Flood Management

Kirby Mills, Kirkbymoorside YO62 6NP - 6NS

Meeting at The Cornmill, YO62 6NP at 2pm on Friday 16 April 2021

Present:
Robin Derry, Flood and Coastal Risk Management Advisor, Environment Agency
Emily Mellalieu, Development Management Team Leader, NYCC
Richard Marr, Highway Area Manager, NYCC
Chris Tinkler, The Cornmill and riparian owner
Chris Creighton, MD, Peacock & Smith
Cllr Nick Holroyd, Mayor
Cllr Chris Dowie
Lisa Bolland, clerk to Kirkbymoorside Town Council

These notes have been cross referenced with the Flood Risk Mapping Studies Report carried out by JBA Consulting, commissioned by the Environment Agency dated January 2003.

Chris Tinkler provided a summary of the flooding issues that affect the properties in Kirby Mills:

There are three water pipes (highway drainage outfalls) to the Cornmill property. The first pipe directs water to the Mill Race. The second pipe directs water to the River Dove close to the A170 and has a single flow valve[1]. This pipe passes below the bridge at the Cornmill and the size of the pipe presents a significant obsruction to the flow through the Mill Race when the water levels rise.[2] The third pipe directs water to the River Dove close to the weir and also has a single flow valve When the river is full the valves on the river pipes close which causes the water to back up and then water exits through the man holes.

In addition, the Mill Race is a – presumably, man-made - spur off the River Dove which was originally used to power the water wheel in the Mill. It exits back into the River Dove about 100 yards the other side of the A170 behind a row of cottages there. Entry of water into the Mill Race is managed via a sluice gate close to the weir. Even when the sluice gate is fully closed, it allows a small flow of water through it, presumably to ensure that the Race doesn't end up with stagnant pools.

In flood conditions, the rising water levels in the river result in water entering the Mill Race at the exit end and the overall water levels in both the river and Race increase at the same rate. As water backs along the pipes leading to the river to escape through the manhole covers into the area of Kirkby Mills to the north of the A170, the road outside the Cornmill has a dip in it which starts to filll with this water, plus water coming out of the full roadside drains and finally joined by water flowing off the playing fields onto the Keldholme road and down the snicketway passed Alderson House. In this period, the pipe into the Mill Race continues to discharge into it. As levels rise further, the banks of the Mill Race on the north of the A170 start to breach the garden walls on the south side of The Cornmill, covering it, the bridge into The Cornmill car park, flowing upwards into the car park and down the driveway to meet the water gathering in the dip in the road outside The Cornmill.

There is a significant difference in the height of the river banks and the height of the Mill Race banks. When the River Dover breaches its banks on the north of the A170 water flows across the paddock and the car

1 Page 9, **3.4.9 Information from NYCC Highways Dept**. 3.4.11 NYCC are also responsible for road drainage. There is evidence that the highway drainage intercepts surface water from the former open watercourse above a "sinks" at Swineherd Lane, north east of Kirkbymoorside. The Council (NYCC) acknowledges that there are two highway drainage outfalls to the Mill Race (letter from NYCC to resident dated 22 March 2001), both of which are impeded during floods. They also expressed a hope that shortcomings could be overcome by provision of new pipe from Kirkbymoorside to an outfall to the River Dove near the Industrial Estate.

2 Page 2, **1.3. Recommendations,** 1.3.4 The Environment Agency should consider inclusion of capital flood defence scheme within the Long Term Plan at Keldholme and Kirkby Mills. Other partners in the scheme would probably include North Yorkshire County Council and Yorkshire Water. Discussions should be held with Yorkshire Water regarding possible modifications to the 600mm diameter pipe crossing the Mill Race, which is currently caising a significant obstruction to flow.

park to join up with the water breaching the banks of the Mill Race. It's at this point that flooding to properties in this part of Kirkby Mills becomes a significant risk.

Variations to the level of the River Dove seriously impacts the community of Keldholme upstream of the weir, the properties immediately in the viccinity of the Mill Race and Kirkby Mills south of the A170.[3] [4]

Who is responsible for these three water pipes?

