2020 Flood Events:

Flood and Water Management Act

Section 19 - Investigation

Price Court, Shobnall

(Photo of Flooding to Shobnall Fields at rear of Price Court - Photograph provided to SSC LLFA by representatives from Shobnall Centre)

This report has been prepared by Staffordshire County Council as Lead Local Flood Authority for Staffordshire County, under Section 19 of the Flood and Water Management Act 2010, with the assistance of Severn Trent Water and the Housing Association.

This report is based on the information available at the time of preparation. Consequently, there is potential for further information to become available, which may lead to future alterations to the conclusions drawn in this report for which Staffordshire County Council cannot be held responsible.

Document Ref:			**2020 Flooding: Section 19 Flood Investigation for Price Court, Shobnall**		
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Staffordshire County Council

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Executive Summary

When made aware of flooding, Staffordshire County Council, in its role as Lead Local Flood Authority, has a duty to investigate a flood to determine the causes of the flooding and identify appropriate actions that may be undertaken by the relevant Risk Management Authority (RMA).

Several storms occurred in 2020 across the Midlands region which impacted many areas. Storm Dennis, in February, was a long duration, low-to-moderate intensity event, causing widespread flooding nationwide. The event led to a severe weather warning over much of Wales and the Midlands. As a result of these storms, a significant number of flooding incidents were reported to Staffordshire County Council, including Price Court, located in Shobnall, Burton-Upon-Trent.

Following the storm events, Staffordshire County Council worked closely with the various Risk Management Authorities (RMAs) and local residents to gather information and determine the impact of the flooding.

Staffordshire County Council, in partnership with the Environment Agency, Severn Trent Water and the Housing Association, has undertaken an investigation into each of the areas where internal property flooding was reported, to determine the most likely cause of flooding (surface water flooding, flooding from rivers, flooding from sewer infrastructure and flooding from highway drainage).

This report focuses on Price Court, located in Shobnall, Burton. The investigation undertaken has been summarised, outlining the extent of flooding reported, the most likely cause of the flooding and the actions that have been completed, or are proposed to be completed in the future.

Introduction

Several storms occurred in the Midlands in 2020 resulting in flooding at several locations in Staffordshire. Storm Dennis hit the Shobnall area of Burton-upon-Trent on the 16th February 2020.

This storm caused widespread flooding to highways and properties across Staffordshire and as a result, Staffordshire County Council has undertaken investigations in the areas where flooding occurred.

This report will aim at providing a broad overview of the cause of the flooding at Price Court, Shobnall resulting from the event in February 2020 and identifies the next steps, if any, that need to be taken by the relevant Risk Management Authorities (RMAs).

Although this report specifically focuses on Price Court, Shobnall, flooding associated with Storm Dennis resulted in more than 130 applications for grant support from residential and business properties across East Staffordshire. Many areas also experienced incidents in which five or more properties were internally flooded, reaching the criteria for a Section 19 investigation.

Lead Local Flood Authority

Following Royal Assent of the Flood and Water Management Act in 2010 (FWMA), Staffordshire County Council (SCC) became the Lead Local Flood Authority (LLFA) for Staffordshire. As such, SCC is responsible for the management of surface water food risk, groundwater flood risk and the flood risk from ordinary watercourses[1].

As LLFA, SCC is required to work in partnership with other agencies and authorities to manage flood risk. These agencies and authorities include, but not exclusively:

- Environment Agency, who hold responsibility for Main Rivers.
- Severn Trent Water, who hold responsibility for the public sewer network.
- Emergency service providers; and,
- Other public agencies and bodies.

Section 19 Requirements

The FWMA also places a duty on Lead Local Flood Authorities to investigate incidents of flooding. This is set out in Section 19 of the act and the investigations are therefore typically termed '*Section 19 Reports*.' The Act states:

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

a) Which risk management authorities have relevant flood risk management functions, and

b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

[1]An ordinary watercourse is defined as any watercourse not designated as 'Main River,' i.e. watercourse that are not managed by the Environment Agency.

2) Where an authority carries out an investigation under subsection 1) it must
    a) Publish the results of its investigation, and
    b) Notify any relevant risk management authorities.

It should be noted that not all flooding will require a formal investigation and report.
SCC has set out in its *Local Flood Risk Management Strategy*[2]*, in Appendix D the* process which will be used to determine to what extent it considers is 'necessary or appropriate' to investigate and what constitutes a significant flood event.

Stage 1 is an initial assessment, sufficient to ascertain with some confidence the extent of the flooding consequences. The second stage is to carry out a detailed investigation of the sites where it has been deemed necessary and appropriate. Reporting and publishing is the third, and final, stage. These stages may be described as: -

- Stage 1: Initial assessment
- Stage 2: S19 Investigation
- Stage 3: S19 Report and publish

It follows that there will be requirements for coordination and cooperation between Risk Management Authorities at each stage and, where required, following the outcome of a S19 Investigation. This will be undertaken via day to day officer communication, and through the LLFA's governance process for flood risk management.

Flood Investigation Methodology

SCC will undertake/coordinate a Flood Investigation in accordance with Section 19 of the Flood and Water Management Act (2010) when one or more of the following thresholds are exceeded:

- Five or more residential properties are reported to have been internally flooded during a single flood event in one location;
- Two or more business properties are reported to have been internally flooded during a single flood event in one location, or;
- One or more items of critical infrastructure are reported to have been adversely affected during a single flood event in one location

SCC may investigate flooding outside these categories, but only when all outstanding issues with a higher priority have been considered. These guidelines set numerical thresholds, however, in recognition of the fact that all floods will be different; a certain amount of discretion will be required in order to implement this policy effectively.

This policy only relates to how flood investigations will be prioritised and does not guarantee that any flood risk mitigation works will be installed at the locations where investigations are undertaken.

This report has been based on the number of reported incidents of flooding; however, it is likely that the actual number of incidents of flooding was higher than that reported.

This data is the best currently available and is being verified and quality checked for accuracy.

[2] https://www.staffordshire.gov.uk/environment/Flood-Risk-Management/Local-Flood-Risk-Management-Strategy.aspx

Investigation into Flooded areas

Step 1: During the Flood Event

SCC received a high number of calls during the event, which reported flooding of properties, gardens, and highways

During the flood event, the LLFA coordinated with multiple Risk Management Authorities (RMAs) to ensure that flooding was managed effectively and the risk to people and properties was mitigated as far as reasonably practicable.

Step 2: Initial Investigations

Using call records, flooding investigation questionnaires and site visits, the LLFA identified the locations where flooding occurred.

Responses were received, providing personal accounts of the flood event including the estimated time, duration, extent, and depth with any other information which was felt pertinent.

Following receipt of the Flood Survey responses, the LLFA identified areas where at least one property experienced internal flooding.

Step 3: Detailed Investigation and Analysis

The LLFA conducted detailed investigation and individual location analysis of each of the areas where a minimum of one property experienced internal flooding. It should be noted that SCC have defined internal property flooding as:

'Flooding that occurs in a habitable room within a single property, excluding garages, porches and underfloor ingress of water.'

These investigations typically included a review of existing infrastructure and topography, identification of predominant flow paths, site visits and local knowledge gathering.

Through a detailed analysis, the LLFA have identified the types of flooding that occurred at each location during the events of February 2020.

The LLFA does not undertake detailed investigation of external flooding to garages, gardens, and highways due to limited resources and funding. Indeed, gardens often act as flood storage areas and highways can be designed to convey flood waters reducing the extent/level of internal property flooding.

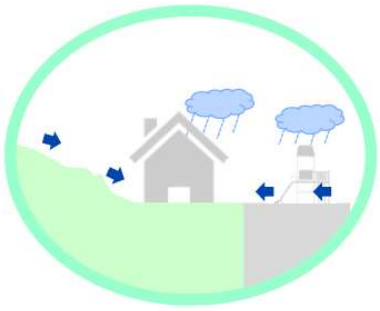
Step 4: Recommended Actions

Following the analysis of the affected area, the LLFA have worked in collaboration with other RMAs to identify opportunities and options to mitigate the potential that a similar rainfall event will result in similar outcomes. These have been summarised as 'Recommended Actions' and a lead RMA has been identified to undertake these actions.

Types of Flooding

Surface Water Flooding

Surface water is rainwater which is on the surface of the ground and has not soaked into the ground or entered a watercourse, drainage system or sewer. During a storm event, rainfall will land on the ground and depending on the characteristics of the ground it will behave in different ways.



Soft surfaces, known as *permeable surfaces*, allow water to soak (infiltrate) into the ground. These are typically in the form of gardens, parks, fields, and green spaces,

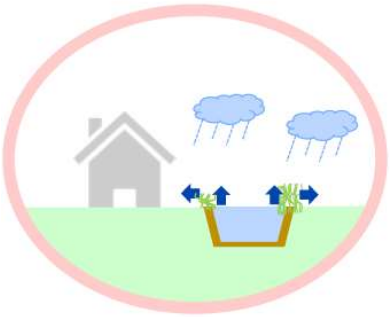
Hard surfaces, known as *impermeable surfaces*, do not allow any rainfall to soak into the ground and this rainfall will become (surface water) runoff. Runoff is usually very quick too. These are typically in the form of highways and roads, roofs, car parks and public squares.

Surface water flooding occurs under several circumstances, most commonly occurring when:

- There has been a prolonged period of rainfall and the permeable surface becomes saturated therefore no more water can infiltrate into the ground.
- The rainfall intensity is very high, and the rain is falling faster than it can infiltrate into the ground.
- There has been a prolonged warm dry period, the permeable surface may be baked hard and effectively turn the permeable surface into hard impermeable surface.
- It rains on impermeable surfaces, and there is no formal means of managing the rainfall.
- There is heavy rainfall on impermeable surfaces and surface water cannot enter the drainage system provided to manage rainfall as the system is at capacity.

During most storm events, the rainfall rate is low enough to allow surface water to soak into the ground or drain into formal drainage systems (e.g. gully pots). However, during an extreme event, where the intensity of the rainfall is high or there is an excessive volume of water, it is unable to soak into the ground or enter formal drainage systems and as such it will flow across a surface in an uncontrolled manner.

River Flooding



River flooding occurs when the amount of water in a river channel exceeds its capacity. This causes the water level in the river channel to rise above the riverbanks, where water flows from the channel into the surrounding area.
In terms of flood risk management there are two classifications of rivers/watercourses:

Main River and **Ordinary Watercourse**.

