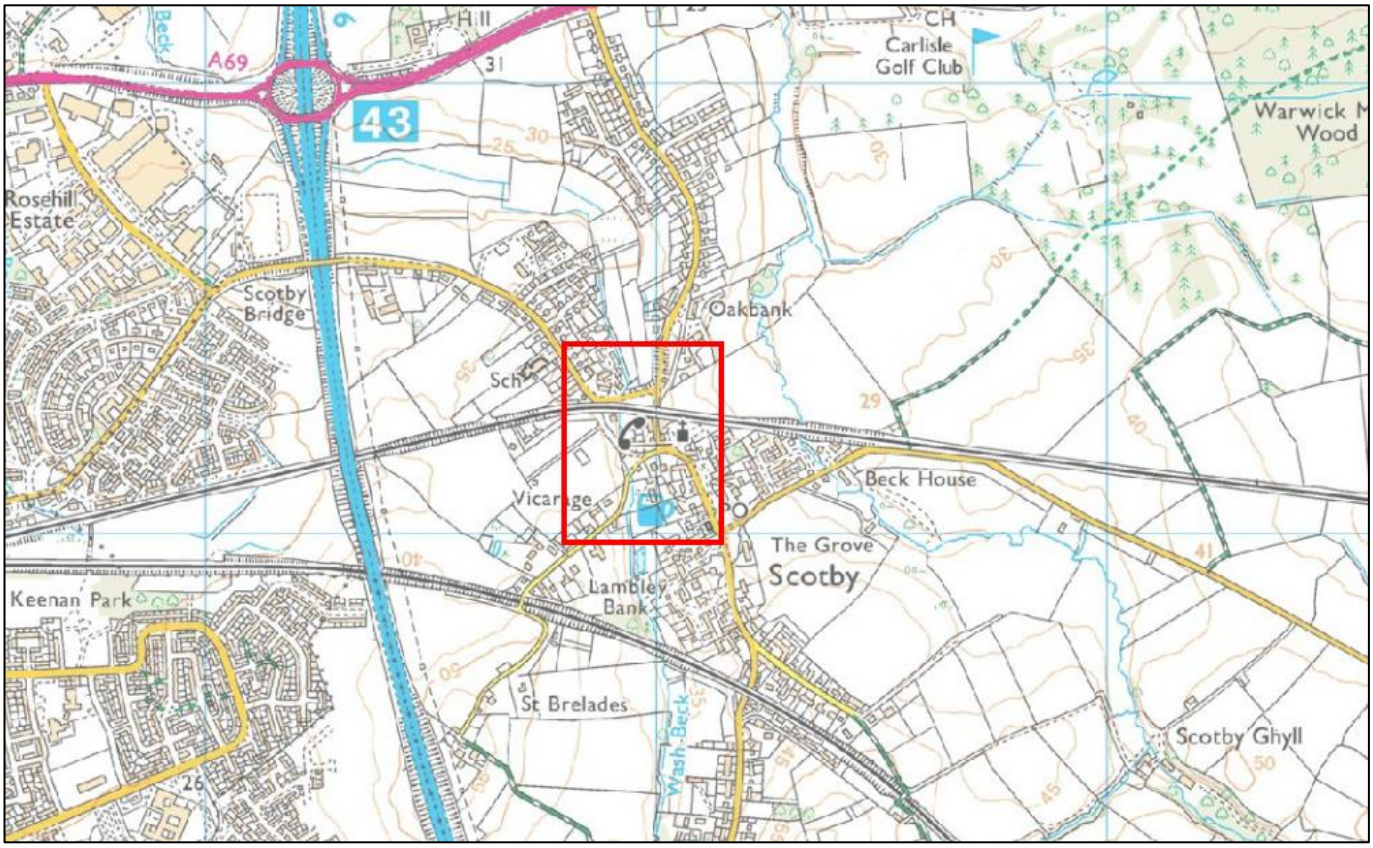
Cumberland Council

Kates Beck Lane, Scotby

Flood Investigation Report No.CC1



Flood Event 23 May 2024

This flood investigation report has been produced by Cumberland Council as a Lead Local Flood Authority under Section 19 of the Flood and Water Management Act 2010.

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1. Executive Summary

Exceptionally wet weather was experienced across parts of England, North Wales, southern and eastern Scotland between the 21st and 23rd May 2024. A slow-moving weather front associated with a low pressure in the North Sea resulted in 50mm of rain over a wide area of northwestern England with 75mm to 100mm experienced in the worst affected locations. On the 22nd May northern England recorded its wettest spring day since 1891, with many stations recording their wettest May day on record.

High rainfall totals in small, agricultural catchments that do not generally experience such high rainfall totals meant that rivers and watercourses rose quickly, with very little warning in some instances. Over 100 properties in and around the Carlisle area were flooded internally during the event and the Section 19 reports investigate the flood event, considers the causes and makes recommendations for further actions.

Cumberland Council as the Lead Local Flood Authority has prepared this report with the assistance of other Flood Risk Management Authorities (FRMA) as it considers necessary to do so under Section 19 of the Flood and Water Management Act 2010.

Any additional information that residents and others can provide to the Environment Agency and Cumberland Council to help develop our understanding of the flooding is welcomed. Information has already been provided, much of which has been used to inform this report. Any additional information should be provided to **lfrm@cumberland.gov.uk.**

1.1 The Flood Investigation Report

Under Section 19 of the Flood and Water Management Act (2010) Cumberland Council, as Lead Local Flood Authority (LLFA), has a statutory duty to produce Flood Investigation Reports for areas affected by flooding. Section 19 of the Flood and Water Management 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,*
    b. *whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.*

2) *Where an authority carries out an investigation under subsection (1) it must –*
    a. *publish the results of its investigation, and*
    b. *notify any relevant risk management authorities.*

This section of the Act leaves the determination of the 'extent' of flood investigation to the LLFA. It is not practical or realistic for Cumberland Council to carry out a detailed investigation into every flood incident that occurs in the County, but every incident with basic details will be recorded by the LLFA. Only those with 5 or more properties/businesses involved will have investigations published.

An investigation will be carried out, and a report prepared and published by the LLFA when the flooding impacts meet the following criteria:

- Where there is ambiguity surrounding the source or responsibility of flood incident
- Internal flooding of one property that has been experienced on more than one occasion
- Internal flooding of five properties has been experienced during one single flood incident
- There is a risk to life as a result of flooding.

As a flood Risk Management Authority (RMA), the Environment Agency have partnered with the Cumberland Council to produce this flood investigation report.

1.2 Scope of this report

This Flood Investigation Report **is**:

- An investigation on the what, when, why, and how the flooding took place resulting from the 22nd to 23rd May 2024.
- A means of identifying potential recommendations for actions to minimise the risk or impact of future flooding.

This Flood Investigation Report **does not**:

- Interpret observations and measurements resulting from this flooding event. (Interpretation will be undertaken as part of any subsequent reports).
- Provide a complete description of what happens next.

The Flood Investigation Reports outline recommendations and actions that various organisations and authorities can do to minimise flood risk in affected areas. Once agreed, the reports can be used by communities and agencies as the basis for developing future plans to help make areas more resilient to flooding in the future.

2. Event Background

This section describes the location of the flood incident and provides details on the rainfall event that occurred at the time.

2.1 Background

The month of May 2024 was relatively dry prior to the event. From the 1st to the 21st May, the north-west region received 46 mm of rainfall which represents 62% of the long term average monthly rainfall for May. Local rain gauges suggest there was no rainfall from 15th May to the 22nd May, and therefore catchment conditions would not have been unusually wet at the start of the event.

The majority of the heavy rainfall associated with this event fell between 21st and 23rd May 2024, (figure 2). Rainfall on 21st May was focused across central England and East Anglia, with 20-30mm falling widely and over 50mm falling in the wettest locations. On 22nd May, the main rain-bearing front tracked north with the focus of the rain across North Wales, much of northern England, southern and eastern Scotland, with over 50mm falling widely.