Chris Tinkler has correspondence from Yorkshire Water specific to the drainage pipe feeding to the River Dove and their right of access from which it is possible to deduce that responsibility lies with them.

Lisa Bolland confirmed that despite trying to contact Yorkshire Water via email, telephone and via post she has been unable to make contact with a suitable representative. The only response from Yorkshire Water has been from a Customer Care Manager who reported that their network team had no reports of issues with the sewer network in and around the Kirkby Mills area. They have been unable to find any reports on their systems from customers that there has been any sewage flooding. It would appear that in periods of heavy rainfall the sewer network becomes overwhelmed.

Emily Mellalieu confirmed that she would be able to provide contact details for Gary Collins at Yorkshire Water and he would be the most appropriate personnel to address the issues concerned.

The recent flooding in January 2021 affected properties in Kirby Mills. Two properties were breached by flood water. Many residents undertook their own flood preventative measures, using sandbags and door boards. The majority of properties were protected from any breach because the Fire Brigade was in service to pump water away from the properties.

Chris Tinkler confirmed that prior to the recent flooding the sluice gate on the weir had been open for three weeks. This has worked in the past but the volume of water and the ground saturation meant that this measure had little effect.

Chris Tinkler confirmed a significant amount of debris is washed downstream to the Mill Race and it has been necessary to clear the silt to ensure unobstructed flow of water.

When the water levels rise the Mill Race becomes contaminated by water (sometimes including sewage) from the pipe next to the bridge. The pipe under the Cornmill bridge is large and presents a significant obstruction to the flow of water when the Mill Race rises.[5]

Herewith photographic evidence of the manholes overflowing with foul water as a result of the flood in 2000.

3 Page 9, **3.5 Information from the Questionnaire Survey** 3.5.1 The questionnaires returned by residents suggest that there are two fundamental flooding problems. In October 2000 some of the houses at Keldholme were flooded from the River Dove but there are complications including overland flow from Gray Road and nearby roads and fields. At Kirkby Mills it seems evident that flooding is caused by high levels in the River Dove backing up the Mill Race. The problems are exacerbated by flooding from a surcharging sewer and can be augmented by highway drainage.

4 Page 25, **7.1 Findings**, 7.1.1 It is clear that the River Dove was placed on the Section 105 Schedule because of the recent flood history and the substantial number of properties affected. This study has revealed that there are two separate problem areas. At Keldholme there are six houses and local roads at risk. At Kirkby Mills there are at least 21 houses, 6 commercial properties and local roads at risk.

5 Page 25, **7.1 Findings** 7.1.3 The flood mechanism at Kirkby Mills is connected with high flows in the River Dove backing up the Mill Race, which causes overflow at the lowest points. Recently this has been accompanied by surcharge from the 600mm diameter pipeline which discharges to the River Dove upstream of the A170 such that floodwater is often contaminated with sewage. High levels in the Mill Race cause backing up of road drains, all of which contribute to the accumulation of floodwater.

Water contaminated with sewage from the over flowing manhole at 21a Kirkby Mills

The Weir

Ownership and responsibility of the weir is ambiguous. Whilst the Environment Agency may be responsible for the flow of water the owner of the weir is responsible for the integrity of the structure itself.

Cllr Dowie suggested that the Kirkbymoorside History Group may have information regarding ownership of the weir as they have published details about previous repairs and these accounts should give some indication as to who the riparian owner is. Lisa Bolland agreed to contact the History Group.

Emily Mellalieu agreed to check the Land Registry records and Robin Derry agreed to make enquiries to determine the extent of the Environment Agency's responsibility.