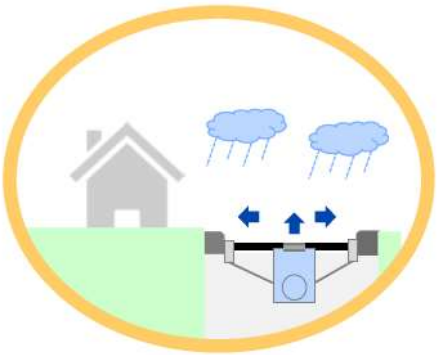
The Environment Agency holds responsibility for the management of flood risk on Main Rivers. All other watercourses, which are not specified as Main Rivers are termed Ordinary Watercourses. Flood risk management of these watercourses is the responsibility of the LLFA. However, in both cases, the riparian owner, that is anyone who owns land or property next to, or over, a watercourse, is responsible for maintenance of watercourse through their land.

River flooding occurs under several circumstances, most commonly occurring when:

- There has been a prolonged period of rainfall and the river levels have risen due to surface water runoff and inflow from sewer infrastructure.
- There has been a prolonged period of rainfall whereby permeable surfaces become saturated and the rate of surface water runoff increases thereby reaching the river faster.
- There is heavy rainfall on impermeable surfaces and the provided drainage system conveys water to the river quickly.
- There are high flows within the river which become restricted by structures (e.g. bridges and culverts) which results in water levels upstream rising and spilling from the banks.
- Sediment and debris builds up in the river channel and reduces the capacity of the river channel causing flows to spill from the banks.

During most storm events, rivers are capable of conveying flows within their channels however, during an extreme event where the volume of water may be significant, flows may exceed the channel capacity and spill from the river in an uncontrolled manner.

Flooding from Sewer Infrastructure



Where rainfall falls on an impermeable surface, it will typically be served by a formal drainage system, most commonly this is a sewer.

There are different types of sewer, including:

Surface Water Sewers carry rainfall and surface water away from properties to watercourses.

Foul Water Sewer, carries wastewater away from properties to be treated; and,

Combined Sewer drain both wastewater from properties along with runoff from highways, roofs, car parks and other sources. These systems were typically constructed up to the 1950s and hence are still found in historic areas of cities.

Flooding from sewer infrastructure occurs under several circumstances, most commonly occurring when:

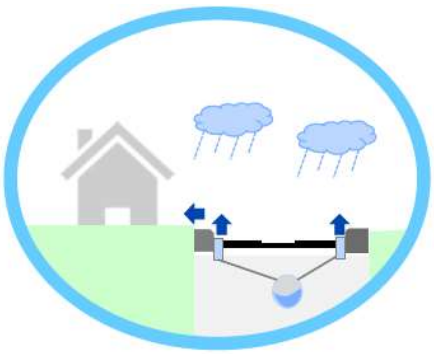
- There is a blockage, or the sewer itself collapses, which restricts or prevents flow within the sewer network. This causes water to back-up through the network and find its way to the surface, typically through a manhole or associated drainage structure.
- There is a period of heavy and/or prolonged rainfall, which results in significant flows that exceed the capacity of the sewer network. This prevents water from entering the sewer network and may result in surface flooding.

Severn Trent Water, as the sewerage company, is responsible for the operation and maintenance of the public sewers within the Staffordshire area.

Surface water and foul water sewers are currently designed in accordance with Sewers for Adoption (8th Edition, published 2018). This guidance states that sewers should have the capacity to deal with all runoff from a storm with a 3.33% or greater probability of occurring in any given year and not cause any above ground flooding. This guidance is relatively recent having been brought into effect in the last 10 to 15 years. In addition, improvements in computer aided design and calculations also ensure designs agree with the existing standards.

Therefore, at the time of construction of much of the sewer network across Staffordshire, the design standards may have been to accommodate a smaller storm event. The designs will likely have been done by hand and may have used “rules of thumb” to determine the required sizes. As a result, the drainage network is complex with some sewers able to accommodate storms well above current design standards and other sewers much lower. Thus, when a large storm event occurs, the existing drainage network (combined or surface water sewers) may be significantly overwhelmed.

Flooding from Highway Drainage



Highway drainage consists of gullies, drainage channels and other features which collect and drain rainfall away from the highway. These features are typically located on one, or both, side(s) of the highway where they connect to an underground highway drainage system which ultimately connects to the public sewer infrastructure.

Where rainfall falls onto the highway, this will enter the highway drainage system or flow within the highway channel until a point where it enters the system or ponds on the surface.
In new development, it is common practice to use highways to contain and convey heavy rainfall events away from properties, however historically this practice has not happened.

Across Staffordshire, properties can be seen at or below the level of the adjacent road. This means that should a carriageway not be able to contain the water flowing within it, flow will overtop the kerbs on the highway and spill over adjacent land into properties.

Flooding from highway infrastructure occurs under several circumstances, most commonly occurring when:

- There is a blockage or build-up of surface debris in the vicinity of a gully, typically trash, leaves and twigs, which prevents, or restricts, the highway runoff from entering the gullies and subsequent highway infrastructure.
- There is a period of heavy and/or prolonged rainfall, whereby the volume of rainfall falling onto the highway overwhelms the highway drainage features and is unable to be captured. The resulting flows are then conveyed or contained within the highway, until such times as the water level overtops the kerbs and flows overland into properties.
- The sewer, culvert, or watercourse to which the highway drainage is connected is at full capacity and therefore the highway run-off has no-where to drain to.

Staffordshire County Council, in their role as the local highway authority, is responsible for the highway drainage and gullies across East Staffordshire Borough Council. This work includes maintenance of the highway drainage including roadside gully pots.

Flood Risk Mapping

Flooding is traditionally very difficult to predict, and there are many local factors that influence flooding. There are a number of publicly available national information tools which can enhance our understanding of the potential flood risks within a local area, more specifically risk of flooding from surface water and from rivers.

Surface Water Flood risk

In 2013, the Environment Agency, working with LLFAs, produced the Risk of Flooding from Surface Water map. This is the third national surface water map produced by the Environment Agency under their Strategic Overview role and is the first publicly available surface water flood risk map.

Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when. This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.

This mapping assesses surface water flood risk as a result of the chance of rainfall occurring in any given year, and is categorised into the following three scenarios:

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk: Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

It should be noted that this mapping has been produced at national scale with a number of assumptions and therefore there are some limitations at a local scale and is not appropriate for identifying individual property level flood risk. This mapping is publicly available for use: https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode

Figure 1: Example of Environment Agency updated Flood Map for Surface Water Flooding

River flood risk

With regards to river flooding the Environment Agency publish the Flood Risk from Rivers or the Sea map. This shows the flood risk from Environment Agency Main Rivers and from the sea, considering any flood defences that may be present.

Storms are usually given with an annual probability or the chance of occurring in any given year. Typically, smaller storms have a higher probability of occurring in any given year and larger storms have a lower probability of occurring. However, the probability only describes the chance a storm will occur and not when. This means that if a large, low probability storm occurs, it can happen again soon after or can happen a long time after.
This mapping assesses flood risk from rivers or the sea as a result of the chance of rainfall occurring in any given year, and is categorised into the following four scenarios:

High Risk: Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year or 3.3% chance that the storm will occur in a single year

Medium Risk: Flooding occurring as a result of rainfall between 1 in 100 and 1 in 30 chance in any given year or between 1% and 3.3% chance that the storm will occur in a single year

Low Risk: Flooding occurring as a result of rainfall between 1 in 1000 and 1 in 100 chance in any given year or between 0.1% and 1% chance that the storm will occur in a single year

Very Low Risk: Flooding occurring as a result of rainfall with less than 1 in 1000 chance in any given year or less than 0.1% chance that the storm will occur in a single year.

This modelling is publicly available as the Environment Agency's Flood Risk from Rivers or the Sea map and is available online: https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode

Figure 2: Example of Environment Agency updated Flood Map for Surface Water Flooding

Analysis of Flooding Location

Price Court, Shobnall, Burton-Upon-Trent

The following sections of this report describe the flooding event that occurred at Price Court, Shobnall, on 16th February 2020. The event has been assessed through the review of anecdotal evidence from local residents and through consultation with the various Risk Management Authorities (RMAs).

Event Background

Several storms occurred in winter 2019-2020 across the UK and Midlands. The combined impacts of Storms Ciara, Dennis and Jorge led to exceptionally high rainfall totals across the UK, causing flooding in several areas.

Storm Dennis (15-16 February 2020) was the fourth named storm in the 2019/20 season, which arrived one week after Storm Ciara and brought with it heavy and persistent rainfall[3]. In the twelve months prior to Storm Dennis, Staffordshire had exceptionally high rainfall compared to the average (**Figure 3**). Rainfall in December and January was unremarkable. However, rainfall totals in February were exceptionally high, with February the wettest month in a series from 1862; the England figure was 258% of the long-term average (1981-2010). Crucially, soil moisture deficit from December 2019 through to February 2020 was generally practically zero/remained close to zero in Central England[3] (**Figure 4**). This means in the time running up to Storm Dennis there was generally little to no capacity within soils to drain or infiltrate rainfall. River flows in large rivers were also exceptionally high through February.

