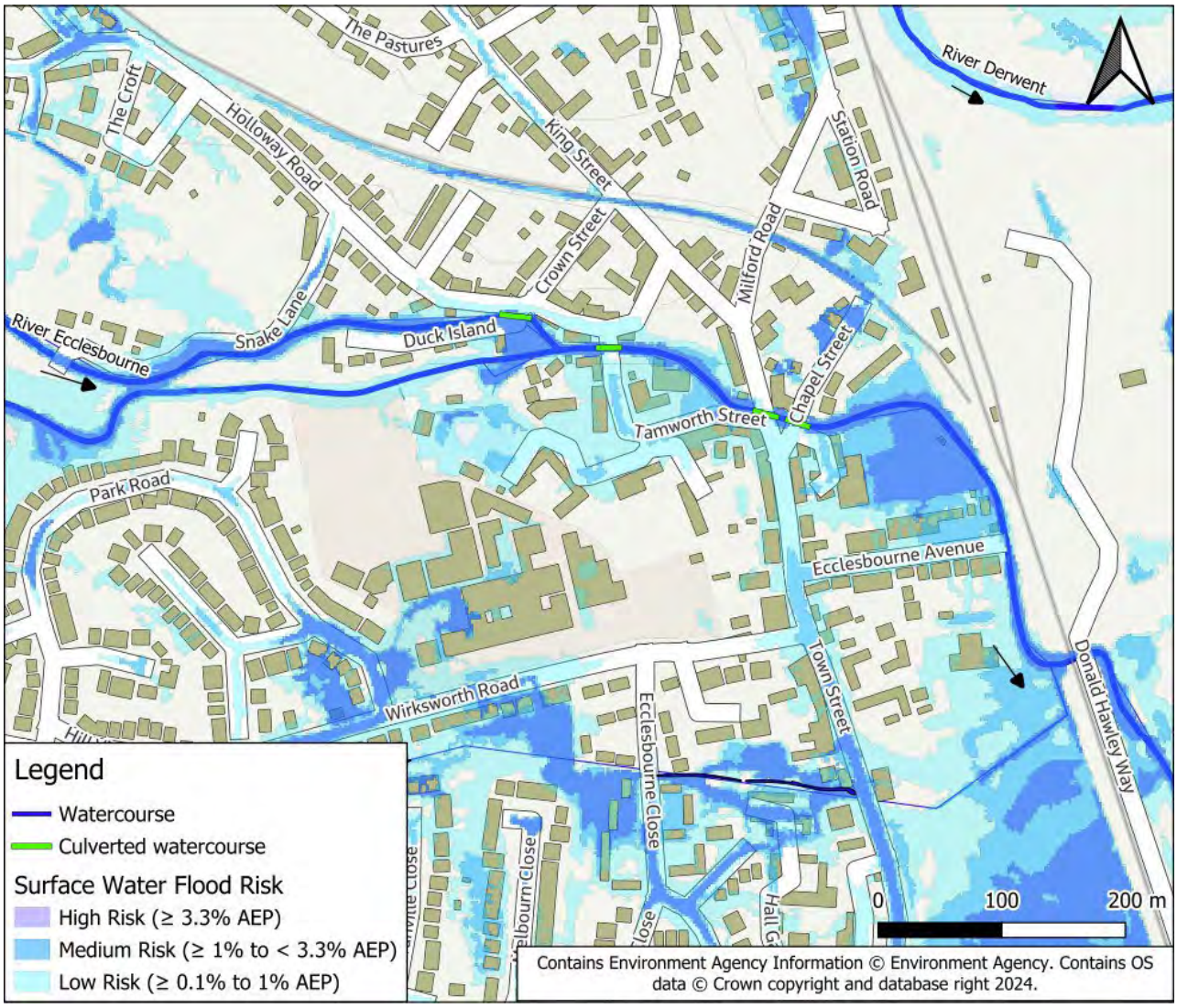

Figure 3-39: Map showing the chance in any given year of flooding from surface water at Duffield (Source: Long Term Flood Risk Map)

In Duffield there are multiple Historic England Conservation Areas and 36 listed buildings. There are also two local wildlife sites: at Duffield Cemetery and Duffield Millenium Meadow. The east of Duffield is within the Derwent Valley Mills UNESCO World Heritage Site.

3.11.2 Current Flood Risk Management Arrangements

Thirty three of the flooded properties in Storm Babet are within a flood alert or flood warning area. These include: the 'River Ecclesbourne in Derbyshire' Flood Alert Area; 'Lower Derwent in Derbyshire' Flood Alert Area; and the 'Rivers Ecclesbourne and Derwent at Duffield' Flood Warning Area. On anticipation of a potential flood event, residents who are signed up to alerts and warnings are informed when flooding is expected. One flooded property is not within a Flood Alert Area or Flood Warning Area.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show various formal flood defences being present in the community.

After a significant flood event in 1965, flood defence walls were constructed throughout Duffield along the River Ecclesbourne between 1970 to 1975, providing a 1% AEP standard of protection relative to the flood event data available at the time.

In 2010, natural flood management measures in the form of buffer strips were implemented on the River Ecclesbourne upstream of Duffield, by the Environment Agency, Severn Trent Water and Derbyshire Wildlife Trust.

Between 2015 and 2021, the Broadway Flood Mitigation Scheme was implemented to the southwest of

Duffield by Derbyshire County Council to reduce flood risk to 32 homes.
The Environment Agency is responsible for maintenance to flood defence walls, flap valves and penstocks associated with the 1975 scheme delivered in Duffield. The Environment Agency also choose to exercise their permissive powers to undertake maintenance on the River Ecclesbourne in an intermittent basis. Two months before Storm Babet, 600 tonnes of silt were removed from under the bridge at Town Street and Chapel Street to improve conveyance.

Aside from the maintenance specified above, the responsibility for the maintenance of watercourses and drainage networks falls with the riparian owners.

3.11.3 Storm Babet Incident Details

A flood alert was issued to the 'River Ecclesbourne and Lower Derwent in Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm, and a flood warning was issued to the 'Rivers Ecclesbourne and Derwent at Duffield' Flood Warning Area on the 20th of October at 1:43pm.

Internal flooding of affected properties is understood to have taken place on the afternoon and evening of the 20th of October. At 1:19pm the defence walls at Duffield Tennis Club started to overflow. By 2:04pm, the flood water had reached the thresholds of properties at Village Court and soon after that, internal flooding of properties started to occur. At 2:47pm, the flooding from the tennis courts started to flood the rear gardens of Ecclesbourne Avenue and then onto the road itself, with several properties on this road internally flooding. By 4:00pm, flood water had started to flow down Town Street, which was subsequently closed.

Twenty-three homes were flooded internally on Village Court and Ecclesbourne Avenue. A further five homes flooded internally on Town Street. One property internally flooded in each of Duck Island, Holloway Road and Wirksworth Road.

Of the three non-residential properties that flooded, two are located on Town Street and Duffield Meadows Primary School is located off Park Road.

3.11.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding in Duffield during Storm Babet was the River Ecclesbourne. However, local ordinary watercourses and surface water flooding were considered to be contributing factors.

The River Ecclesbourne exceeded its capacity and overflowed its banks and formal defences in several locations through Duffield, which directly caused internal flooding to many of the affected properties.

At Duck Island and Holloway Road, the River Ecclesbourne overflowed the left bank and flowed overland via the riverside footpath, which led to flooding on Holloway Road and Tamworth Street. The river also flooded onto Duck Island bridge, with a property on Duck Island internally flooding. Figure 3-40 shows flood water flowing over the bridge to Duck Island.

Figure 3-40: Flood water flowing over Duck Island Bridge

The flood defence walls at Village Court and Duffield Tennis Club were reported to be overtopped around 2:04pm on 20th of October 2023. This led to flooding across the tennis courts and to properties on Village Court, including the tennis club. Figure 3-41 shows the flooding to Duffield Tennis Club.

Figure 3-41: Flooding of Duffield Tennis Courts backing onto properties on Ecclesbourne Avenue

Village Court is a retirement complex; the Fire and Rescue Service was needed to evacuate these properties safely. With the flood defences continuing to be overtopped, flood water made its way into the properties on Ecclesbourne Avenue.

Properties on Town Street were flooded when the ordinary watercourse, that is culverted under the road, could no longer pass through the culvert due to the volume of water exceeding the culvert's capacity. Flood

water flowed down Town Street, which had to be closed for safety.