Concern was expressed about the debris that gets caught on the weir and the deposits of silt and gravel which have affected the levels close to the sluice gates. It was evident that no maintenance has been carried out for some time as there is a large piece of tree trunk lodged on the weir and a small tree is growing in the accumulated silt. In addition silt has accumulated in the channel leading to the mill race sluice gate and very little water was flowing into the mill race It is necessary to establish who is responsible for clearing any obstructions of the watercourse and the information detailed in the Flood Risk Mapping Report denoted this responsibility to the Environment Agency. [6] [7] Chris Tinkler explained that he has cleared debris off the weir in the past but only when weather and water levels permit it with minimal personal risk. Since the covid-19 pandemic he has not done any clearing of debris as the risk of ending in hospital if injured has been the predominant factor. He has also occasionally removed the plants and trees growing on the weir edifice in the silt that is swept down to it in flood conditions, but does this only occasionally as he finds that he is nauseous after spending prolonged time on the weir.

The merit of clearing the silt deposits was discussed. Robin Derry said, from the point of view of the Environment Agency, removal of the deposits at this point, on the weir side of the sluice gate, is unlikely to impact the flow of water at the Mill Race. Furthermore, the Environment Agency has a responsibility for both the environment and flood management. When determining the extent of works appropriate to mitigate flood risk consideration of environment impact must be taken and any action must be accordingly sympathetic.

Returning to the paddock behind The Cornmill a cursory inspection of the non-return/single flow valve on the outlet pipe close to the A170 was made. Richard Marr and Cllr Holroyd suggested that the merit of the valve was not clear as it prevented egress of water from the pipe if the river was in full flow, resulting in the overflow of the manholes further up the pipes. It would be necessary to check with Yorkshire Water whether the valve can be removed or if there is an alternative mechanism that will better allow the flow of water into the river from the pipe.

6 Page 2, **1.3 Recommendations,** 1.3.2 The Environment Agency should review the planned maintenance activities for the River Dove because of the flood problems. This especially applies to tree management and clearance of gravel shoals.

7 Page 26, **7.2 Recommendations,** 7.2.2 The Environment Agency should review the planned maintenance activities for the River Dove. In particular tree management should ensure that the canopy is maintained well above flood level throughout Reaches 03 and 04. Trees which are in aprecarious state, and accumulations of gravel islands, should be removed.

With regards to the seepage of foul water into waterways, Emily Mellalieu and Richard Marr explained that there would be a permissive amount of foul water that can be channelled into rivers as a necessary alternative to foul water entering properties or overwhelming roadside drains and contaminating the streets.

Cllr Dowie suggested that the data from the water pump station downstream would be useful to ascertain how the river is affected during the periods of flooding. [89]Further enquiries will need to be made of Yorkshire Water as to how this data can be applied. Additionally Yorkshire Water should be asked to clarify the following:

a) the source of the outflow from all 3 pipes;

b) their purpose. i.e. are they there to deal with water in heavy rain conditions or do they discharge into the river at other times: and

c) if sewage enters the River Dove when it is at normal level.[10]

8 Page 2, **1.3 Recommendations**, 1.3.3 The Environment Agency should investigate the possibility of providing flood warnings to Keldholme and Kirkby Mills based on the relationship between the guage at Cherry Tree Farm, (on Hodge Beck) and the River Dove at Kirkby Mills, or use warnings triggeres from the (downstream) Kirkby Mills Guaging Station.

9 Page 25, **7.1 Findings**, 7.1.6 extract - Kirkby Mills Guaging Station has 30 years of records and lies within the Study Reach. The flood hydrology should therefore be very reliable.

10 Page 26, **7.1 Findings,** 7.1.12 This study is primarily concerned with flood defence. However, there are water quality issues at Kirkby Mills associated with licensed CSO discharges. Yorkshire Water are unlikely to address any of these matters, obviously of local concern, during the present phase in Asset Management Planning which runs until 2005 unless otherwise directed by the Environment Agency.

Extract from Flood Risk Mapping Studies Report 2002

Page 2:

1.3 Recommendations

1.3.1 Landowners adjacent to the River Dove and Mill Race should be made aware of their rights and responsibilities as riparian owners. They should be aware that there is a medium to high flood risk and need to be aware of the present information and warning systems provided by the Environment Agency. They are advised to make their own contingency plans, in case of flood alerts.

