WARRINGTON
Borough Council

Environment & Transport

S19 Flood Investigation Report

Engineering & Flood Risk Management Team
Warrington Borough Council – Lead Local Flood Authority
Date: December 2018
Location: Borough Wide Rainfall Event
Flood Investigation Reference Number: 2018/019/001
Version: Final 01

Disclaimer

Although every effort has been taken to ensure the accuracy of the information contained within the pages of this report, we cannot guarantee that the contents will always be current, accurate or complete.

This report has been prepared as part of Council's responsibilities under the Flood and Water Management Act (2010) as Lead Local Flood Authority (LLFA).

The findings of this report are based on a subjective assessment of the information available to those undertaking the investigation and therefore may not include all relevant information. Therefore it shouldn't be considered as a definitive assessment of all factors that may have triggered or contributed to the flood event.

The opinions, conclusions and any recommendations in this report are based on our assumptions when preparing this report, including, but not limited to those key assumptions noted in the reports, including reliance on information provided by third parties.

The Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with any of the assumptions made being incorrect. The opinions, conclusions and any recommendations in these reports are based on conditions encountered and information reviewed at the time of preparation and the Council expressly disclaims responsibility for any error in, or omission from, this report arising from or in connection with those opinions, conclusions and any recommendations.

Control and Distribution

This document is owned, maintained, and updated by the Engineering & Flood Risk Team, Warrington Borough Council.

All users are asked to advise the Engineering & Flood Risk Team of any changes in circumstances or information that may materially affect this investigation.
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This document will be reviewed following any new information being received in relation to the flood event and its causes/effects.

Revision Schedule & Approvals

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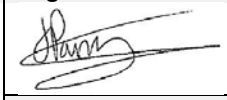
Revision Final 01	Name Jonathan Dawson-Parry	Name Jim W Turton	Name Tom Shuttleworth
Date December 2018	Signature 	Signature 	Signature 
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Document Status: Final01			

Supporting Documents List

Table of Contents

1 Introduction

This document has been prepared by Warrington Borough Council, as the Lead Local Flood Authority (LLFA), for the specific purpose of meeting the requirements of Section 19 (1) and (2) of the Flood and Water Management Act (2010) which 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.

(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 report aims to meet the requirements of Section 19 of the FWMA (2010) as well as provide a reference for the effective future management of flooding in the administrative area of Warrington Borough Council by:

- Providing details of the flooding incident,
- Undertaking analysis of the flood history of the area,
- Identifying the responsibilities of Risk Management Authorities (RMAs) and the actions which were carried out,
- Identifying successful response measures and lessons learned, and
- Recommending the next steps.

The supporting data has been collated from a variety of sources. Whilst every effort has been made to identify the cause, and consequence of flooding, this document does not include every flooding occurrence, only where flooding has been reported and is indicative only.

2 Incident Summary

Table 2.1: Incident Summary

Incident Reference	2018/019/001
Location	Borough Wide
Date(s) of Incident(s)	21 September 2018
Reason for Investigation	Flooding across multiple locations across Warrington
Identified Cause	Pluvial Flooding

2.1 Affected Areas

Warrington Borough Council is aware that flooding occurred on 21 September 2018 at the following locations:

- Campbell Crescent, Great Sankey
- Liverpool Road, Great Sankey
- Fairfield Road, Stockton Heath
- Sankey Street
- Wash Lane, Latchford
- Barnes Avenue, Fearnhead
- Oughtrington Lane, Lymm

Warrington Borough Council was notified that flooding occurred on 21 September 2018 at the following locations by United Utilities:

- Highfield Road, Penketh
- Bridge Street, Warrington Town Centre
- Fox Street, Whitecross
- Duncansby Crescent, Penketh
- Milner Street, Bewsey
- Alderbank Road, Penketh

3 Flood Incident Details

This section of the report details the meteorological conditions, rainfall and weather warnings during the period 20th – 23rd September 2018.

This review has used data supplied by the Environment Agency, the Met Office, Warrington Borough Council, United Utilities, and local / national news reports.

3.1 Antecedent Conditions

The following information has been used to help provide an overall picture of the conditions that led to the flooding events in Warrington during September 2018:

- Environment Agency Water Situation Reports - The Environment Agency issues monthly water situation reports for England at both national and regional scale, which provide an overview of various hydrological information including rainfall, soil moisture and river flows for the month.

- CEH Hydrological Summary reports – The Centre for Ecology and Hydrology (CEH) issues reports for the United Kingdom, which, similar to the Environment Agency Water Situation Reports, provide analysis of various hydrological records for the month.

- Information supplied from Environment Agency (on request) for the area of interest within an authority area. This information includes data obtained from monitors recording rainfall, ground water level and watercourse levels, as well as any flood alerts issued to the general public.

3.1.1 Rainfall Summary

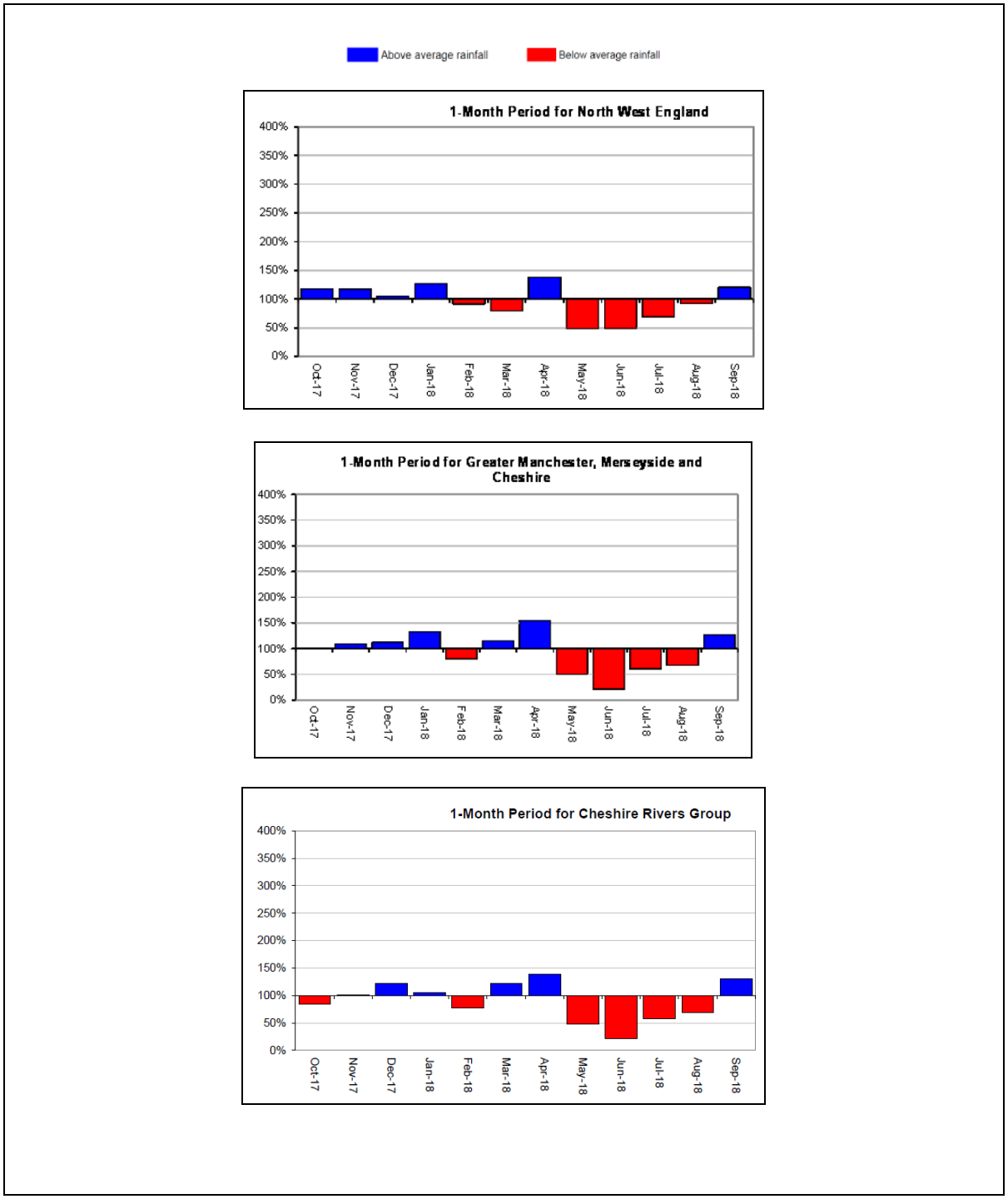
The weather during September was influenced by the remnants of Hurricane Helene and Storm Florence arriving from the Atlantic in the second half of the month, in addition to the arrival of the first of the UK's named storms of the season - Ali and Bronagh; all in quick succession, bringing wet and windy conditions to parts of North West England.

Rainfall for North West England as a whole was classed as 'Normal' for September (120% of the Long-Term-Average for September).

Rainfall for Lancashire and Greater Manchester, Merseyside and Cheshire was classed as 'Above normal' (121% and 127% of the LTA respectively).

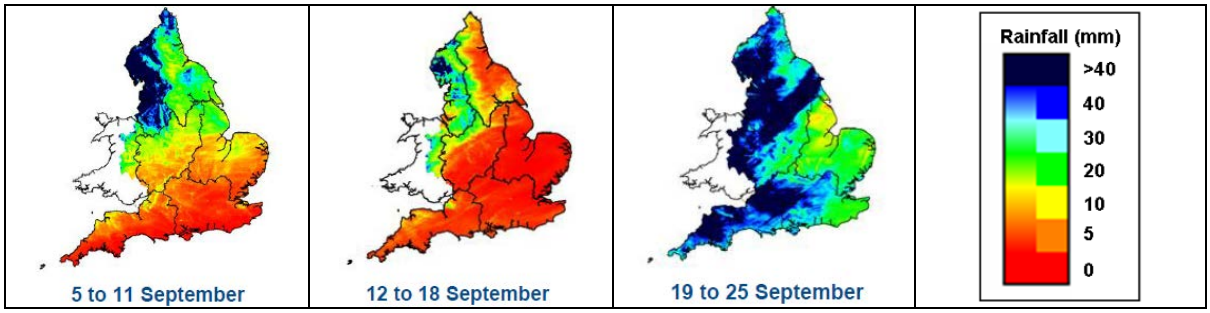
Generally, there were improvements observed in the classification of the cumulative 3 month rainfall totals, with all but one area now classified as 'Normal' for this period; only the Mersey and Irwell area was classed as 'Below normal'. There were also quite a few changes noted in the classification of the 6 month cumulative rainfall totals, with most areas observing some recovery, and only the Cheshire Rivers Group remaining unchanged at 'Notably low'.

Figure 1: Total rainfall (as a percentage) for hydrological areas across North West England for September 2018, previous three, six and twelve months, classed relative to an analysis of respective historic totals.



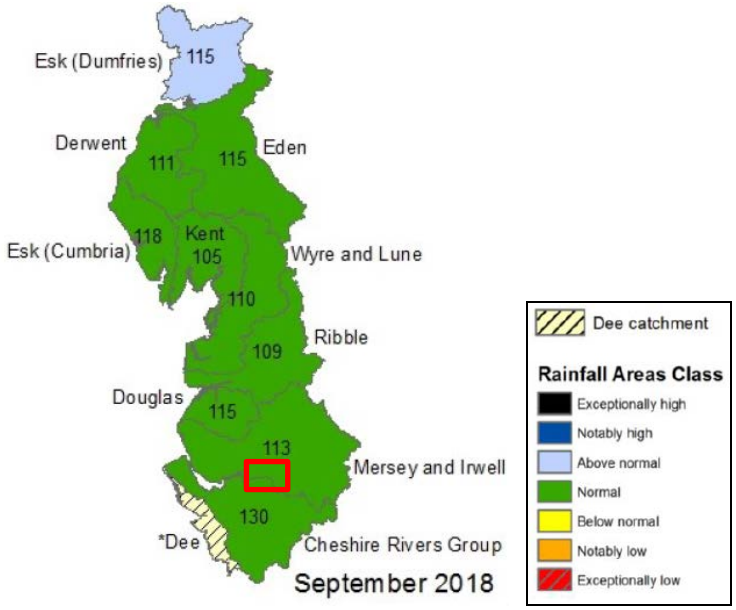
Source: Environment Agency Monthly Water Situation Report – North West

Figure 2: Weekly precipitation across England and Wales. UKPP radar data. EA Weekly rainfall and river flow summary 5th – 25th September 2018



Source: Environment Agency national weekly rainfall and river flow summary

Figure 3: Total rainfall (as a percentage) for hydrological areas across North West England for September 2018



Data based on the Met Office 5km gridded rainfall dataset derived from rain gauges. Provisional data based on Environment Agency 1km gridded rainfall dataset derived from Environment Agency intensity rain gauges.

