Contents

5. Dove Catchment

5.1 Dove Catchment Event Hydrology

This section describes the hydrological conditions that were experienced across the Dove 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.

5.1.1 Catchment Characteristics

The River Dove, from its source near Buxton to its confluence with the River Trent near Newton Solney, forms the western boundary of Derbyshire. The river flows south from Church Mayfield to Rocester and Uttoxeter then to Hatton. The confluence with the Trent at Newton Solney is very close to the major town of Burton on Trent. The main tributaries include the River Manifold, River Churnet and River Tean on the right bank (right bank of the river when looking downstream), and Bentley Brook, Henmore Brook, Brocksford Brook, Foston Brook and Hilton Brook on the left bank (left bank of the river when looking downstream). Only the left bank tributaries of the River Dove are in Derbyshire. Figure 5-1 indicates the Dove 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.

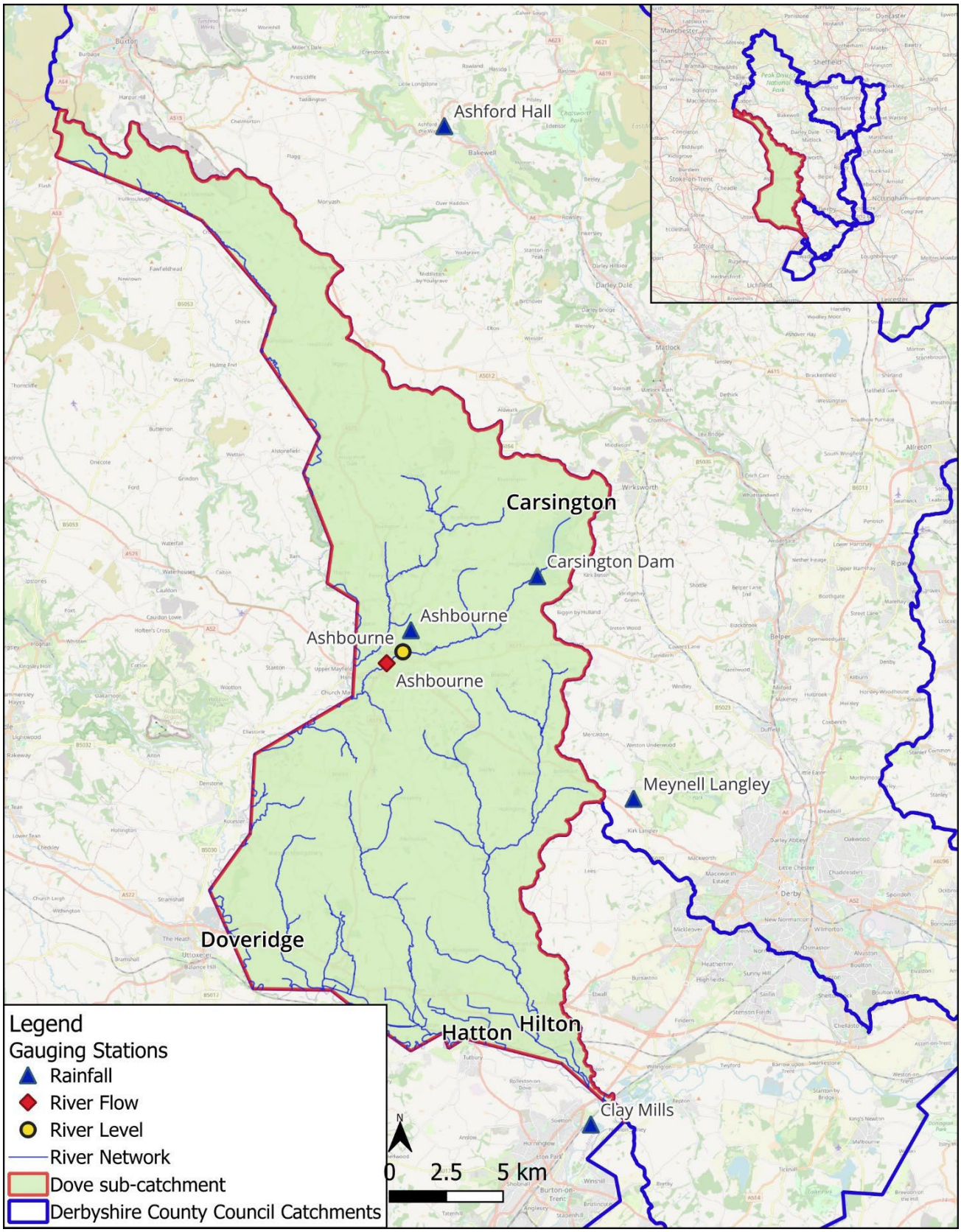

Figure 5-1: Dove catchment extent and rainfall, river flow and river level gauges.

5.1.2 Hydrological Summary

5.1.2.1 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.

5.1.2.2 Rainfall

During Storm Babet, heavy rainfall lasted from 18th to 21st of October 2023 across the Dove sub-catchment, with rainfall peaking early on 20th of October from 2:00am. Heavier rainfall occurred to the east of the sub-catchment, impacting settlements including Carsington and Brassington. The extremity and rarity of rainfall was similar across the catchment, with recorded rainfall equating to 1.9% to 3.9% AEP events at all stations. Towns experiencing this extreme rainfall include Ashbourne and Hilton.

5.1.2.3 Rivers

The only river gauging station in the Dove sub-catchment is in Ashbourne on the Henmore Brook. During Storm Babet, the peak flow was the second highest in the station's record. The lag time between peak rainfall and peak river flow recorded in Ashbourne was 3 hours, indicating Henmore Brook reacted relatively quickly to Storm Babet. The highest peak flow recorded on Henmore Brook occurred prior to the construction of defences along the river.

5.1.2.4 Communities

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

- 2.8% AEP: Ashbourne
- 3.9% AEP: Hilton

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

5.2 Community Impacts – Ashbourne

5.2.1 Location Characteristics

Sixteen properties to the west of Ashbourne, Derbyshire, suffered internal flooding as a result of Storm Babet. Thirteen of the properties were residential and three were non-residential. Figure 5-2 below shows the area where the properties flooded. The Henmore Brook flows through the community from the north east towards the south west. The brook is a tributary of the River Dove. The section of Henmore Brook that flows through Ashbourne is designated as a main river.