1.3.2 The Environment Agency should review the planned maintenance activities for the River Dove because of the flood problems. This especially applies to tree management and clearance of gravel shoals.

1.3.3 The Environment Agency should investigate the possibility of providing flood warnings to Keldholme and Kirkby Mills based on a relationship between the gauge at Cherry Tree Farm, (on Hodge Beck) and the River Dove at Kirkby Mills, or use of warnings triggered from the (downstream) Kirkby Mills Gauging Station.

1.3.4 The Environment Agency should consider inclusion of a capital flood defence scheme within the Long Term Plan at Keldholme and Kirkby Mills. Other partners in the scheme would probably include North Yorkshire County Council and Yorkshire Water. Discussions should be held with Yorkshire Water regarding possible modifications to the 600mm diameter pipe crossing on the Mill Race, which is currently causing a significant obstruction to flow.

1.3.5 The Environment Agency should continue to encourage appropriate use of SUDS to reduce the impact of development and climate change on flood risk. The Ryedale District Council Local Plan robustly addresses the problems of development and flood risk. This is endorsed.

1.3.6 Ryedale District Council emergency procedures and Major Incident Plans should include the possibility of flooding at Keldholme and Kirkby Mills. The residents should be informed of the services which the Council is able to offer in a flood emergency.

1.3.7 North Yorkshire County Council (Highways Division) should be encouraged to undertake interception and diversion works to prevent discharge into the Mill Race.

1.3.8 The detailed survey work and hydraulic modelling involved in further Section 105 survey and improved flood mapping could be used to underpin the maintenance regime and to help make progress towards an improved standard of service at Kirkby Mills and Keldholme. However, it is not recommended that a Phase 2 study be undertaken solely for the purposes of refining the floodplain outline.

Pages 25 – 26:

7 FINDINGS & RECOMMENDATIONS

This section aims to collate the information gathered, assesses the likely level and extent of flood risk and examines whether further studies would improve knowledge and flood risk planning and alleviation.

7.1 Findings

7.1.1 It is clear that the River Dove was placed on the Section 105 Schedule because of the recent flood history and the substantial number of properties affected. This study has revealed that there are two separate problem areas. At Keldholme there are six houses and local roads at risk. At Kirkby Mills there are at least 21 houses, 6 commercial properties and local roads at risk.

7.1.2 The full flood mechanism at Keldholme is not clear. Certainly some flooding below Keldholme Bridge, in particular Priory Cottage, arises from the River Dove. There is other evidence of flooding arising from roads and land above Keldholme following the extreme rainfall events in Autumn 2000 and August 2002.

7.1.3 The flood mechanism at Kirkby Mills is connected with high flows in the River Dove backing up the Mill Race, which causes overflow at the lowest points. Recently this has been accompanied by surcharge from the 600mm diameter pipeline which discharges to the River Dove upstream of the A170 such that floodwater is often contaminated with sewage. High levels in the Mill Race cause backing up of road drains, all of which contribute to the accumulation of floodwater.

7.1.4 It is likely that the road drainage problems are exacerbated by water rising above Swinehead Lane, which is now understood to be connected into the highway drainage system. Direct overflow of the Mill Race downstream of the A170 floods almost all the houses, the access road to Kirkby Mills Industrial Estate and potentially six commercial properties on the Estate.

7.1.5 Flood levels in the River Dove at Kirkby Mills are exacerbated by the constricted access bridge to Riverside Farm and the poor standard of channel maintenance. River flooding is often accompanied by surface run-off from the A170 road.

7.1.6 Flood estimates for this study have been based on methods recommended in the Flood Estimation Handbook. Kirkby Mills Gauging Station has 30 years of records and lies within the Study Reach. The flood hydrology should therefore be very reliable. The river flood hydrology does not help in explaining the flooding from surface water run-off since this is a function of catchment wetness. Furthermore, it does not predict the flooding caused by overloading of the road drainage systems. This could be caused by blockages with litter or silt, lack of maintenance or simply that the rainfall intensity in the event was greater than the drainage design standard.