Duffield Meadows Primary School suffered internal flooding primarily from the overflow of ordinary watercourses west of the school property and south of the River Ecclesbourne. In addition, overland surface water routes from the south are thought to have contributed to internal flooding at the school. The school had to be temporarily closed, with pupils having to relocate to temporary classrooms for several months while the flooded classrooms were being repaired.

The flooding explained above is shown in Figure 3-42 below. The black arrows indicate the direction of flooding to the affected areas described above.

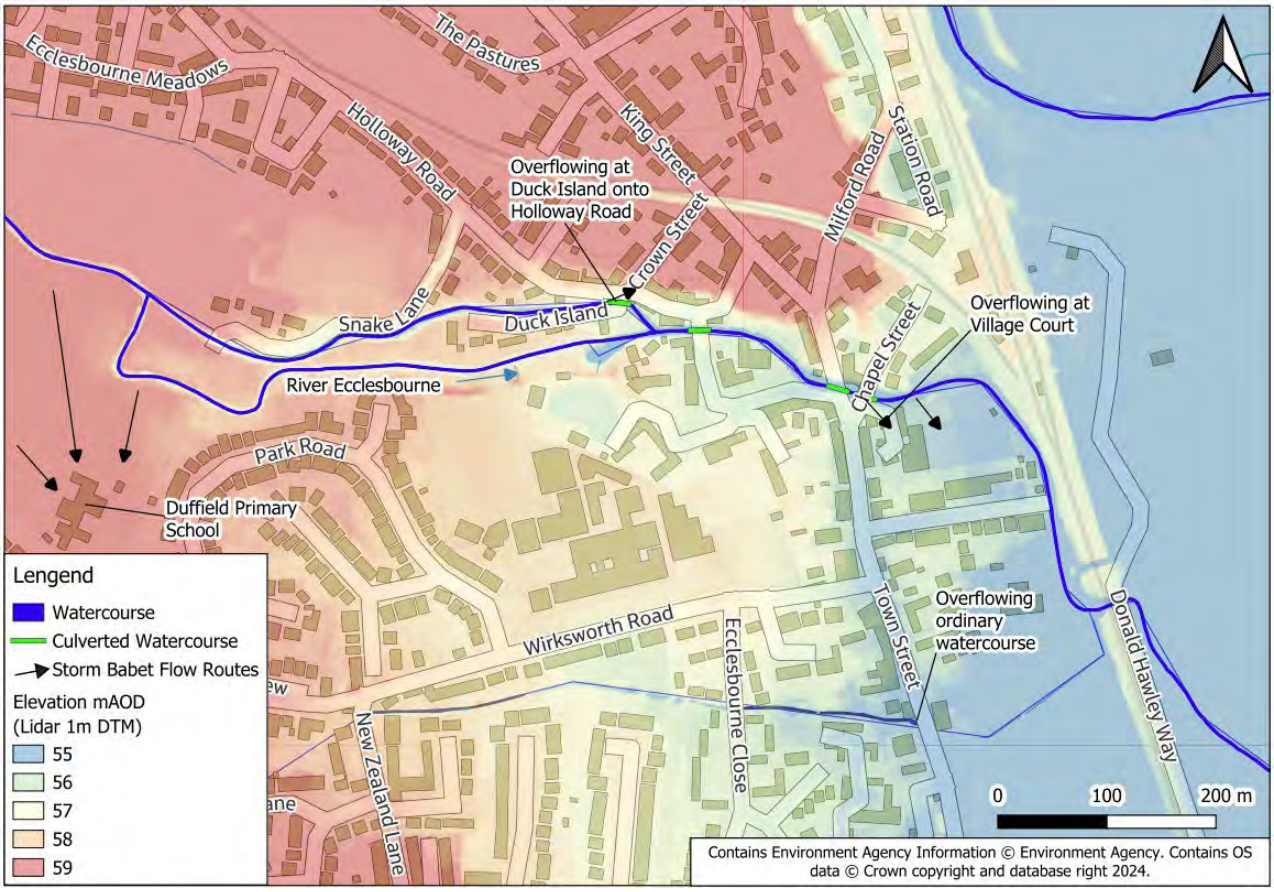

Figure 3-42: Map of Duffield with flooding flow routes indicated with blue arrows.

3.11.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Amber Valley Borough Council
- Emergency Services

The Environment Agency issued a Flood Alert to the River Ecclesbourne and Lower Derwent in Derbyshire on the 19th of October 2023 at 7:13pm, and a Flood Warning to the Rivers Ecclesbourne and Derwent at Duffield on the 20th of October at 1:43pm.

The Derbyshire Fire and Rescue Service attended Village Court to evacuate residents safely as this was one of the worst affected areas.

Following the flood event, the Environment Agency completed inspections of their assets at this community and confirmed that they operated as normal but that the volume of water would have exceeded their capacity.

Derbyshire County Council and the Environment Agency have undertaken several post-event site visits, both together and independently, to investigate the flood mechanisms and support properties and business affected.

On the 15th of January, a multi-agency drop-in event was held at Belper to provide support and guidance to those affected. RMAs in attendance included the Environment Agency, Derbyshire County Council and Amber Valley Borough Council.

Derbyshire County Council are investigating flooding mechanisms from ordinary watercourses upstream of Duffield Meadows School to determine if any maintenance actions are required.

The Environment Agency stated that they would continue to work in partnership with partner organisations to explore options for communities affected this winter.

3.12 Community Impacts – Bradwell

3.12.1 Location Characteristics

Twenty-six residential properties and three non-residential properties internally flooded as a result of Storm Babet in Bradwell. Bradwell is a village in the Peak District National Park and is part of the Derbyshire Dales District Council. It is to the south of the Hope Valley, situated less than 1km east of the Breedon Hope Cement Works. Bradwell Brook, designated as main river, flows through the village, and joins the River Noe approximately 1km to the north-east. There is an unnamed watercourse in the east of Bradwell that flows into Bradwell Brook at Soft Water Lane. Figure 3-43 provides an overview of Bradwell.