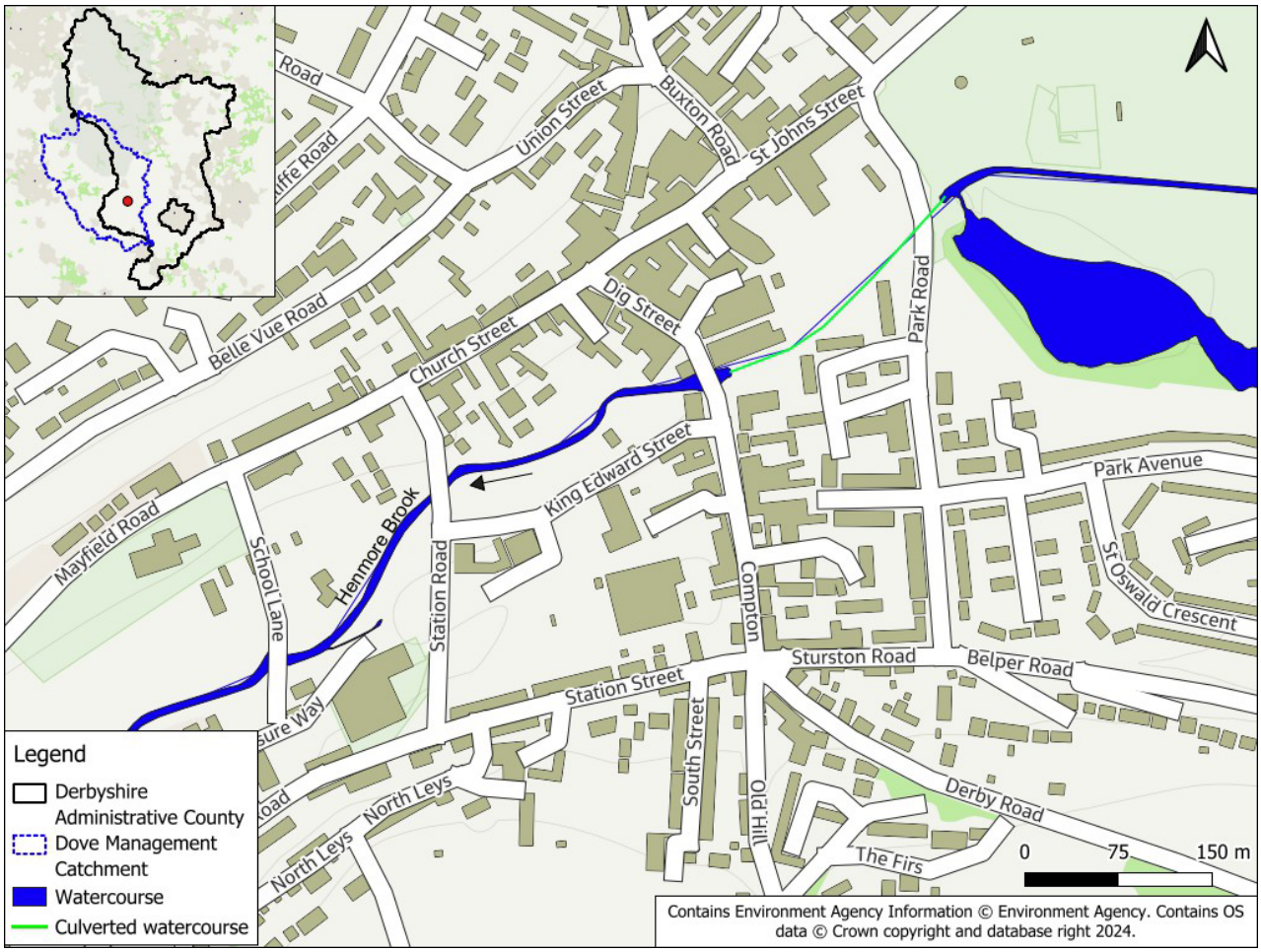

Figure 5-2: Overview map of Ashbourne.

The community affected by flooding is mainly residential, with the majority of the properties being part of the Almshouses complex on School Lane, towards the west side the figure above. The other residential properties affected are located on Coachmans Close, which is a small road off School Lane, north of Henmore Brook. The non-residential properties flooded include Oswald's Church Centre (hall), Kingdom Hall and the Bridge Public House on Dig Street.

Critical infrastructure in the area includes the A515 (Clifton Road and Station Road) 100m to the south of Henmore Brook. There are several vulnerable groups within the area, including St Oswald's Primary and Nursery School, north of the community which flooded, and St Oswald's Hospital, southwest of the community. Neither is known to have flooded during Storm Babet.

The community is located on the floodplain of Henmore Brook. The local topography is relatively flat and not significantly higher than the banks of Henmore Brook. Local superficial geology is alluvium, including gravel, sand, silt, and clay.

Environment Agency records show that the properties at Ashbourne which were internally flooded during Storm Babet were also internally flooded in September 2008, which prompted the flood defence scheme that was constructed in 2010. The Environment Agency's Historic Flood Map shows similar flood extents having occurred in 1960, prior to Kingdom Hall being built. Anecdotal evidence provided by the Environment Agency shows that there was property flooding in September 2008 which prompted the flood defence scheme that was constructed in 2010.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that all of the flooded homes within this community are in Flood Zone 2 and 3, see Figure 5-3. Areas in Flood Zone 2 have between a 1% and 0.1% AEP of river flooding. Areas within Flood Zone 3 have a greater than 1% AEP of flooding from rivers.