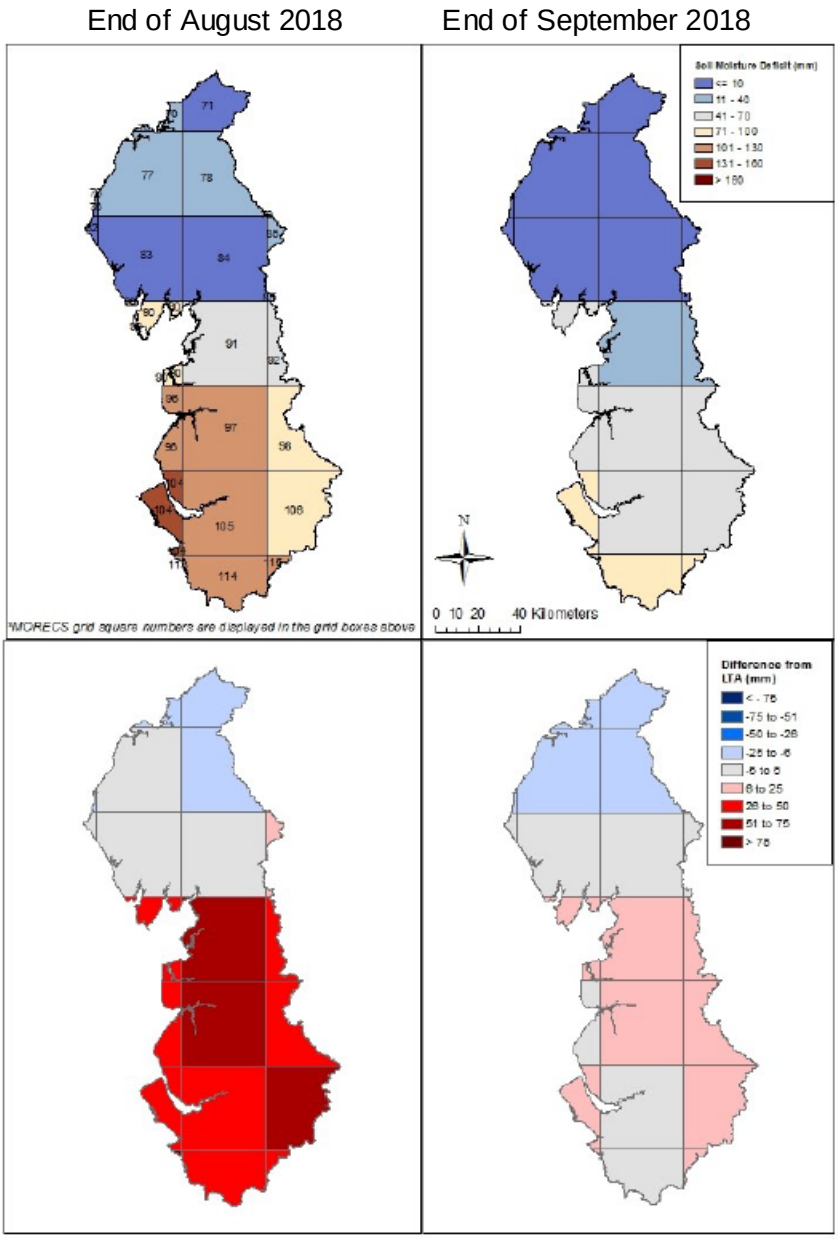
Source: Environment Agency Monthly Water Situation Report – North West

3.1.2 Soil Moisture Deficit

The Soil Moisture Deficit (SMD) is a measure of how saturated the ground is; low values reflect more saturated ground conditions, high values reflect less saturated ground conditions. The Environment Agency Water Situation Reports provide a measure of SMD on a 40 x 40 km grid of the UK. Warrington falls within grid square 105.

At the end of September, the contrast between SMD levels across North West England that was observed in August continued, however, the difference was less marked with levels falling in all areas. In Greater Manchester, Merseyside and Cheshire levels were generally above 40mm by the month's end and above the LTA for the time of year. Levels across Cumbria and Lancashire continued to decrease; with levels in Cumbria all less than 10mm with some close to or at saturation point, and all lower than the LTA for the time of year.

Figure 4: Soil Moisture Deficits for North West – August and September 2018



Top row shows actual soil moisture deficits (mm) and bottom row shows the difference (mm) of the actual from the 1961-90 long term average soil moisture deficits. MORECS data for real land use

Source: Environment Agency Monthly Water Situation Report – North West

3.2 Rainfall Data

Figures 6 to 8 provide a summary to the weather conditions for the main periods of rainfall between 20th – 23rd September 2018.

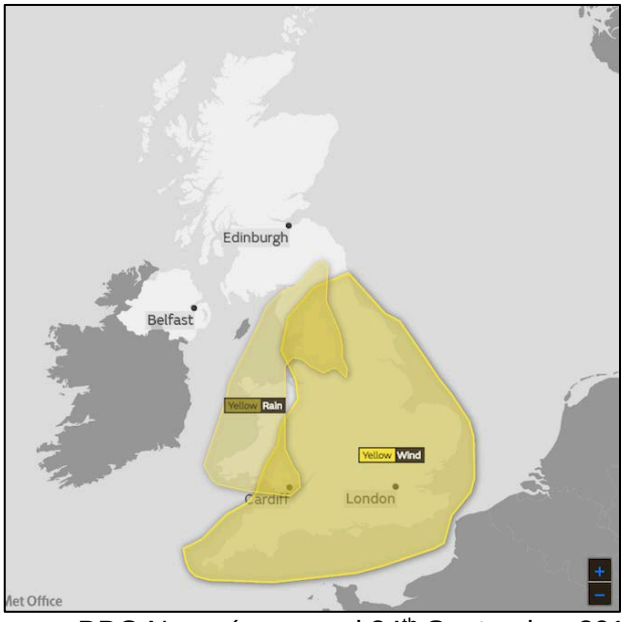
According to the Met Office, a storm event will be named when it has the potential to cause an Amber 'Be Prepared' or Red 'Take Action' warning. Other weather types will also be considered, specifically rain if its impact could lead to flooding advised by the Environment

Agency. Therefore 'storms systems' could be named on the basis of impacts from wind but also include the impacts of rain and snow.

Storm Ali occurred on 19th September 2018 affecting the north west of the UK. Storm Ali brought heavy rain and damaging winds to Northern Ireland, Scotland and parts of Northern England.

Storm Ali was quickly followed by Storm Bronagh which occurred between 20th – 23rd September 2018; this weather warning was announced by the Met Office for both wind and rain.

Figure 5: Met Office Weather Warning for Storm Bronagh



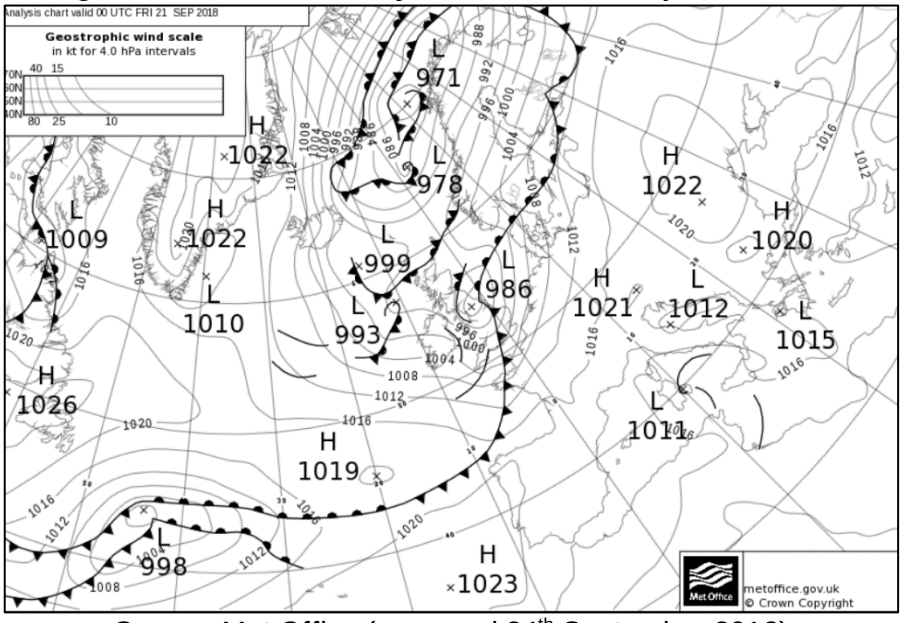
Source: BBC News (accessed 24th September 2018)

Nationally, Storm Bronagh brought travel disruption and localised flooding in the Sheffield area and mid-Wales. Ferry services from Holyhead to Dublin and some flights from Cardiff Airport were cancelled, while debris and fallen trees blocked some roads and railway lines. The Humber Bridge was closed to high-sided vehicles for a time.

Northern PowerGrid reported about 2000 customers lost power, and flights at East Midlands airport were diverted. Storm Bronagh brought some very wet weather with well over 50mm of rain recorded across upland areas of Wales and the south Pennines

The analysis chart at 0000 UTC 21st September 2018 shows Storm Bronagh centred across northern England. This storm continued to deepen rapidly as it moved eastward into the North Sea.

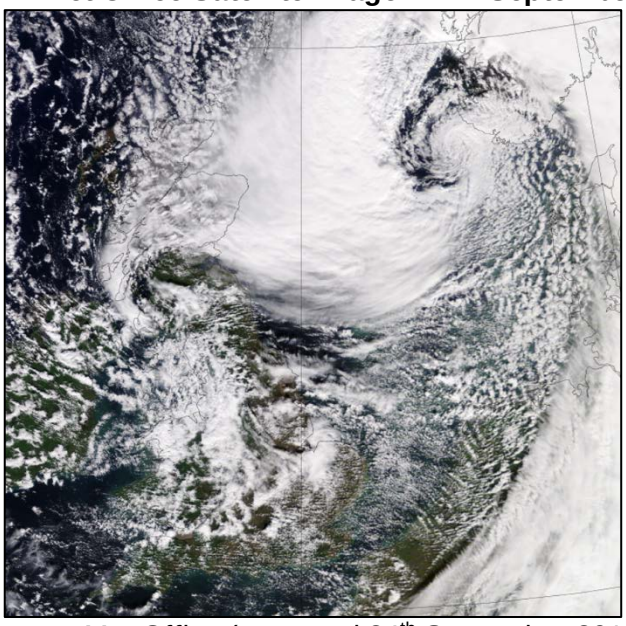
Figure 6: Met Office Analysis Chart – 21st September 2018



Source: Met Office (accessed 24th September 2018)

Having moved across the UK overnight, the satellite image shows the centre of storm Bronagh approaching Denmark the following day, 21st September 2018.

Figure 7: Met Office Satellite Image – 21st September 2018

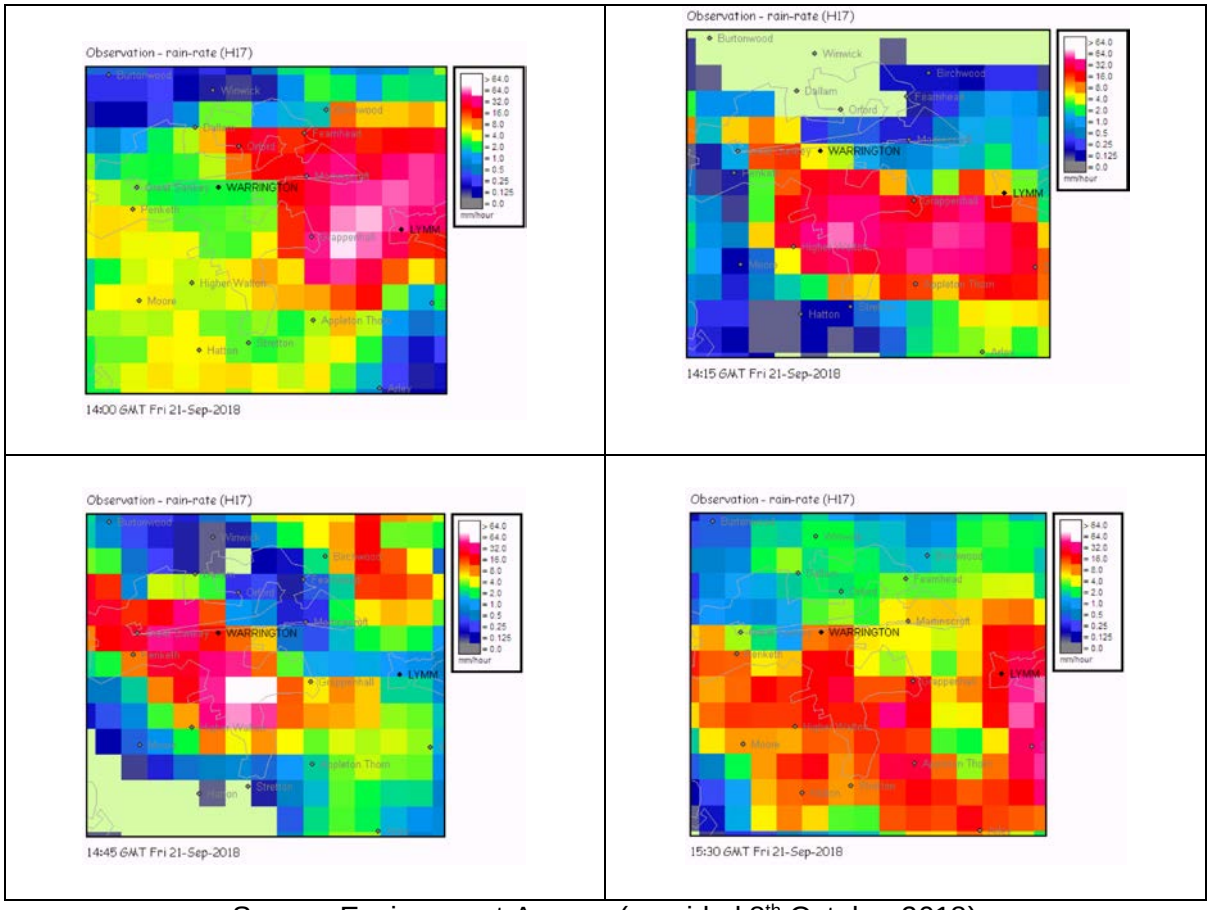


Source: Met Office (accessed 24th September 2018)

At the local level HYRAD (HYdrological RADar) provided real time information to show the precipitation movement and patterns and intensities. This information enables forecasters to raise, or amend, weather / flood alerts thus enabling the appropriate action to be taken.

Rainfall intensities observed were, at times, in excess of 32 mm/hr.

Figure 8: HYRAD Information 14:00 – 15:30 on 21st September 2018



Source: Environment Agency (provided 8th October 2018)

The following rain gauges are located within the administrative boundary of Warrington Borough Council.