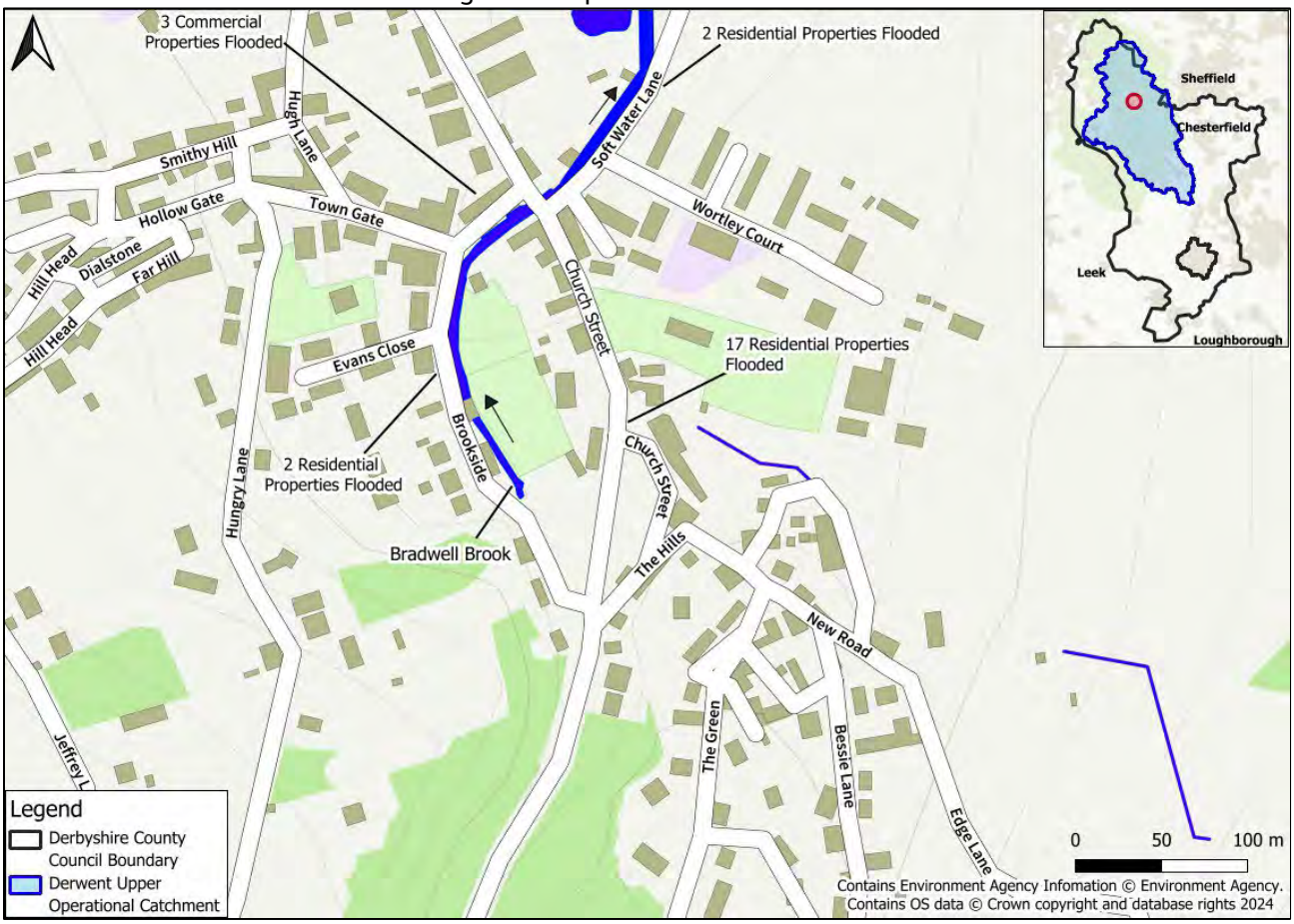

Figure 3-43: Overview map of Bradwell.

The community affected by flooding is a mixture of residential properties, holiday lets, commercial properties and businesses, along with public buildings, schools, and churches. The B6049, also known as Main Road, Netherside and Church Street, is the main road through the village. There are two schools in the village. There are no other known vulnerable groups within the community, for example schools, hospitals and residential care homes.

The local superficial geology is alluvium (i.e., gravel, sand, silt, and clay) and head (angular rock debris or clayey hillwash, and soil creep, created by the slow movement downhill of materials). The local geology is

Limestone which is porous and easily erodes. Historic mining in the area has led to water being able to flow through the ground more rapidly, leading to water reaching watercourses more quickly during heavy rainfall.

The Environment Agency Historic Flood Map, and records from the Environment Agency and Derbyshire County Council, confirm that flooding has previously occurred multiple times in Bradwell. Previous flooding has been reported in 1991, 1997, 1998, 2007, 2010, 2015, 2021, and 2022. Bradwell is vulnerable to flooding from several sources including main river, ordinary watercourse, surface water, and old mining drains.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that majority of flooded homes within this community are in Flood Zone 3. Flood Zone 3 means the properties have a greater than 1% AEP of flooding from rivers. Only one of the properties is located within Flood Zone 2. Flood Zone 2 means the properties have between a 1% and 0.1% AEP of river flooding.

Additionally, some properties are at risk of surface water flooding based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode) The B6049, Bridge Street and Soft Water Lane are all at high risk of surface water flooding with a 3.3% AEP . Several properties on the B6049 and Bridge Street are at medium risk of surface water flooding having between a 3.3% to 1% AEP. Further properties are at low surface water flood risk on Church Street, the B6049, Town Gate and Bridge Street. A low surface water flood risk means there is between a 1% to 0.1% AEP of surface water flooding. Figure 3-44 shows the surface water flood risk for Bradwell.

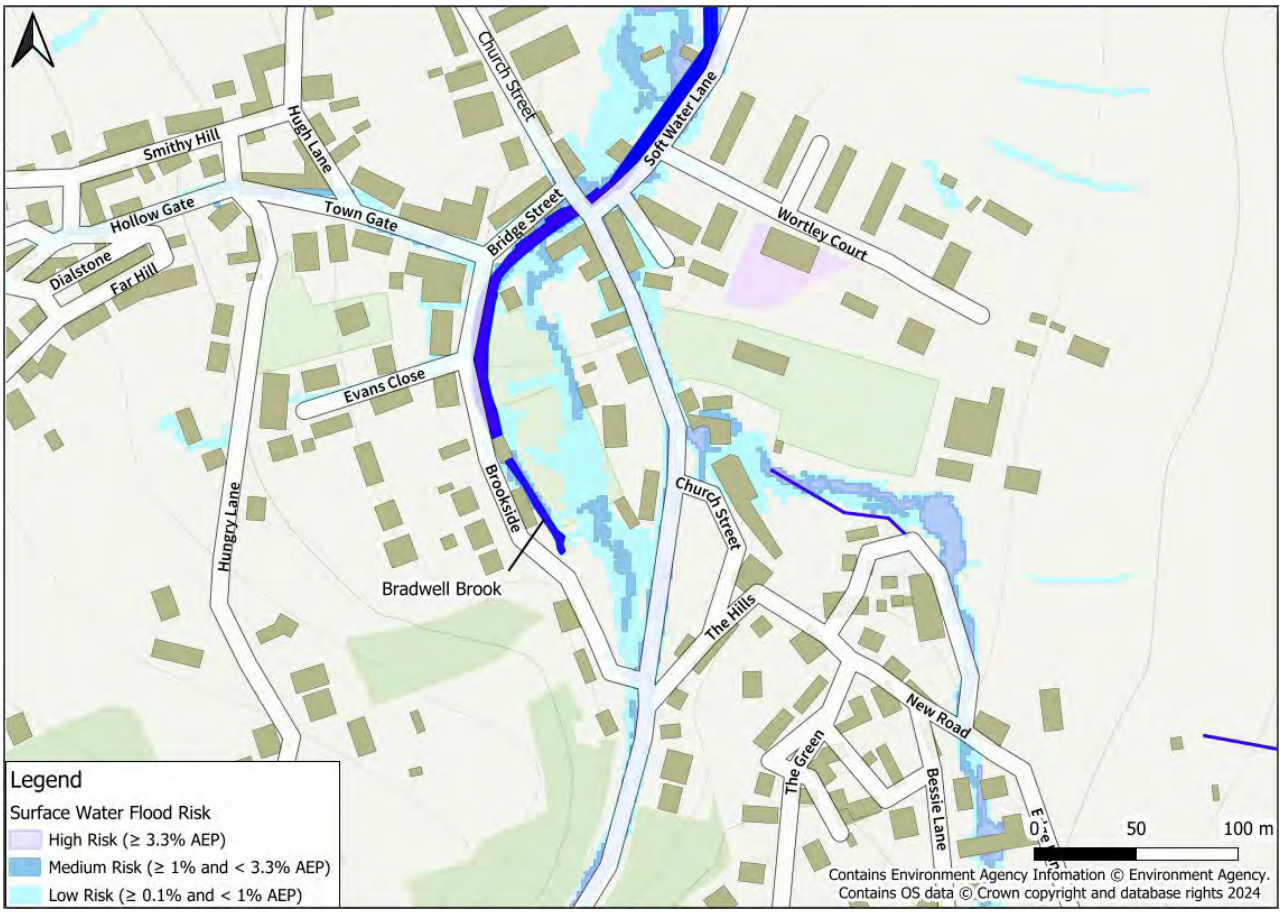

Figure 3-44: Map showing the chance in any given year of flooding from surface water at Bradwell (Source: Long Term Flood Risk Map)

Bradwell is partly located within the Bradwell Dale and Bagshaw Cavern Site of Special Scientific Interest (SSSI). The Bradwell Meadow SSSI is also located along Edge Lane on the south-east side of the village.

3.12.2 Current Flood Risk Management Arrangements

The majority of the properties flooded are within the 'Tributaries in North Derbyshire' Flood Alert Area and the 'Bradwell Brook at Bradwell' Flood Warning Area. On anticipation of a potential flood event, residents who are signed up to alerts and warnings are informed when flooding from Bradwell Brook is likely to occur.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show there are no raised flood defence structures located in Bradwell.

There are several culverts that convey Bradwell Brook under roads and buildings within the area. Some of these culverts appear to be under the responsibility of riparian owners, or Derbyshire County Council where they pass under highways. There is a debris screen to the south of New Road which is maintained by the Environment Agency. The maintenance of all the watercourses within Bradwell is the responsibility of the riparian owners.

The Environment Agency reports that a site visit by ARUP conducted on the 29th of November 2023 found some properties to have Property Flood Resilience (PFR) measures.

Bradwell Parish Council has a group of flood wardens who were active during Storm Babet.

Figure 3-45 shows the flood risk management arrangements described above.