7.1.7 The performance of the surface water, foul and highway drainage systems against high levels in the receiving watercourses can only be analysed by use of detailed hydraulic models of both the river system and the drainage systems.

7.1.8 The small communities of Keldholme and Kirkby Mills have grown recently, but there is no evidence from the Local Plan that further large scale development is likely. There is very little available in-fill land available. Nonetheless PPG25 recommends the use of appropriate Sustainable Urban Drainage Systems (SUDS) in any new developments and these should be incorporated into any future proposals. The Local Plan Deposit Draft

does show land liable to flood at Kirkby Mills, but not at Keldholme. The inset plans in the Deposit Draft could be improved by use of the 2001 Indicative Floodplain Mapping.

7.1.9 In flood emergencies Ryedale District Council does respond by provision of pumping plant and sandbags even when resources are stretched, as they were in November 2000.

7.1.10 There are no special flood warnings for Keldholme and Kirkby Mills. There is an NTS site at Cherry Tree Farm on the Hodge Beck (OS NGR SE 65150 90300), which is immediately adjacent to and west of the River Dove Catchment. In the absence of any river level alarms upstream of Keldholme, it ought to be possible to relate the response at Cherry Tree Farm to that at Kirkby Mills Gauging Station. This should provide a reliable prediction although the target lead time[8] of two hours may be unachievable because of the steepness of these catchments. It may also be possible to use the Kirkby Mills Gauging Station as a trigger station for the villages although, as this station is downstream of the affected areas, achievement of a 2-hour lead time would be problematic.

7.1.11 The 2001 IFM does encompass all the houses identified in this study as being at risk of flooding. It also includes some areas of housing which may be above flood levels. The problems in Keldholme and Kirkby Mills involve different mechanisms, including surface run-off, foul, surface water road drainage combined with river flooding. There are no sound reasons to alter the present flood outline, based on the findings of the simple visual examination undertaken for this study.

7.1.12 This study is primarily concerned with flood defence. However, there are water quality issues at Kirkby Mills associated with licensed CSO discharges. Yorkshire Water are unlikely to address any of these matters, obviously of local concern, during the present phase in

[8] Flood Warning Service Strategy for England and Wales, Environment Agency, September 1999

7.2 Recommendations

Environment Agency

7.2.1 Landowners adjacent to the watercourses should be made aware of their rights and responsibilities as riparian owners.

7.2.2 The Environment Agency should review the planned maintenance activities for the River Dove. In particular tree management should ensure that the canopy is maintained well above flood level throughout Reaches 03 and 04. Trees which are in a precarious state, and accumulations of gravel islands, should be removed.

7.2.3 Residents should be aware that there is a Medium to High flood risk from the watercourses (as defined by the Environment Agency[9]). They should be aware of the present information and warning systems provided by the Environment Agency and advised to make their own contingency plans, in case of flood alerts.

7.2.4 Since the number of properties at risk is in the order of 30 (Medium Numbers) and the chance of flooding is Medium to High some improvement in direct flood warnings to Keldholme and Kirkby Mills may be justified. As a minimum, use of the relationship between Hodge Beck and the River Dove for flood warning purposes should be investigated

7.2.5 The Agency should continue to encourage appropriate use of SUDS through the planning process to prevent increase in run-off through development within the catchment.

7.2.6 The Environment Agency should consider inclusion of a capital scheme in the Long Term Plan to reduce the flood risks in Kirkby Mills and Keldholme. This should take account of different parties who have an interest, including Yorkshire Water and North Yorkshire County Council (Highways Division).

7.2.7 The Environment Agency should reconsider whether the flood problems in Kirkby Mills require a review of YWS's present Asset Management Plan. In particular, the 600mm pipe crossing of the Mill Race at the Corn Mill Access is an obstruction to flow. Under normal circumstances, under Sections 109 and 110 of the Water Resources Act 1991, illegal obstructions can be removed by the Agency, costs recovered and the culprit charged with a criminal offence. It is therefore recommended that discussions with YWS regarding this pipe crossing are initiated.