[3] Met Office – Winter 2019/2020 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/summaries/uk_monthly_climate_summary_winter_2020.pdf

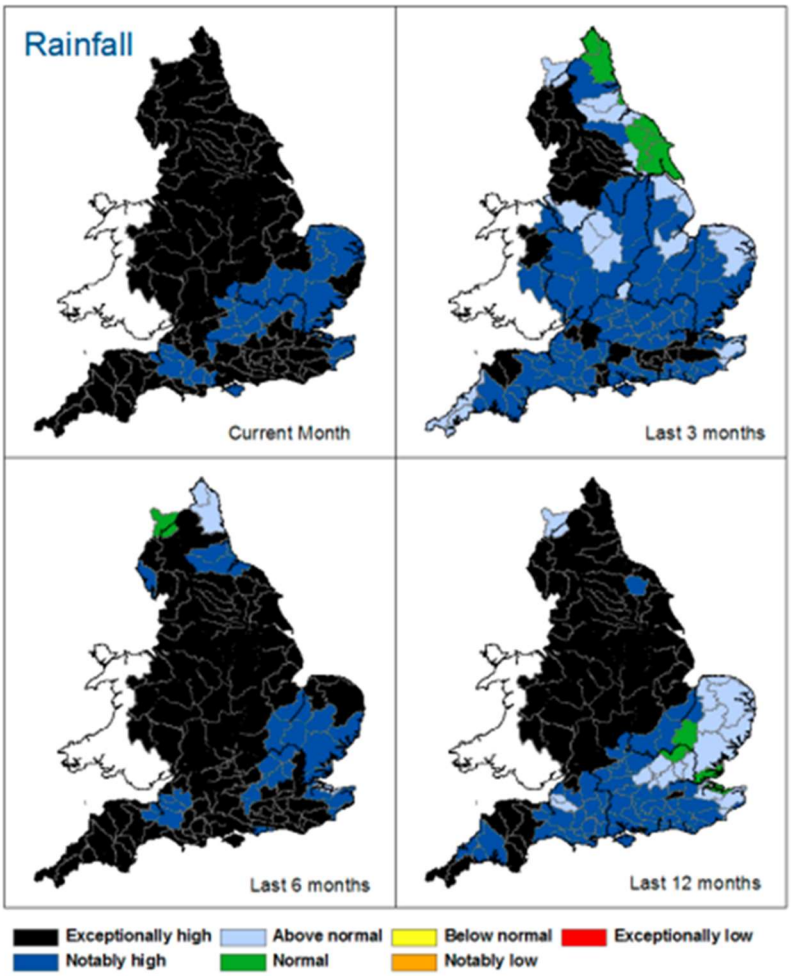


Figure 3: Total Rainfall Across England up to February 29 2020 (Source: Environment Agency[4])

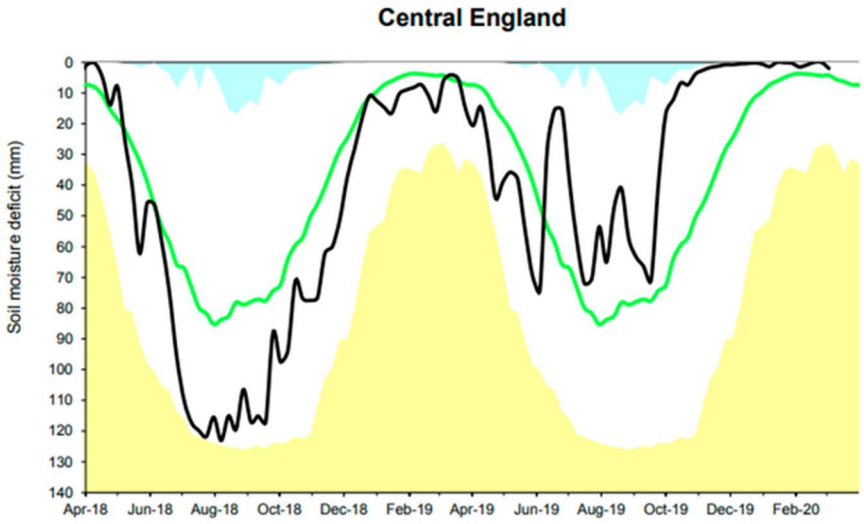


Figure 4: Central England Soil Moisture Deficit (Source: Environment Agency[4])

[4] Environment Agency – Monthly water situation report: England
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/871949/Water_situation_February_2020.pdf

On 14 February, Storm Dennis developed off the west coast of Ireland moving east and arriving in England by early afternoon. By mid-afternoon the front swept into Staffordshire and by late Friday night/early hours of Saturday morning this front had passed east out of Staffordshire. On Saturday 15 February a large front of rainfall developed in the morning and approached Staffordshire quickly, sustaining through to mid-day and continuing to remain over Staffordshire until early afternoon on Sunday 16 February. **Figure 5** shows radar-images of the rainfall across the UK. Through the rest of Sunday, the sustained/persistent rainfall moved over the rest of Europe, leaving scattered rainfall showers over Staffordshire through to Monday. For a more detailed account of Storm Dennis please refer to The Met Office[5] and Centre for Ecology and Hydrology[6].

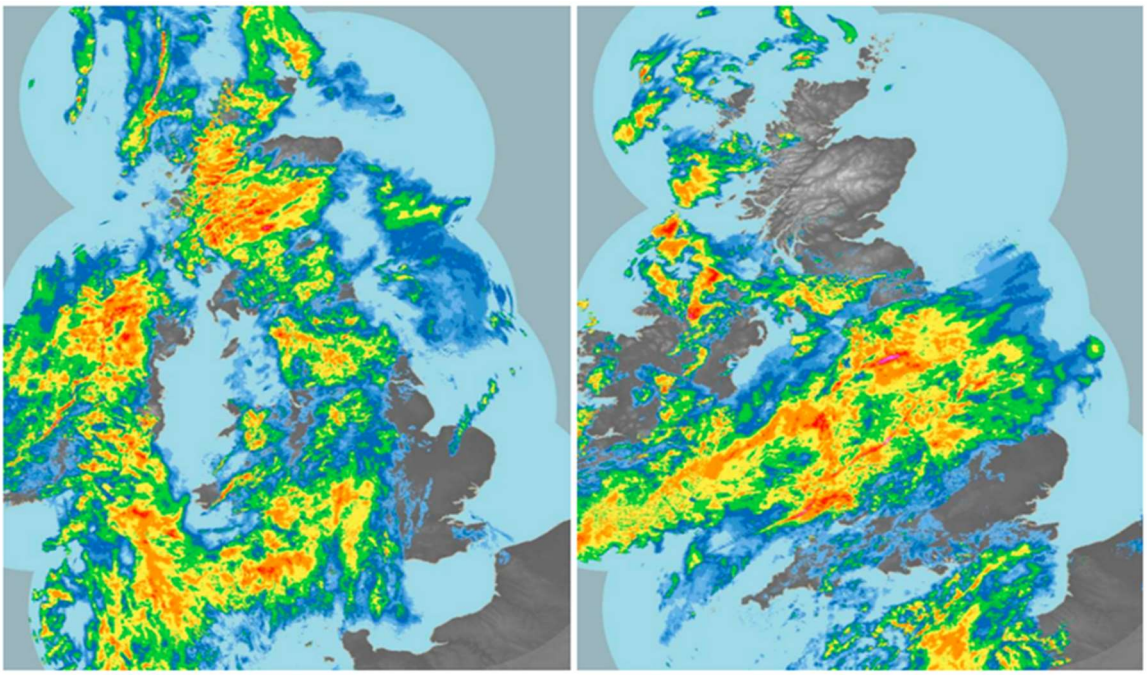


Figure 5: Rain-radar images at 12 UTC 15th and 00 UTC 16th February 2020 show the heavy and persistent rainfall from storm Dennis with the fronts sweeping across the UK (Source: The Met Office[5])

[5] Met Office – Storm Dennis https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2020/2020_03_storm_dennis.pdf

[6] Centre for Ecology and Hydrology – Briefing note: Severity of the February 2020 floods – preliminary analysis https://nrfa.ceh.ac.uk/sites/default/files/Briefing_Note_V6.pdf

Location Background

Price Court is located in Shobnall, a settlement and civil parish situated at the western edge of Burton upon Trent, Staffordshire. The area is mixed use in character, comprising brewery buildings to the south, flats and dwellings to the east and west and public open space to the north. The properties impacted during the event on 16th February 2020 are located to the north of Shobnall Road, in a small residential development which is owned and managed by a housing association.

Figure 6 shows the location of Price Court within Staffordshire and highlights the part of the development affected by the flood event.

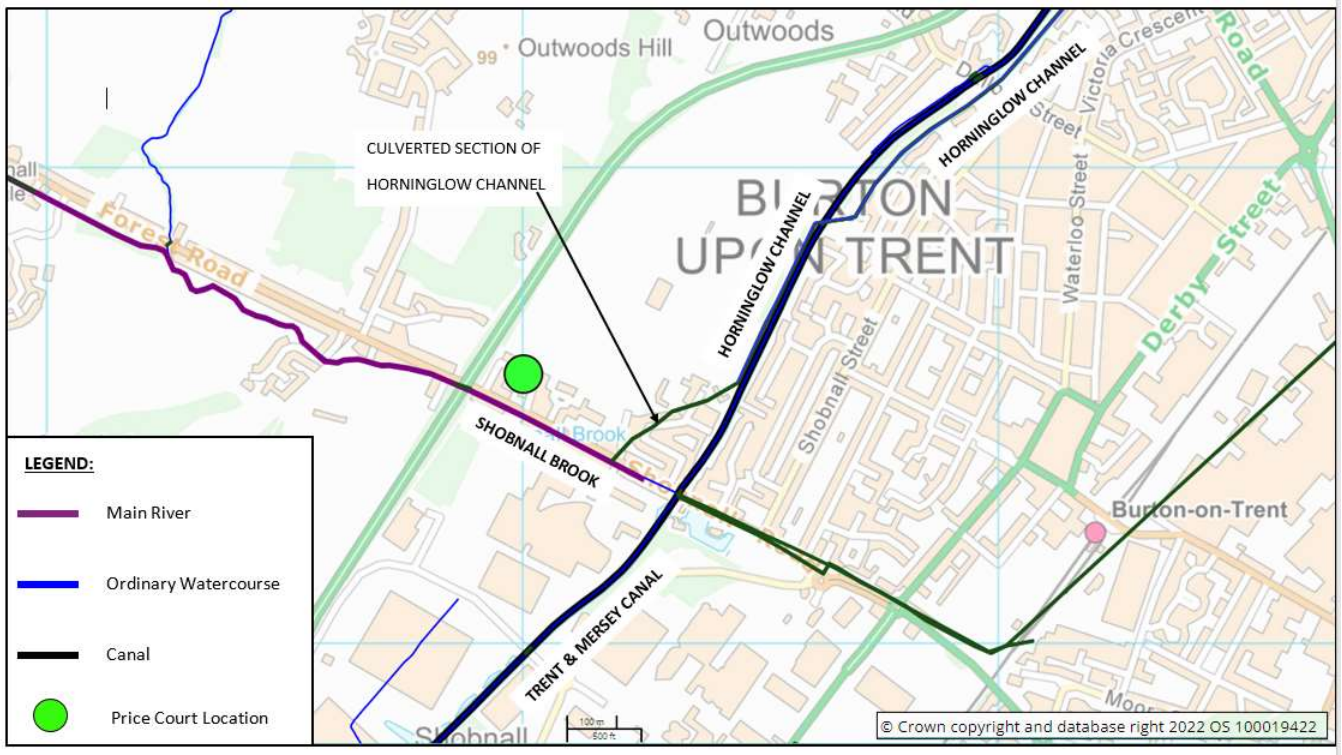


Figure 6: Location of Price Court and local watercourses

Local Watercourses:

Shobnall Brook, a tributary of the River Trent, is situated to the south of Price Court (Figure 6). The watercourse rises in the vicinity of Henhurst Wood and flows in a predominantly south-easterly direction. The brook is culverted at a number of locations including Lordswell Road and the A38 before continuing to flow in a south-easterly direction through Shobnall, running parallel to the southern side of Shobnall Road. Between Shobnall Dingle and Bridgewater Road, the brook is designated main river and is the responsibility of the Environment Agency.