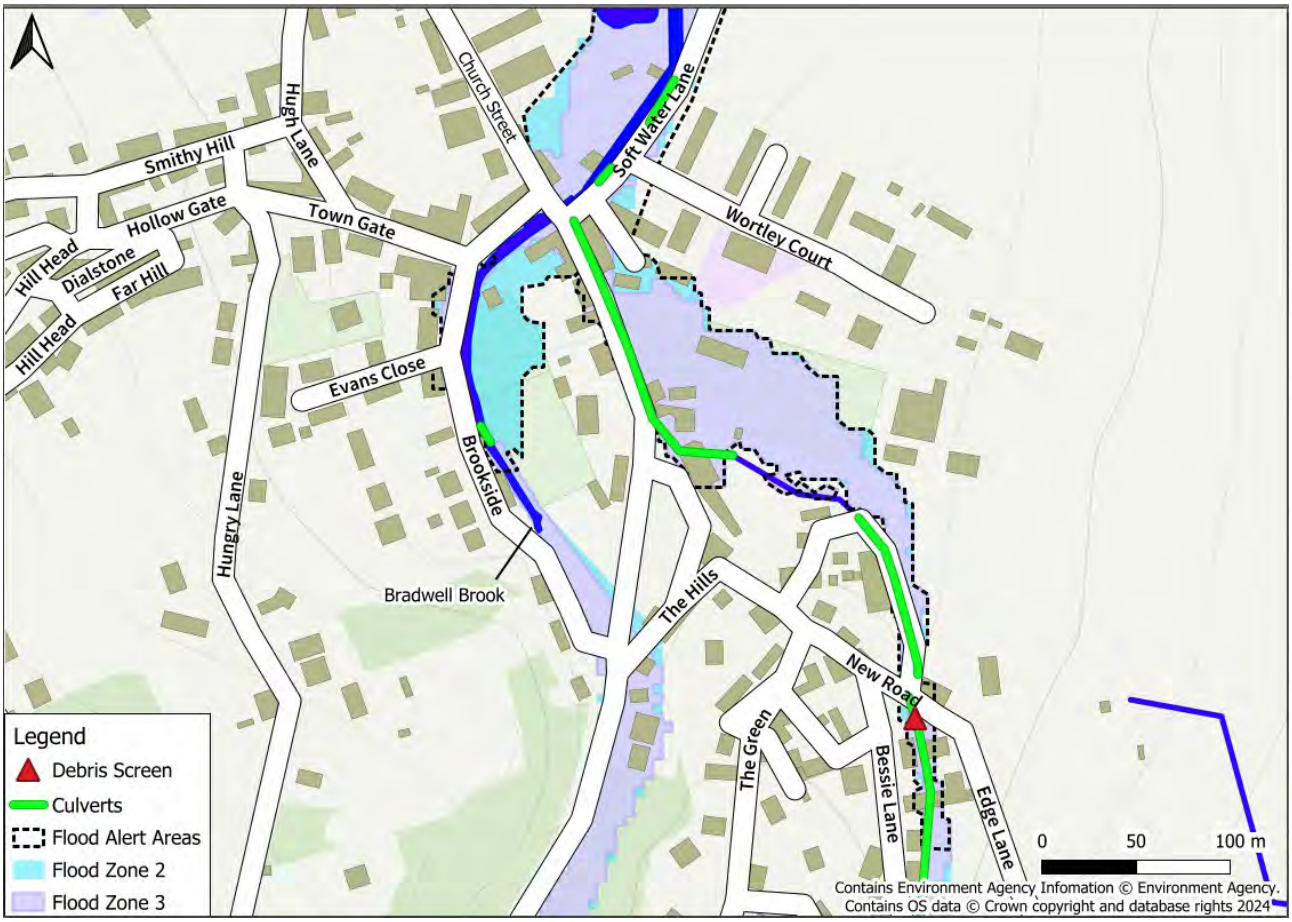

Figure 3-45: Flood risk management arrangements for Bradwell.

3.12.3 Storm Babet Incident Details

A flood alert was issued to the 'Tributaries in North Derbyshire' Flood Alert Area on 19th of October 2023 at 7:13pm. A flood warning was issued to the 'Bradwell Brook at Bradwell' Flood Warning Area on the 20th of October at 1:16pm. Flooding of properties was first reported at around 10:15am on the 20th of October.

There were twenty-nine properties that internally flooded as a result of Storm Babet on the 20th of October. Twenty-six of the properties were residential houses and three were non-residential. The houses that were flooded are located across Bradwell. Seventeen of the internally flooded houses were on Church Street, there were two houses on Brookside and two houses on Soft Water Lane also. The following streets had one internally flooded house each on them: The Hills, Town Gate, Bridge Street and New Church Street.

3.12.4 Flood Mechanisms, Extent and Impacts

There were multiple sources of flooding in Bradwell due to the heavy rainfall during Storm Babet. This led to flooding from Bradwell Brook, the unnamed watercourse and surface water flooding.

Surface water flows were reported on Brookside. Surface water flowed downhill from the west towards Bradwell Brook. Figure 3-46 shows the surface water runoff coming through the walls to the west of Brookside.

Figure 3-46: Surface water runoff flowing through a drystone wall and onto Brookside.

Surface water also flowed down the B6049 from south to north, towards Bradwell. Flooding to the road was shallow but it did extend across the entirety of the road.

Properties on Church Street suffered internal flooding from the unnamed watercourse that flows to the rear of the properties. Residents reported fast flowing water coming through their properties. Residents opened the doors of their properties to let the water flow through them, to limit structural damage. This flood water from the unnamed watercourse also contributed to flooding on the B6049. Anecdotal evidence reported to Derbyshire County Council stated that the drains on Church Street were visibly surcharging, with manhole covers lifted out of place, posing a safety risk to residents. Severn Trent did not receive any reports of issues in this area during the event. However, during the Section 19 investigation Severn Trent were made aware and are therefore investigating this issue further.

Flooding also occurred on Soft Water Lane from multiple sources. Surface water flowed from the north, east and the south, converging as it flowed towards Bradwell Brook. This convergence of surface water and the high flows in Bradwell Brook, meant the watercourse exceeded its capacity, and flooded onto Church Street and Soft Water Lane. Figure 3-47 shows Bradwell Brook overflowing at Church Street Bridge.

Figure 3-47: Bradwell Brook exceeding its capacity at the Church Street bridge.

One of the properties on Soft Water Lane is built over Bradwell Brook. A buildup of silt and debris under the property over time may have reduced the capacity of the culvert, which would have led to flooding on Soft Water Lane. The depth of flooding on Church Street near the bridge was reported to be shin deep, with depths on Soft Water Lane even deeper.

3.12.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Derbyshire Dales District Council
- Severn Trent
- Emergency Services

The Environment Agency issued a Flood Alert to Bradwell on 19th of October2023 at 7.13pm and a Flood Warning on 20th of October 2023 at 1:16pm.

Prior to Storm Babet, the Environment Agency conducted CCTV surveys of the culverts to ascertain the condition.

During the event Environment Agency operatives visited the village to remove large blockages and debris.

The Environment Agency hosted a public drop in for residents and businesses affected by flooding in Bradwell and Castleton on the 6th of February 2024 in Castleton.

Derbyshire County Council and the Environment Agency have undertaken several post-event site visits, both together and independently, to investigate the flood mechanisms and support properties and business affected.

During the S19 investigation, Severn Trent were made aware of issues of potential drainage surcharging on Church Street and so are investigating this issue further.

3.13 Community Impacts – Castleton

3.13.1 Location Characteristics

Twenty-four residential properties and five non-residential properties internally flooded as a result of Storm Babet in Castleton. Castleton is a village in the Peak District National Park, Derbyshire, England. It is at the western end of the Hope Valley on the Peakshole Water, a tributary of the River Noe, between the Dark Peak to the northwest and the White Peak to the south. Both watercourses are designated main river. Figure 3-48 is an overview map of Castleton.