Ryedale District Council

7.2.8 The Council should maintain and rehearse their emergency response procedures to take account of the possibility of flooding at Keldholme and Kirkby Mills. Both areas should be included in the Major Incident Plans.

7.2.9 The Council should inform residents of the service they are able to give residents in a flood emergency.

7.2.10 It is recommended that the policy on Development and Flood Risk in the final adopted version of The Local Plan be endorsed. In the River Dove catchment generally, the use of SUDS will prevent the effects of future development contributing to flood problems elsewhere within the River Derwent catchment.

North Yorkshire County Council (Highways Division)

7.2.11 It is recommended that the proposal to improve road drainage, by interception and diversion to below the Mill Race, be encouraged.

Subsequent to the meeting additional information has been made available:

The Weir

Below is a document provided by Chris Tinkler from when Peter Boocock was selling The Cornmill on to Jeff Lee stating that when the previous weir collapsed in 1990 he paid £5,000.00 towards its replacement with 'the Council' also contributing £5,000.00. It is presumed that 'the Council' refers to NYCC as when Chris Tinkler contacted Ryedale District Council a few years ago about needing to make repairs to the weir, he received a response stating that the District Council had not paid anything and accepted no liability.

With regards to ownership/responsibility of the river the enquiries refer to a statement by Peter Boocock that he owned the Mill Race and, concerning the river from the weir to the A170 "there is nothing to disturb the presumption that the respective riparian owners own the riverbed half and half" (being The Cornmill and Mr, Dowson). Nothing was stated about ownership of the river above the weir.

ADDITIONAL ENQUIRIES

RE: MILL HOUSE AND MILL, KIRBY MILLS, KIRBYMOORESIDE, YORK

1. We understand that the weir between the mill race and river was rebuilt about ten years ago. Did Mr. Boocock have to contribute to these costs and if so, how much and on what basis?	1. The re-building took place in 1990. Mr. Boocock paid £5,000.00 towards the cost and the Council provided £5,000.00.
2. You have supplied a copy of two Council Orders relating to the mill race. Please specifically confirm that Mr. Boocock owns the mill race and let us know who is responsible for maintaining the retained walls of the two properties on the far side of the mill race.	2. The Sellers do own the mill race (please see the Declaration in the Court Order dated 31st January 1992). The retained walls were re-built by the adjoining owners two years ago.
3. Who is responsible for maintaining the sluice gate? Our clients' survey suggests it is not in full working order. Is this correct? If it is not in working order is Mr. Boocock prepared to carry out the necessary maintenance prior to completion?	3. The sluice gate was constructed in 1990 and Mr. Boocock says it is in perfect working order.
4. Are there are any fishing rights on the mill race or the river and if so, who exercises these?	4. Nobody other than the Sellers exercises any such rights.
5. Who owns the river?	5. As far as Mr. Boocock is aware, there is nothing to disturb the presumption that the respective riparian owners own the riverbed half and half.
6. Please produce title to the access between the cottages coloured yellow on the Contract plan.	6. Please see the exception and reservation contained in clause 2 (b) of the Conveyance dated 15th December 1981 to Mr. & Mrs. J. Farrow.
7. We understand there is shared access with Mill Cottage. Who owns the driveway and are there any expressed easements or arrangements for maintenance?	7. Mr. Boocock is looking into this query and we will reply to it in due course.
8. We are instructed that there is a gate from the bypass into the paddock. Who owns the verge between the main road and the paddock and are there any rights of access	8. The Sellers do not claim ownership of the verge and believe it to be part of the highway.

Prof. Roger Jackson is a retired forensic mathematician and Kirkby Mills resident of over 20 years. He has conducted a mathematical flow exercise and compiled a Flood Risk Assessment Report for the River Dove at Kirkby Mills.