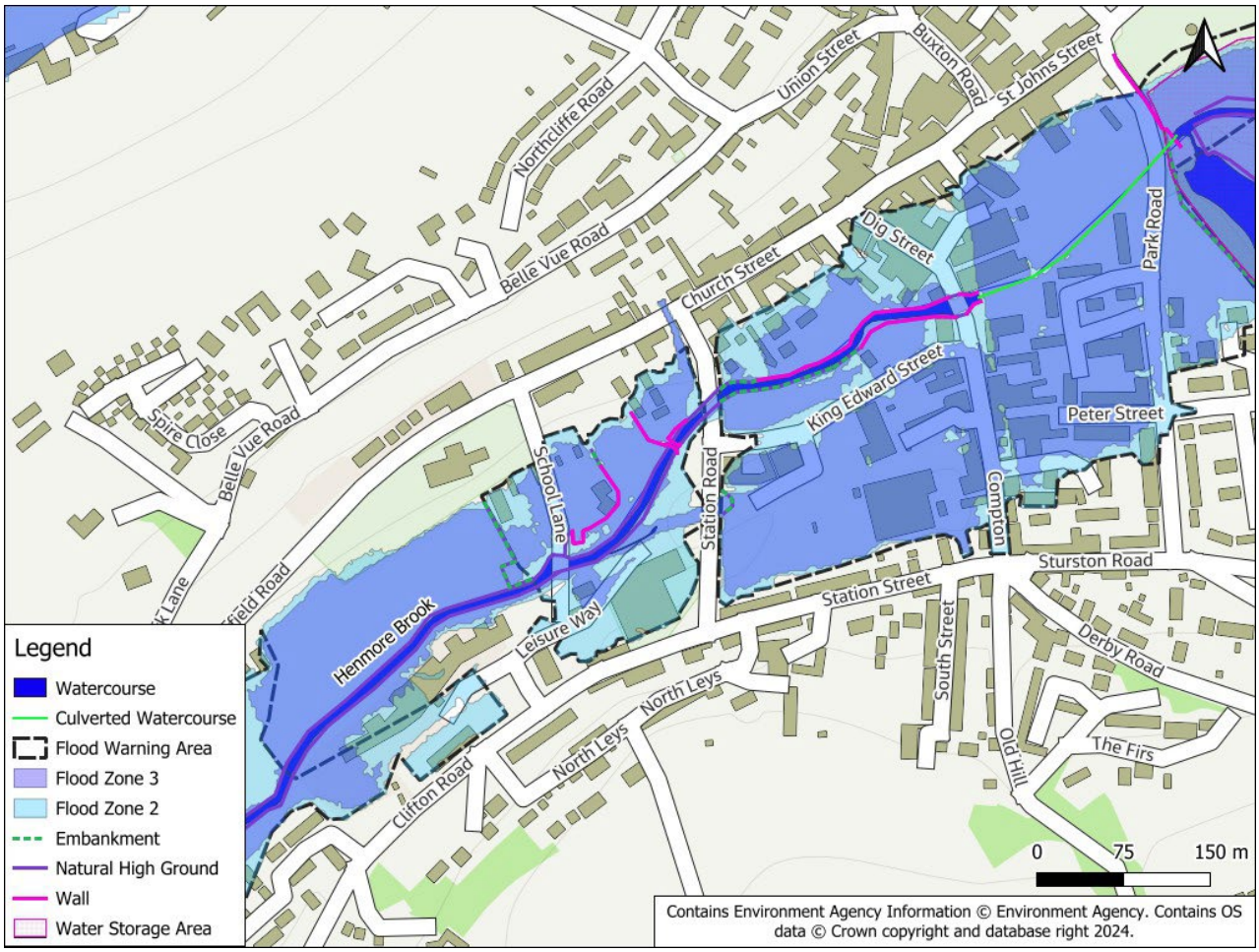

Figure 5-3: Flood Risk Management Arrangements and flood zones within Ashbourne.

Additionally, some areas on Coachmans Close have a high 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 5-4. High risk is defined as greater than 3.3% AEP of flooding. More typically there is a low (between 0.1% AEP and 1% AEP) chance of surface water flooding on School Lane, Coachmans Close and the Kingdom Hall.