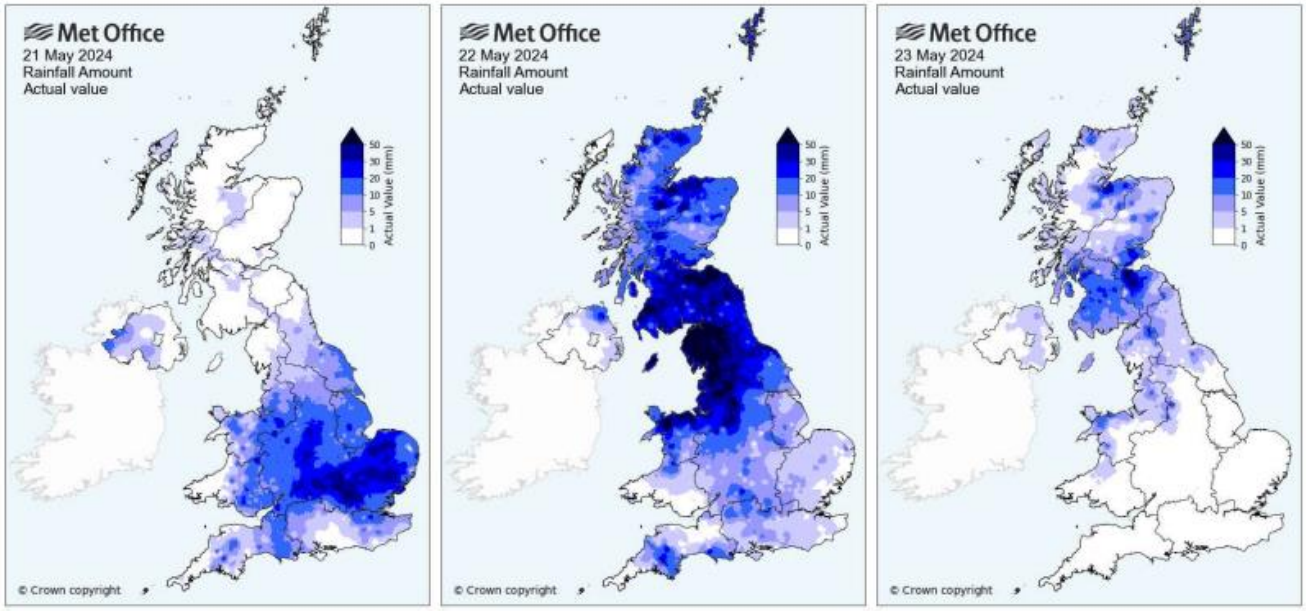

Figure 1: Met Office Rainfall amounts

2.2 Rainfall event

On Wednesday 22nd May to Thursday 23rd May 2024 locations in North-West England experienced heavy rainfall resulting from a slow-moving low-pressure system moving across England and Wales. Rain fell consistently from the morning of 22nd May until the afternoon of 23rd May, with the heaviest totals between 5pm on 22nd May and 2am on 23rd May. 24-hour rainfall totals exceeded 100 mm at several rain gauge sites, approximately twice the long-term average rainfall for the month of May.

The measured total rainfall over a 12 hour period was up to 100mm in the northern fell areas south of Carlisle, equivalent to a 1 in 300 year storm at its peak. The intense and localised

nature of the event meant that the catchments were quick to react and the watercourses rose quickly to unprecedented levels in some locations.

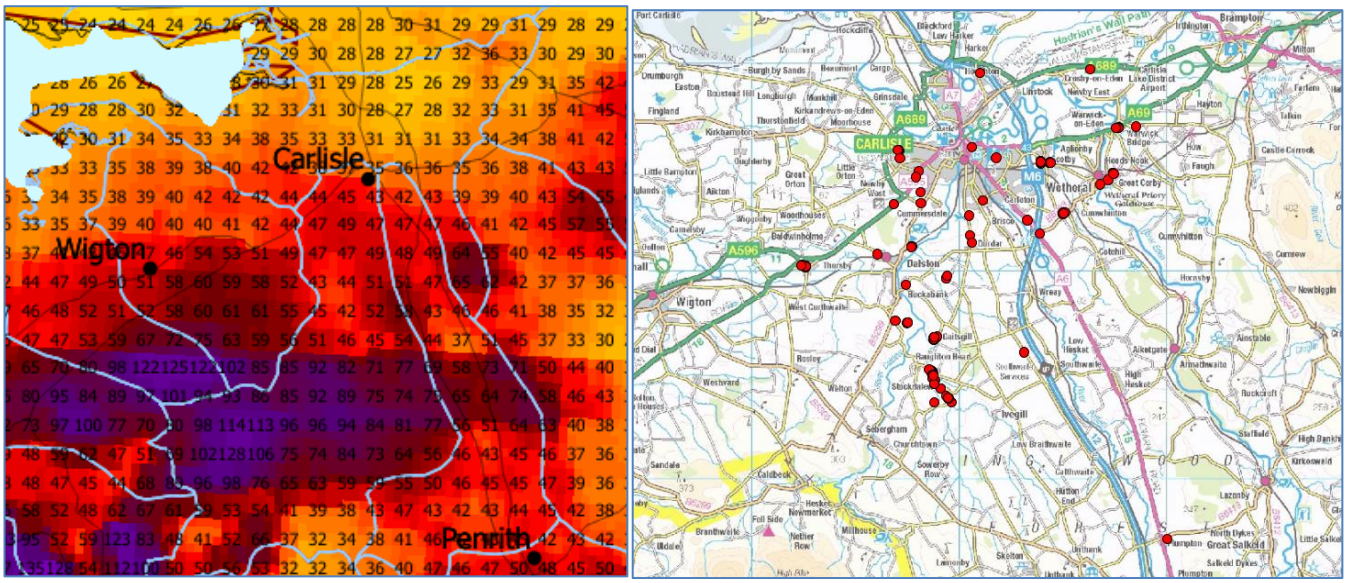

Figure 2. 24 hr rainfall totals and flooded properties from this event

The sheer volume of water in the watercourses and on roads overwhelmed the hydraulic capacity and the riverbanks were breached and roads flooded in many locations, with very little warning in some instances. Over 100 properties in and around the Carlisle area were flooded internally during the event and these reports investigate the rainfall event, the causes and makes recommendations for further actions.

2.3 River levels

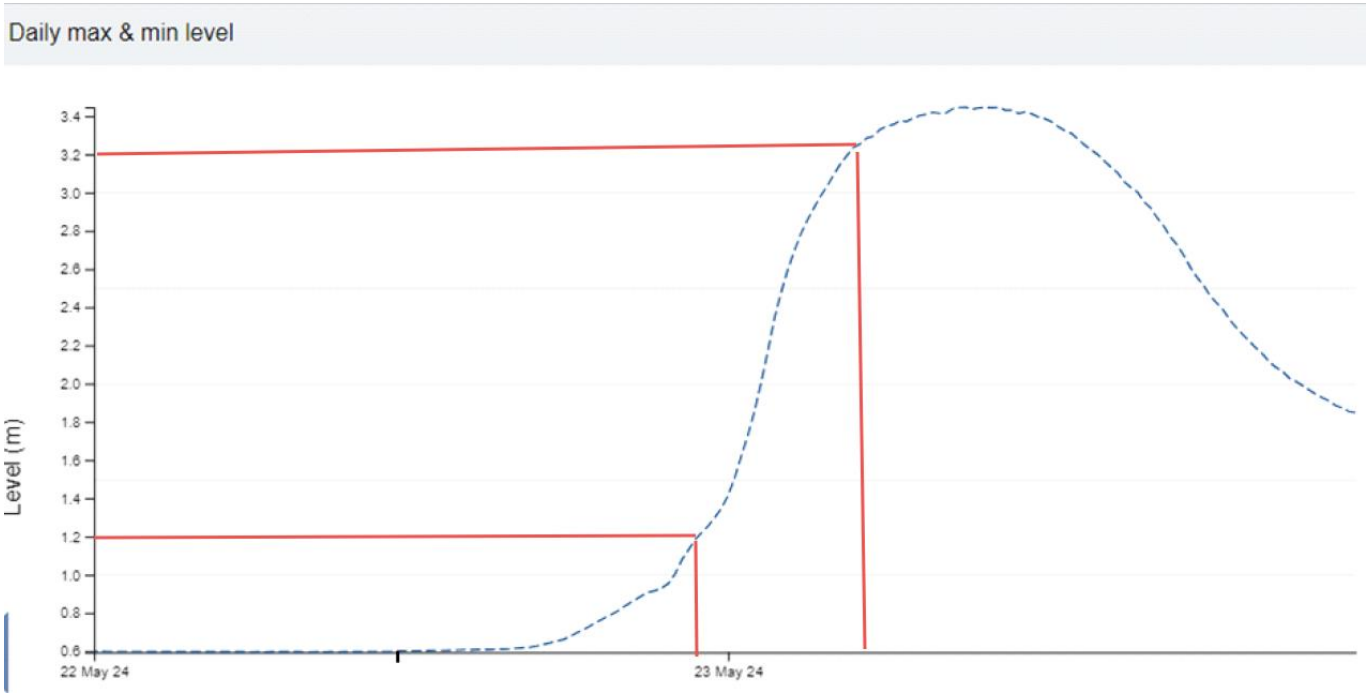

Figure 3. River Level in Eden downstream of Great Corby (nearest river level monitoring station) Note: River level rose 2m in 6hrs from 22.00 – 04.00

2.4 Local weather station records

Brampton Weather Station, Cumbria UK Met Office No 7076		Latitude: N 54° 56' 06" | Longitude: W 02° 44' 04" | Altitude: 117 m
Rainfall		
High Hourly Rainfall	8.1 mm	at 18:29 on 22 May 2024
High Daily Rainfall	66.7 mm	on 22 May 2024

Figure 4. All-time records from the Brampton Weather Station (since 01/01/2012)

From the above records it is apparent that this rainfall event was extreme and broke several records. The analysis shows that it was approximately a 1:300 year (0.33 AEP) event. As such, an event having a recurrence interval, or likelihood of occurring in any single year will be 0.33%. Therefore, it is not surprising that houses that have never flooded before were impacted during this event as well as those within mapped flood risk areas (fluvial and pluvial sources as shown below in Figures 7 and 8).