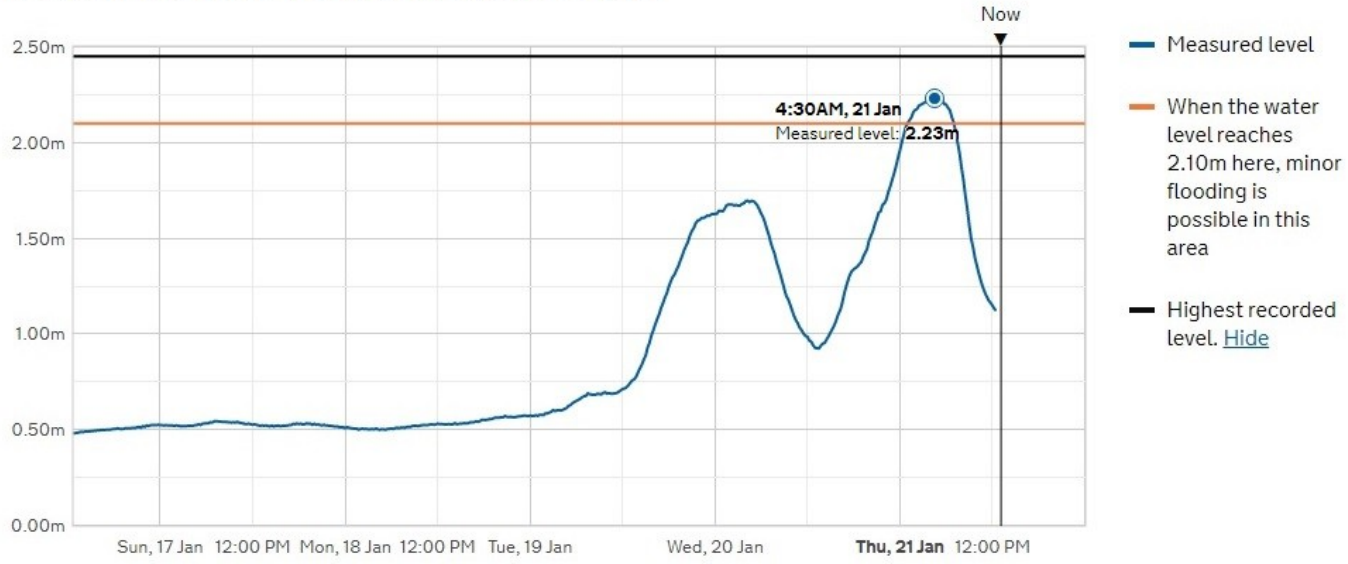
River levels recorded at Kirkby Mills in January 2021:

River Dove at Kirkby Mills

Check for flood warnings in this area

Latest recorded level **1.12m** at **12:30pm Thursday 21 January 2021**.

River levels at this location in the last 5 days



Flood Risk Assessment for Kirkby Mills

Overview

This assessment has been carried out by Prof. Roger Jackson, who is a forensic mathematician with extensive experience in mathematical modelling over a thirty year period with AMR research. The modelling contained in this assessment benefits from an unusually large amount of empirical data which has resulted from the author being a resident of Kirkby Mills for over twenty years. Although the modelling procedure is complicated, an attempt has been made to provide the results in a clear and concise form which can be understood by those who do not have specialised knowledge.

Flooding History and Prognosis

Kirkby Mills has a long history of flooding. The pattern of flooding has changed due to intervention, with the building of the weir to the north of Kirkby Mills and the pumping station to the south. Whilst there has been flood alleviation work on other rivers in the area, we have been unable to find any documented works which have affected the River Dove catchment area.

During the last twenty five years, which is the period where more detailed information is available, there have been a number of severe flood events, resulting in damage to property. In addition, there have been many occasions when the mill stream flow has been reversed by the increased levels in the River Dove, causing a near flood. These incidents have doubled in the second half of the period. These findings are in accordance with the forecast for more extreme weather events due to global warming and would indicate that the frequency and severity of flooding in Kirkby Mills is likely to worsen over the next twenty five years.