Outside of Marstons Brewery (NGR SK23192328) Shobnall Brook adjusts its course from its original channel to flow in a north easterly direction. In the 1970s, East Staffordshire Council, in their role as sewerage agency, constructed a diversion channel to help solve flooding problems along Shobnall Road and provide a drainage route for large areas of new development planned in Horninglow and

Shobnall at the time. According to the Severn Trent Water Sewer plan, the culvert crosses land on the opposite side of the road, following the route of an old railway embankment, before discharging into an open channel (referred to as Horninglow Channel) situated adjacent to the Trent and Mersey Canal. All flow is diverted into Horninglow Channel and there is no continuation flow into the downstream culvert. The exception to this is during periods of heavy rainfall when it is understood that flows may pass forward onto the old route of the Shobnall Brook.

From the point the watercourse enters the culvert at Bridgewater Road and the downstream sections of open channel (referred to as Horninglow Channel), the watercourse is classified as a public surface water sewer, and is the responsibility of Severn Trent Water (STW). At the time of writing this report, discussions were being held between STW and the Environment Agency to transfer the responsibility of Horninglow Channel to the Environment Agency and reclassify it as Main River. Consultation with STW has indicated that there are proposals for channel clearance work and screen upgrades to be undertaken in order to bring the channel up to an acceptable standard prior to transfer to the Environment Agency.

Horninglow Channel flows through Shobnall Playing fields parallel to the canal for approximately 370m until it reaches a footbridge. From here it is culverted beneath the canal before emerging in a newly cut channel that runs along the route of the abandoned London and North Western railway line that follows the Trent and Mersey canal northwards. At NGR SK24822523 the watercourse turns and flows in an easterly direction, before ultimately discharging into the River Trent at Wetmore Hall Farm, approximately 1km downstream.

Local Drainage Systems:

Price Court is served by gravity fed foul and surface water sewers which are privately owned and maintained. Records indicate that the foul sewer connects into the combined 450mm diameter Severn Trent sewer to the south of the development along Shobnall Road. The combined sewer then flows in a north easterly direction, ultimately discharging to Claymills Severn Trent Sewage Works at Meadow Lane, Burton-upon-Trent.

Surface water flows drain to the north-eastern corner of the site via a gravity fed surface water sewer. Specific details and dimensions of this surface water sewer are currently unknown. Development plans provided as part of this investigation indicate that the surface water sewer discharges into a manhole located on the public footpath to the northeast of the development boundary. The available drawings do not demonstrate the onward connectivity of the surface water sewer past this point. Consultation with Staffordshire County Council Highways indicates that previous site observations of the manhole within the public footpath showed the surface water sewer continuing in an easterly direction from the public footpath. Historic maps for the area from 1804 show a railway line associated with the old Malt Houses was situated along the boundary of the playing field to the north of Price Court. It is therefore possible that old drainage associated with the railway line has been used to connect the surface water network from Price Court to the Horninglow Channel to the east, however this has not been confirmed.

The gullies within the development are not part of the adopted highway and are privately owned and managed.

Historical Flooding at Price Court, Shobnall

Historic records indicate that the main source of flooding to Price Court has been from the Shobnall Brook and from localised surface water flooding. The most notable event occurred in July 1999. East Staffordshire Borough Council's Level 1 Strategic Flood Risk Assessment (SFRA), details how Shobnall Brook experienced flooding along its entire length. According to The UK Storm Guide website (Source: http://www.ukspeedtraps.co.uk/weather/burtonflood.htm, accessed April 2021), a '*river flowed down the road. It was so deep in places that cars were almost covered to the roof line*.'

Photographs on the UK Storm Guide website (http://www.ukspeedtraps.co.uk/weather/burtonflood.htm, accessed April 2021) show flooding at the entrance to Price Court, with water from Shobnall Brook flowing in a northerly direction towards the properties. Staffordshire County Council Flood Risk Officers that visited the site described how the main Shobnall Road was impassable adjacent to Marstons Brewery, and that the highway at Price Court was underwater.

Staffordshire County Council Flood Risk Officers indicate that there have been occasions when the car park adjacent to the flats at the western side of Price Court have also experienced flooding. Again, this is thought to be a result of flood water from the Shobnall Brook, which once reaches capacity, will overtop, follow the prevailing topography and flow down towards Price Court.

Environment Agency Flood Risk Maps

Price Court is at risk of flooding from multiple sources. Figures 7 and 8 below demonstrate the Environment Agency's Flood Zones from Rivers and Sea (RoFRS) and the Risk of Flooding from Surface Water (RoFSW) maps for Price Court, Shobnall.

The Environment Agency's Flood Zone map shows Price Court to be situated within Flood Zones 2 and 3 (Figure 7). Upstream of Marston's Brewery, there is an area of notable flood risk with clear flow routes on both the left and right banks of the watercourse. Review of the local topography demonstrates that ground levels fall away from Shobnall Brook to the north and south. Consequently, water that overtops the watercourse will drain away from the brook, and flow towards lower lying areas adjacent to the watercourse. Previous hydraulic modelling undertaken by JBA in December 2013, indicates flood depths of up to 3.71m for the 1 in 100 year event (Flood Zone 3) and 4.43m for the 1 in 1000 year event (Flood Zone 2).

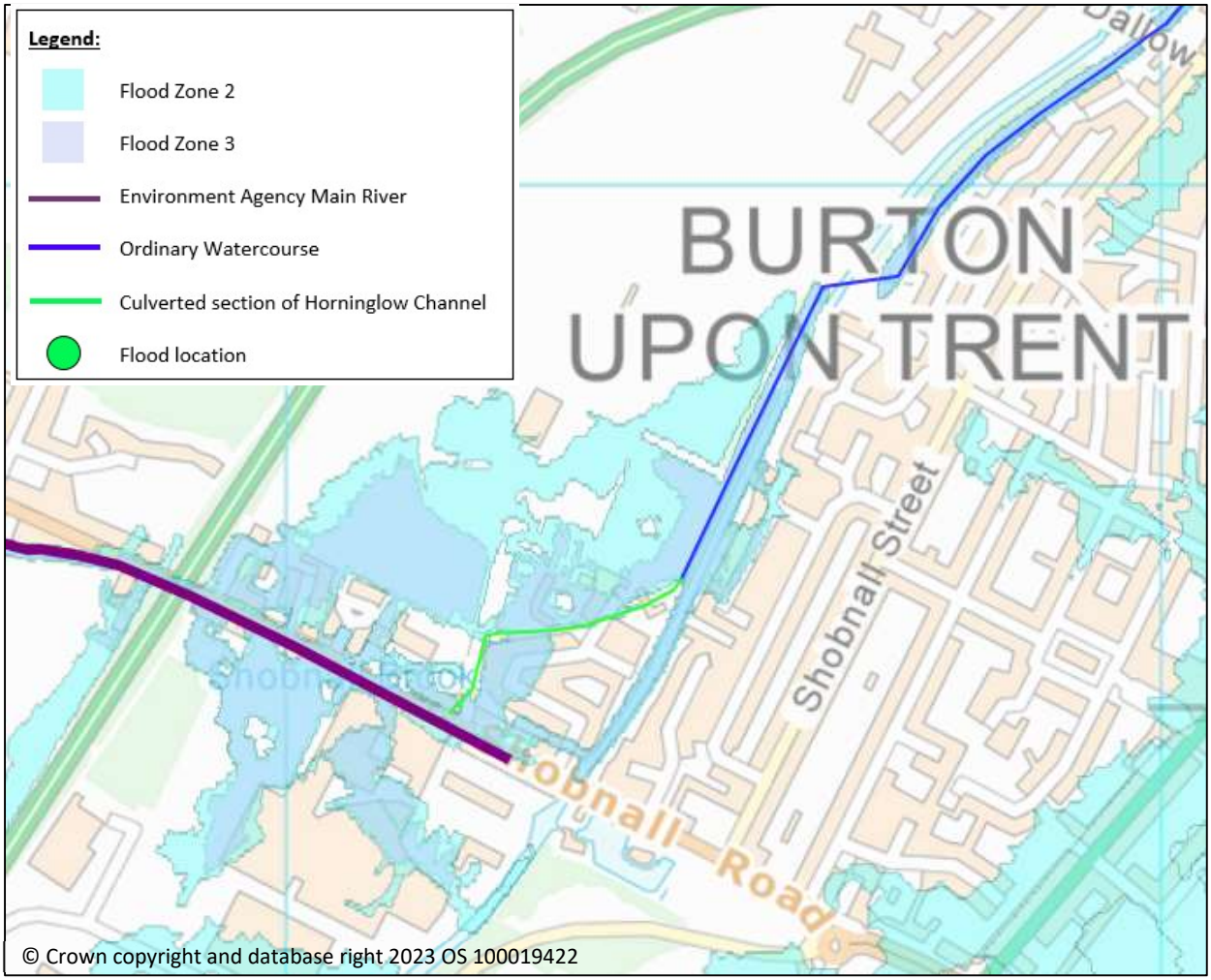


Figure 7: Environment Agency Risk of Flooding from Rivers and Sea (RoFRS) map demonstrating Flood Zones 2 and 3 at Price Court, Shobnall.

Review of the RoFSW maps (Figure 8) also shows a risk of surface water flooding to the properties at Price Court. Price Court is located within the 1 in 30 year RoFSW, 1 in 100 year RoFSW and the 1 in 1000 year RoFSW maps. The maps show that surface water flows are likely to follow the local topography and drain towards Price Court and also pond in Shobnall fields to the north. This corresponds with observation made during recent flood events with residents describing flood waters flowing down Shobnall Road and onto Price Court.