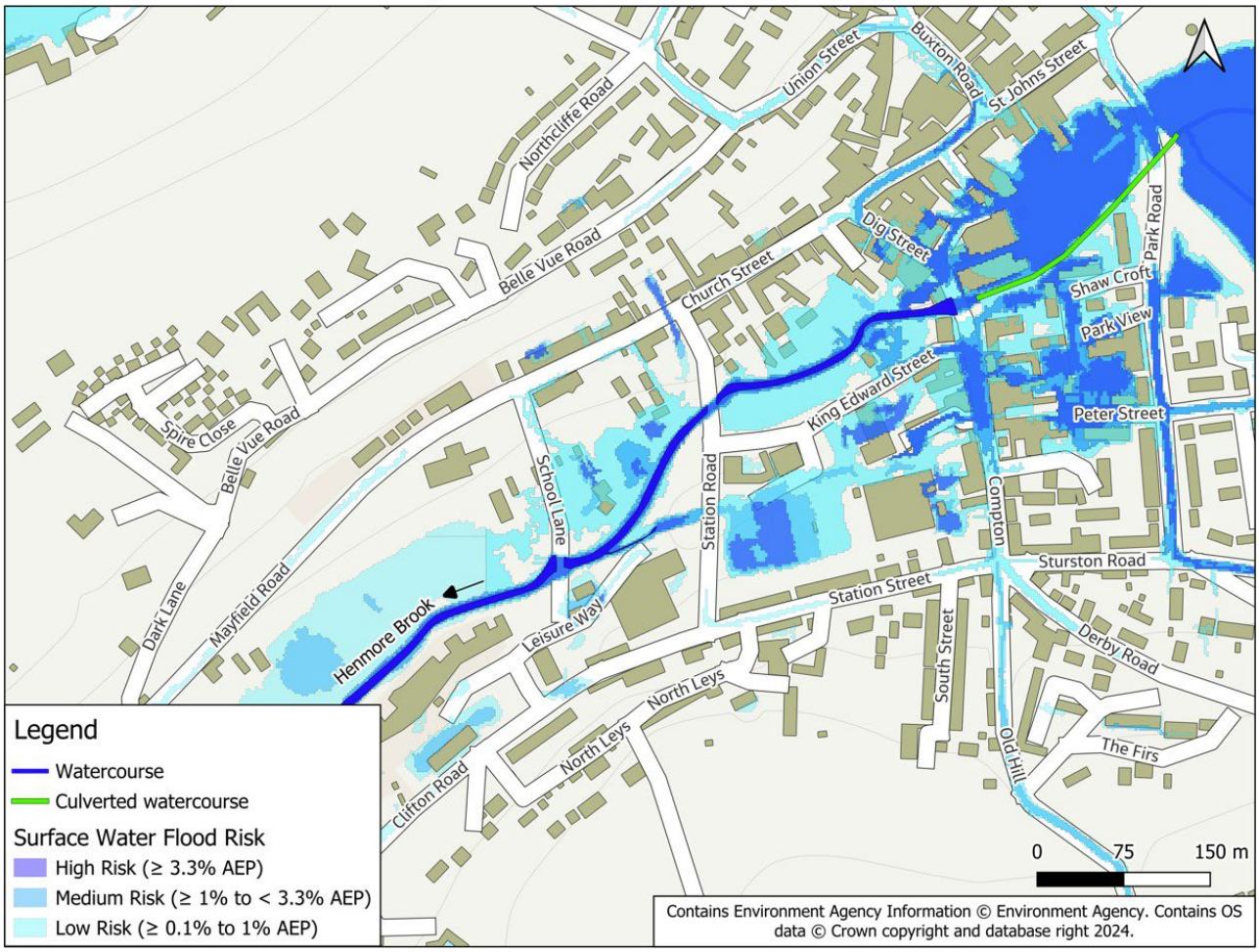

Figure 5-4: Map showing the chance in any given year of flooding from surface water at Ashbourne (Source: Long Term Flood Risk Map).

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

5.2.2 Current Flood Risk Management Arrangements

All properties flooded within this community were located within the 'Upper Dove' Flood Alert Area and the 'Henmore Brook at Ashbourne' Flood Warning Area. On anticipation of a potential flood event, residents who are signed up to alerts and warnings are informed when flooding is likely to occur.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) shows there are several flood defence assets within the community, as well as the wider Ashbourne area. There are 3 purpose built flood defences in the vicinity of the properties that overtopped as their design level was exceeded by the flood. The defences are designed to provide a 1% AEP Standard of Protection (SoP). The Mansion House Garden flood wall is located to the south and east of the properties on Coachmans Close and is at target condition. The Mansion House garden embankment is an extension to the Mansion House Gardens floodwall and is currently below required condition, however there is a programme of works to rectify this. The Church Hall Car Park Embankment is to the west of School Lane and is at target condition. All of these flood defence assets were built in 2012 and are maintained by the Environment Agency. All the aforementioned condition assessments were undertaken post Storm Babet.

The Ashbourne Flood Storage Reservoir (FSR) built in 2014 in Ashbourne Park is approximately 550m upstream of the flooded properties. It was designed to store water during flood events and provide 1% AEP SoP to the properties downstream in Ashbourne. The reservoir is maintained by the Environment Agency and is considered to be in good condition. Figure 5-3 shows all the flood risk management arrangements described above.

5.2.3 Storm Babet Incident Details

A Flood Alert was issued to the 'Upper Dove' Flood Alert Area on the 20th of October 2023 at 7:28am. A

Flood Warning was issued to the 'Henmore Brook at Ashbourne' Flood Warning Area a short time later at 9:14am.

The sixteen internally flooded properties are located on School Lane and Coachmans Close. There were ten residential properties and two non-residential properties that internally flooded on School Lane and one on Dig Street. Three residential properties internally flooded on Coachmans Close.

5.2.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting all of the properties within this community was from the Henmore Brook. Figure 5-5 shows the assumed flow routes and elevations which will have contributed to the flood extent.

Hydrology data shows that on the 20th of October, the peak level recorded at the Ashbourne Storage Reservoir level gauge, upstream of the flooded properties, reached 2.52m; the highest level ever recorded.

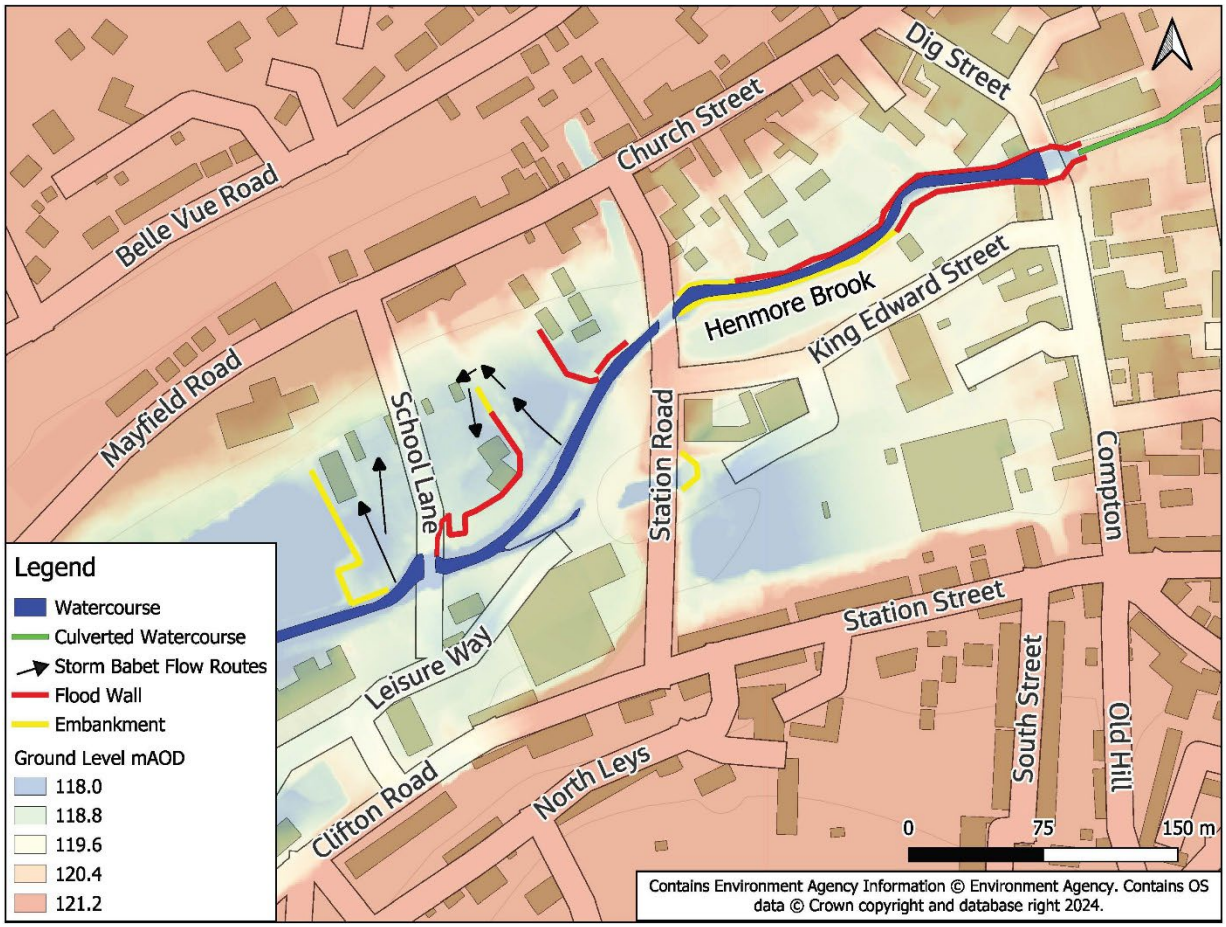

Figure 5-5: Ground level and Storm Babet flow routes at Ashbourne.