Table 1 – Location of Rain Gauges within Administrative Boundary

Monitor name and Reference	Description	Co-ordinates	Comment
Richard Fairclough House TEL - 564160	15 minute recording intervals	362124, 387278	Environmental Agency rain gauge - Operational
Gatewarth E. Tr. Wks - 566601	15 minute recording intervals	358251, 387174	Environmental Agency rain gauge - Operational

Figure 9 - Location of Rain Gauges within Administrative Boundary

Table 2: Summary of Storm Bronagh

Monitor name and Reference	Rainfall Duration	Drainfall Depth (mm)	Peak Intensity (mm/hr)	Biham Event Return Period	
				Entire event	Peak of event
Richard Fairclough House TEL - 564160	35 hours	52.6	24.8	3.58 years	2.71 years
Gatewarth E. Tr. Wks - 566601	35 hours	49.6	19.2	2.94 years	2.55 years

Figure 10: Rainfall Intensity (mm/hr) at Environment Agency rain gauges

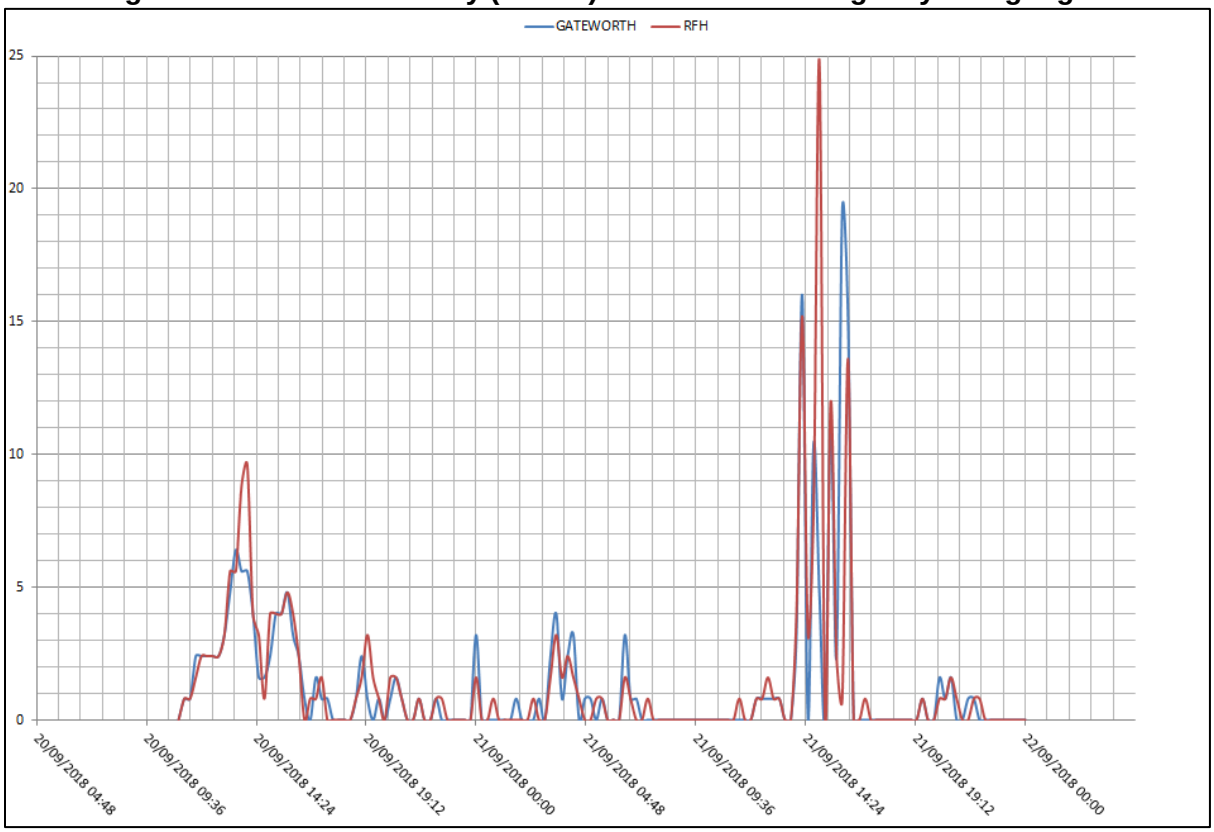
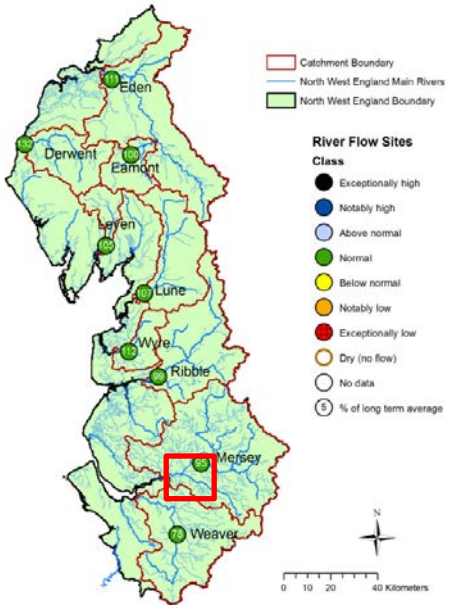


Figure 8 (HYRAD information) illustrates spatial variation was evident during the storm event. With only two rain gauges installed within the Borough, both recording at 15 minute intervals, there is a high probability of variation in rainfall intensity which may have contributed to localised flooding not reported to Warrington Borough Council. There are no known other rain gauges (either private and / or installed for a short term flow survey for United Utilities) within the Borough to provide supportive evidence of spatial variation with respect to Figure 8 (HYRAD information).

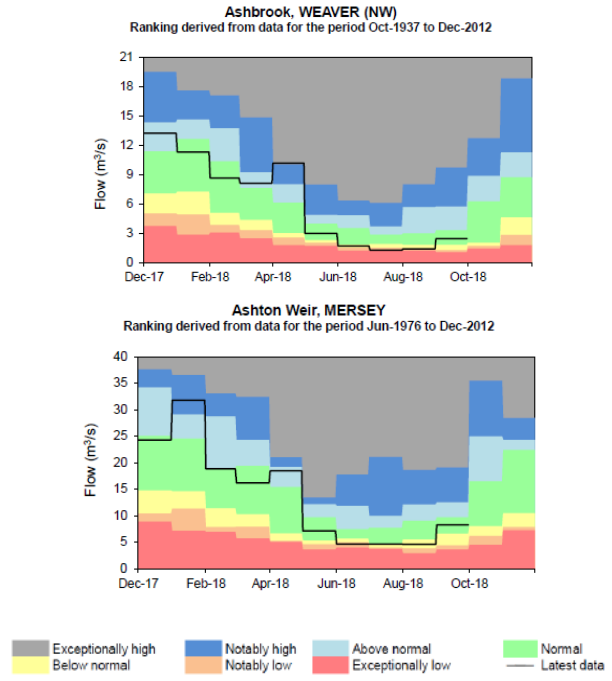
3.3 Watercourse Data

Within the North West, monthly mean river flows increased in all catchments when compared to August, with all flows classed as 'Normal' for September. River flows were highest in the Derwent catchment (132% of LTA) and lowest in the Weaver (78% of LTA).

Amidst the September storms, heavy rainfall resulted in a few notable peaks, for example Caton gauging station (Lune catchment) recorded an instantaneous flow value above Q1 on the 21st September 2018 (i.e. this flow has been exceeded less than 1% of the time at this gauging station).



Monthly mean river flow for this month, expressed as a percentage of the month's long term average and classed relative to analysis of historic monthly means



Monthly mean river flows for the past 10 months for sites across North West England

Source: Environment Agency Monthly Water Situation Report – North West

The following watercourse level gauges are located within the area of Warrington.

Table 3 – Location of Watercourse Level Gauges within Administrative Boundary

Monitor name and Reference	Description	Co-ordinates	Comment
Longford Bridge - 694045	15 minute recording interval	360605, 390070	Surface water level (including tide and lake level) - continuous - Operational
Higham Avenue - 694042	15 minute recording interval	359607, 390213	Surface water level (including tide and lake level) - continuous - Operational
Liverpool Road - 694041	15 minute recording interval	358573, 387642	Surface water level (including tide and lake level) - continuous - Operational
Causey Bridges - 694039	15 minute recording interval	358747, 392212	River flow – continuous - Operational
Westy Flow Ultrasonic - 693976	15 minute recording interval	362834, 388341	River flow - continuous - Operational
Hilden Road - 693750	15 minute recording interval	362153, 390122	Surface water level (including tide and lake level) – continuous – Not operational
Grosvenor Grange - 693700	15 minute recording interval	363913, 390145	Surface water level (including tide and lake level) - continuous - Operational
Howley Weir Downstream - 693538	15 minute recording interval	361671, 387710	Surface water level (including tide and lake level) - continuous - Operational
Little Woolden Hall Ultrasonic - 693032	15 minute recording interval	368489, 393888	River flow - continuous - Operational
Woolston Weir - 693600	15 minute recording interval	365215, 388703	Surface water level (including tide and lake level) - continuous - Operational
Morris Brook - 693555	15 minute recording interval	364253, 386690	Surface water level (including tide and lake level) - continuous - Operational
Fiddlers Ferry - 694063	15 minute recording interval	356605, 386761	Surface water level (including tide and lake level) - continuous - Operational

Figure 11 - Location of Watercourse Level Gauges within Administrative Boundary

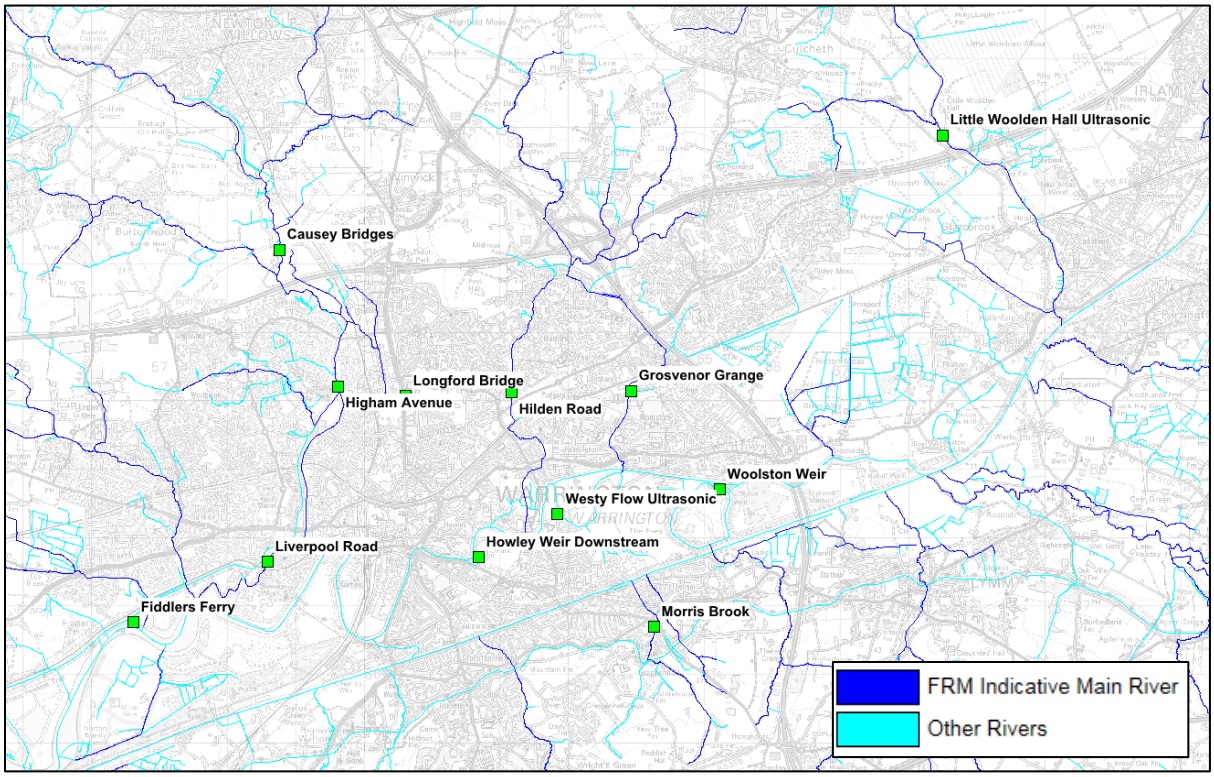


Figure 12: Depth of water (m) at monitor locations for period 20th – 23rd September 2018

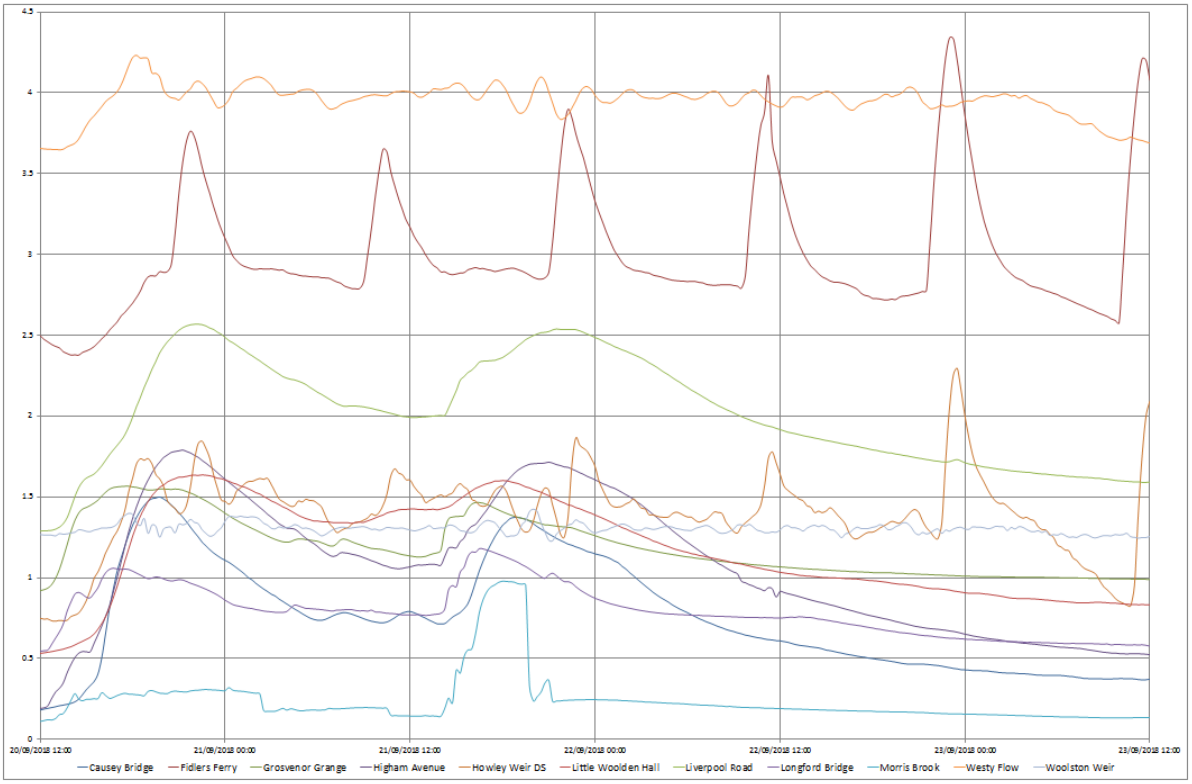


Figure 12 illustrates watercourse levels increased on average 1m as a consequence of Storm Ali and Storm Bronagh compared to normal dry weather levels. Reviewing the long term data

for all locations the recorded peak depths are within the typical depth range. This is most likely as a consequence of a prolonged dry summer which neared drought conditions.