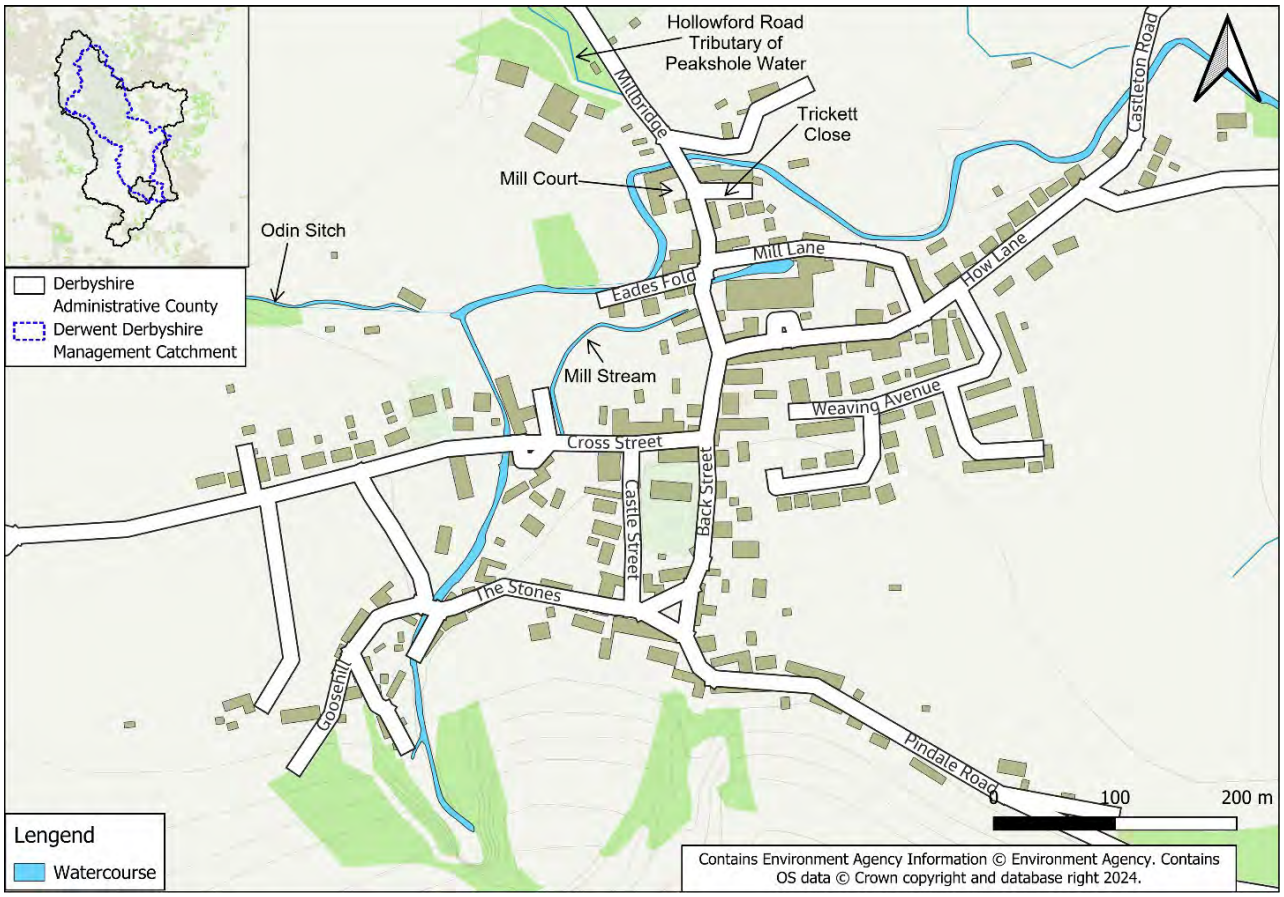

Figure 3-48: Overview map of Castleton.

The community is a mixture of residential properties, holiday lets, commercial properties and businesses, along with public buildings, such as museums, schools and churches. The area is a busy tourist destination, therefore the A6187 main road is critical infrastructure for the local economy, allowing the movement of people visiting the area or passing through to other parts of the Peak District. There are no known vulnerable groups within the community, for example schools, hospitals and residential care homes.

The community flooded is located on the floodplain of Peakshole Water, which flows eastward to join the River Noe near Hope. There are three other watercourses in Castleton. Odin Sitch is a tributary of Peakshole Water and joins it at the west edge of the Castleton Visitor Centre Car Park. There is another tributary of Peakshole Water that flows south, parallel with Hollowford Road, joining Peakshole Water opposite Mill Court. The third watercourse is a mill stream that is diverted off Peakshole Water to the south of The Island. This mill stream flows through the centre of Castleton into a mill pond parallel to Mill Lane.

The local superficial geology is alluvium, including gravel, sand, silt, and clay; and head which is angular rock debris or clayey hillwash, and soil creep, created by the slow movement downhill of materials. The local bedrock geology is Limestone. Limestone is porous and is eroded more easily by water. This leads to cave systems being created over time such as the Peak Cavern cave system that Peakshole Water flows out from. Due to its nature, water flows through limestone more quickly than other rocks meaning groundwater flows reach the watercourses more rapidly during heavy rainfall.

The Environment Agency Historic Flood Map indicates that most of the properties that flooded as a result of Storm Babet, have also been flooded previously from Peakshole Water. Previous floods have occurred in 2019, but not to the extent of Storm Babet, and also in 1991 and 1947.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that the majority of the homes and commercial properties that flooded during Storm Babet are located within Flood Zone 3, with the others being located in Flood Zone 2. Properties in Flood Zone 2 having between a 1% and 0.1% AEP of river flooding, while properties in Flood Zone 3 having greater than a 1% AEP of river flooding.

Based on the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode) most of the properties on Millbridge, Trickett Close and Mill Court, have a high (more than 3.3% AEP) chance of surface water flooding. There is up to a medium risk of surface water flooding in some additional low lying areas in the village. Figure 3-49 shows the surface water flood risk described.

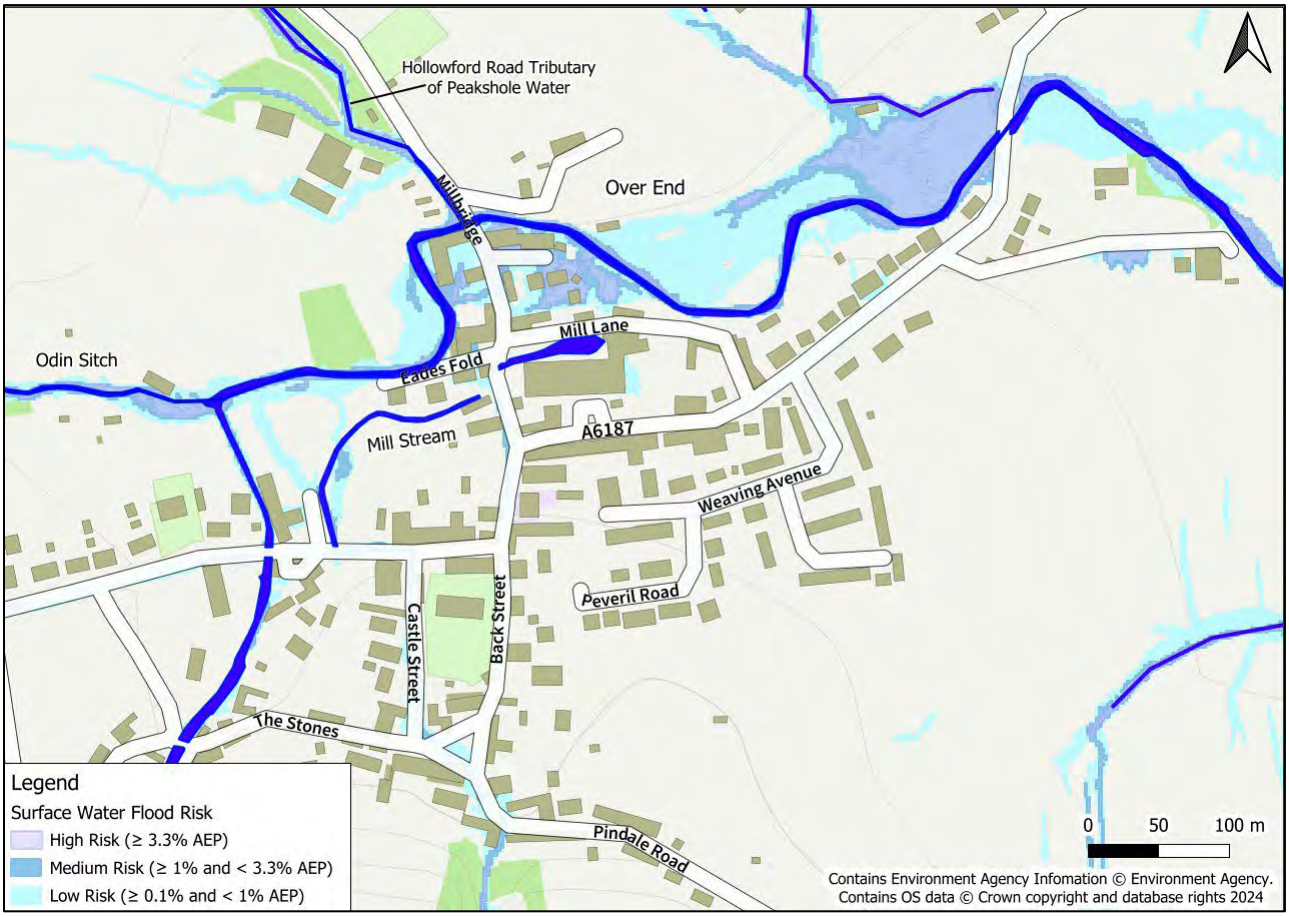

Figure 3-49: Map showing the chance in any given year of flooding from surface water at Castleton (Source: Long Term Flood Risk Map).