The three residential properties on Coachmans Close flooded as flood water flowed over the embankment to the north of the properties. The flood defence wall to the east and south of Coachmans Close overtopped along its length. This led to internal flooding of the properties to a reported depth of 0.5m.

The ten residential properties on School Lane were internally flooded to a depth of up to 15cm. Flood water overtopped the banks of Henmore Brook and a wall that retained high ground. Water flowed in a northwards direction along School Lane and entered the Almshouses courtyard, where flood water entered the properties through the doorways. Flood levels exceeded the previous 1% AEP design standard in this location and at Coachmans Close. The embankment protecting the Almshouses did not overtop, but it was purposefully lowered, following Storm Babet's peak, to let water drain back out from the flooded area when it became trapped. This has now been reinstated.

St Oswald's Church Hall flooded as a result of flood water flowing over and around the embankment to the south of the car park. When in the car park, water became trapped, leading to internal flooding of the hall to a

reported depth of 23 cm. Figure 5-6 shows that channels were excavated through the top of the flood embankment to allow flood water to drain away from the church hall. These were excavated around 3:00pm on the 20th of October.

Figure 5-6: Channels were excavated into the flood embankment to the west of St Oswald's Church Hall to allow water to escape.

The Kingdom Hall, on the south side of Henmore Brook, also flooded internally as a result of flood water overtopping banks adjacent to School Lane bridge before flowing towards the hall.

5.2.5 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
- Derbyshire Dales District Council
- Environment Agency

During Storm Babet, the Environment Agency:

- issued a Flood Alert to the Upper Dove on the 20th of October 2023 at 7:28am and a Flood Warning to Henmore Brook at Ashbourne a short time later at 9:14am.
- attended the affected locations, including School Lane and Coachmans Close, to speak with residents, investigate flooding and make records.

The Environment Agency have consequently set out short and long-term actions in response to the flooding on 20th of October 2023.

The Environment Agency organised a multi-agency drop-in event which was held in Ashbourne on the 14th of

May, with Derbyshire County Council and Derbyshire Dales District Council also in attendance. This enabled residents to ask questions about the flood event and the actions of the responding Risk Management Authorities. It also provided valuable information to the responding authorities regarding residents' experiences of flooding.

In the short term, they plan to raise the lowest sections of the flood defences around Coachmans Close to have a consistent level all along the defence wall that matches the current crest level. The embankment will also be raised to match the height of the coping stones on the defence wall. These works are planned for summer 2024. De-silting and removal of vegetation from School Lane bridge are also scheduled for 2024.

In the long term, the Environment Agency are updating the flood model for Henmore Brook, to investigate what standard of protection the defences are currently providing, and what improvements need to be made. The model will also be used to test if water can be stored in the Ashbourne Flood Storage Reservoir earlier, in lower magnitude flood events.

5.3 Community Impacts – Hilton

5.3.1 Location Characteristics

Four residential properties and two commercial properties in Hilton, south-west of Derby, suffered internal flooding as a result of Storm Babet. Figure 5-7 below provides an overview of the community and the surrounding area. Hilton Brook flows from north to south through the community and is a tributary of the River Dove. The section of Hilton Brook that flows through Hilton is designated as a main river.