Outfalls situated at low levels would have experienced hydraulic restriction due to the raised watercourse levels, therefore affecting the performance of the surface water drainage systems.

3.4 Weather / Flood Warning

Under the Land Drainage Act (1991) and the FWMA (2010), the Environment Agency has permissive powers to issue flood warnings to communities at risk of flooding.

The Met Office has a statutory duty to provide forecast information for the public, relevant Government agencies (e.g. the Environment Agency), and the water authorities. Legislation supporting the Civil Contingencies Act (2004) states that Category 1 responders must have regard to the Met Office's duty to warn the public, and provide information and advice, if an emergency is likely to occur or has taken place.

Sections of Warrington are covered by the Environment Agency's Flood Warning service and Flood Alert Areas. The Flood Warning Area is applicable to all Main Rivers. Flood Alert Areas are applicable to all Main Rivers and some adjacent discrete watercourses.

The Environment Agency uses three flood warning codes depending on the severity of flooding expected. These are issued at different intervals in advance of flooding.

Flood Alert areas generally cover a large area, whilst Flood Warning areas are usually more detailed and broken down into specific locations. Locations within a Flood Alert area are also not necessarily within a Flood Warning area.

It should be noted that these alerts / warnings are not intended to provide warning of other sources of flooding (such as that arising from surface water, ordinary watercourses, sewers and groundwater).

Table 4: Met Office Flood Warning Codes

Flood Warning Codes	Description	When actioned
	Flooding is possible. Be prepared.	Two hours to two days in advance of flooding.
	Flooding is expected. Immediate action required.	Half an hour to one day in advance of flooding.
	Severe flooding. Danger to life.	When flooding poses a significant threat to life.

Figure 13: Area Coverage of Environment Agency Flood Warning Service

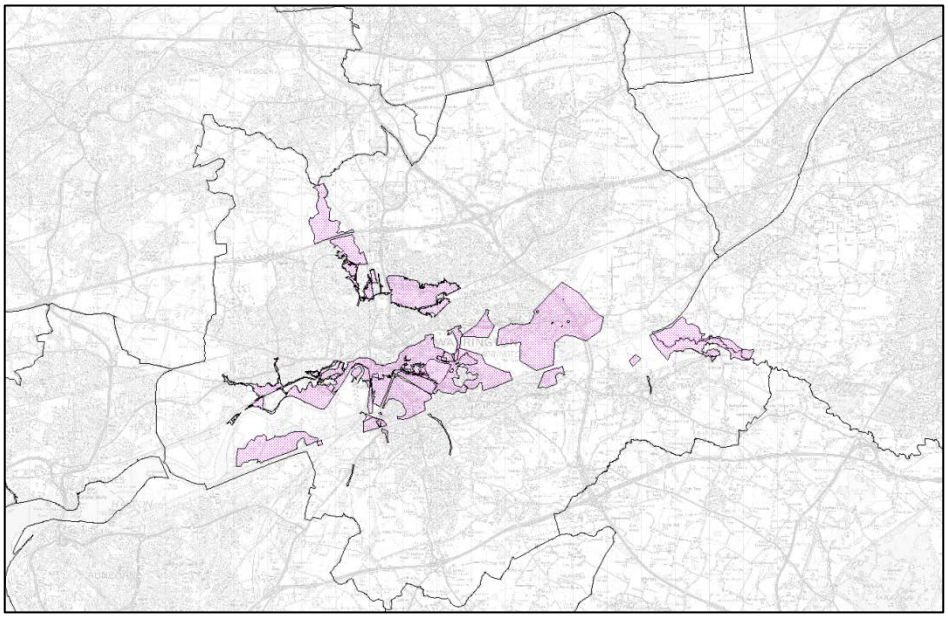


Table 5: Flood Warning Area Information

Flood Warning Area Code	Flood Warning Area Name	Description	Associated Watercourse
013FWFCH14	Sankey Brook at Gemini	Areas at risk include commercial and retail property off Europa Boulevard at Gemini Industrial Park. Additional properties at risk include parts of Fairbourne close.	Sankey Brook
013FWFCH17	Sankey Brook around areas of Gemini, Dallam, Bewsey, Longford, Orford, Great Sankey and Penketh	Areas at risk include properties on Alder and Hall Lane. Also Winwick Quay, Longford, Hawleys Business Park, Orford, Callands, Bewsey. Also parts of Penketh and Sankey Bridges South of the A562 and A57 and Gatewarth Industrial Estate	Sankey Brook
013FWFCH28	Sankey Brook at Dallam (area A)	Areas at risk include Chepstow close, Colwyn close, properties on and around Higham Ave, Tavlin Ave, Hodgkinson ave, Marshall Ave, Hawleys lane and Mullen close.	Sankey Brook
013FWFCH29	Sankey Brook at Dallam, (Area B)	Areas at risk include properties between Callands Rd and Sankey Brook. Other areas at risk include Marshall Avenue, Hawleys Lane, Southworth avenue, Charter avenue and Longshore Street from Hawleys Lane to the allotments.	Sankey Brook
013FWFCH30	Sankey Brook at Sankey Bridges, (Area A)	Areas at risk include Liverpool Road from Kent Road to Beaufort Street, Rostherne Close, Evelyn Street and Huntley Street.	Sankey Brook
013FWFCH31	Sankey Brook at Sankey Bridges, (Area B)	Areas at risk include the Sankey Recreation ground, Samuel St, Booth St, Dale Close, Bond Close and parts of Hepherd St and Marina Avenue.	Sankey Brook

Flood Warning Area Code	Flood Warning Area Name	Description	Associated Watercourse
013FWFGM77	River Bollin at Heatley	Areas at risk include land adjacent to the Ship Canal and River Bollin, Reddish Hall, and some properties on Rushes avenue, Birch Brook Road and Chaise Meadow. Property on Old Mill Lane.	River Bollin
013FWTTCH1	Mersey Estuary at Moss Side	The area at Moss Side Lane and Lapwing Lane are at risk of flooding from the estuary due to high tides.	River Mersey/Irish Sea
013FWTTCH10	Mersey Estuary at Centre Park, Warrington	The Centre Park area is at risk of flooding from the Estuary due to high tides. Areas at risk include the industrial units between the driving range and Arpley Meadows on Slut chers Lane	Mersey Estuary
013FWTTCH11	Mersey Estuary at Westy, Warrington	Areas including Newman High School, Brook Ave, Davenport Ave, Waring Ave, Bryant Ave, Bowman Ave and Mort Ave are at risk of flooding from the Estuary due to high tides	Mersey Estuary
013FWTTCH12	River Mersey from Runcorn to Lymm	Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also parts of Howley, Wilderspool, Latchford, Westy, Paddington, Woolston, Thelwall and Lymm	Mersey Estuary
013FWTTCH18	Mersey Estuary at Victoria Park, Knutsford Road, Warrington	Victoria Park including the car park, bowling greens, running track, allotments, playground, skatepark and sports pitches.	Mersey Estuary
013FWTTCH3	Mersey Estuary at Arpley Bridge, Warrington	Chester Road between Brian Bevan Island and Arpley Railway Bridge; and Arpley Road in Warrington	Mersey Estuary/Irish Sea
013FWTTCH4	Mersey Estuary at Fiddlers Ferry, Warrington	Fiddlers Ferry area including the Sailing Club, The Ferry Tavern and Riverside Trading Estate are at risk of flooding from the Mersey Estuary due to high tides.	Mersey Estuary/Irish Sea
013FWTTCH5	Mersey Estuary at Eastford Road, Warrington	Property is at risk of flooding from the Estuary due to high tides. In particular houses on Eastford Rd backing onto the disused canal, properties on Baronet Rd and Taylor St closest to the junction with Eastford Rd and Morley Common are at risk	Mersey Estuary
013FWTTCH6	Mersey Estuary at Knutsford Road, Warrington	The Knutsford Road area of Warrington is at risk of flooding from the Estuary due to high tides. Properties at risk extend from Knutsford Rd to the railway embankment behind St Marys Street.	Mersey Estuary
013FWTTCH7	Mersey Estuary at Howley, Warrington	The Howley area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk include the Riverside Retail Park; Wharf St; Wharf St industrial estate; Riverside Cl, Parr St; Cleeves Cl; Harbord St; Fairclough Ave & Sutton St	Mersey Estuary

Flood Warning Area Code	Flood Warning Area Name	Description	Associated Watercourse
013FWTTCH8	Mersey Estuary at Bank Quay, Warrington	The Bank Quay area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk includes industrial units behind the railway embankment at Bank Quay Station next to the Estuary and property around the Atherton Quay area.	Mersey Estuary
013FWTTCH9	Mersey Estuary at Kingsway North, Warrington	The Kingsway North area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk include; Bennett Ave, Princess Ave, Bibby Ave; Peacock Ave; Kingsway North; the units behind Farrell St; the ambulance station and allotments	Mersey Estuary

Figure 14: Area Coverage of EA Flood Alert Areas

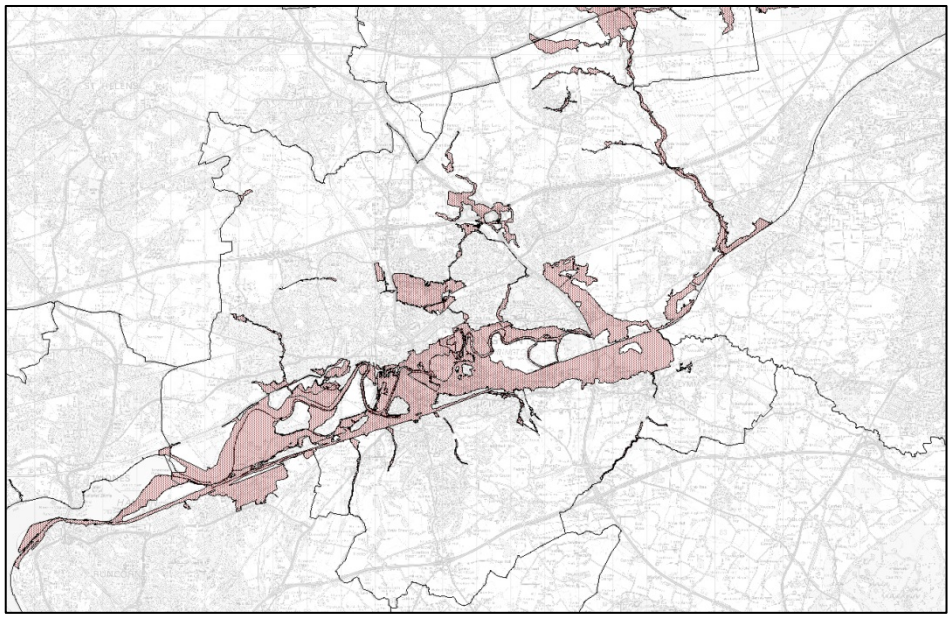


Table 6: Flood Alert Area Information

Flood Alert Area Code	Flood Alert Area Name	Description	Associated Watercourse
013WAFBO	River Bollin catchment, including Knutsford, Wilmslow, Macclesfield and Bollington	The River Bollin catchment includes the Rivers Bollin, Dean and Pedley, Birkin and Mobberley Brooks and their tributaries. Areas around Knutsford, Wilmslow, Hale, Macclesfield and Bollington may be affected.	River Bollin
013WAFDI	River Ditton catchment including areas around Huyton-with-Roby and Widnes	The Ditton catchment includes, Ditton, Logwood Mill, Fox's Bank, Dog Clog, Stewards, and Netherley Brooks and their tributaries. Also including the areas around Huyton, Widnes and Penketh.	River Ditton

Flood Alert Area Code	Flood Alert Area Name	Description	Associated Watercourse
013WAFGL	River Glaze catchment including Leigh and East Wigan	The Glaze catchment includes Moss, Hey, Bedford and Borsdane Brooks and their tributaries. Other locations which may be affected are Leigh, Tyldsley, Hindley, Westhoughton, Atherton, Worsley, Walkdon and East Wigan.	Glaze Brook
013WAFLM	Lower River Mersey including Warrington, Runcorn and Lymm areas	The Lower River Mersey catchment includes the Fishington, Bradley, Sow, Keckwick and Lumb Brooks and their tributaries.	Lower River Mersey
013WAFMM	Middle River Mersey catchment including areas near Bramhall, Stockport, Sale, Altrincham and Urmston	The Middle River Mersey catchment includes Micker, Cringle, Sinderland and Poynton Brooks and their tributaries. Other locations which may be affected are Stretford, Gatley, Cheadle Hulme and Cheadle	Lower River Mersey
013WAFSA	River Sankey catchment with St Helens and Warrington	The Sankey catchment includes Black, Barkers, Windle and Whittle Brooks and their tributaries. Other locations which may be affected are around Rainford, Billinge, Prescot, Newton-le-Willows, Haydock, Ashton-in-Makerfield and Golbourne	River Sankey
013WATMEW	Mersey Estuary at Warrington	Areas at risk include Fiddlers Ferry, Eastford Road, Arpley Bridge, Knutsford Road, Howley, Kingsway North and Westy.	Mersey Estuary

Note: Warning and alert areas also cover contain areas in adjacent local authority areas.

For the period 20th – 23rd September 2018, the Met Office forecasts produced for the UK highlighted the potential for significant rainfall in the North-West region thus providing a risk of flooding. Consequently a Met Office National Severe Weather Warning Service rain warning was issued and are summarised in Table 7.