2.5 Theoretical Flood Risk as Indicated by EA Modelling and Mapping

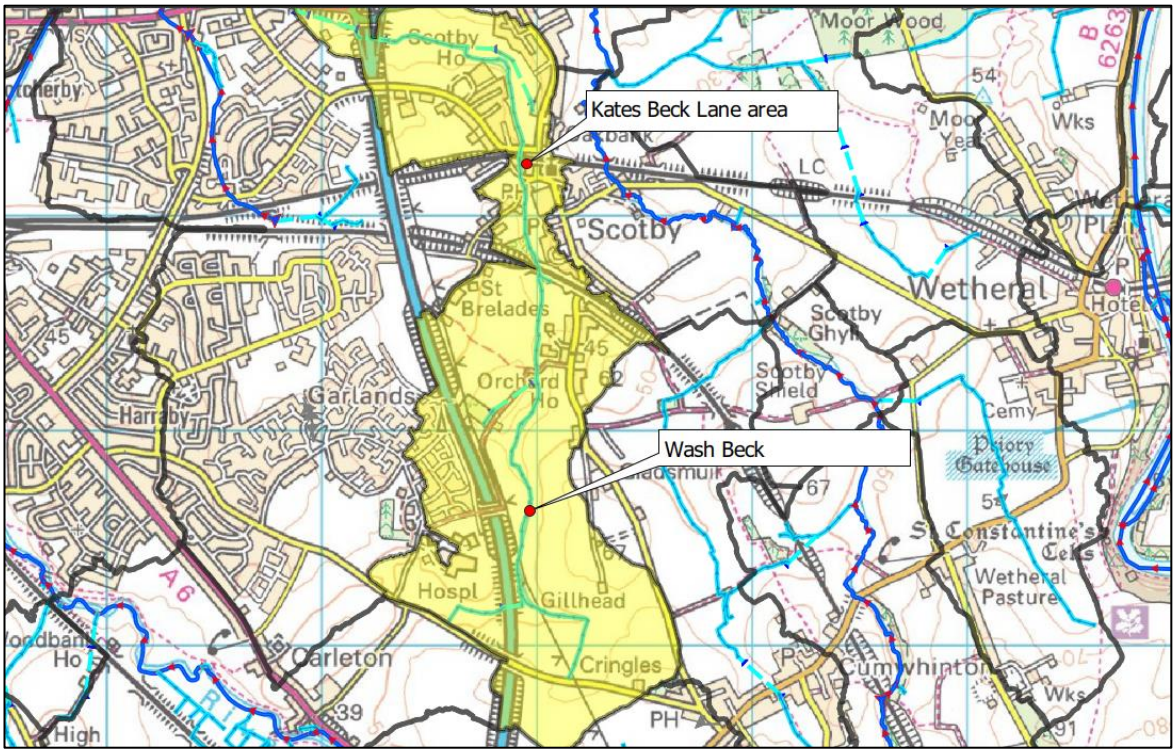

Figure 5 – Wash Beck catchment

This part of Scotby lies on the Ordinary Watercourse Wash Beck. Wash Beck catchment extends southwards to Cumwhinton Road