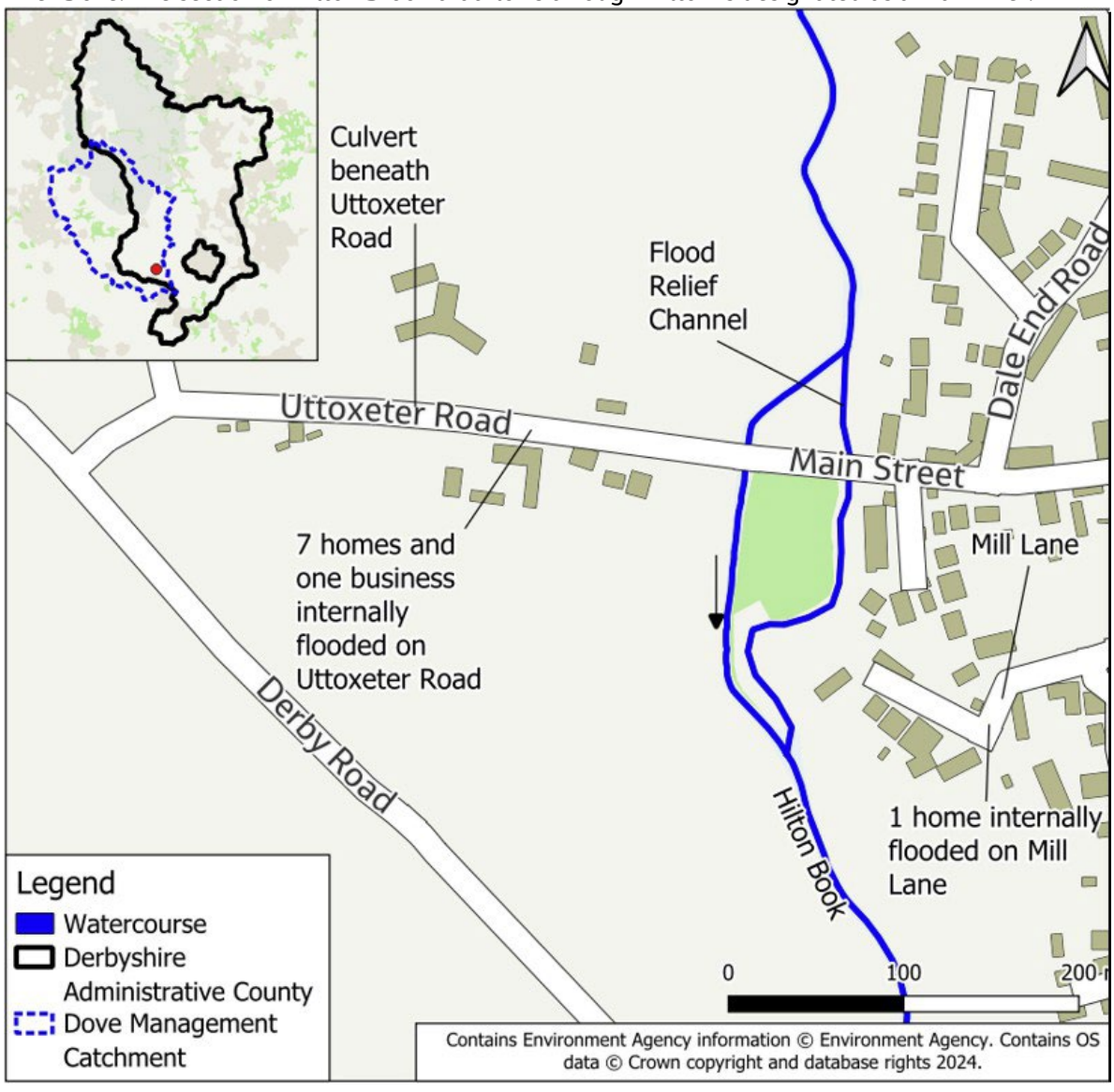

Figure 5-7: Overview map of the Hilton community and surrounding area.

The community is mainly residential with some isolated businesses. Homes are predominantly a mix between

terraced and semi-detached. Critical Infrastructure within the area includes the A5132 Egginton Road, which is to the east of the map provided above. There are also railway lines to the south of Hilton that connects Uttoxeter to Willington and Egginton to Ilkeston. There are no known vulnerable groups within the community.

The community is located on the floodplain of Hilton Brook which flows southwards. The local topography is flat and relatively low-lying. Most of the flooded homes are west of Hilton Brook. The community sits at a similar elevation of the Hilton floodplain, with the land slopping gradually towards the brook. The local superficial geology is alluvium, including gravel, sand, silt and clay.

The Environment Agency's Historic Flood Map indicates that most properties that flooded as a result of Storm Babet were also flooded previously. Recorded historic flood events occurred in 1957 and 1977.

The Flood Map for Planning (https://flood-map-for-planning.service.gov.uk/) shows that the majority of the flooded properties within this community are in Flood Zone 2 or Flood Zone 3, as shown in Figure 5-8. Areas in Flood Zone 2 have between a 1% and 0.1% AEP of river flooding and Flood Zone 3 means the properties have a greater than 1% AEP of flooding from rivers.

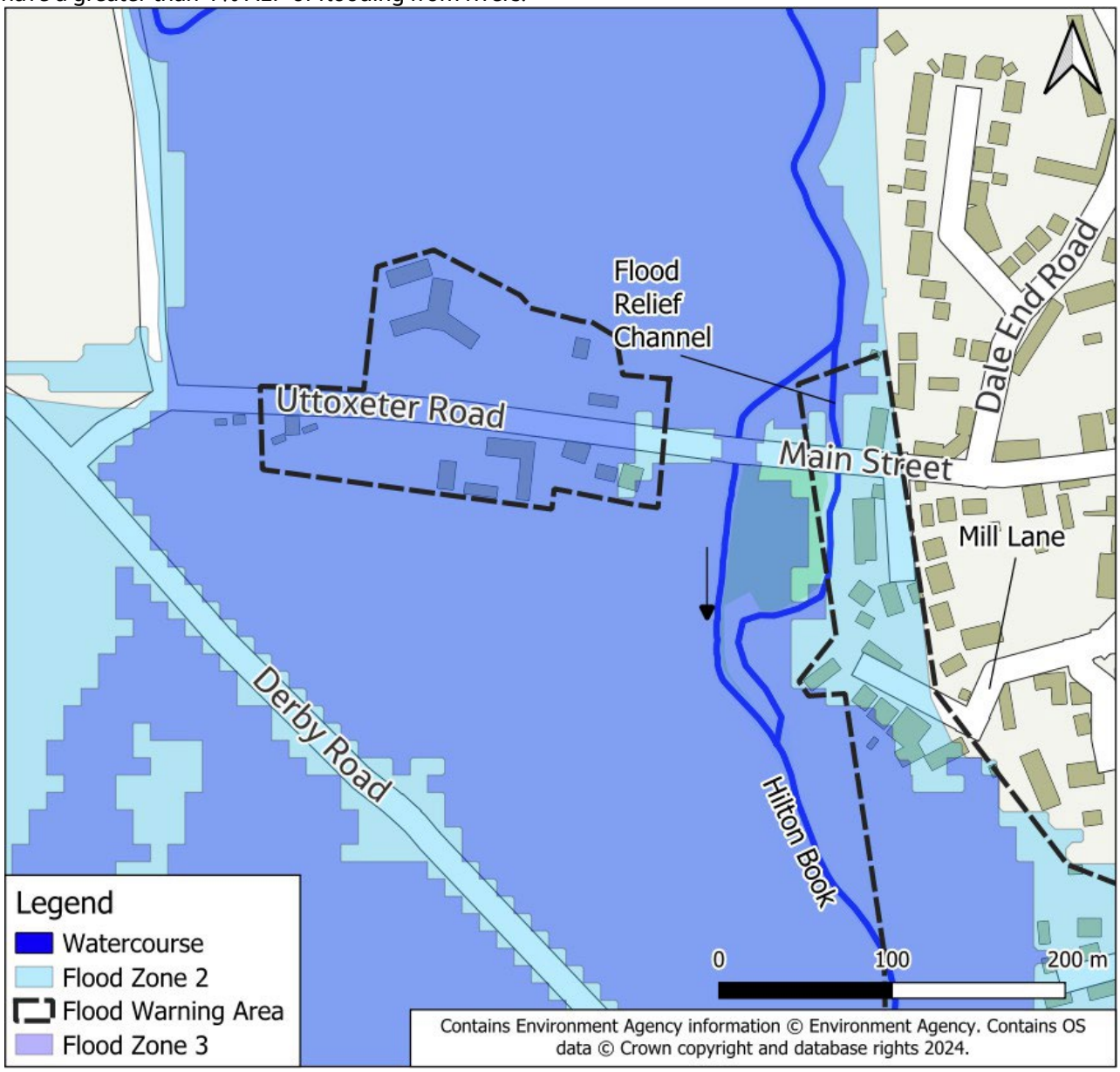

Figure 5-8: Flood Zones and flood risk management arrangements in place at the Hilton community.