Table 7: Summary of Warnings / Alerts raised during September 2018 for the North West region

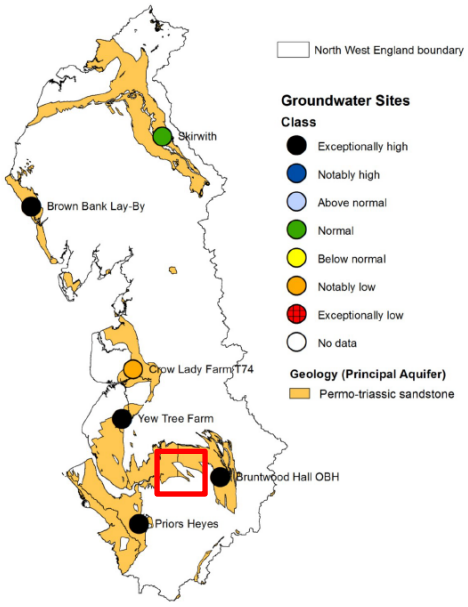
Date Issued	Code	Name	Type	Area
20/09/2018	013FWFCH32	Rivacre Brook at Great Sutton	Flood Warning	Greater Manchester, Merseyside and Cheshire
20/09/2018	012WAFEL	River Calder	Flood Alert	Cumbria & Lancashire
20/09/2018	012WAFUR	Upper River Ribble, Hodder	Flood Alert	Cumbria & Lancashire
20/09/2018	011WAFUE	Upper River Eden	Flood Alert	Cumbria & Lancashire
20/09/2018	011WAFPC	Rivers Caldew and Petteril	Flood Alert	Cumbria & Lancashire
20/09/2018	011WAFLE	Lower River Eden	Flood Alert	Cumbria & Lancashire
21/09/2018	011WAFME	Middle River Eden	Flood Alert	Cumbria & Lancashire

No flood warnings or alerts were raised within the Warrington area.

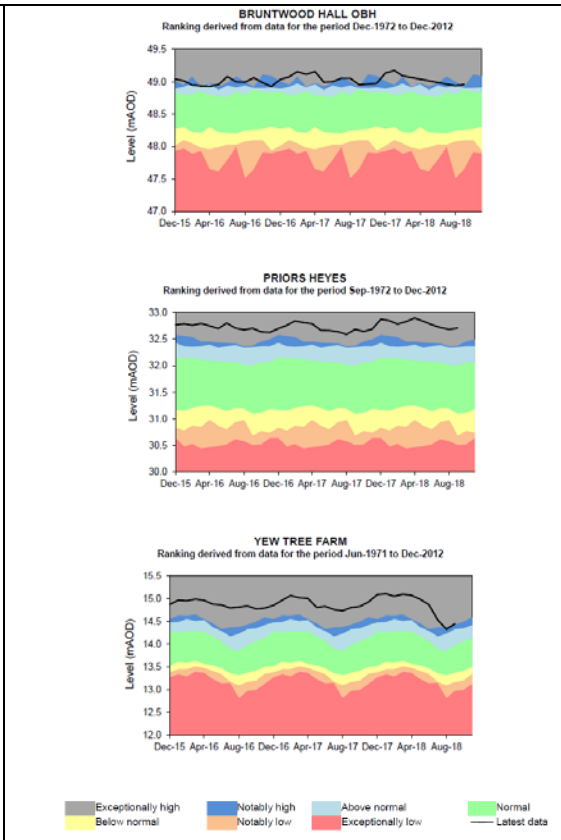
3.5 Groundwater Conditions

Within the North West, groundwater levels for September were classed as between 'Notably low' and 'Exceptionally high', with a few changes in classification observed since the end of August. Brown Bank Lay-By and Priors Heyes remained classed as 'Exceptionally high', Skirwith remained classed as 'Normal'; however, Crow Lady Farm changed from 'Below normal' to 'Notably low', Bruntwood Hall changed from 'Above normal' to 'Exceptionally high' and Yew Tree Farm changed from 'Notably high' to 'Exceptionally high'. Levels at Crow Lady Farm continued to fall due to abstractions at a nearby borehole. The levels at Priors Heyes and Yew Tree Farm still remain relatively high compared to historic levels because the aquifer is recovering from the effects of historically high abstractions.

Figure 15: Groundwater Levels for the North West region



Groundwater levels at the end of the month classed relative to an analysis of historic groundwater levels for the same month



End of month groundwater levels for the past 34 months for North West England groundwater sites

Source: Environment Agency Monthly Water Situation Report – North West

Within Warrington there are a total of 16 groundwater monitors which are owned and maintained by the Environment Agency.

Figure 16: Location of Groundwater Monitors within Warrington

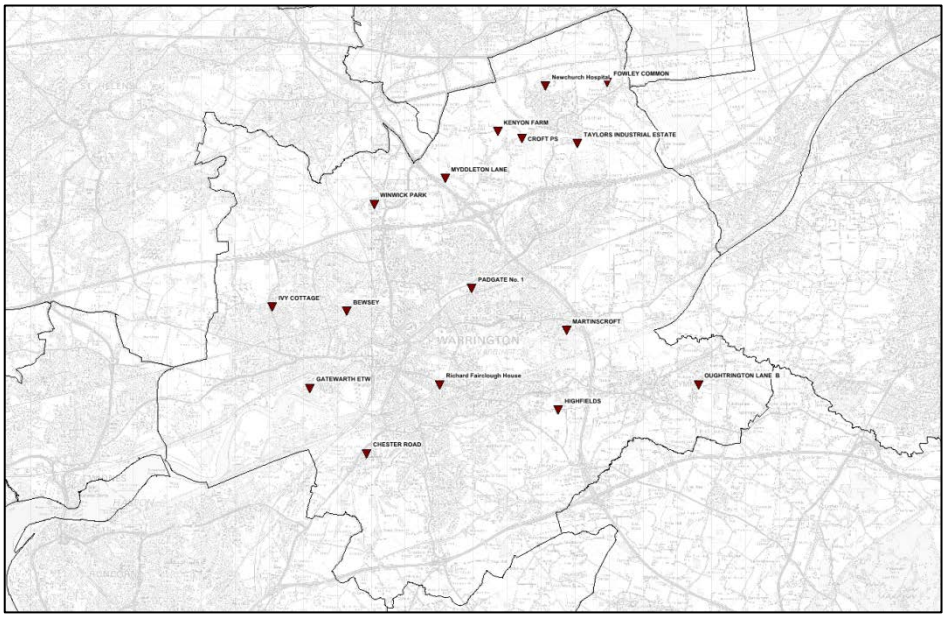


Table 8: Location of Groundwater Monitors within Warrington

Monitor name and Reference	Description	Co-ordinates	Comment
Chester Road - SJ58/117	1 hour recording interval	359839, 385299	Operational
Ivy Cottage - SJ58/127	1 hour recording interval	357070, 389610	Not operational in September 2018
Gatewarth STW - SJ58/150	1 hour recording interval	358170, 387219	Not operational in September 2018
Bewsey - SJ58/162	1 hour recording interval	359259, 389480	Not operational in September 2018
Highfields - SJ68/42	1 hour recording interval	365479, 386580	Operational
Oughtrington Lane B - SJ68/54	1 hour recording interval	369599, 387320	Not operational in September 2018
Martinscroft - SJ68/78	1 hour recording interval	365719, 388920	Not operational in September 2018
Richard Fairclough House - SJ68/87	1 hour recording interval	361989, 387320	Not operational in September 2018
Croft PS - SJ69/129C	1 hour recording interval	364400, 394550	Operational
Fowley Common - SJ69/130	1 hour recording interval	366919, 396199	Not operational in September 2018
Myddleton Lane - SJ69/133	1 hour recording interval	362149, 393379	Operational
Padgate No.1 - SJ69/149A	1 hour recording interval	362929, 390149	Not operational in September 2018
Newchurch Hospital - SJ69/31	1 hour recording interval	365100, 396099	Not operational in September 2018
Kenyon Farm - SJ69/37B	1 hour recording interval	363699, 394760	Not operational in September 2018
Taylors Industrial Estate - SJ69/39	1 hour recording interval	366040, 394400	Not operational in September 2018
Winwick Park - SJ69/46	1 hour recording interval	360067, 392619	Partially operational in September 2018

Figure 17: Ground water levels within Warrington

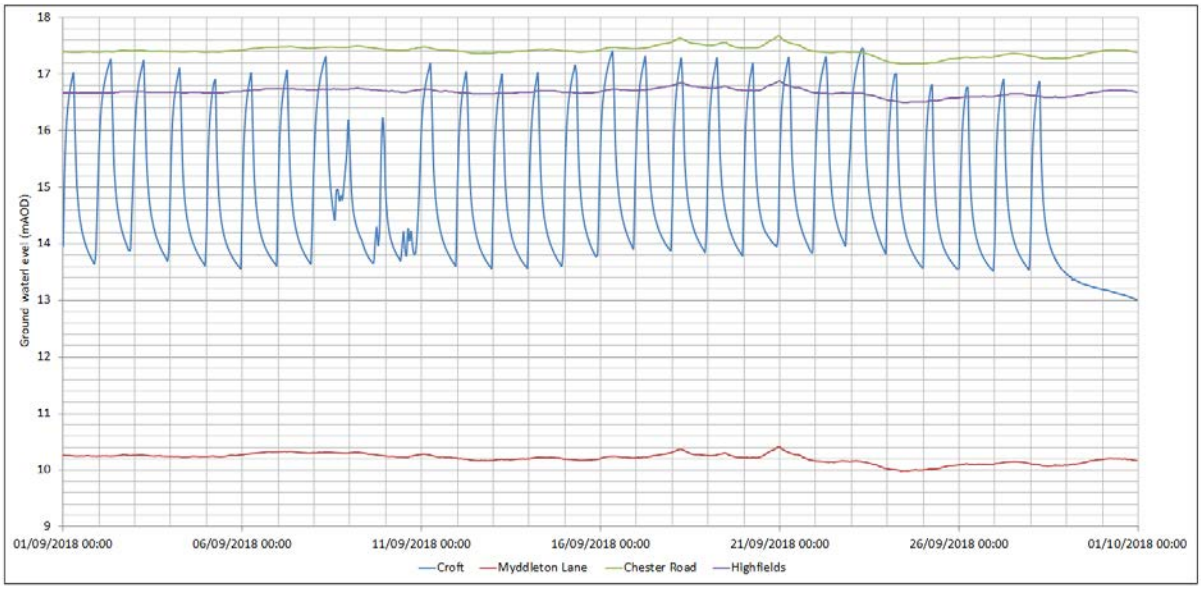


Figure 17 illustrates there is a noticeable increase in ground water conditions as a consequence of Storm Ali and Storm Bronagh. Reviewing the long term data for all locations with respect to the North West region, ground water levels were considered 'Notably high' for the time of year. Whilst near drought conditions were experienced during Summer 2018, only the surface soil layers experienced moisture depletion.

Warrington Borough Council received several reports of surface water flows from adjacent fields being received on the highway. Evidence suggests only surface layers during both storm events where relatively dry, reducing the effective infiltration capacity. With the high intensity rainfall exceeding the current effective infiltration capacity, excess water either remained on the surface or flowed elsewhere due to local topography.

Based on the information collated by Warrington Borough Council and nature of the event, it is considered ground water did not directly contribute to flooding due to water levels being lower than average for this time of year.

4 Flooding Locations

4.1 Campbell Crescent, Great Sankey

Campbell Crescent, Great Sankey is a residential street located in Great Sankey North & Whittle Hall Ward within the administrative area of Warrington Borough Council. It is approximately 2 miles to the west of Warrington town centre

4.1.1 Effects of the Flood Event

It is understood that external flooding occurred to at least one property and flooding occurred to public highway.

4.1.2 Flood History

It is understood that flooding occurred in 2004, the effect of this flooding is not known.

4.1.3 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland. The mapping indicates a watercourse flowing through the area and a possible pond to the south of “Holly House Farm”.

Figure 18: Extract of Historic Mapping (National Library of Scotland)