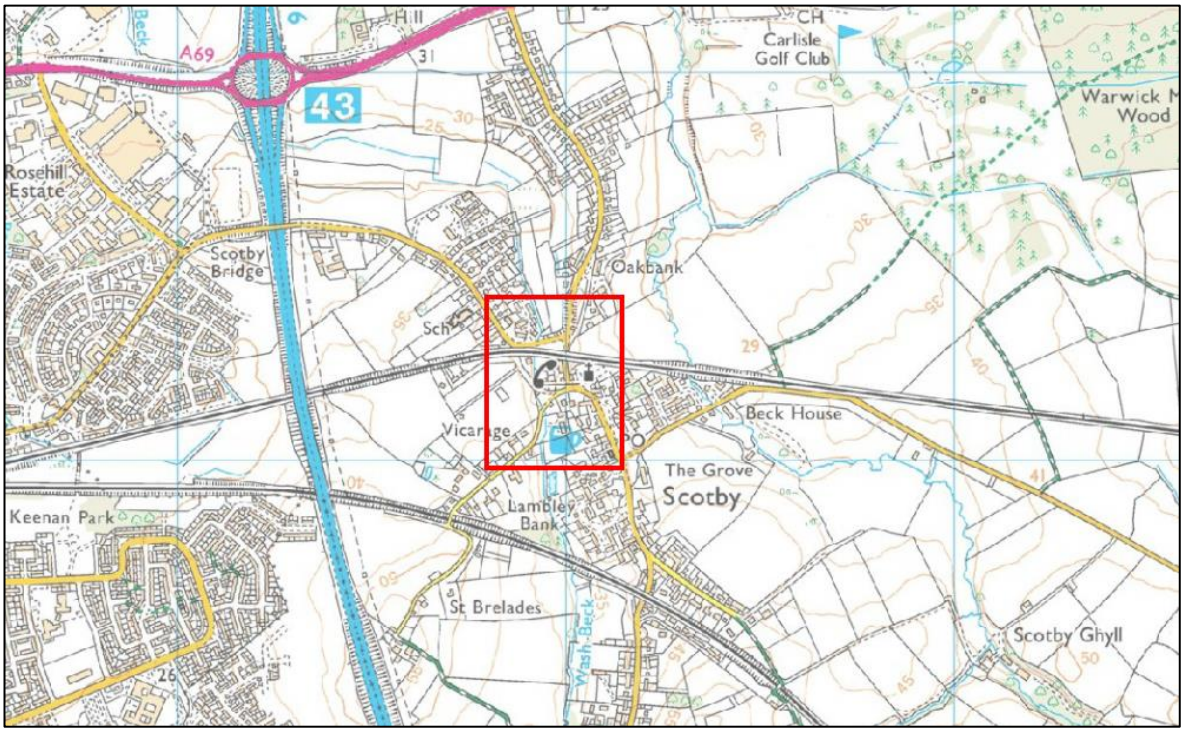

Figure 6. Location Plan showing study area

2.5.1 Fluvial (River flood risk)

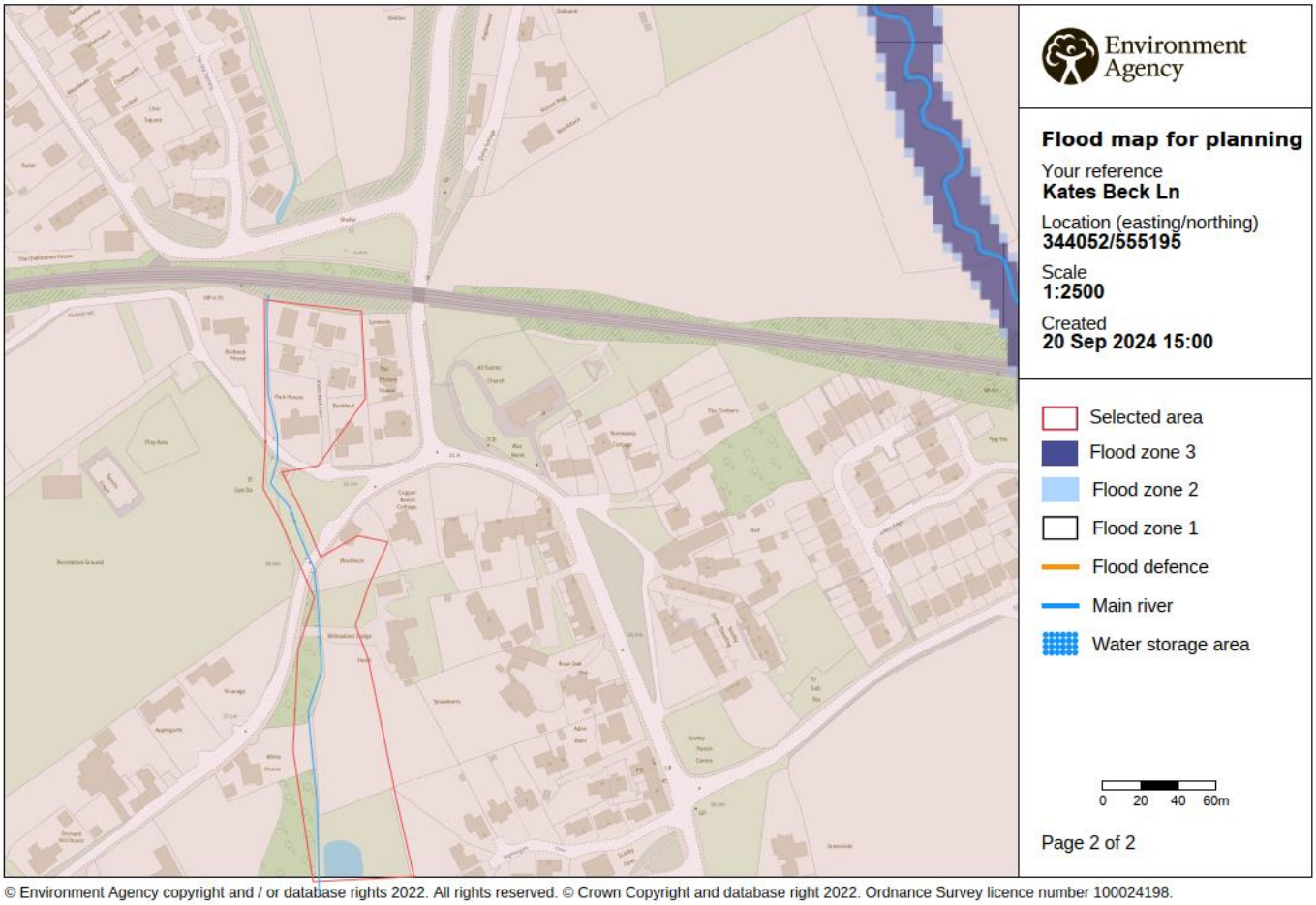

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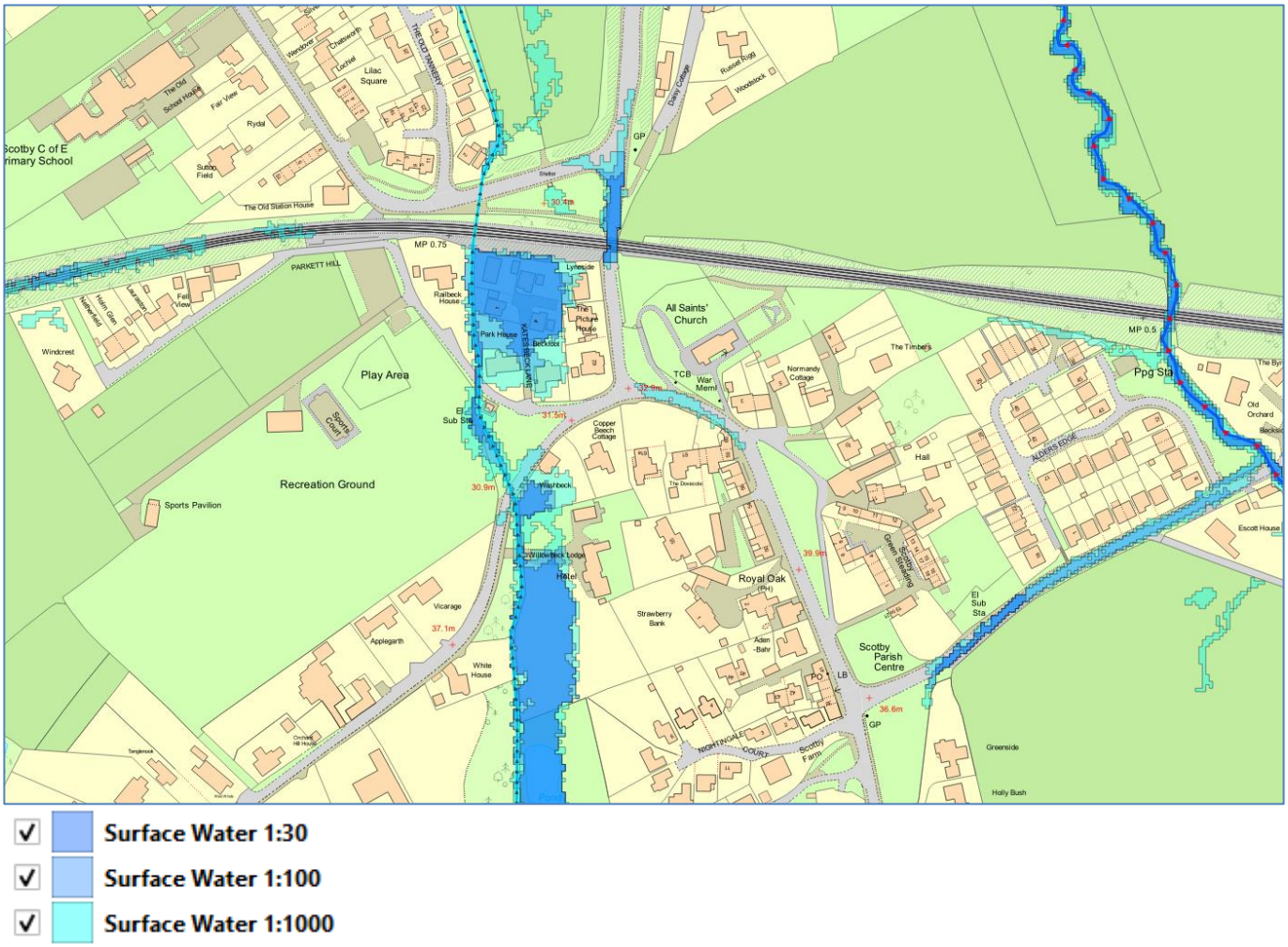
Figure 7 – Risk of Fluvial Flooding

The study area adjacent to Wash Beck as shown in the above Figure 7, is shown to be in Flood Zone 1 (not shaded) – i.e.very low risk of fluvial or tidal flooding (or a Low Probability – i.e. has an annual probability of flooding from rivers or sea less than 0.1%. However, this information is not specific to a property and should be used as a course tool to assess the flood risk to an area in general. The lack of any fluvial flood risk in this catchment from Wash Beck is likely to be down to the lack of fluvial flood modelling on minor watercourses. Instead, the surface water flood risk based on LiDAR topography provides a good approximation of fluvial flooding extents especially in rapid, or small catchments like this.

2.5.2 Surface Water Flood Risk Map



Surface Water 1:30

Surface Water 1:100

Surface Water 1:1000

Figure 8 - EA Surface Water risk of flooding

The study area adjacent to Wash Beck south of the Newcastle railway line is shown to be predominantly in a 'High Risk' area, meaning that this area has a chance of flooding of greater than 1 in 30 (3.3%) each year. Kates Beck Lane is in a localised depression adjacent to the river and slopes down from Parkett Hill. The lower lying land of the cul-de-sac is in a 'High Risk' area and the higher land towards the road in a 'Low Risk' area. The 'High Risk' area at the bottom of the plan is the large pond at the Willowbeck Lodge Hotel.

The areas are based on LIDAR analysis of the pre-development site area but correlates well with the reported flood outline shown in Figure 9 below which indicates that the flood event is more extensive than the 1 in 100 event but not as much as the 1 in1000 outline.

3. Investigation

This investigation has been compiled by the LLFA using information collected on the ground after the event, residents accounts, where available, and a post-flood event desk-top study. Whilst every effort has been made to establish the precise flow routes and flood mechanisms, the event occurred in the middle of the night and, with some areas not visible from the affected properties, it is not possible to say this is a definitive picture of exactly what happened.