Additionally, the majority of properties that suffered internal flooding have at least a 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. There are also areas off Main Street that have a high risk of surface water flooding. High risk is defined as greater than 3.3% AEP of flooding. Figure 5-9 shows the surface water flood risk for the community based on the national

mapping referred to above.

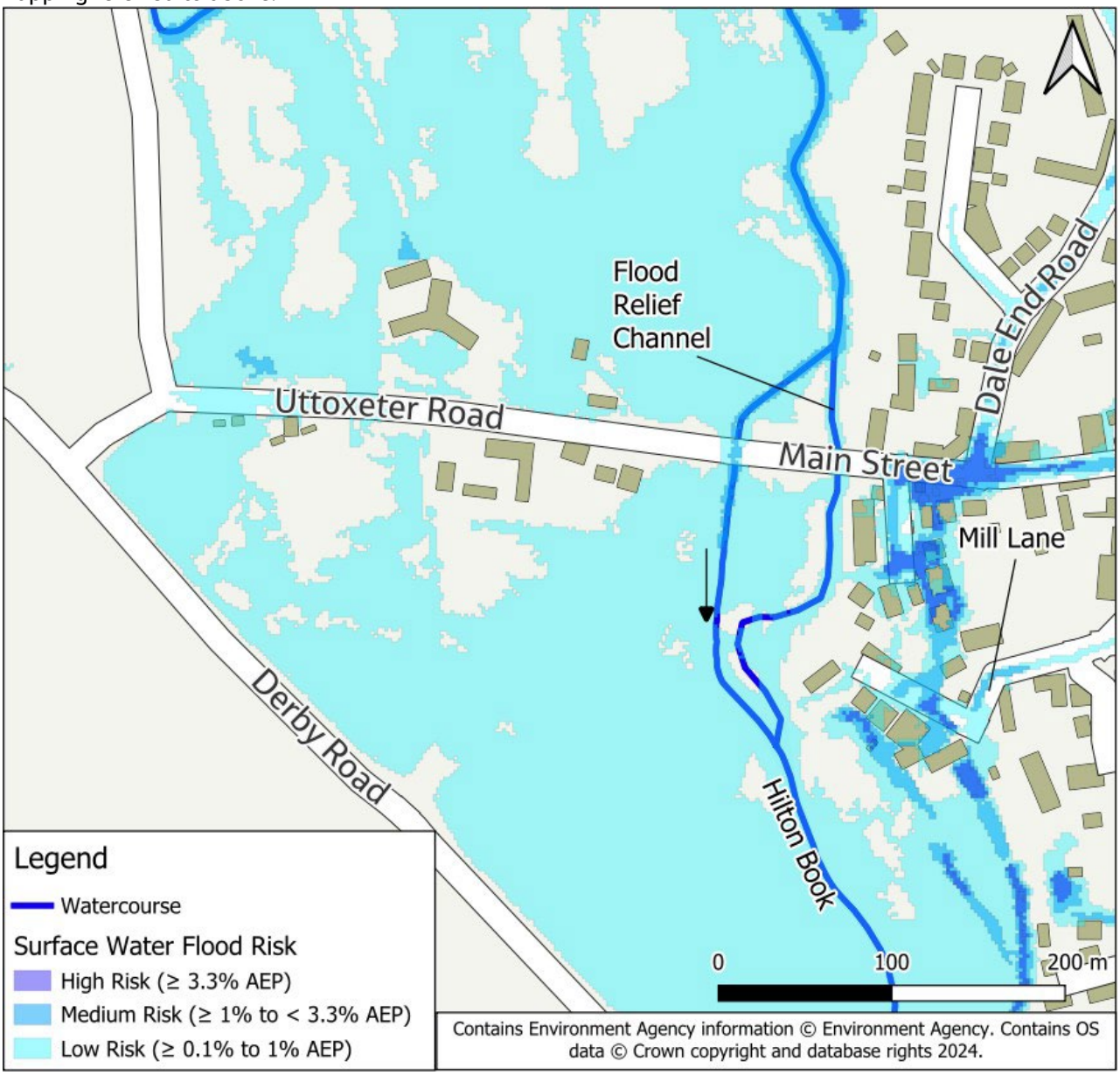

Figure 5-9: Map showing the chance in any given year of flooding from surface water at Hilton (Source: Long Term Flood Risk Map).

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

5.3.2 Current Flood Risk Management Arrangements

All properties flooded within this community were located within the 'Lower Dove Brooks and Egginton Brook Catchment' Flood Alert Area and the 'Hilton Brook at Sutton on the Hill and Uttoxeter Road Hilton' Flood Warning Area. On anticipation of a potential flood event, residents who are signed up to alerts and warnings are informed when flooding is likely to occur.

The Environment Agency's Asset Information and Maintenance Programme (https://environment.data.gov.uk/asset-management/) shows that Hilton Brook is surrounded by natural high ground which extends across the whole watercourse until the confluence at the River Dove. A flood relief channel is identified to tie into engineered high ground directly east of Hilton Brook adjacent to Uttoxeter Road.

5.3.3 Storm Babet Incident Details

A Flood Alert was issued to the 'Lower Dove Brooks and Egginton Brook in Derbyshire Catchment' Area on the 20th of October 2023 at 10:44am. A Flood Warning was issued to the 'Hilton Brook at Sutton on the Hill and Uttoxeter Road Hilton' Area a short time later at 1:15pm.

Internal flooding of properties is understood to have taken place in the early hours of the 21st of October. The five homes and three commercial properties which flooded internally include properties on Uttoxeter Road and Mill Lane.

5.3.4 Flood Mechanisms, Extent and Impacts

The primary source of flooding affecting all properties within this community is assumed to be from Hilton Brook due to overflowing upstream of Hilton village and flooding Uttoxeter Road.