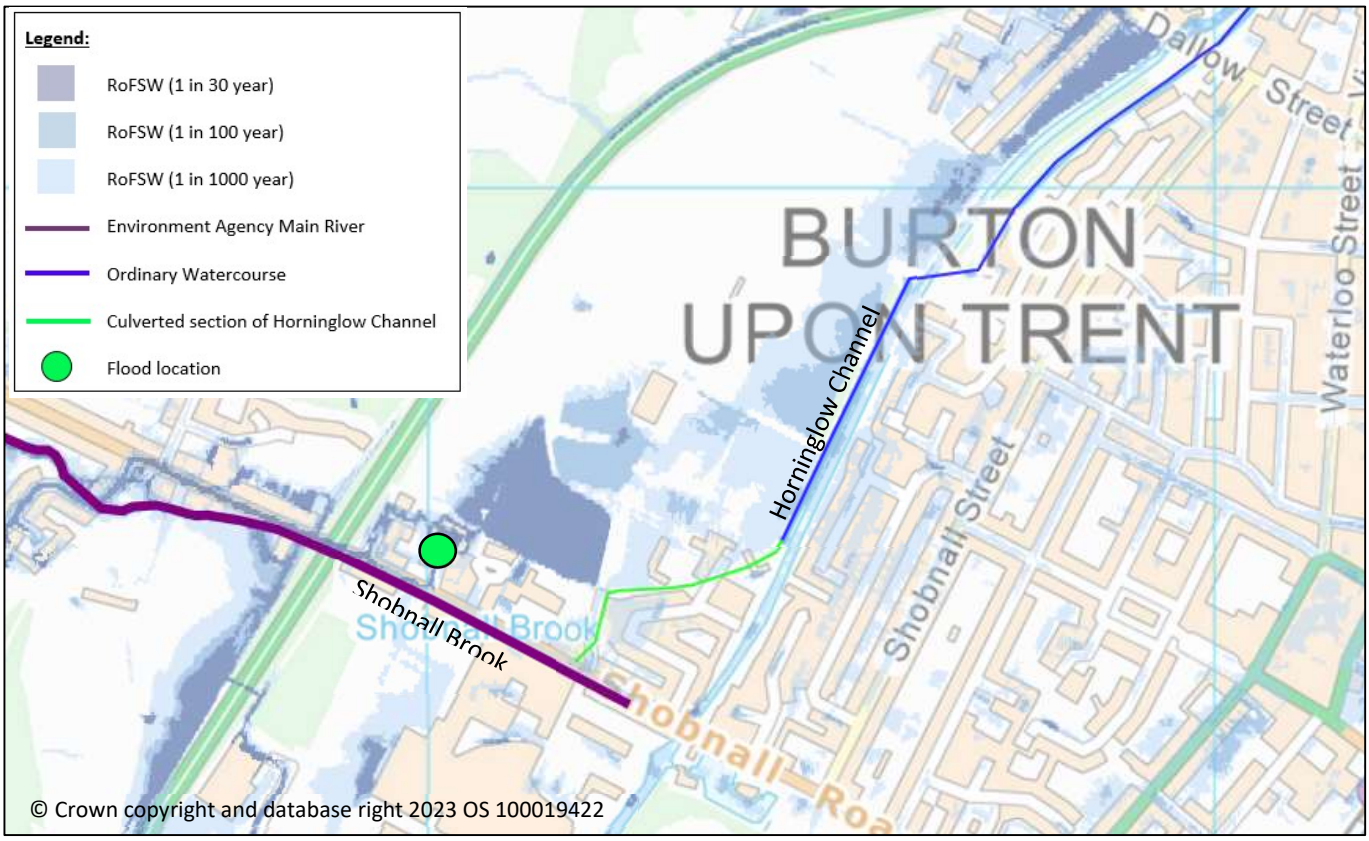


Figure 8: Environment Agency Risk of Flooding from Surface Water (RoFSW) maps for Price Court

February 2020 Flood Event

On the 16th February 2020, multiple properties at Price Court reported that they had experienced flooding. Accounts from residents describe flood water entering properties in the early hours of Sunday 16th February 2020. In addition to internal property flooding, flooding to gardens, driveways and the adjacent sports fields was also reported. Information provided suggests that the flooding originated from a variety of sources including river (Horninglow Channel), surface water, overwhelmed sewers and highway drainage.

Identified Flooding Type(s)			
River	**Surface Water**	**Highway Drainage**	**Sewer**
			

Records passed to us by East Staffordshire Borough Council (ESBC) and the Housing Association indicate that 6 residential properties experienced flooding internally. This information came via properties that claimed for damages as a result of the flooding. It is therefore possible that some additional properties did flood internally but did not claim.

Anecdotal reports from residents have described how nearby gullies overflowed and water and sewage entered properties, reaching a depth of approximately 2ft. In addition, reports suggest that the capacity of the nearby Horninglow Channel was exceeded and water flowed across the playing fields towards the properties on Price Court. Figure 9 overleaf presents a photograph taken following the flood event on 16th February 2020. This shows the main areas affected, with vast areas of the fields at Shobnall leisure centre under water and flood water ponding to the rear of the properties at Price Court. It should be noted that the exact date and time of the photograph is unknown and therefore may not be representative of the full extent of the flooding experienced. Figure 10 shows the flooding observed on the footgolf pitch at Shobnall Leisure Centre to the north east of Price Court. Again, the exact date and time of the photograph is unknown.

The extent of damage to the properties resulted in the Housing Association evacuating residents from their properties.

Figure 9: Flooding to the Leisure complex fields to the rear of Price Court (pink circle). Photo is looking in a southerly direction towards Price Court. (Source: Photograph provided to SSC LLFA by representatives from Shobnall Leisure Centre. The exact date and time of the photograph is unknown).

Figure 10: Flooding observed on the footgolf pitch at Shobnall Leisure Centre (Source: Photograph provided to SSC LLFA by representatives from the Leisure Centre. The exact date and time of the photograph is unknown).

Flood Incident Response:

Price Court is covered by the Environment Agency's Burton-upon-Trent flood alert area but is not included within the Flood Warning Area for the River Trent. Records indicate that a flood alert for the Burton-upon-Trent area was issued on the 15th February 2020 at 12:39. On 16th February 2020 at 15:01 this was upgraded to a flood warning for the Burton-upon-Trent area.

On Sunday 16th February 2020, a number of calls were received by Staffordshire County Council and East Staffordshire Borough Council's emergency telephone line, informing the Council of localised flooding being experienced in various parts of the Borough, including the Burton-on-Trent area. Officers immediately put the Town Hall on standby in case it needed to be mobilised as a rest centre.

Over the course of Monday 17th February, the Council was advised that flooding was potentially becoming more widespread within the Borough and at 5pm on Monday, officers chaired a multiagency conference call which resulted in formal Strategic and Tactical Co-ordinating groups being set up. This included Staffordshire County Council, Police, Fire, West Midlands Ambulance Service and the Civil Contingencies Unit (CCU) as part of the local resilience forum response.

As part of the response, it was highlighted that a number of properties may need to be evacuated and the Town Hall was mobilised as a rest centre, to accommodate any residents displaced due to flooding. However, emergency services indicated that this would not be required, and rest centre facilities were closed shortly after. On the morning of 18th February, the Strategic Coordinating Group stood down the response phase and moved into the recovery phase.

Subsequent consultation with the Housing Association as part of this section 19 investigation has indicated that several property owners at Price Court had to vacate their properties and were required to move into temporary Housing Association accommodation until repairs had been completed. This is understood to have taken approximately three to four months.

East Staffordshire Borough Council (ESBC) received more than 130 applications for grant support from residential and business properties across East Staffordshire. By the end of the scheme, the DEFRA Property Flood Resilience grant scheme and ESBC will have provided grants to approximately 86 properties that equals an approximate value of £370,840 across the Borough.

Investigation

Flooding to both property and the highway at Price Court has occurred on several occasions. Prior to February 2020, SCC Lead Local Flood Authority (LLFA) had limited knowledge of the issues and flooding mechanisms at this location. Following the flood event, SCC LLFA have worked in conjunction with the relevant Risk Management Agencies (RMAs) and other relevant organisations, including the Housing association, to obtain data to help understand what happened on 16th February 2020.

Rainfall Analysis:

Rainfall data has been obtained from various sources to obtain a better understanding of the February 2020 event. On the 15th and 16th of February, Storm Dennis generated a severe weather warning over much of the Midlands. The Storm Dennis event has been characterised as a long duration, low to moderate intensity rainfall event that spread over large catchments, which is typical with winter rainfall storm events.

Figure 11 shows the 5-minute HydroMaster rainfall data for Price Court. A total of 28.9mm of rainfall was recorded over the 24 hour time period 15th February 2020 to 16th February 2020. Of this total, 26.2mm was recorded during a 17-hour period between 21:10 on February 15th and 13:40 on 16th February 2020 demonstrating that the storm was relatively intense, with rainfall falling continuously throughout the duration of the storm.