3.1 Flow Routes and mechanisms

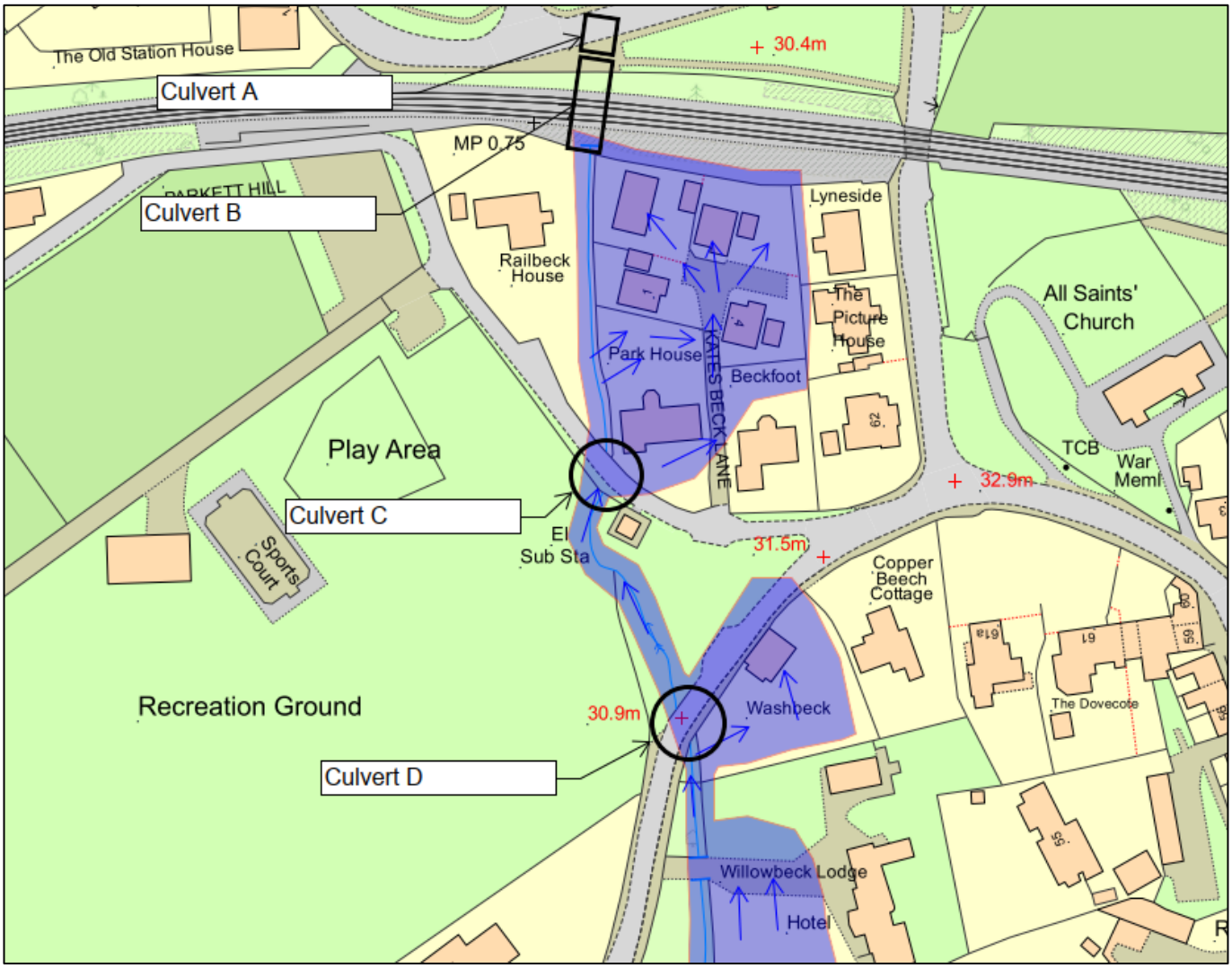


Figure 9. Diagram of flood water flow routes and flooded area and location of culverts on Wash Beck

The purple shaded area represents flood extent at the peak (circa 08.00 on Thursday 23 May 2024 as reported by residents). This area correlates well with the Surface Water Flood Risk map. The blue arrows show the observed flow routes.

The arrows show the flow route from Wash Beck into the gardens (of Park House primarily), then onto the roads and driveways, gradually rising before receding and draining down via the

surface water drainage system into the existing culvert under the railway. The water entered the cul-de-sac at 05.15, peaked at 08.00 and receded from the property at 12.00 noon. It has been reported that the water receded over the late morning and afternoon and was all gone by 15.00.

3.2 Impact of the flood event

From the information we have gathered we understand that six residential properties suffered internal flooding from this flood event linked to Wash Beck. Adjacent roads also flooded.

The rapid onset of the flooding along with the fact that it occurred overnight and had not been forecast the previous day meant that many residents were unable to take measures to protect their property (such as moving cars or furniture etc).

The fire service was called in the early hours of Thursday 23rd May by residents to provide assistance with pumping water from the flooded area. The fire service did attend with a tender but informed the residents that the influx of water from the river was far in excess of what could be pumped and that there was also nowhere to pump the water to.

3.3 Photographs after the flood

Image 1. Wash Beck in the grounds of Railbeck House showing the fence to Park House where the river overtopped its banks and flowed through the fence into the garden.

Image 2. The garden of Park House where Wash Beck came through (sand deposits indicate point of entry).

3.4 Surface Water Drainage System in Kates Beck Lane

The surface water drainage system consists of carrier drains, channel drains, a geo-cellular tank and flow control chamber discharging into an existing culvert under the railway.

The SW drainage system in Kates Beck Lane is maintained (by a private management company) and it is understood that it has always worked as designed with no previous flooding events. From observed accounts on this flood occasion, the flood water receded fairly rapidly (all water gone by 2pm on the 23rd).

3.5 Flooding History

There is no history of property flooding in the study area that he LLFA is aware of, but some of the houses were only built relatively recently with the newest four properties in Kates Beck Lane built in 2020/21. There are anecdotal records of the site and adjacent roads flooding pre-development (no dates or details available).

3.6 Likely Causes of Flooding

Exceedance of Wash Beck is considered by the LLFA to be the prime cause of flooding in this area. It is considered that the volume of water during the flood peak exceeded the railway culverts hydraulic capacity and backed up along the river channel, eventually forced to surcharge the riverbank on the lower lying east side of the river. The capacity and condition of the various culverts could be a contributory factor to capacity, and these have been investigated.

3.6.1 Culvert A – 1.3m diameter concrete pipe under Park Road.

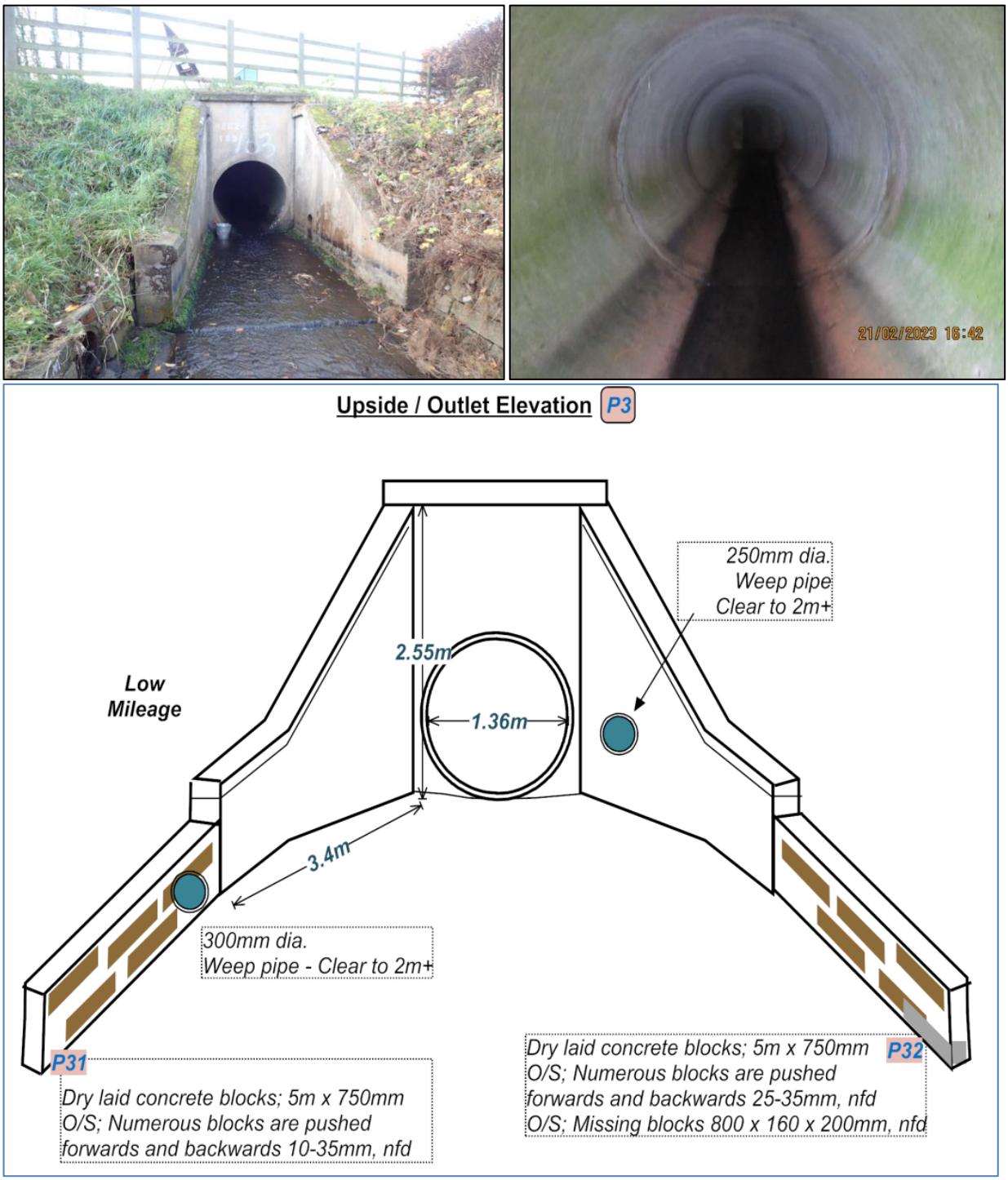


Image 3. Downstream headwall outlet under Park Road (from the 2023 CCTV survey - No blockages or damage was observed during the inspection).