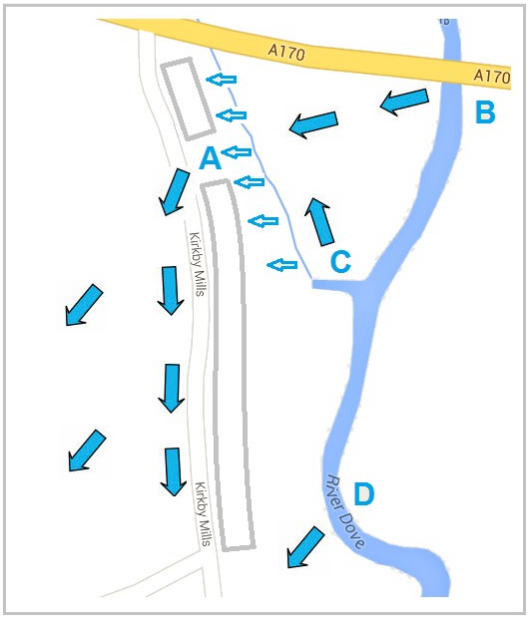
The Flood Event Model

The catchment area for the River Dove is relatively small. At the onset of rain, water enters the watercourse quickly and takes 4.5 hours to reach Kirkby Mills, thus the flood peak occurs 4.5 hours after the rain stops. The rate of fall of the water levels varies with the saturation of the ground, which is in turn linked to the duration of the rainfall. The flow is able to deal with continuous light rain, but as the rainfall increases, there reaches a critical point at which the river level begins to rise. The model takes into consideration the amount of rainfall and also the length of time during which it falls. The model also incorporates the escape pattern of water, in and downstream from Kirkby Mills and is able to calculate flood flows and heights.

Pattern of Flood Events

Reference is made in this section to the Flood Flow Map.

Flood Flow Map - Kirkby Mills



At the onset of flooding, the level of water in the River Dove is rising faster than that in the mill stream. Once the river level at point “C” on the plan becomes higher than that of the mill stream, the flow is reversed in the mill stream and water flows back towards point “A”. The level of water in the mill stream now rises at the same rate as the river.

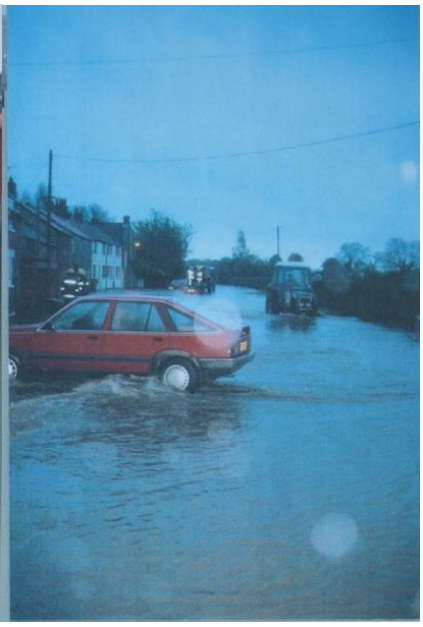
If the level continues to rise, the mill stream over-tops the bank nearest the houses and initially at a point adjacent to Number 10, which has historically suffered the worst and most frequent flooding. The river also breaks the bank at point “D”, flooding the lower portion of road.

As the level rises further, the mill stream over-tops the nearside bank along the line of houses and water begins to flow through the gap at point “A” and continues down the road and into the field opposite the houses.

If the levels continue to rise, the River Dove breaks it’s bank at point “B” and water flows across to point “A” and increases the flow through the gap..

Case Study

The following photographs show such a flood event in the year 2000.



Water can clearly be seen flowing through the gap “A” on the plan and escaping down the street and into the field across from the houses. We have calculated that, at the peak of the flood, in excess of 1000 cubic metres of water per minute were flowing through the gap. None of the houses suffered ingress of water through the front door, but the pressure of water to the rear of the properties built up to a height of over 600mm in places.

Summary

Any works which result in additional water being discharged into the mill stream, or the River Dove, to the north of the A170 will result in more frequent and severe flood events to the domestic properties in Kirkby Mills and to the properties on the Kirkby Mills Trading Estate. The occasions when the trading estate is isolated due to flood water at point D on the plan would also increase.

18/04/2021