Hydrology data has been taken from the Sutton Mill river level gauge on Hilton Brook. The gauge is located upstream of the community affected at Sutton Mill. The Sutton Mill gauge shows that on the 20th of October 2023, the peak level recorded was1.84m; the highest level ever recorded at this gauge. The gauge indicated that the water began to rise at 1:30am, reaching its peak at 5:30pm.

The depth of internal flooding was almost 1m at some properties. The semi-detached properties within the area are known to frequently flood. One property has a sump and pump chamber already installed. A few of these properties only flooded externally. South Derbyshire District Council have stated that, water had overtopped Hilton Brook upstream of the village and flooded Uttoxeter Road before it got to the relief channel. Anecdotal evidence suggests that in addition to a sharp bend in the brook, there was also a weir at this location that may have an impact on flow causing water to escape the channel. Details of action taken during the event by flood risk management authorities are included in section 5.3.5.

It was reported by a councillor from South Derbyshire that the Hilton Brook culvert beneath Uttoxeter Road was blocked. This resulted in the channel overtopping upstream of the culvert inlet. Floodwater then flowed onto Uttoxeter Road and downslope westwards, internally flooding seven properties on Uttoxeter Road. Figure 5-10 shows the ground level and Storm Babet flow routes at Hilton.

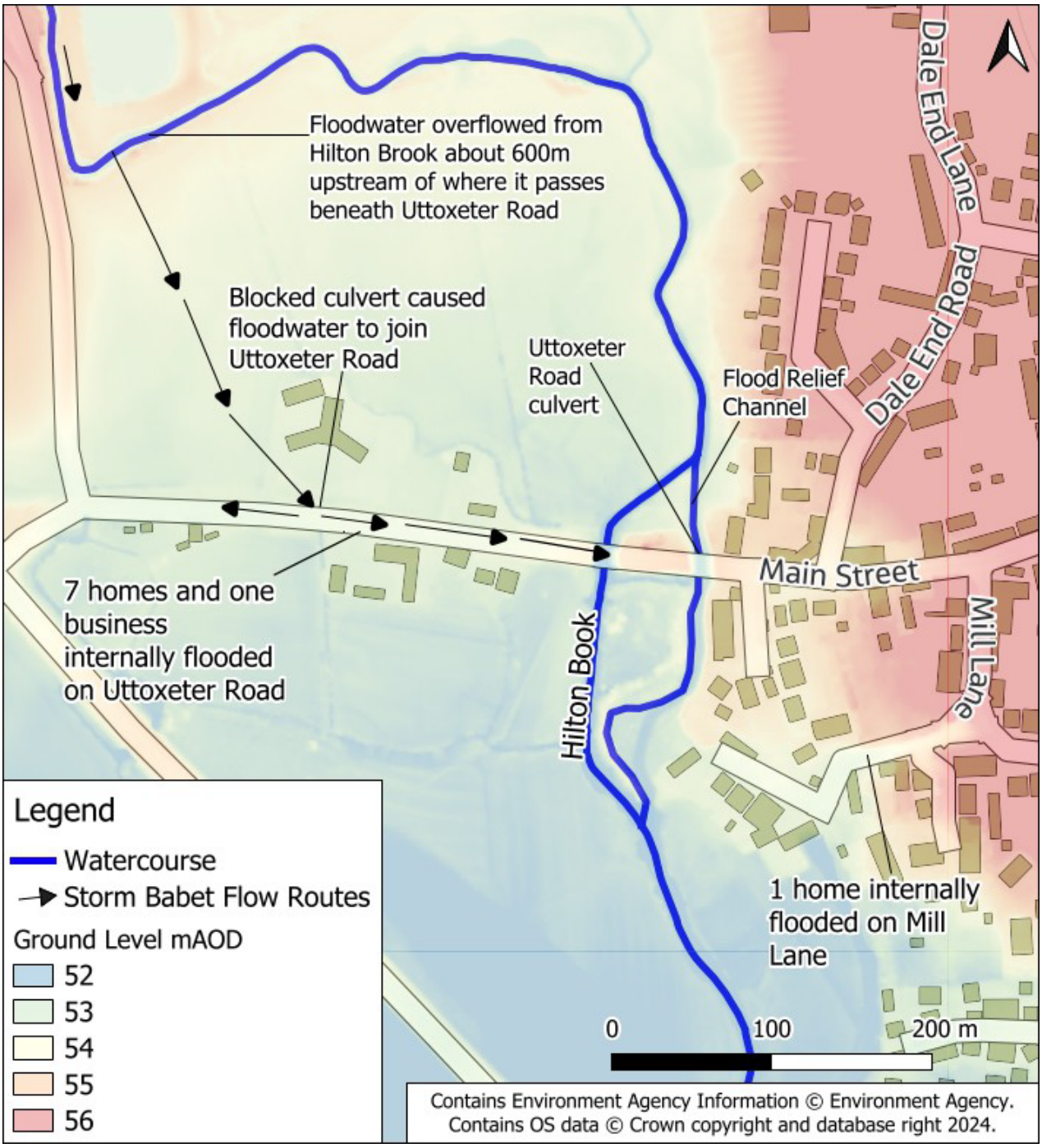

Figure 5-10: Ground level and Storm Babet flow routes at Hilton.

5.3.5 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
- South Derbyshire District Council
- Environment Agency

The Environment Agency issued a Flood Alert to the 'Lower Dove Brooks and Egginton Brook in Derbyshire Catchment' on the 20th of October 2023 at 10:44am. A Flood Warning was issued to the 'Hilton Brook at Sutton on the Hill and Uttoxeter Road Hilton' a short time later at 1:15pm.
South Derbyshire District Council provided some properties with sandbags during the event, but these were eventually overwhelmed by high flood levels. South Derbyshire District Council attended Hilton following the

flood event to take records of the flood event and to provide support to the local community.

The Environment Agency have subsequently discussed the flooding with a local District Councillor and as requested inspected the Hilton Brook around the flooded properties. The Flood Relief channel was found to be operating as designed. The Environment Agency determined there may be an opportunity to redirect floodwater, that escapes further upstream away from property, back towards the Hilton Brook channel which would reduce the chances of property flooding in the future. Investigations are underway to determine the feasibility of these adaptations..

Both the Environment Agency and Derbyshire County Council have undertaken multiple site visits since Storm Babet.