3.6.2 Railway Culvert B

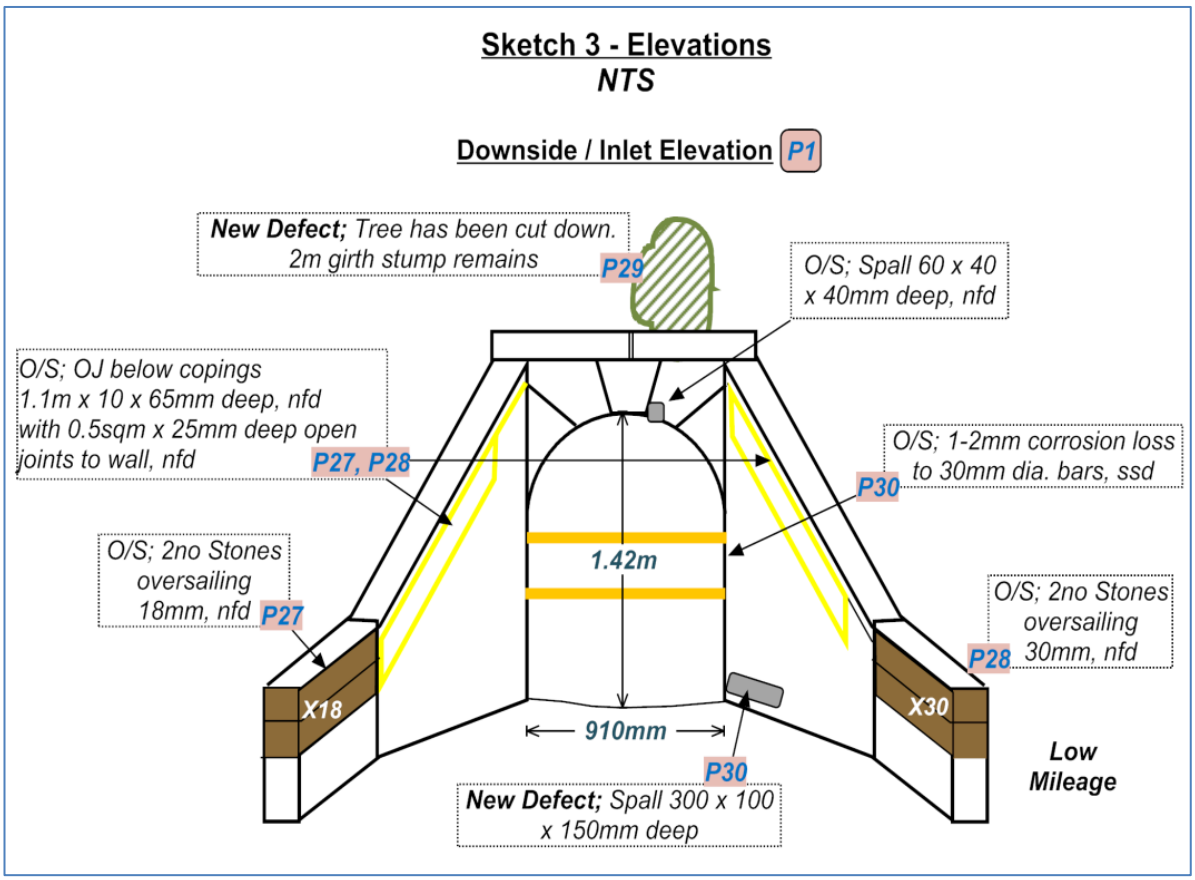


Image 4. Upstream headwall between No. 2 Kates Beck Lane and Railbeck House.

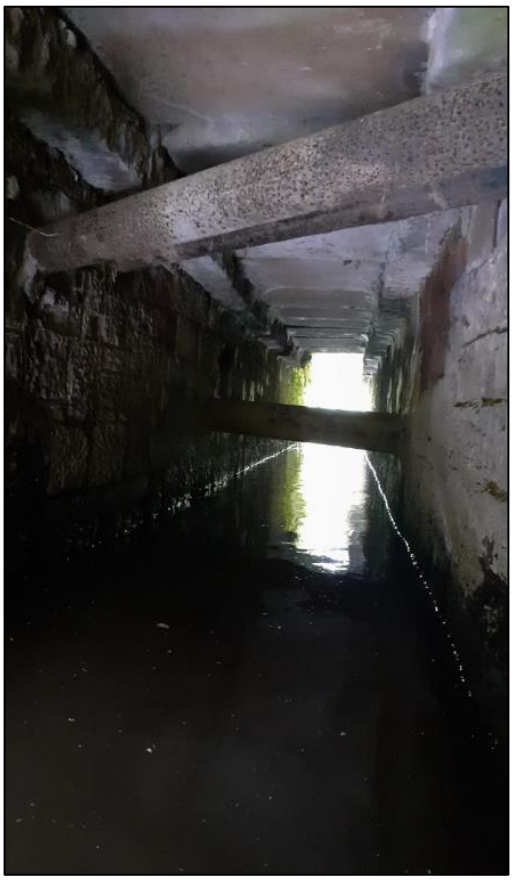
Image 5. Upstream headwall between No. 2 Kates Beck Lane and Railbeck House.

Image 6. Upstream of railway showing Wash Beck with Kates Beck Lane to the left (under construction) and Railbeck House to the right.

Image 7. Concrete slab middle section (1.4m high x 0.9m wide). Note service intrusions.

3.6.3 Parkett Hill Bridge C

Image 8. Upstream headwall to Parkett Hill culvert during construction in 2011.



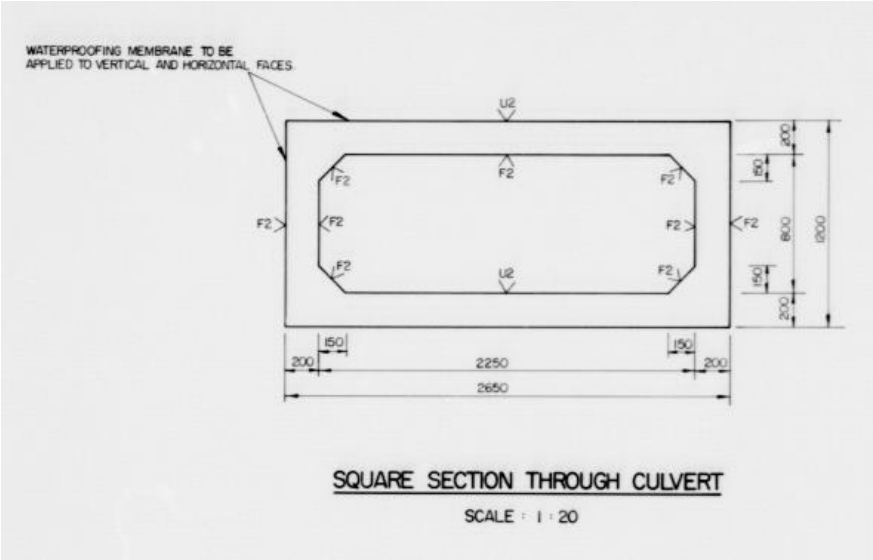
Images 9 and 10 - inside the Parkett Hill culvert

Parkett Hill Culvert Notes:

1. Culvert is 0.95m wide and 1.3m high (internal)
2. upstream grille has been removed
3. Service intrusions (these are not considered to have a material impact on flow)
4. The culvert has recently been cleaned
5. The culvert walls and soffit are in good condition

3.6.4 Bridge (culvert) D under Lambley Bank

[internal dimensions 2250mm x 800mm]



This culvert was last inspected on 21/02/23. Due to the restricted height of the structure the Highway Authority was unable to inspect this bridge internally on this occasion, but no blockages were observed. Note build-up of silt and bed material reducing overall height.

Image 11. Upstream end of Lambley Bank Culvert with garden to Washbeck to the right.

3.6.5 Bridges and Culverts Conclusion

Without a full and detailed hydraulic model of Washbeck and its catchment, it is not possible to determine an empirical conclusion on the exact impact any of these structures had on the flood event. Such a model would be prohibitively costly and due to the short storm duration, small catchment any results are likely to be unreliable.

3.7 Main Causes of Flooding

Taking into account the unprecedented rainfall event, facts gathered from the site visit, LiDAR analysis of levels and the event and flood mapping, the LLFA are satisfied that the main cause of flood exceedance into Kates Beck Lane was due to overwhelming of the culvert capacity under the railway and Park Road. This is likely to have been only for a relatively short time but during that time the water had no option but to back-up, over-top the riverbank and then flow into lower lying ground.

The maintenance of the railway culvert and road culvert further downstream) is well managed and there is no evidence that the capacity of the culvert was materially reduced due to blockages or build-up of debris etc. at the time of this flood event.