The community sits on the edge of the Castleton Site of Special Scientific Interest.

3.13.2 Current Flood Risk Management Arrangements

The majority of the properties in this community are located within the 'Tributaries in North Derbyshire' Flood Alert Area. On anticipation of a potential flood event, residents who are signed up to alerts are informed when flooding from Peakshole Water is expected. There is currently no Flood Warning Area covering this community but one is in development.

A Flood Warden Group exists in the community, to alert and prepare people for flooding.

The Environment Agency's Asset Information and Maintenance Programme (data.gov.uk) (https://environment.data.gov.uk/asset-management/) shows there are currently no formal flood defences in the community. The only asset in Castleton that the Environment Agency maintain is a flap valve in the visitor centre car park. The flap valve prevents water from Peakshole Water backing up into the surface water drainage network when river levels are high. There is a small wall that has been built on the Riverside Path to fill a gap between a drystone wall and the wall of a property. The drystone walls in Castleton are not flood defence walls or flood risk management assets. Figure 3-50 shows the flood risk management arrangements for Castleton.

The maintenance of all the watercourses within Castleton is the responsibility of the riparian owners.

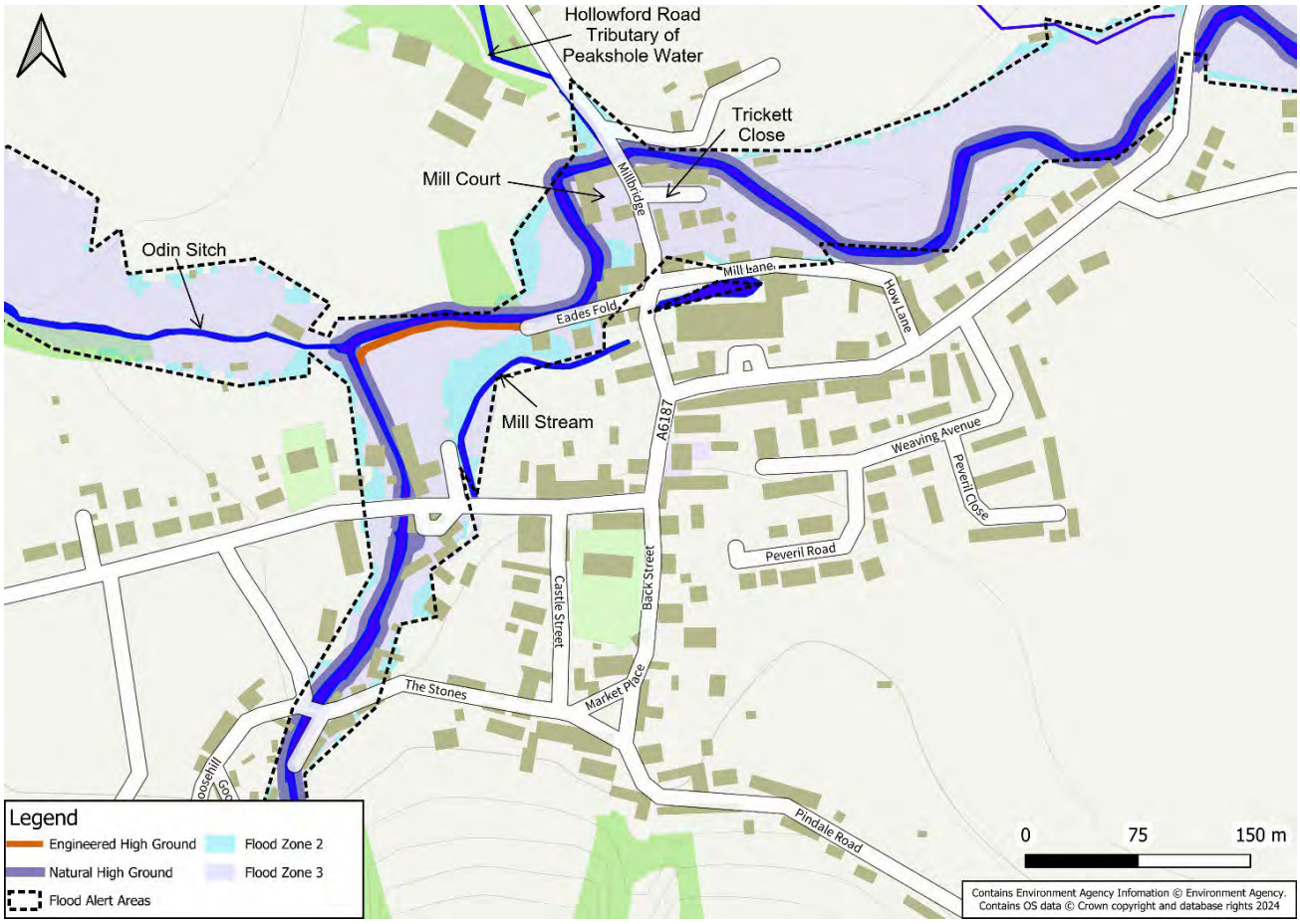

Figure 3-50: Castleton flood risk management arrangements.

3.13.3 Storm Babet Incident Details

A flood alert was issued to the 'Tributaries in North Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm. Internal flooding of homes and businesses is understood to have taken place on the 20th of October. Before the event, residents prepared with sandbags which are stored in the village shop. Flood wardens also constructed a makeshift flood defence at the top of the Riverside Path.

The twenty-nine homes and commercial properties internally flooded include, seventeen homes and three commercial holiday lets on Millbridge, Trickett Close, and Mill Court. Another four homes flooded internally on The Island, along with two commercial properties. A further home was flooded on Waterside, one on The Stones and one on Eades Fold.

3.13.4 Flood Mechanisms, Extent and Impacts

The main source of flooding was identified to be Peakshole Water, the main watercourse that flows through Castleton. During Storm Babet, the intense rainfall caused large volumes of water to flow through the cave system south of the village, feeding Peakshole Water, which comes out of Peak Cavern. In addition to flooding from Peakshole Water, surface water was another significant source of flooding. Anecdotal reports from residents suggested that the sewer network became overwhelmed with the volume of water and surcharged. However, Severn Trent did not receive any reports of any issues related to its network and a site visit that was undertaken by Severn Trent did not reveal sewer network issues to be a contributing source of flooding.

The sewer network, which receives both foul and surface water, also became overwhelmed with the volume of water and surcharged.

Flooding on The Stones was reportedly caused by a large volume of water coming out of the cave system just upstream. Peakshole Water which quickly reached capacity and flooded over the right bank onto The Stones.

Floodwater also flowed from Peakshole Water along the Riverside Path. A small concrete defence wall (not registered on the Environment Agency's Asset Information and Maintenance Programme) has been built at the top of the Riverside Path; this wall did not overtop. However, the adjacent drystone wall let water through, which flowed onto the Riverside Path and flooded properties on The Island.

Flooding on Eades Fold and Vicarage Lane was caused by Peakshole Water overflowing its banks.

Flooding to the properties on Millbridge, Tricketts Close and Mill Court occurred when water from Peakshole Water came through the drystone walls that back onto the gardens of properties on Mill Court. The water subsequently flowed onto Millbridge and then Tricketts Close. Residents described the flow down Tricketts Close as a surge of water that occurred after the initial onset of flooding. This was the first time flooding was recorded as having flowed down Tricketts Close from Millbridge. The route of previous floods had been from behind the houses to the north side of Tricketts Close. The low bridge over Peakshole Water on Millbridge acted as a constraint to the flow, causing it to back up upstream of the bridge. Flood water also escaped from the watercourse after arriving at the grill on the culvert at Eyre's Farm and subsequently flowed southwards down Hollowford Road.