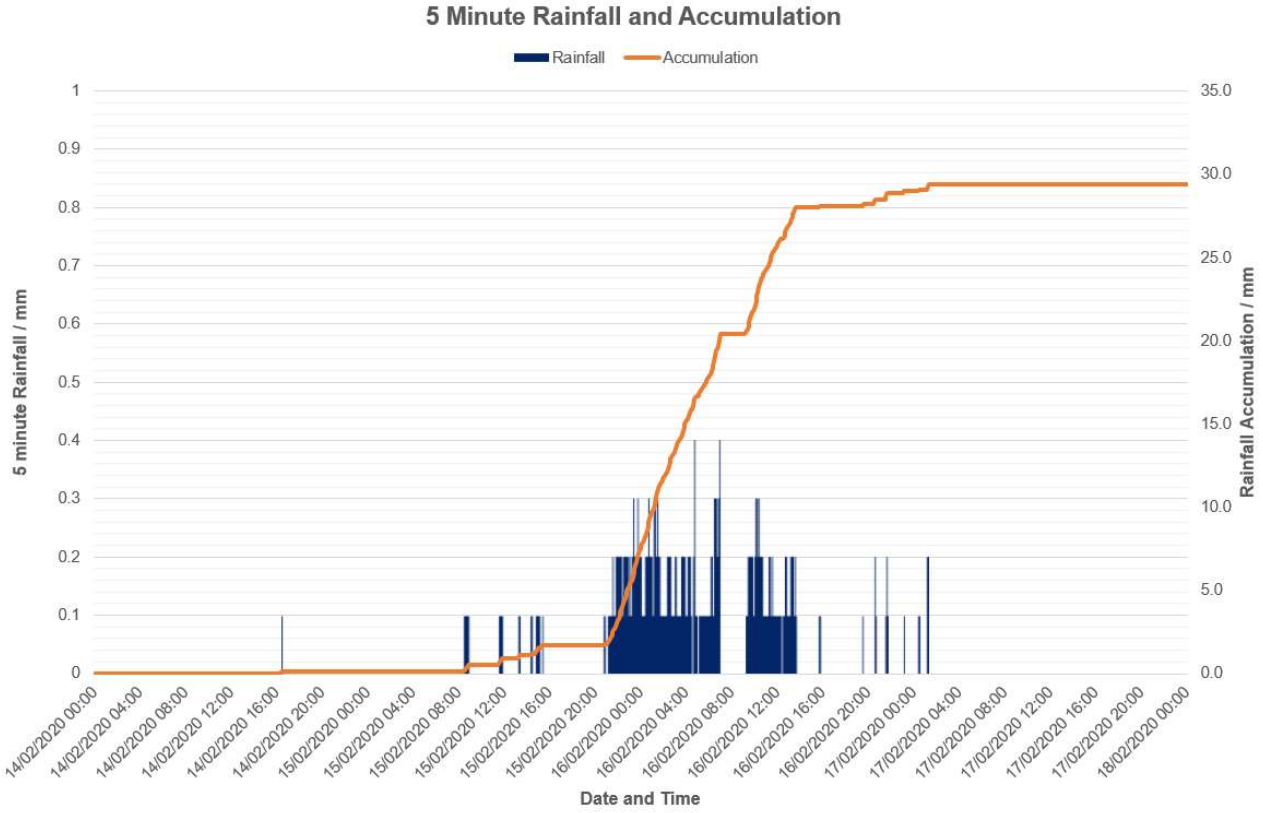


Figure 11: 5-minute Rainfall data for Price Court, Shobnall, from February 14th 2020 to February 18th 2020 (Source: Hydromaster)

This intense period of rainfall prior to the flooding incidents that occurred across the County resulted in significant volumes of surface water flooding over what was already saturated ground.

The rainfall return period of the February 2020 event has been estimated as less than a 1-year event (Table 1). Whilst the magnitude of the rainfall event alone was not exceptional, when combined with the preceding conditions and extremely saturated ground it resulted in a more extreme, lower probability flooding event.

Table 1: Rainfall event return periods for Storm Dennis on February 16th and 17th 2020

Event duration	Event occurrence (date / time)	Total rainfall (mm)	Rainfall Intensity (mm/hr)	Event return period
6-hour	15/02/2020 21:55 – 16/02/2020 03:55	12.3	2.1	<1-year
12-hour	15/02/2020 22:30 – 16/02/2020 10:30	19.6	1.6	<1-year
24-hour	15/02/2020 13:45 – 16/02/2020 13:45	27.5	1.1	<1-year
48-hour	15/02/2020 05:15 – 17/02/2020 05:15	31.0	0.6	<1-year

Similar rainfall totals for the same period were recorded by DEFRA Environment Agency rain gauges within the area. The closest gauge to Price Court, Clay Mills, recorded daily (24 hour) rainfall totals as 10.6mm on 15th February and 33.2mm on 16th February, with a total of 43.8mm over the two days. Comparable rainfall values were also recorded at Byrkely Park (40.6mm) and Overseal rain gauge (42.4mm) which are equal distances from the flood location. This demonstrates that in excess of 40mm of rainfall fell over the wider area prior to the flood event on February 16th, whilst soils were already saturated throughout the catchment from Storm Ciara the previous week.

Historic average annual rainfall data from the MET Office shows that for the nearest rain gauge to Mead Crescent (Sutton Bonington), the average annual rainfall for the month of February is 38.85mm (based on the baseline climate period 1981 to 2010). Therefore, it can be concluded that almost one month's rainfall fell in the 24 hour time period between 15th February 2020 to 16th February 2020.

Watercourse Analysis:

The Storm Dennis event and associated rainfall resulted in many of the watercourses within Staffordshire experiencing high levels and flows. There are two watercourses within the vicinity of Price Court: Shobnall Brook and Horninglow Channel. As previously noted, outside of Marston's Brewery, Shobnall Brook adjusts its course from its original channel being culverted in a north easterly direction, before discharging into the Horninglow Channel within the south eastern corner of Shobnall playing field.

At Price Court, the Shobnall Brook catchment covers an area of approximately 4.2km^2. Analysis of the rainfall data from the event has indicated that Storm Dennis was a medium intensity storm, with prolonged periods of heavy rainfall. Shobnall Brook is an ungauged watercourse. ReFH (Revitalised Flood Hydrograph) software has been used to create a hydrograph from the observed rainfall and catchment characteristics, along with a series of uncalibrated modelled hydrographs for design storms of different return periods. Comparison of the peak flows enabled the flow return period to be estimated. Figure 12 shows the modelled hydrograph.

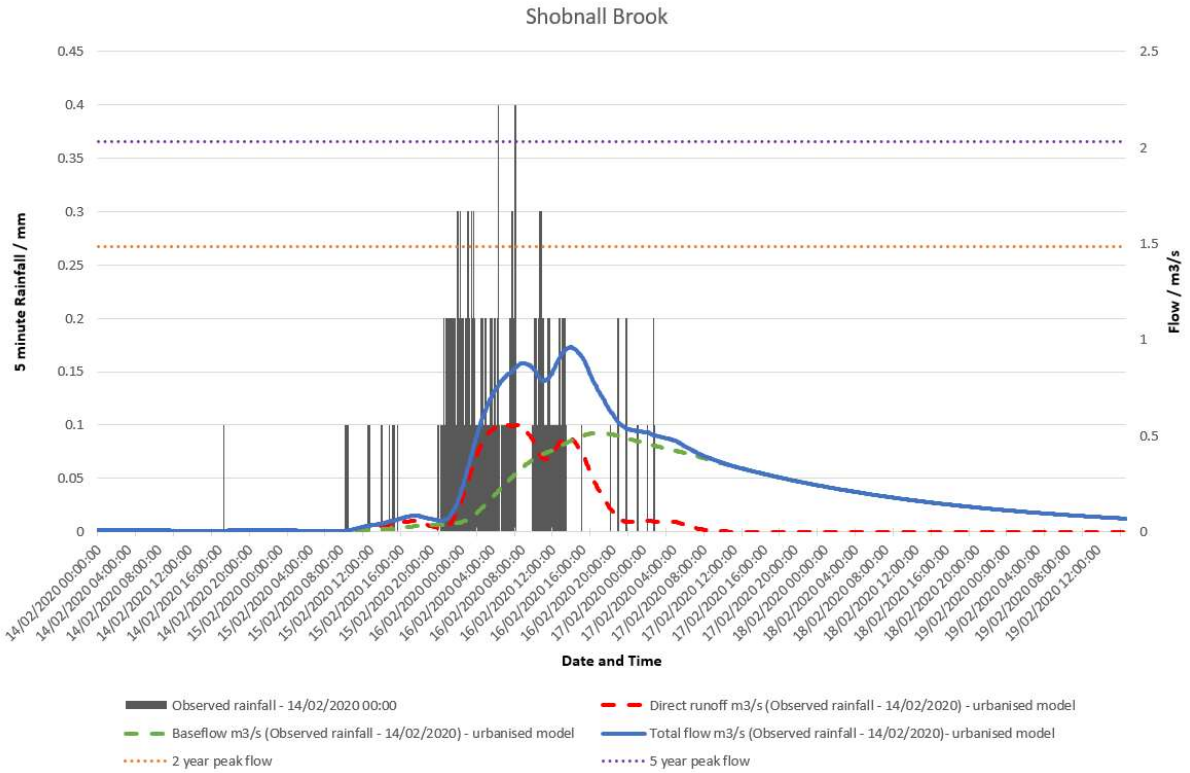


Figure 12: ReFH design flood hydrograph for Shobnall Brook following the Storm Dennis rainfall event on 15th and 16th February 2020

Figure 12 shows that following a relatively intense period of rainfall on 16th February, flow within the Shobnall Brook increased relatively quickly, resulting in a peak flow of approximately 1.0m^3/s at 14:25 on 16th February 2020. The modelled hydrograph indicates that the peak runoff for the Storm Dennis event was equivalent to an event with a return period of less than 2 years. This is surprising based on the evidence gathered after the flooding which shows extensive flooding to the fields to the north of Price Court. It is therefore likely that the flooding was exacerbated by several factors to produce a greater impact than would be expected from a storm of this magnitude.

Anecdotal evidence obtained as part of this investigation has identified two possible flow routes that were observed during the event. Figure 13 below demonstrates the two flow routes as described to SCC LLFA:

1. The blue arrow shows a flow route which originated from the open section of the Horninglow channel to the east. Reports have indicated that the capacity of the Horninglow

Channel was exceeded and flood water flowed in a westerly direction across Shobnall playing fields towards Price Court.

2. The pink arrows show water flowing from the left bank of the Shobnall Brook upstream of Marston's brewery and following the prevailing topography in a northerly direction, before ponding on low spots on Shobnall playing fields.