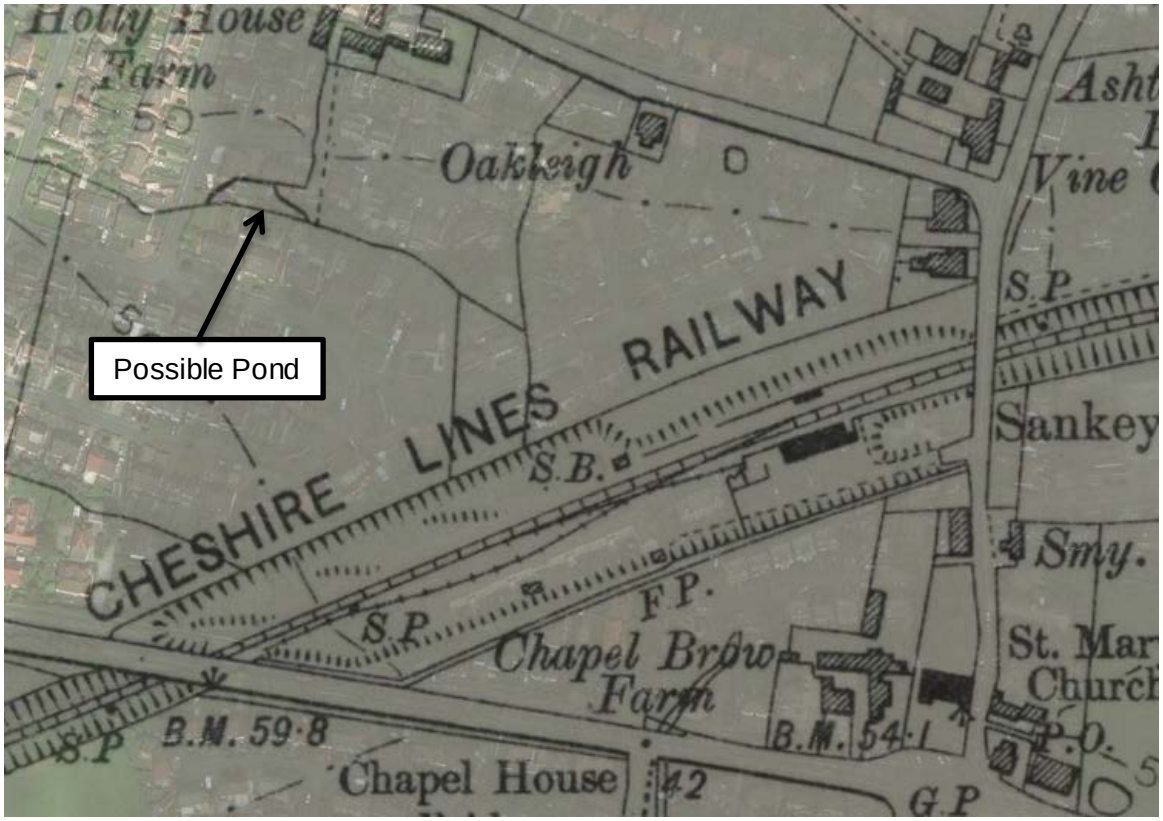
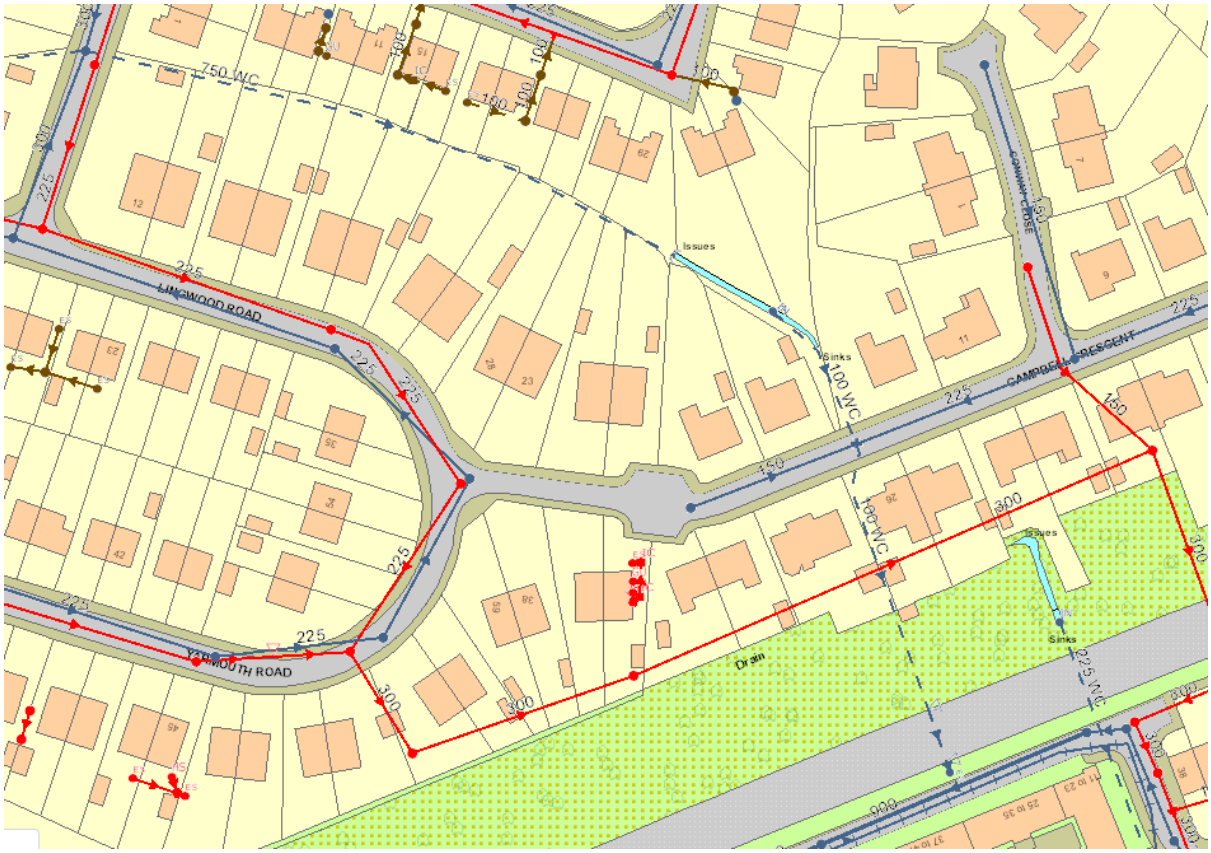


Figure 19: Extract of Historic Mapping (National Library of Scotland)

4.1.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Campbell Crescent. The mapping shows a watercourse running to the rear of several properties on Lingwood Road and Campbell Crescent before crossing Campbell Crescent and siphoning under the railway line.

Figure 20: Extract from United Utilities Statutory Sewer Map



4.1.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Campbell Crescent and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Therefore Campbell Crescent is considered as having a low probability of flooding from rivers or the sea.

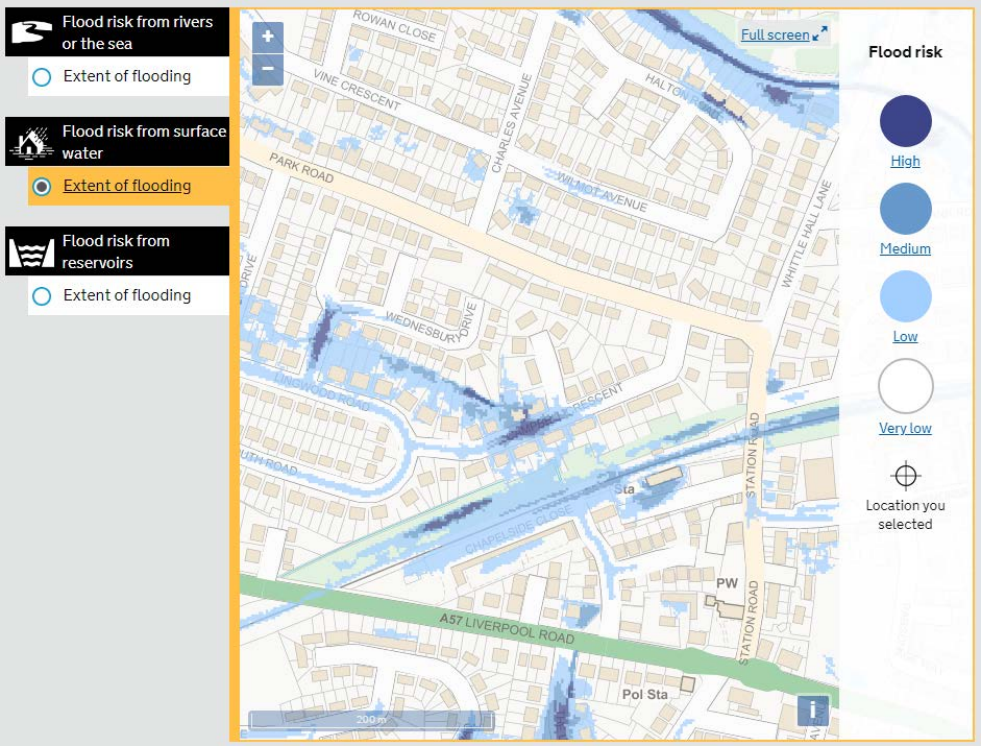
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Campbell Crescent is generally shown as being at risk of surface water flooding but differing in degrees of risk across the area. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 21: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Campbell Crescent is not at risk of flooding from reservoirs.

4.1.6 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Campbell Crescent was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.

4.1.7 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.2 Liverpool Road, Great Sankey

Liverpool Road, Great Sankey is a mixed residential / industrial street located in Great Sankey South Ward within the administrative area of Warrington Borough Council. It is approximately 1.2 miles to the west of Warrington town centre

4.2.1 Effects of the Flood Event

It is understood that external flooding occurred to numerous property and flooding occurred to public highway as evidenced by the extract from the Warrington Guardian website.

Figure 22: Extract from Warrington Guardian Website

Liverpool Road floods after heavy rain

3 comments

WARRINGTON motorists are facing difficult driving conditions for the commute home this evening, Friday, after heavy rain.

Reader Amy Finley sent in this video of her journey home.

Footage of Liverpool Road from around 5.30pm shows flooding while drivers have also reported muddy water flooding Chester Road from the surrounding fields.

4.2.2 Flood History

It is understood that Liverpool Road has a long history of flooding as evidenced by the following images.

Figure 23: Images of Liverpool Road (estimated 1960's)

Figure 24: Image of Liverpool Road (date unknown)

Figure 25: Images of Liverpool Road (04 July 2007)

4.2.3 Historic Mapping

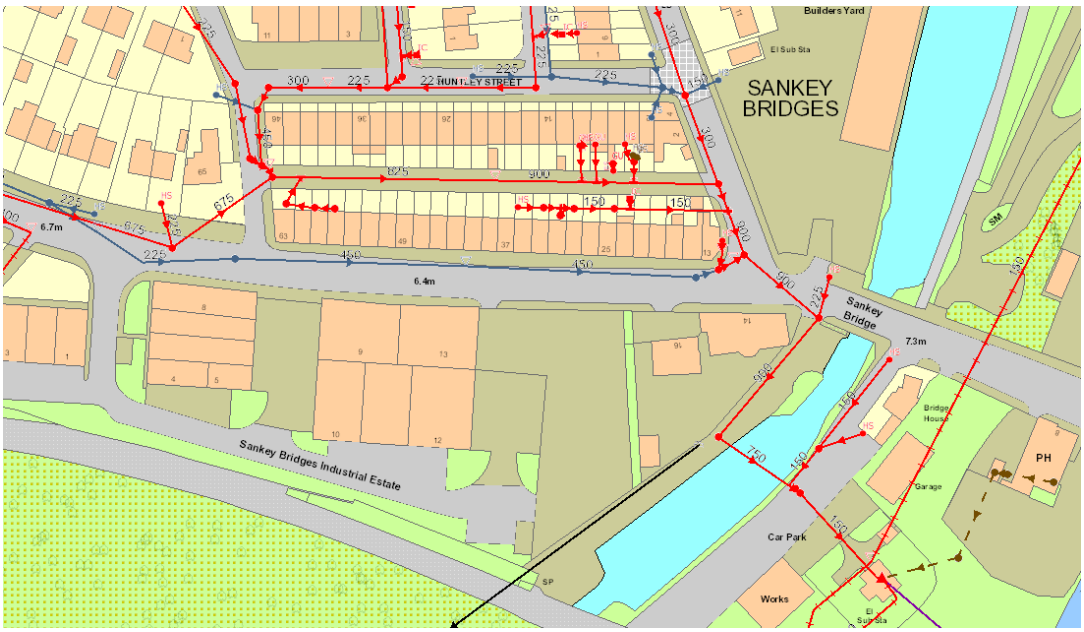
Historic mapping was obtained for the area from the National Library of Scotland. The mapping indicates that several areas in and around Liverpool Road were “liable to floods”.

Figure 26: Extract of Historic Mapping (National Library of Scotland)

4.2.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the section of Liverpool Road which was affected. The mapping shows a 450mm diameter surface water sewer running along the road which discharges to a 900mm diameter combined drainage system. St Helens Canal runs north to south through Sankey Bridges.

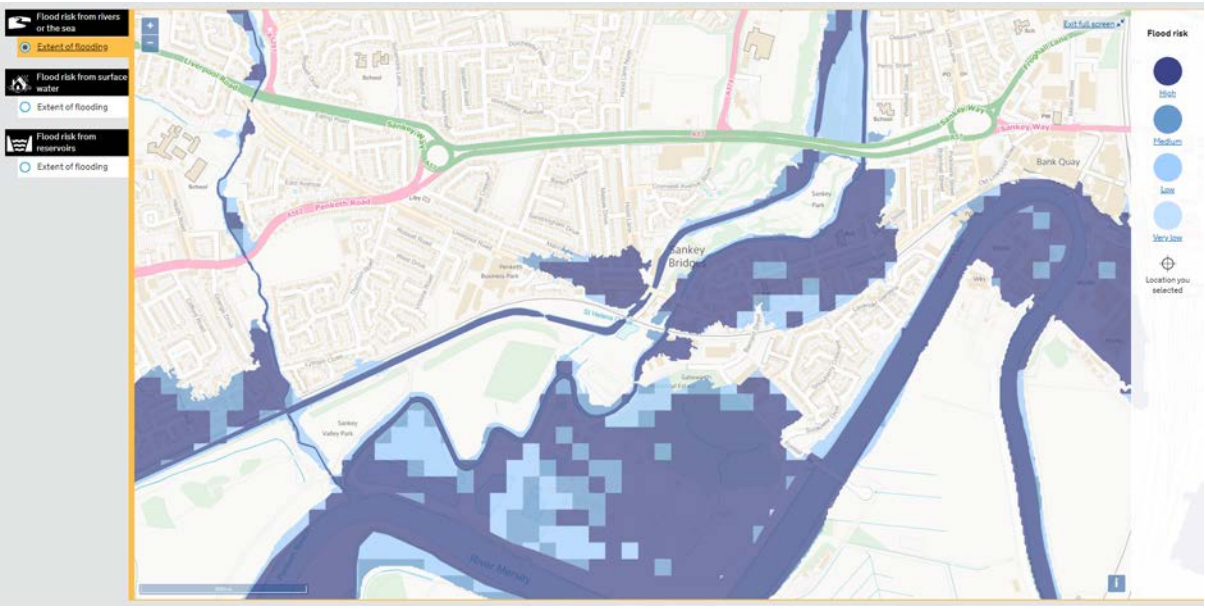
Figure 27: Extract from United Utilities Statutory Sewer Map



4.2.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Liverpool Road and surrounding area as being at high risk or flooding (Flood Zone 3). Flood Zone 3 is defined as "Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding".

Figure 28: Flood Risk from Rivers or the Sea



Therefore Liverpool Road is considered as having a high probability of flooding from rivers or the sea.