The garden to Washbeck is shown to be on edge of the mapped Surface Water flood risk area so it is not too surprising that it flooded in this event taking into account the unprecedented rainfall and the indicative nature of the mapping.

3.8 Conclusion

The unprecedented intensity (and volume) of rainfall that fell during this event in a relatively small areas in a short amount of time meant that the rivers rose very quickly, overwhelming many culverts and bridges, which then forced water either around, or in this case, where the railway embankment blocked any exceedance routes, back up the river causing surcharging.

It is not practicable or realistic to expect structures, and river channels to accommodate this level of flow. It is such a rare event that it would be prohibitively expensive (even if practicable) to upgrade structures to cope.

Whilst upstream attenuation storage can be an option for some catchments to ‘slow the flow’, the topography and limited suitable land in the catchment in this case may also not lend itself to attenuation storage.

Instead, the recommendation is to look at localised river defences in the gardens to provide localised property protection. The flooded area is quite well defined so it should be possible to have an effective system of flood walls.

However, channelising or containing a river will naturally force exceedance flood water upstream even further with possible increased risk of flooding upstream. If this option is

pursued the LLFA recommend that modelling is carried out to demonstrate the effectiveness and impact.

4. Next Steps

4.1 Next steps and timescales

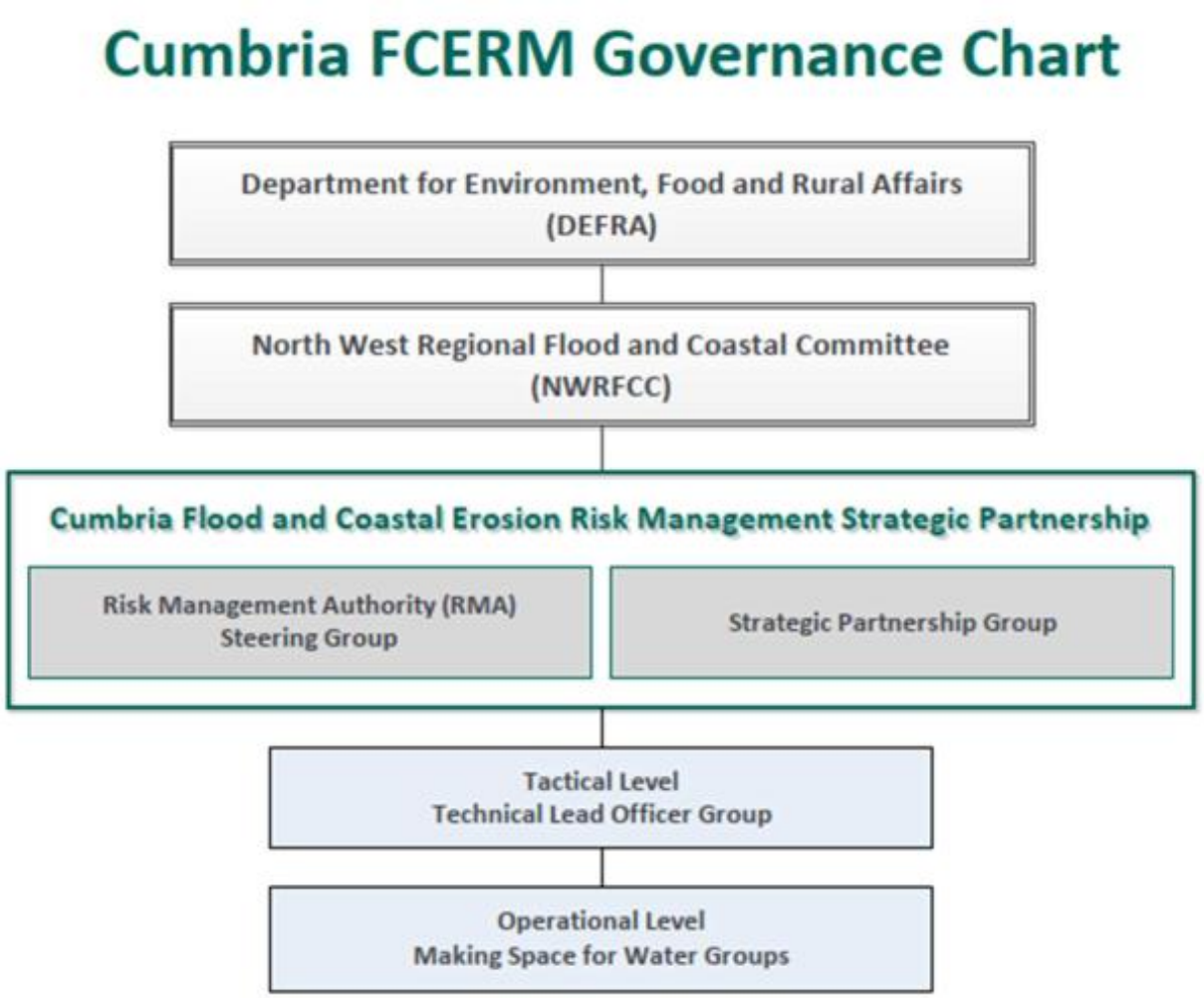
Recommended Action	Action by	Comments
Check private surface water drainage system in Kates Beck Lane is functioning and ensure programmed maintenance takes place as scheduled.	Residents and Management Group in Kates Beck Lane	
Regular inspections of Parkett Hill and Lambley Bank culverts and remove debris as and when necessary	Riparian owners	Advisory to inspect on a routine basis and after significant flood events
Regular inspections of Railway and Highway culverts and remove debris as and when necessary	Maintenance regimes in place for NR culvert and highway culvert	
Procure flood model to test flood wall options beside Wash Beck	Residents Group	To demonstrate that the flood walls do not have an unacceptable impact on flood risk upstream
Investigate options for property resistance and resilience measures	Owners with assistance via The Flood Hub	

5. The Cumbria Floods Partnership

The Cumbria Floods Partnership has brought together a wide range of community representatives and stakeholders from a variety of sectors to plan and take action to reduce flood risk. The Cumbria Floods Partnership, led by the Environment Agency, is producing a 25 year flood action plan for the Cumbrian catchments worst affected by the December 2015 flooding, including Carlisle. The plan will consider options to reduce flood risk across the whole length of a river catchment including upstream land management, strengthening flood defenses, reviewing maintenance of banks and channels, considering water level management boards and increasing property resilience. The Cumbria Floods Partnership structure below details how these 5 themes are being delivered in the Flood Action plans which will be completed in July.

The 'Cumbria Floods Partnership' was set up by Flood Minister Rory Stewart following December's floods and includes all of Cambria's Flood Risk Management Authorities. They are working alongside the existing 'Cumbria Strategic Partnership', which was formed as part of the Flood and Water Management Act and comprises of the county's Flood Risk Management Authorities (RMAs) including the Environment Agency, Cumberland Council, Local Authorities and United Utilities. Both partnerships are working with communities, businesses and relevant stakeholders to understand and reduce flood risk across Cumbria.

This diagram below helps demonstrate how the two partnerships are working together:



6. Appendices

Appendix 1: Glossary

Acronyms

EA	Environment Agency
CC	Cumberland Council
UU	United Utilities
LLFA	Lead Local Flood Authority
LFRM	Local Flood Risk Management
MSfWG	Making Space for Water Group
FAG	Flood Action Group
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
WRA	Water Resources Act 1991

Appendix 2: - Assessment of typical mitigation measures

	Description	Benefits	Constraints / Potential Problems
1	Increase hydraulic capacity of culverts downstream of Kates Beck Lane under the railway and Park Road	Would reduce likelihood of riverbank overtopping with no work required to contain flow in channel.	• Would be prohibitively expensive and would require Network Rail agreement • Would interfere with utilities. • Could increase flood risk downstream if passing more water
2	Install high-capacity overflow route from Kates Beck Lane to drain down the estate separate from Wash Beck	The introduction of the railways has cut-off this low-lying area from the downstream fields north of Park Road.	• There are no practical routes – the railway and steep banks with side restrict possibilities of engineering an exceedance or drain-down route apart from the existing 150mm surface water drain.
3	Construct flood walls on eastern riverbank (or in gardens) to contain river in channel for longer (See Diagram below)	This would reduce or prevent over-topping risk and reduce flood risk to Kates Beck Lane	• Reducing or removing the flood prone area could push flood water extent and depth upstream • Could increase flood risk to infrastructure (electricity sub-station) and properties
4	Property Level Protection (i.e. flood doors and air bricks with flaps etc)	Would prevent water entering the properties in an ideal situation	• Flood water combined with ground water and rose through the floor. PLP would slow but not prevent interior flooding
5	Make ground floor and garages flood resilient	If flooded again, it would be possible to recover more quickly and with minimal waste and expense	• Would require significant re-building of floors, walls, sockets (possibly), using suitable materials and furniture etc • High initial cost outlay. • Insurance companies may not include this as an option • May be too late to go down this route
6	Carry out routine inspection and maintenance of culverts to clear debris and remove any excessive silt	Will reduce likelihood of blockages and water backing up as quickly	• Over excavation and / or disturbance of natural bed material can damage habitat for fish and other river life • Over excavation of bed material can cause scouring and lead to instability of old stone structures