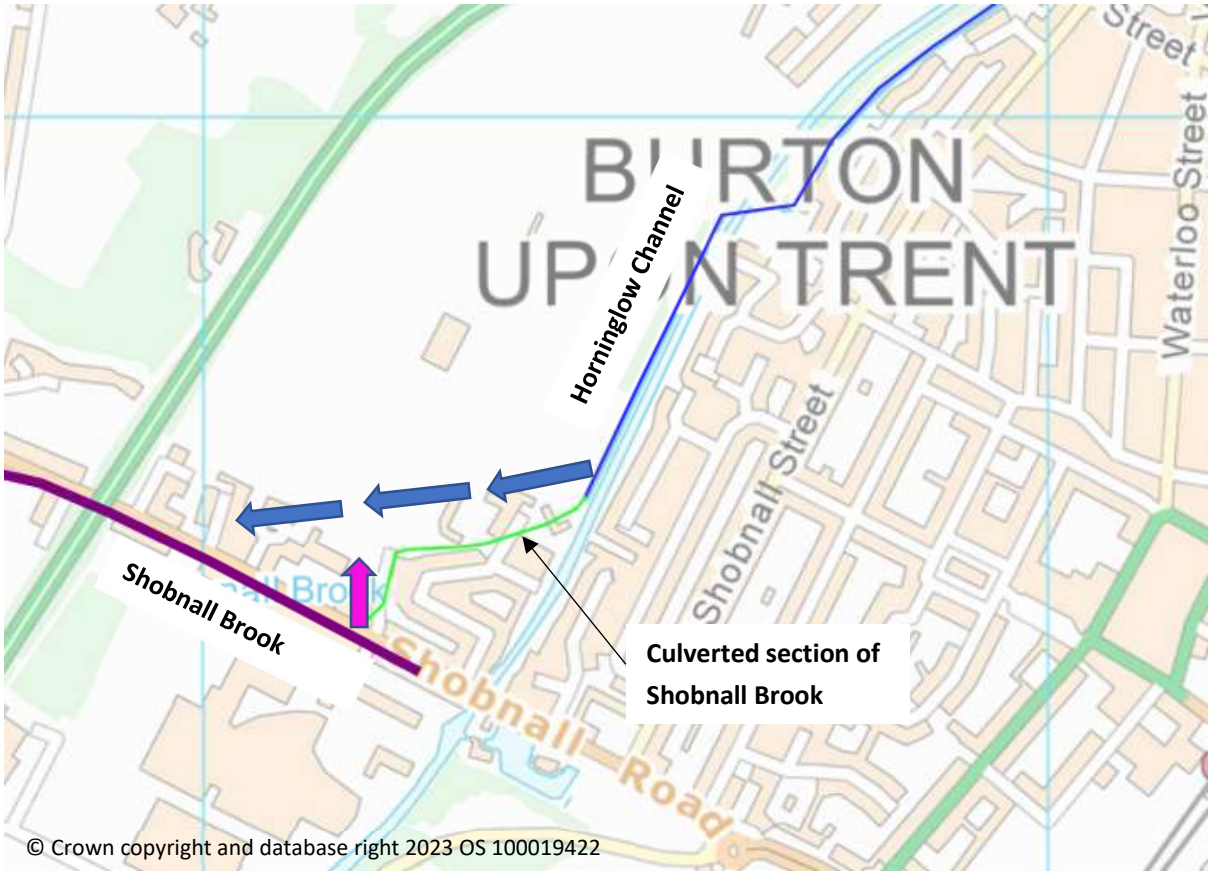


Figure 13: Observed flow routes as described to SCC LLFA following the February 2020 flood event. Blue arrows show overland flow route from Horninglow Channel and pink arrow shows flow route observed from Shobnall Brook upstream of Marston's Brewery.

The ReFH analysis presented above estimates a low return period (less than 2 years) for the Shobnall Brook. Whilst some of the reports received suggest a flow route from the left bank of the Shobnall Brook upstream of Marston's Brewery, this seems unlikely given the estimated return period of the event. Consultation with the Environment Agency has indicated that they did not receive any reports of flooding from Shobnall Brook during the February 2020 event. Discussions with SCC LLFA Flood Risk Officers have also indicated that when flooding does occur from the left bank of Shobnall Brook upstream of Marston's Brewery, the road adjacent to the brewery is often unpassable. SCC Highways have indicated that they have no reported incidents of flooding along Shobnall Road during the February 2020 event.

It therefore seems more likely that water flowed across the playing fields from the direction of Horninglow Channel.

Figure 14 below presents an estimated flood extent based on the photograph of flooding to the fields at the rear of Price Court and compares this with the RoFSW map.

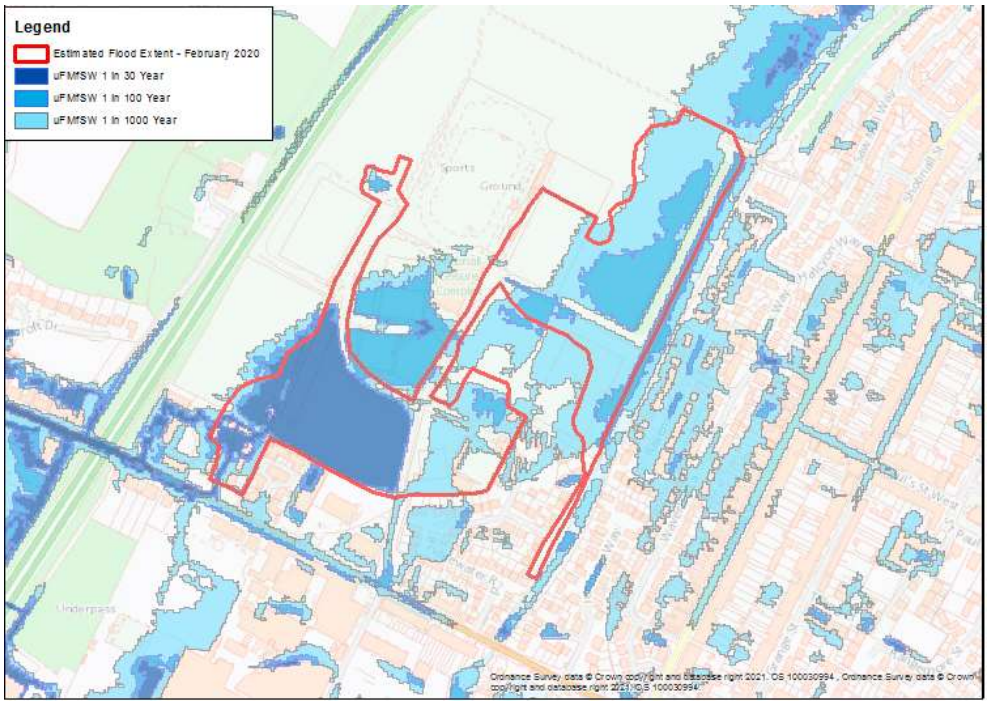


Figure 14*:* Comparison of the Environment Agency RoFSW map and estimated flood extent based on the recorded flooding shown in Figure 10

Review of the photograph shows that the flood water on the playing fields is similar in colour to the water in the Horninglow Channel, suggesting that it originated from the open section of the watercourse which flows through the playing field. Comparison of the observed flood extents following the February 2020 event with the Environment Agency's Risk of Flooding from Surface Water map shows the observed flood extent is similar to the 1 in 100 year RoFSW map and exceeded it in several places (Figure 14). It should be noted that the flood event presented is an approximation produced based on the photograph presented in Figure 9 and may not include all areas that were affected by the flooding.

Local knowledge of the Horninglow Channel indicates that levels in the watercourse can be influenced by the water level in the River Trent downstream. A flap valve is located on the downstream outfall pipe from the Horninglow Channel. When water levels along the River Trent are high, the valve will close and prevent water from discharging into the River Trent. The Horninglow Channel will then back-up and fill with water until it reaches capacity and spills onto the adjacent floodplain.

The nearest level gauge on the River Trent to Price Court is Drakelow Park, located approximately 3km to the south east. On 17th February 2020 at 23:00 a peak flow of 384m^3/s and maximum level of

3.8m were recorded (Figure 15). This equates to the second highest recorded flow since records began in 1959. This data demonstrates that levels in the River Trent were elevated during the February 2020 event. It is therefore likely that water from the Horninglow Channel was unable to discharge into the River Trent and backed-up along the channel.

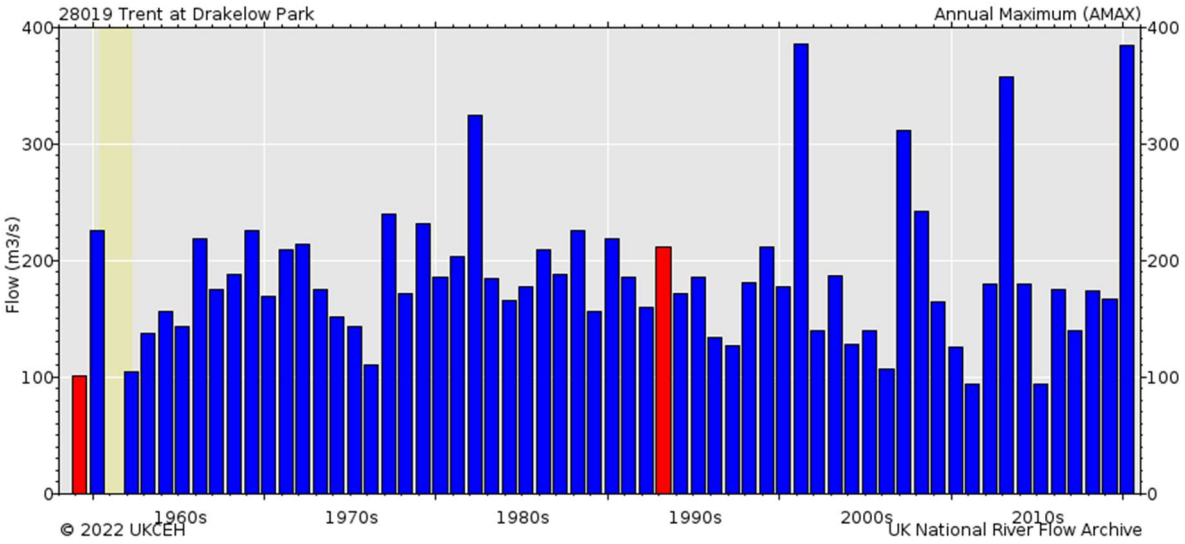


Figure 15: River Trent flow data from 1959 to 2020. February 17th 2020 (outlined in orange) shows the second highest recorded flow at 384m3/s and 3.8m stage (Source: UK National River Flow Archive).

Discussions with representatives from SCC LLFA Flood Risk Team has indicated that historically, the Horninglow Channel has been poorly maintained. Previous CCTV surveys of the culvert diverting the Shobnall Brook from its original course and walkover surveys of the Horninglow Channel downstream of Price Court have shown both the culvert and channel to be in poor condition with significant siltation. If the Horninglow Channel was at capacity, any other surface water sewers / drainage networks connecting into them would have been unable to discharge, resulting in them backing-up, reaching capacity and flooding. Discussions with a representative from the leisure centre have indicated that following the February 2020 event, a member of staff had to remove a significant amount of silt from a manhole containing a water meter. This further indicates that the surface water drainage networks serving the local area may have been at capacity and inundated with both a combination of surface water runoff and flood water from the adjacent watercourse. Further, the prolonged period of rainfall leading up to the event resulted in the catchment becoming saturated. Any rainfall will have fallen onto already saturated ground and therefore unable to infiltrate into the ground and ponded in low lying areas.