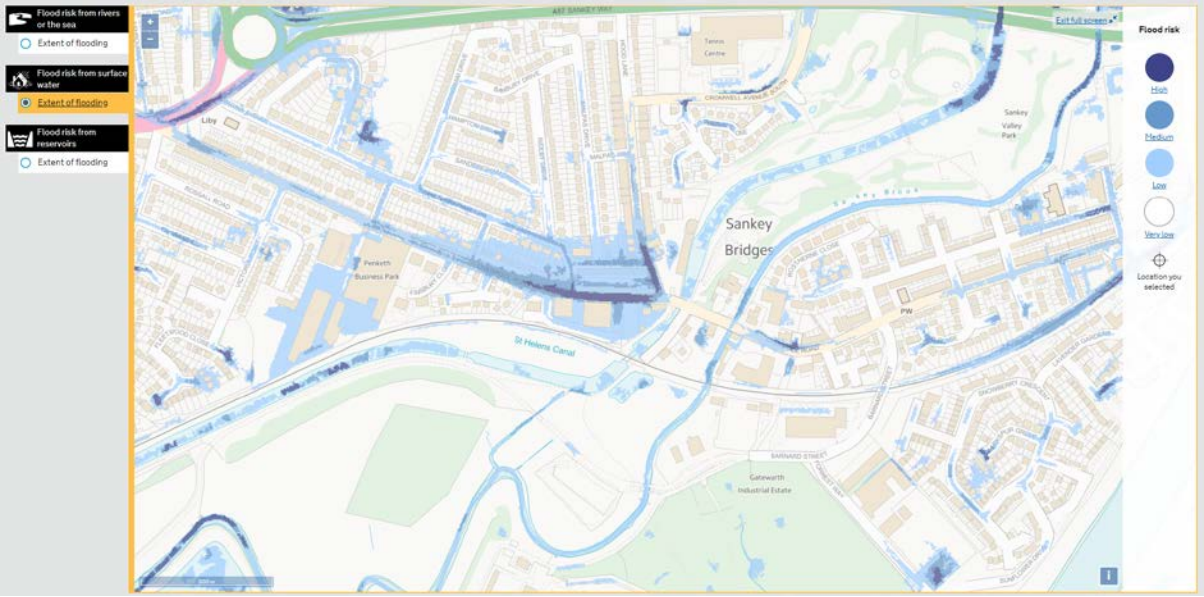
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Liverpool Road is shown as being at risk of surface water flooding but differing in degrees of risk across the area. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

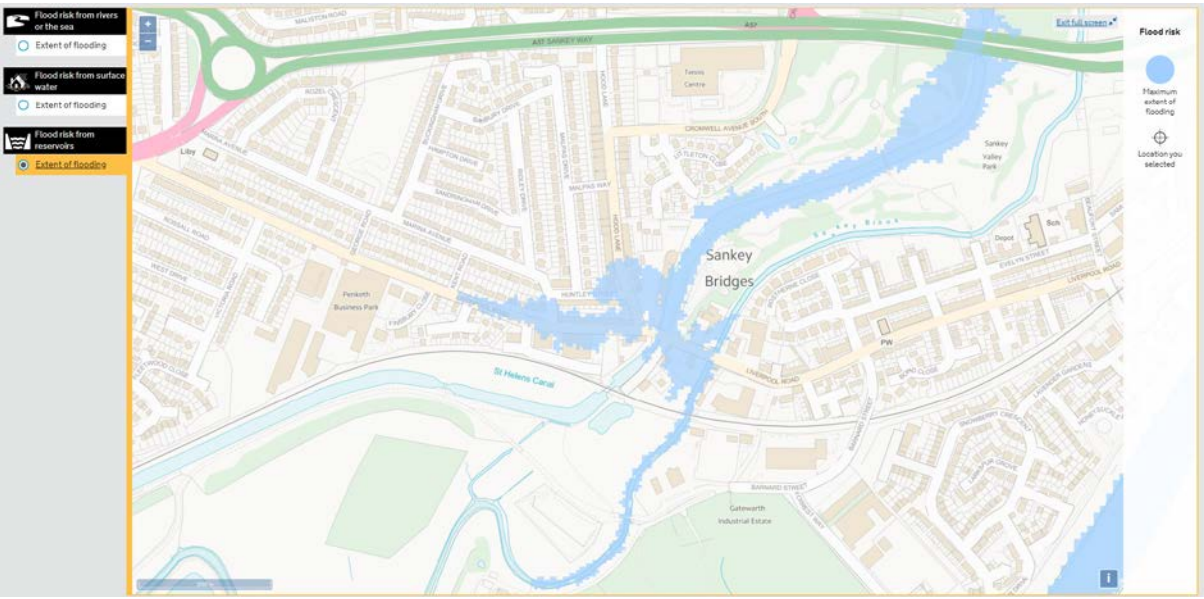
Figure 29: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Liverpool Road is within the maximum extent of flooding from Carr Mill Dam.

Figure 30: Flood Risk from Reservoirs Mapping



4.2.6 Highway Maintenance Records
According to Highway Maintenance records sandbags were delivered on 21 September 2018.

4.2.7 Flooding Mechanism Conclusion

Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Liverpool Road was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.

4.2.8 Actions

Warrington Borough Council will continue to monitor this area for flooding.

Environment Agency is currently looking at a flood risk management scheme covering Sankey Bridges area.

4.3 Fairfield Road, Stockton Heath

Fairfield Road, Stockton Heath is a predominantly residential area located in Stockton Heath ward within the administrative area of Warrington Borough Council. It is approximately 1 mile to the south of Warrington town centre.

4.3.1 Effects of the Flood Event

It is understood that external flooding occurred to numerous property and flooding occurred to public highway at the junction of Fairfield Road and Gaskell Street as evidenced by the extract from the Warrington Guardian website.

Figure 31: Extract from Warrington Guardian Website

4.3.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.3.3 Historic Mapping

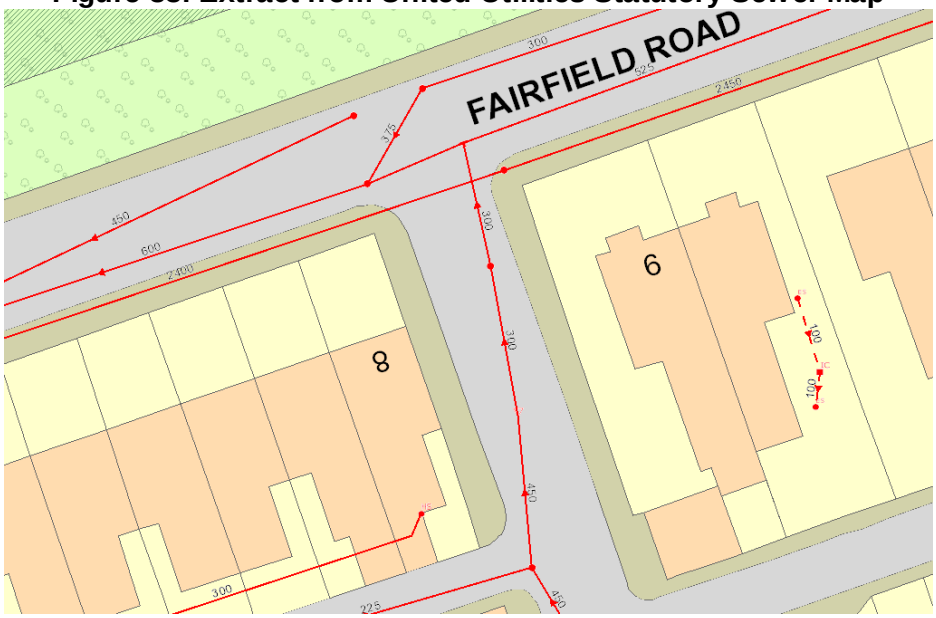
Historic mapping was obtained for the area from the National Library of Scotland. With the exception of the Manchester Ship Canal, no drainage features are visible in the area around the junction of Fairfield Road and Gaskell Street.

Figure 32: Extract of Historic Mapping (National Library of Scotland)

4.3.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the section of Fairfield Road which was affected. The mapping shows several combined United Utilities systems in the area varying in size from 225mm diameter to 2450mm.

Figure 33: Extract from United Utilities Statutory Sewer Map



4.3.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Fairfield Road junction with Gaskell Street and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Therefore Fairfield Road junction with Gaskell Street is considered as having a low probability of flooding from rivers or the sea.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Fairfield Road junction with Gaskell Street is shown as being at risk of surface water flooding but differing in degrees of risk across the area. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 34: Flood Risk from Surface Water Mapping

The area shown by the mapping as being at high risk of surface water flooding at the junction of Fairfield Road and Gaskell Street is comparable with the affected area observed during the flood event in figure 34 above.

Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Fairfield Road is not at risk of flooding from reservoirs.

4.3.6 Highway Maintenance Records
Highway Maintenance Records state that a Highway Inspector attended site with a gully crew and cleared the junction of Fairfield Road with Gaskell Street.

The defect was recorded as “gully blocked causing flooding.”

4.3.7 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Fairfield Road was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by an apparent blocked gully.

4.3.8 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.4 Sankey Street, Bewsey & Whitecross

Sankey Street is a predominantly commercial area in Warrington Town Centre. Sankey Street is located in Bewsey & Whitecross ward which is within the administrative area of Warrington Borough Council.

4.4.1 Effects of the Flood Event

It is understood from a report in the Warrington Guardian that flooding occurred to the public highway on Sankey Street.

No further information regarding the flooding is available.

4.4.2 Flood History

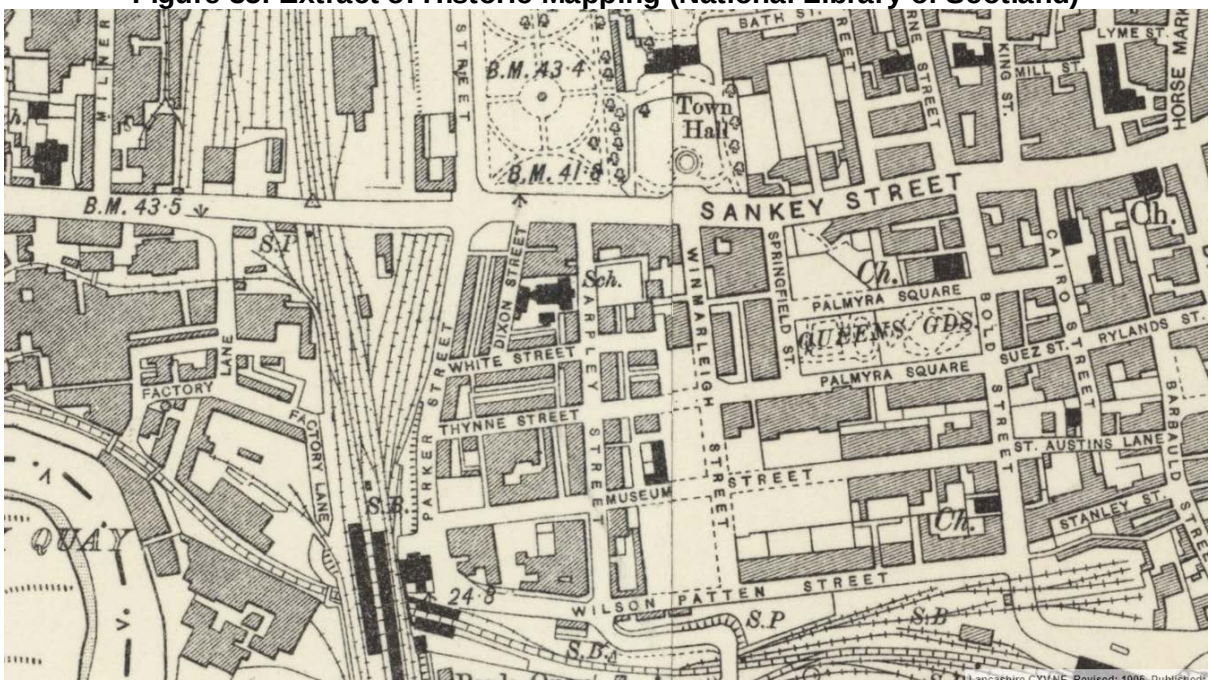
The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.4.3 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland.

With the exception of the River Mersey (approx. 500m to the south west), no drainage features are visible in the area.

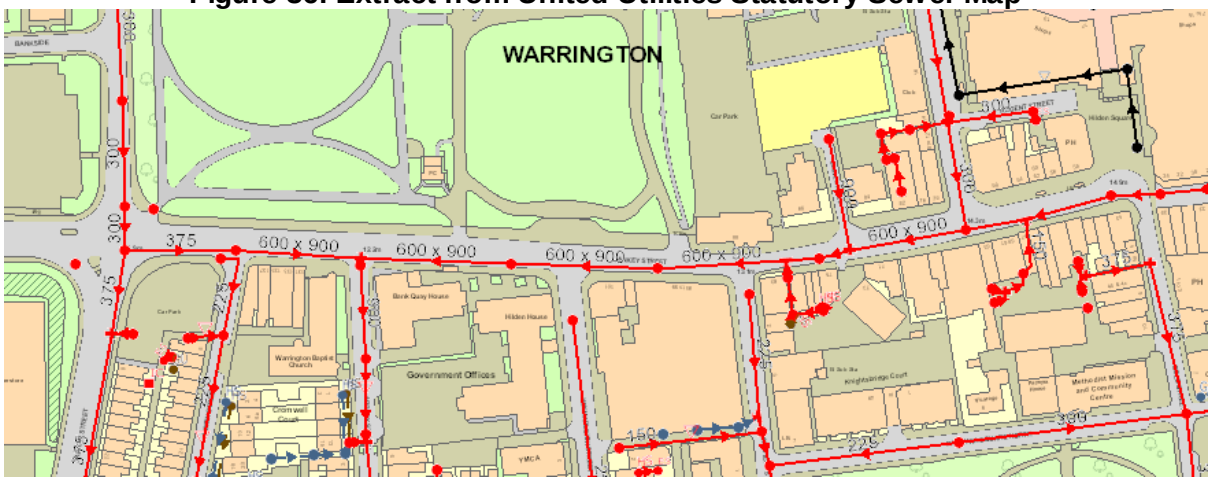
Figure 35: Extract of Historic Mapping (National Library of Scotland)



4.4.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities. The mapping shows a combined United Utilities system which appears to be a box culvert 600mm x 900mm in size serving Sankey Street.

Figure 36: Extract from United Utilities Statutory Sewer Map



4.4.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Sankey Street and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Therefore Sankey Street is considered as having a low probability of flooding from rivers or the sea.