3.13.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- Severn Trent
- High Peak Borough Council
- Emergency Services

The Environment Agency issued a Flood Alert to the Tributaries in North Derbyshire on the 19th of October 2023 at 7:13pm.

Following on from Storm Babet, the Environment Agency and Derbyshire County Council visited Castleton and undertook the following:

- A site visit to the affected areas with the local flood wardens and the Parish Council.
- Provided property flood resilience advice to local residents.
- Held a public engagement event with key stakeholders after the event.

The Environment Agency are developing a Flood Warning Service for Castleton. New river level gauges are being installed to measure river levels, with one having been installed to date and a further two gauges to be installed in the future.

Severn Trent attended a meeting with residents to address concerns of sewer network issues during the event. Their visit indicated that flooding was the result of Peakshole Water overflowing its banks rather than the sewer network being overwhelmed.

3.14 Community Impacts – Clay Cross

3.14.1 Location Characteristics

Forty-five residential properties flooded internally in Clay Cross as a result of Storm Babet. Clay Cross is a town in north-east Derbyshire, approximately 8km south of Chesterfield. The community sits to the west of Smithy Brook, also known as Press Brook. Smithy Brook is a tributary of the River Amber and is designated an ordinary watercourse. Figure 3-51 shows an overview of the community affected.

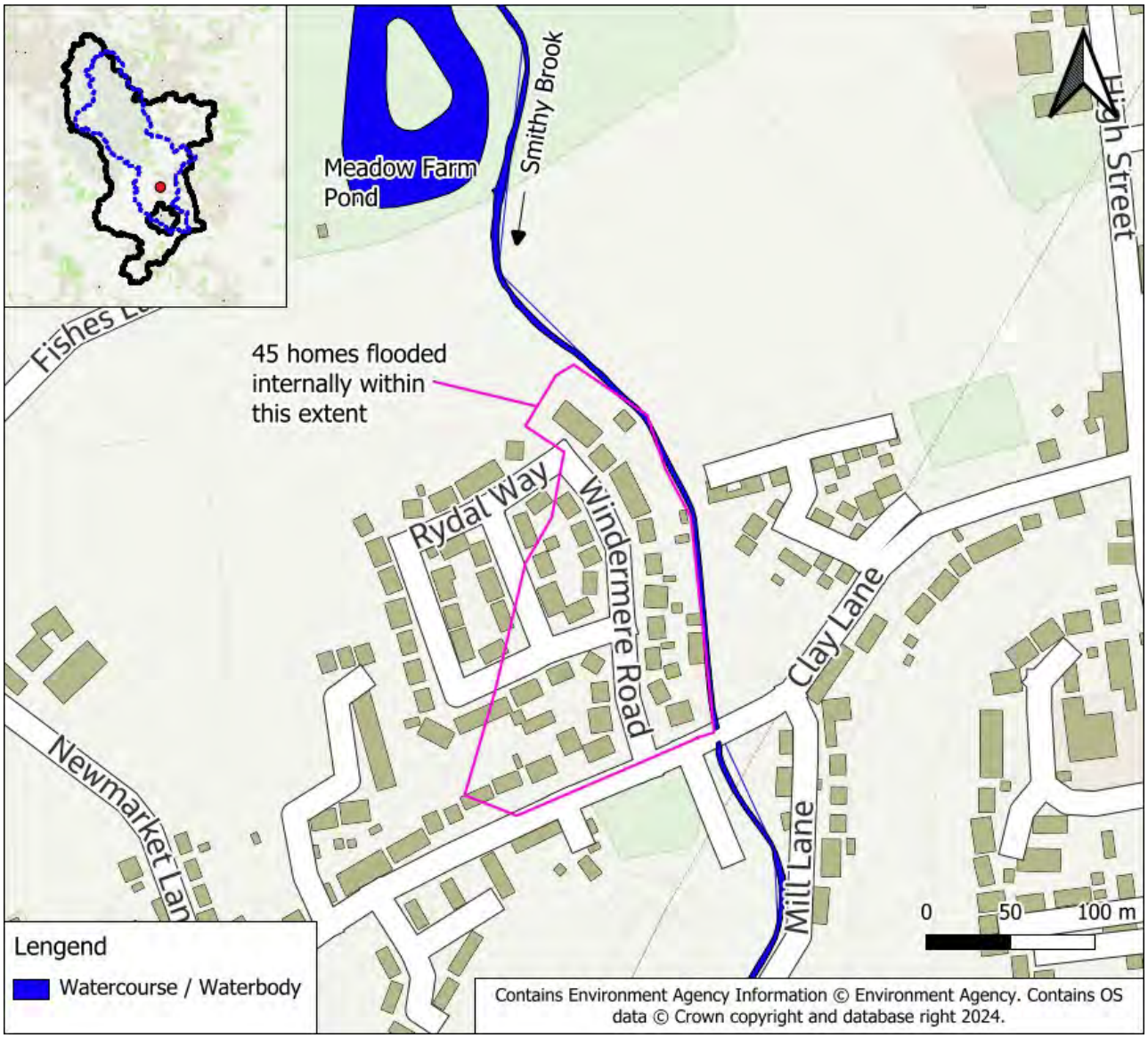

Figure 3-51: Overview map of Clay Cross community.

The community is residential and consists of semi-detached houses and bungalows.

There are no known vulnerable groups within the community, such as schools, hospitals and residential care homes.

Critical infrastructure in the area includes the East Midlands Railway line, that runs in tunnel under Clay Lane to the south-east of the community. The A61 (Stretton Road) is located further to the east of the community and runs north-south through Clay Cross, connecting Derby with Chesterfield and Sheffield.

The community is partly located within the floodplain of Smithy Brook, which flows southwards. The local topography is relatively flat and of a similar elevation to Smithy Brook.

Derbyshire County Council has anecdotal evidence of a flood occurring in this area in the early 1980's, and following that, there were some works undertaken on the Press Brook to widen the channel, to provide an element of flood mitigation.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows all properties that flooded were located in Flood Zone 2 or 3. Properties on the east of Windermere Road are within Flood Zone 3. Flood Zone 3 means the properties have a greater than 1% AEP of flooding from rivers. Flood Zone 2 extends across Windermere Road, to some of the properties on the west side of the road and on Clay Lane. Flood Zone 2 means properties have between a 1% and 0.1% AEP of river flooding. Figure 3-52 shows the Flood Zones described.