Highway Drainage and Sewer Network

Anecdotal reports received from residents has indicated that the privately owned gullies within Price Court became overwhelmed. Consultation with SCC Highways department has indicated that historically there have been issues with blocked gullies at Price Court and on several occasions in recent years they have required jetting. It is therefore possible that at the time of the February 2020 flooding, if the gullies were blocked, they would have become overwhelmed quickly.

It is not clear from the information received as part of this Section 19 investigation where the private surface water sewer from Price Court discharges. Ground investigations completed as part of a recent development at Bridgewater Road demonstrate the route of the Horninglow Channel and connections from the proposed development, but the survey did not include any connections from the direction of Price Court. Therefore, the exact point at which the Price Court surface water sewer discharges remains unknown. Consultation with Severn Trent Water has indicated that they are currently undertaking investigative work of the Horninglow Channel which may confirm if there are any connections into the culverted watercourse. Further investigation of the private surface water sewer at Price Court is required to determine its onward connectivity and establish whether there were any other factors such as a blockage or obstruction that may have contributed to the flooding experienced in February 2020.

It is noted that several residents also reported sewer flooding to their properties. Consultation with STW has indicated that they did not receive any reported incidents of sewer flooding from the combined sewer network in Shobnall Road to the south during the February 2020 event. This suggests that the private foul water network at Price Court became overwhelmed or experienced a blockage within the private network, resulting in internal flooding to the properties.

Site Visit

In addition to the records of the flood event received from the various RMAs and other parties, a site visit was conducted by SCCs LLFA Flood Risk Officer in September 2021 to assess the various factors that may have contributed to the internal flooding in February 2020. During the site visit the condition of Horninglow Channel was assessed and found to contain significant vegetation and debris within the channel.

Observation of Price Court itself showed a raised section of land adjacent to the fence boundary of the properties backing onto Shobnall Fields. Review of historic maps shows an old railway line on both the northern and southern boundaries of the site. It was also noted that the path around the site has a hedge and wire mesh fence in the eastern corner of the development. During the site visit, debris including garden waste/vegetation was observed along the fence. It is possible that any debris along the fence may create an artificial barrier around the site, and surface water runoff from Price Court may have been unable to follow the prevailing topography towards Shobnall fields to the north, subsequently accumulating within lower lying parts of the highway. This could also block water from the fields.

Conclusion:

The flooding incident that occurred at Price Court following Storm Dennis in February 2020 was the result of an exceedance event, with flooding from a variety of sources including surface water runoff, river flooding (Horninglow Channel) and overwhelmed sewers and highway drainage.

In the twelve months leading up to the event, Staffordshire experienced exceptionally high rainfall compared to the yearly average. The intense period of rainfall in the hours preceding the event fell on an already saturated catchment and was unable to infiltrate into the ground. This resulted in the

private drainage network at Price Court becoming overwhelmed and water accumulated in areas of low topography, ultimately flooding residential properties. Historically there have also been issues with blocked gullies at Price Court which have required jetting. It is therefore possible that at the time of the February 2020 flooding, if the gullies at Price Court were blocked, they would have become overwhelmed relatively quickly.

Several watercourses were elevated during and prior to the event due to the significant volumes of rainfall. Whilst the ReFH analysis undertaken using data from the Shobnall Brook has estimated a low return period (less than 2 years) for the event, post event photographs and observations from residents have indicated that the extent of flooding was greater than would be expected from a storm of this magnitude. Much of the water from the surrounding catchment ultimately drains into the River Trent which recorded exceptionally high levels in the days following Storm Dennis. It is therefore likely that if the flap valve on the downstream extent of the Horninglow Channel was closed due to elevated levels in the River Trent, water would have been unable to discharge, and backed-up, before exceeding the capacity of Horninglow Channel and spilling onto Shobnall Fields. Previous site observations have shown Horninglow Channel to be poorly maintained with significant vegetation and debris. Any reduction to the capacity of the channel at the time of Storm Dennis would have further exacerbated the flooding.

Based on the information obtained as part of this investigation, it is thought that the private surface water network serving Price Court discharges into Horninglow Channel to the north east. Whilst it has not been possible to confirm the downstream connectivity of the private surface water sewer from Price Court, it is likely that if the water levels within the adjacent watercourses exceeded the ground levels at the flood location, the drainage network would have been unable to operate effectively during the event, backing-up and flooding the adjacent highway and properties. Further investigation of the private drainage network from Price Court is therefore required to confirm its onward connectivity and determine potential interactions with downstream drainage systems.

Recommended Actions

As part of this flood investigation, it is vital to determine what contributed to the flood event but also to establish a set of recommended actions that may help to alleviate flooding in the future or at least reduce risk to properties.

Table 2 below sets out relevant Risk Management Authorities (RMAs) and other interest parties, actions that have been taken to date and those actions planned for the future, with the relevant RMA who will lead.

Table 2: Risk Management Authorities and recommended actions

Relevant RMA	Actions to Date	Recommendations/Actions
SCC as LLFA	Meeting with Housing Association and STW	Work with local residents to investigate what works might be possible, and the impact of these on third party land and how these might be funded (SCC lead, timescale mid 2023). Work with STW to confirm the downstream connectivity of the private surface water sewer from Price Court.
EA and STW	Ongoing discussions between STW and EA to transfer the responsibility of Horninglow Channel to the Environment Agency and reclassify the watercourse as Main River	EA and STW to undertake improvement works to Horninglow Channel and work towards designation as Main River to ensure future maintenance (EA & STW, Timescale – ongoing).

In line with the Local Flood Risk Management Strategy for Staffordshire, information on flooding that has happened will also be used to inform, where appropriate:

- Our understanding of the level of flood risk around the County and how we take a risk based approach to prioritising our resources,

- Our understanding of where watercourses and assets, such as culverts and trash screens have caused particular issues and future maintenance needs. We will work to achieve these with land and asset owners,

- Where we can support communities to understand flood risk and become more resilient to flooding,

- Responses to major planning applications to ensure new development does not exacerbate existing flood risk issues and where possible, carefully planned Sustainable Drainage Systems on new developments reduce flood risk elsewhere,

- Partnership working with other flood risk organisations to take a joined up approach to flood risk management,

- Work undertaken by the Staffordshire Local Resilience Forum to be more prepared for future flood events, and

- The future programme for flood alleviation schemes across the County

Risk Management Authorities and Other Parties

A summary of each of the RMAs and their role in flood risk management, is provided below:

Staffordshire County Council (LLFA)
LLFAs are county councils or unitary authorities which are required to prepare and maintain a strategy for local flood risk management in their areas, investigate significant local flooding incidents and publish the results of such investigations and play a lead role in emergency planning and recovery after a flood event.

Severn Trent Water
https://www.stwater.co.uk/my-supply/pipes-and-drains/help-with-pipes/sewer-flooding/
As a water and sewerage company, Severn Trent Water manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They ensure their systems have the appropriate level of resilience to flooding, and maintain essential services during emergencies, maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment.

Environment Agency
https://www.gov.uk/government/organisations/environment-agency

The Environment Agency has a strategic overview of all sources of flooding and hold responsibility for flood risk management activities on Main Rivers. The Environment Agency are involved with the ongoing discussions with STW regarding the transfer the responsibility of Horninglow Channel to the Environment Agency and reclassification of the watercourse as Main River.

East Staffordshire Borough Council (ESBC)
As the Local Planning Authority, ESBC are responsible for determining planning applications within the Price Court Catchment in accordance with local and national policies.

Riparian Owners
https://www.gov.uk/government/publications/riverside-ownership-rights-and-responsibilities

A riparian owner is any party or individual who has a watercourse within or adjacent to any boundary of their property. They are responsible for maintaining the riverbed and banks within their section of the watercourse to preventing obstruction to the water flow and mitigate flood risk.

Other Parties:

Housing Association

As owner and manager for the properties at Price Court, the Housing association are responsible for the ongoing management and maintenance of the private drainage network and properties within Price Court.

Conclusions

Several storms occurred in 2020 across the Midlands region which impacted many areas. Storm Dennis, in February was a long duration, low-to-moderate intensity event, causing widespread flooding nationwide. Following the February 2020 storm event, incidents of flooding were reported to Staffordshire Council, including Price Court, Shobnall.

The flooding at Price Court had a significant impact on the community, with records indicating that 6 residential properties experienced internal flooding, with some residents being evacuated from their properties. In addition to this, flooding to gardens, driveways and the highway was also reported.

Historically, Price Court has experienced flooding from the Shobnall Brook to the south, which once reaches capacity, will overtop and flood water will follow the prevailing topography, flowing in a northerly direction towards Price Court. Whilst anecdotal evidence has suggested Shobnall Brook may have overtopped upstream of Marston's Brewery in February 2020, there were no reported incidents of flooding from this location to either the Environment Agency or SCC Highways. In addition, ReFH analysis undertaken using data from the Shobnall Brook has estimated a return period of less than 2 years, which seems low given the extent of flooding shown in post event photographs and observations from residents. It is therefore likely that flooding experienced at Price Court in February 2020 was from a combination of sources including surface water runoff, river flooding (Horninglow Channel) and overwhelmed private drainage network and highway drainage.

The intense period of rainfall in the hours preceding the event fell on an already saturated catchment and was unable to infiltrate into the ground. This resulted in the private drainage network at Price Court becoming overwhelmed and water accumulated in low spots within the highway, ultimately flooding residential properties. Historically there have been issues with blocked gullies at Price Court which have required jetting. It is therefore possible that at the time of the February 2020 flooding, if the gullies at Price Court were blocked, they would have become overwhelmed relatively quickly.

Based on the information obtained as part of this investigation, it is thought that the private surface water network serving Price Court discharges into Horninglow Channel to the north east. Post event photographs have shown water levels within Horninglow Channel to be elevated following the event. This is likely to be a result of the flap valve at its downstream extent being closed due to high water levels in the River Trent. If the water levels within adjacent watercourses were elevated and exceeded the ground levels at the flood location, the drainage network would have been unable to operate effectively during the event, backing-up and flooding the adjacent highway and properties. Further investigation of the private drainage network from Price Court is therefore required to confirm its onward connectivity and determine potential interactions with downstream drainage systems.

Staffordshire County Council in its role as LLFA will continue to work with the identified RMAs to try and reduce the flood risk to properties and infrastructure, as well as assisting the local community to ensure that is resilient and prepared for flood events should they occur in the future.