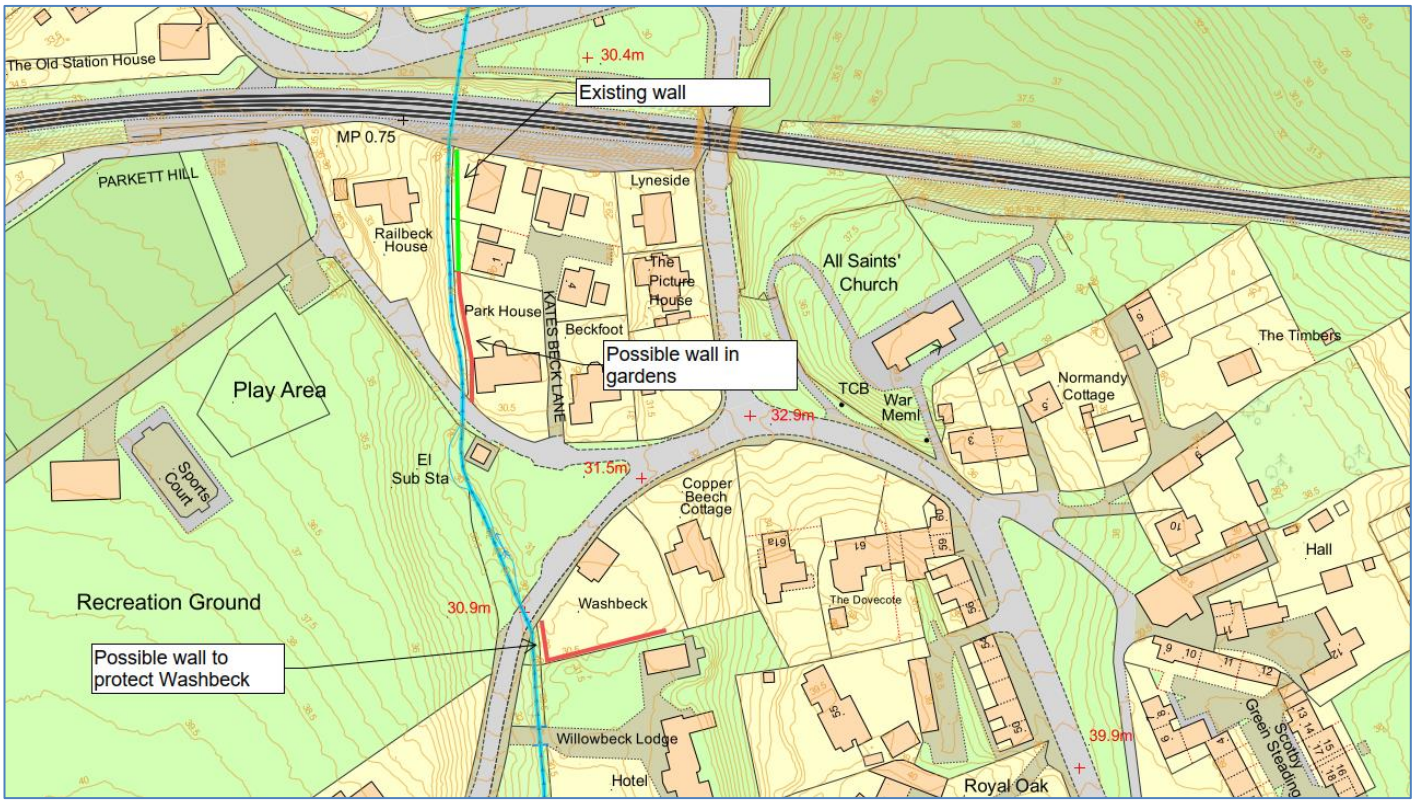


Figure 7. Possible flood mitigation measures

Appendix 3: Summary of Relevant Legislation and Flood Risk Management Authorities

The Flood Risk Regulations 1999 and the Flood and Water Management Act 2010 (the Act) have established Cumberland Council (CCC) as the Lead Local Flood Authority (LLFA) for Cumberland. This has placed various responsibilities on CCC including Section 19 of the Act which states:

Section 19

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

(a) which risk management authorities have relevant flood risk management functions, and

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

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

(a) publish the results of its investigation, and

(b) notify any relevant risk management authorities.

A '*Risk Management Authority' (RMA)* means:

(a) the Environment Agency,

(b) a lead local flood authority,

(c) a district council for an area for which there is no unitary authority,

(d) an internal drainage board,

(e) a water company, and

(f) a highway authority.

The table below summarises the relevant Risk Management Authority and details the various local source of flooding that they will take a lead on.

Flood Source	Environment Agency	Lead Local Flood Authority	Water Company	Highway Authority
RIVERS				
Main river				
Ordinary watercourse				
SURFACE RUNOFF				
Surface water				
Surface water on the highway				
OTHER				
Sewer flooding				
The sea				
Groundwater				
Reservoirs				

The following information provides a summary of each Risk Management Authority's roles and responsibilities in relation to flood reporting and investigation.

Government – Defra develop national policies to form the basis of the Environment Agency's and Cumberland Council's work relating to flood risk.

Environment Agency has a strategic overview of all sources of flooding and coastal erosion as defined in the Act. As part of its role concerning flood investigations this requires providing evidence and advice to support other risk management authorities. The EA also collates and reviews assessments, maps and plans for local flood risk management (normally undertaken by LLFA).

Lead Local Flood Authorities (LLFAs) – Cumberland Council is the LLFA for Cumbria (ex Carlisle, Allerdale and Copeland areas). Part of their role requires them to investigate significant local flooding incidents and publish the results of such investigations. LLFAs have a duty to determine which risk management authority has relevant powers to investigate flood incidents to help understand how they happened, and whether those authorities have or intend to exercise their powers. LLFAs work in partnership with communities and flood risk management authorities to maximise knowledge of flood risk to all involved. This function is carried out at CCC by the Flood and Development Management Team.

Water and Sewerage Companies manage the risk of flooding to water supply and sewerage facilities and the risk to others from the failure of their infrastructure. They make sure their systems have the appropriate level of resilience to flooding and where frequent and severe flooding occurs they are required to address this through their capital investment plans. It should also be noted that following the Transfer of Private Sewers Regulations 2011 water and sewerage companies are responsible for a larger number of sewers than prior to the regulation.

Highway Authorities have the lead responsibility for providing and managing highway drainage and certain roadside ditches that they have created under the Highways Act 1980. The owners of land adjoining a highway also have a common-law duty to maintain ditches to prevent them causing a nuisance to road users.

Flood risk in Cumbria is managed through the Making Space for Water process which involves the cooperation and regular meeting of the Environment Agency, United Utilities, District/Borough Councils and CCC's Highway and LFRM Teams to develop processes and schemes to minimise flood risk. The MSfWGs meet approximately 4 times per year to cooperate and work together to improve the flood risk in the vulnerable areas identified in this report by completing the recommended actions. CCC as LLFA has a responsibility to oversee the delivery of these actions.

Where minor works or quick win schemes can be identified, these will be prioritised and subject to available funding and resources will be carried out as soon as possible. Any major works requiring capital investment will be considered through the Environment Agency's Medium Term Plan or a partners own capital investment process.

Flood Action Groups are usually formed by local residents who wish to work together to resolve flooding in their area. The FAGs are often supported by either CCC or the EA and provide a useful mechanism for residents to forward information to the MSfWG.

Appendix 4: Useful contacts and links

Cumberland Council (Local Flood Risk Management):
lfrm@cumberland.gov.uk, www.cumberland.gov.uk

Cumberland Council (Highways):
https://www.cumberland.gov.uk/parking-roads-and-transport/streets-roads-and-pavements/road-maintenance-closures-and-improvements/report-problem-street-or-road
tel: 0845 609 6609
Out of hours emergencies should be reported via the Police on 101

Insert Neighbourhood forum contact details

United Utilities: www.unitedutilities.com, tel: 0845 746 2200

Insert relevant DC contact details

Flood and Water Management Act 2010:
http://www.legislation.gov.uk/ukpga/2010/29/contents

Water Resources Act 1991:
http://www.legislation.gov.uk/all?title=water%20resources%20act

Land Drainage Act:
http://www.legislation.gov.uk/all?title=land%20drainage%20act

Highways Act 1980:
http://www.legislation.gov.uk/all?title=highways%20act

EA – Owning a Watercourse Guidance a guide to the rights and responsibilities of riverside occupation:
http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx

EA – 'Prepare your property for flooding' how to reduce flood damage including flood protection products and services:
http://www.environment-agency.gov.uk/homeandleisure/floods/31644.aspx