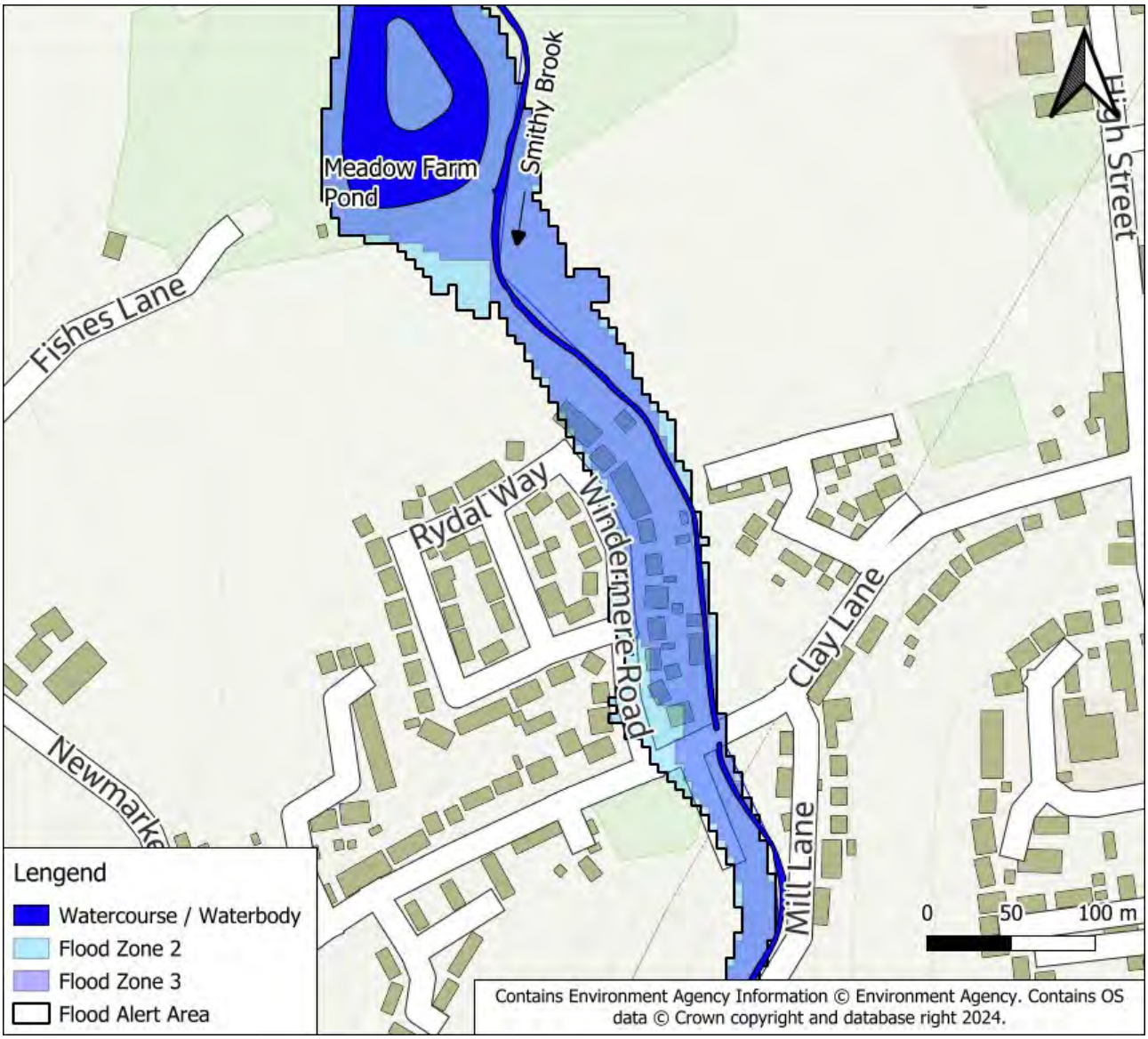

Figure 3-52: Flood Zones 2 and 3 at Clay Cross

Additionally, the Long Term Flood Risk Map (https://check-long-term-flood-risk.service.gov.uk/postcode) shows the majority of the properties on the east side of Windermere Road have at least a medium (between 1% and 3.3% AEP) risk of surface water flooding, with some of the properties being at a high (more than 3.3% AEP) risk of surface water flooding. The majority of the properties internally flooded on the west side of Windermere Road are at low (between 0.1% and 1% AEP) risk of surface water flooding. Figure 3-53 shows the surface water flood risk described.

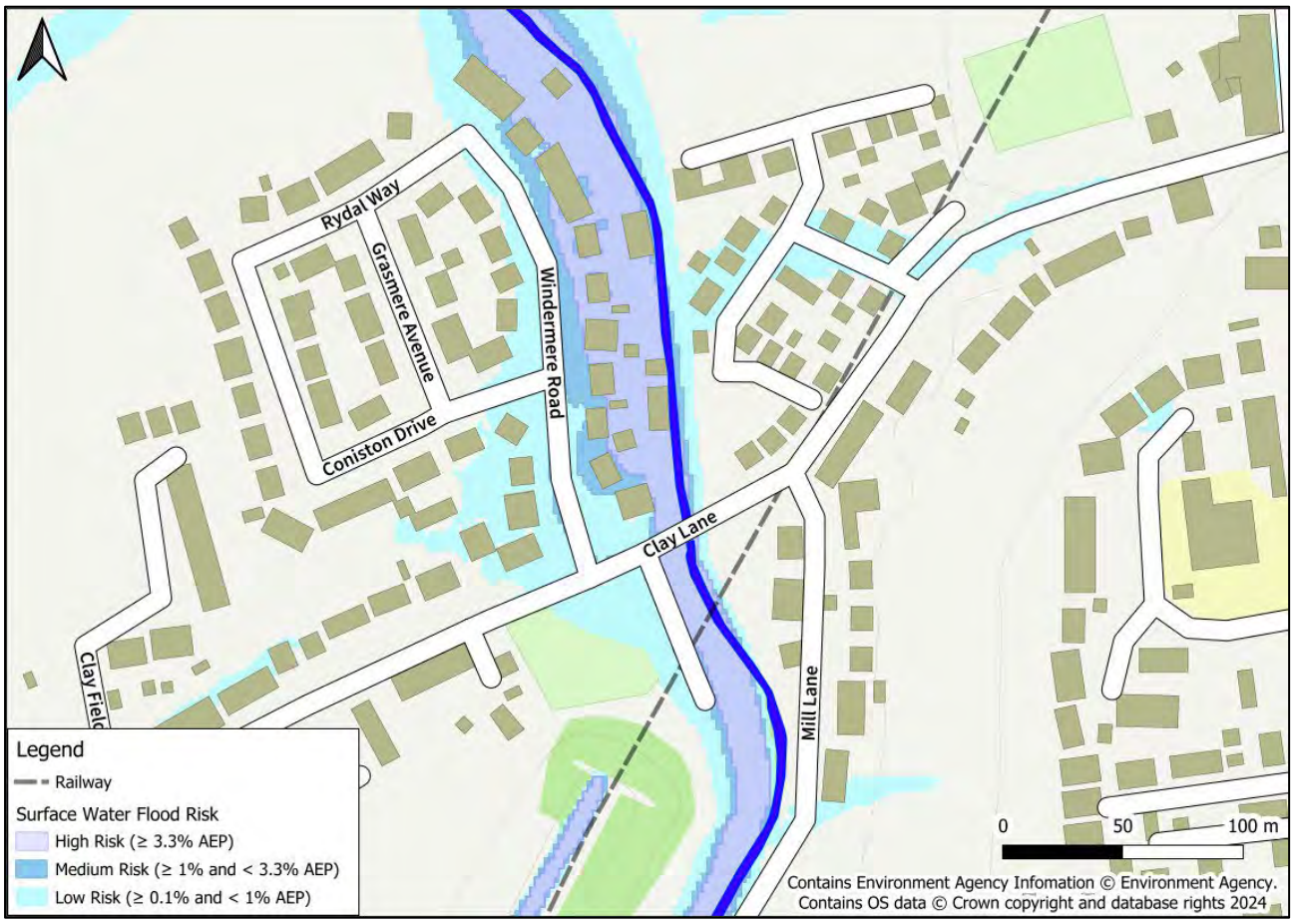

Figure 3-53: Map showing the chance in any given year of flooding from surface water at Clay Cross (Source: Long Term Flood Risk Map).

The community is not located within or near any nationally important designated environmental sites.

3.14.2 Current Flood Risk Management Arrangements

The properties that flooded on Windermere Road are within the 'Tributaries in North Derbyshire' Flood Alert Area. On anticipation of a potential flood event, residents who are signed up to alerts are informed when flooding is possible. The community is not within a Flood Warning Area.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) and Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) both show no formal flood defences being present in this community.

The responsibility for the maintenance of Smithy Brook is with the riparian owners.

3.14.3 Storm Babet Incident Details

A flood alert was issued to the 'Tributaries in North Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm. Internal flooding of properties occurred from the afternoon to the evening of the 20th of October.

The forty-five homes which internally flooded include all the properties on the east side of Windemere Road and the majority of properties on the west side. Some properties on Clay Lane, Coniston Drive and Grasmere Avenue also flooded.

3.14.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting all the properties was from Smithy Brook. Water reportedly overflowed the banks of Smithy Brook, parallel to Windermere Road. The flood water flowed southwards down Windermere Road, flooding properties from the front. The water then flowed onto Clay Lane, to the south of the community, and flooded additional properties. The depth of flooding can be seen in Figure 3-54

below, where the water mark, on the wall, to the right of the door.

Figure 3-54: Flood water marks about halfway up the door and wall of a property in the community marked by a red arrow.

3.14.5 Actions by Public Bodies

This section outlines the actions undertaken by public bodies immediately and in the aftermath of the flood event which are specific to this community. Please refer to section 8.1 of this report for a summary of actions that were implemented at all communities.

Public bodies that have been involved in the flood-event response at this community include:

- Derbyshire County Council
- Environment Agency
- North East Derbyshire District Council
- Severn Trent Water
- Emergency services

The Environment Agency issued a Flood Alert to the 'Upper Tributaries in North Derbyshire' Flood Alert Area on the 19th of October 2023 at 7:13pm.

Derbyshire County Council and the Environment Agency have undertaken several post-event site visits, both together and independently, to investigate the flood mechanisms and support properties and business affected.

During event, North East Derbyshire District Council attempted to deliver sandbags to the community but were unable to because of impassable roads.

North East Derbyshire District Council officers visited Clay Cross on 22nd of October 2024 to begin coordinating clean-ups and next steps.