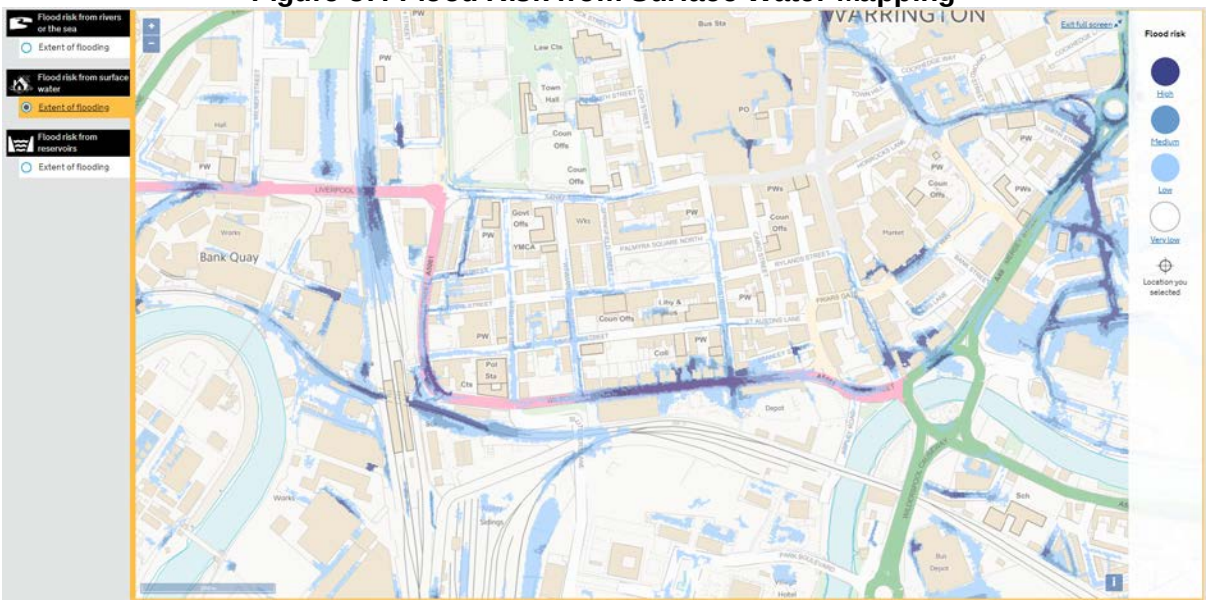
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Sankey Street is shown as being at low risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 37: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Fairfield Road is not at risk of flooding from reservoirs.

4.4.6 Highway Maintenance Records
Highway Maintenance Records indicate an inspection was undertaken on 26 September 2018 following a reported blocked gully on 25 September 2018.

The defect was recorded as “gully blocked causing flooding.”

4.4.7 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Sankey Street was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by an apparent blocked gully.

4.4.8 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.5 Wash Lane, Latchford

Wash Lane is a mixed commercial / residential area in Latchford East ward which is within the administrative area of Warrington Borough Council.

Wash lane is approximately 1.2miles south east of the town centre.

4.5.1 Effects of the Flood Event

It is understood from a report in the Warrington Guardian that flooding occurred to the public highway on Wash Lane.

No further information regarding the flooding is available.

4.5.2 Flood History

The Engineering and Flood Risk Team is aware of a previous flood event on 12 August 2008.

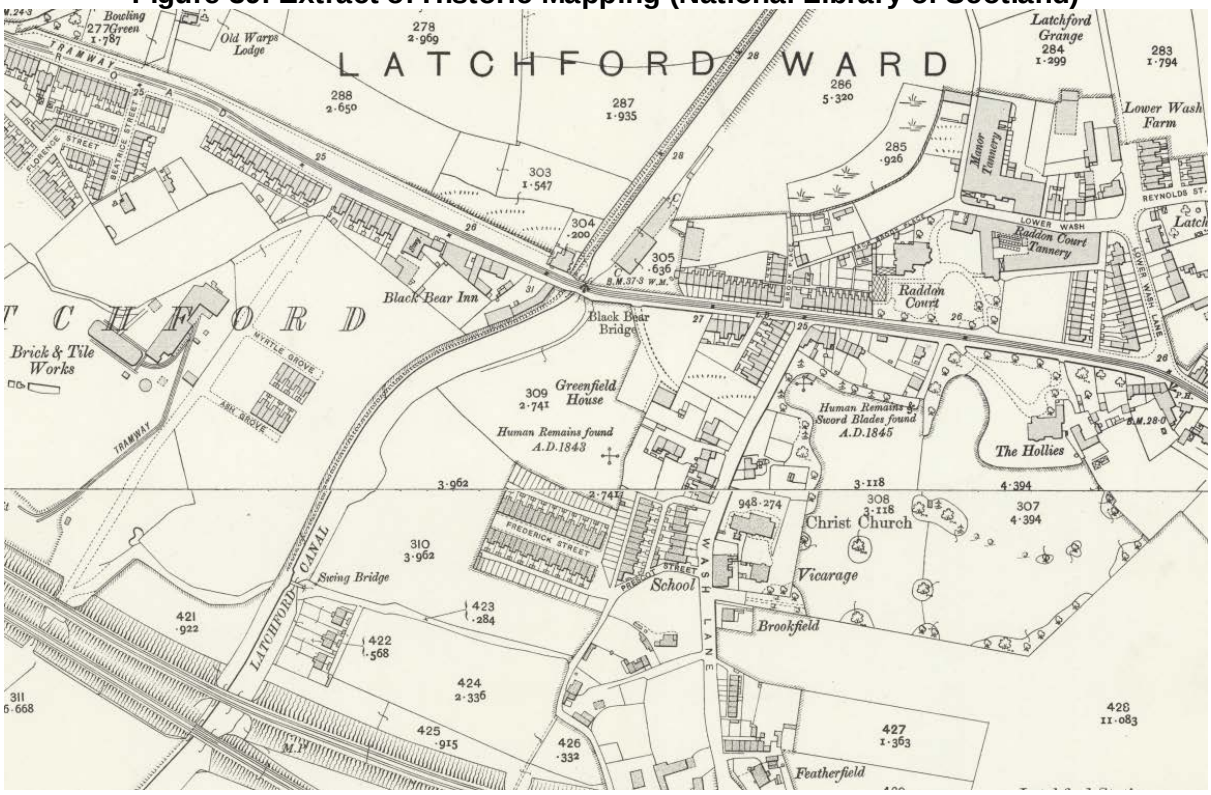
Figure 38: Image of Flood Event 12 August 2008

4.5.3 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland.

With the exception of the Latchford Canal (approx. 200m to the west) which is no longer in existence, no drainage features are visible in the area.

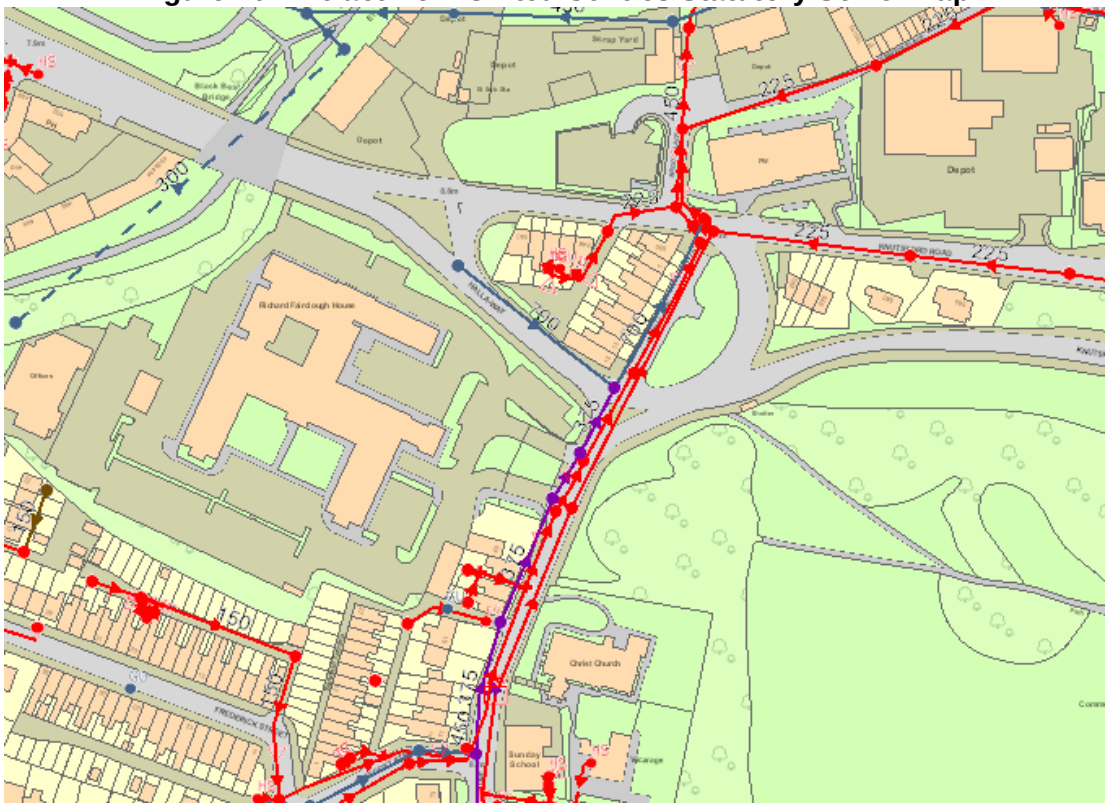
Figure 39: Extract of Historic Mapping (National Library of Scotland)



4.5.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities. The mapping shows separate combined United Utilities system and surface water systems.

Figure 40: Extract from United Utilities Statutory Sewer Map

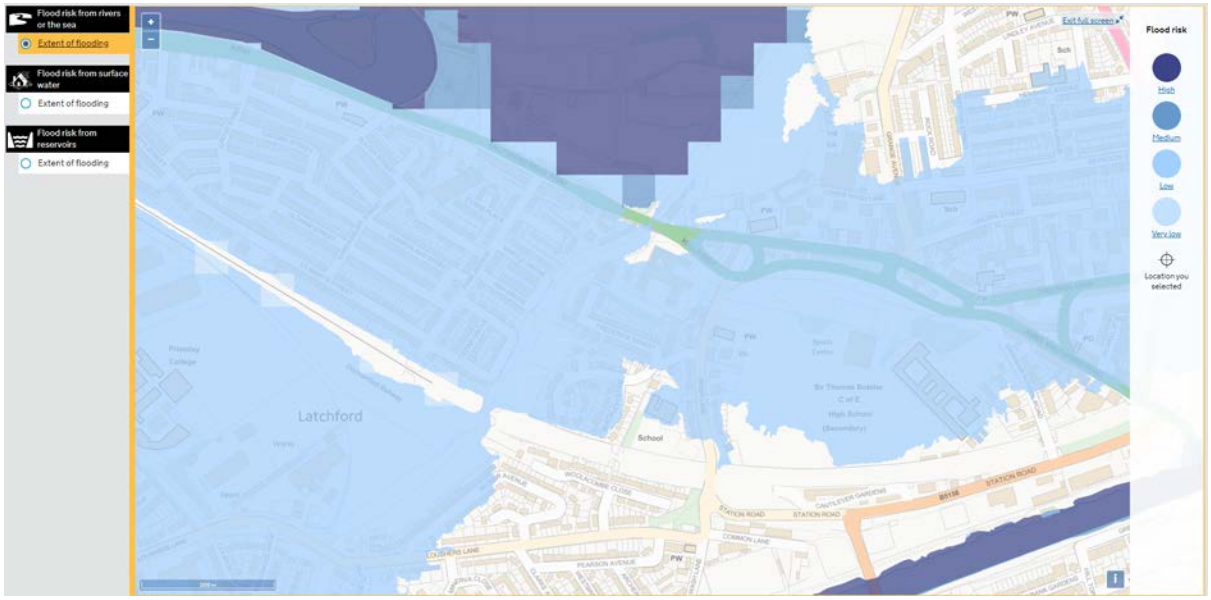


4.5.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Wash lane and surrounding area as being in Flood Zone 2. Flood Zone 2 is defined as medium probability and "Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding".

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Figure 41: Flood Risk from Rivers or the Sea

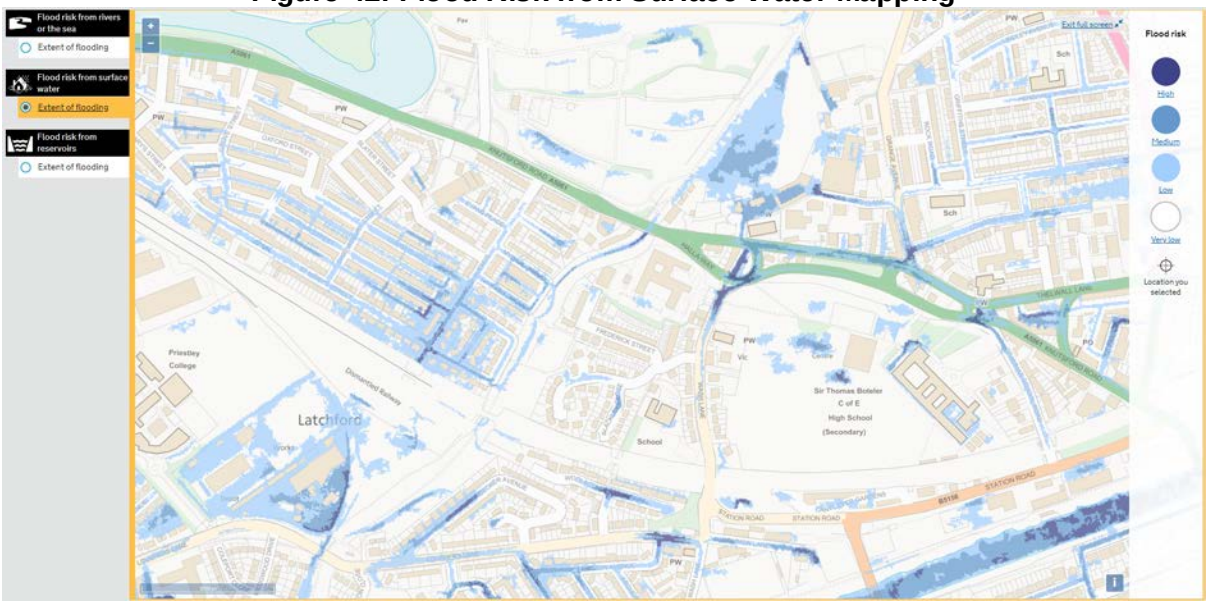


Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Wash Lane is shown as being at high risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 42: Flood Risk from Surface Water Mapping



The area shown by the mapping as being at high risk of surface water flooding on Wash Lane is comparable with the affected area observed during the flood event in 2008 in figure 42 above.

Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Fairfield Road is not at risk of flooding from reservoirs.

4.5.6 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Wash Lane was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.

4.5.7 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.6 Barnes Avenue, Fearnhead

Barnes Avenue, Fearnhead is a residential area in Poulton North ward which is within the administrative area of Warrington Borough Council.

Barnes Avenue is approximately 2.5miles north east of the town centre.

4.6.1 Effects of the Flood Event

It is understood from discussion with residents that external flooding occurred to numerous property and flooding occurred to public highway.

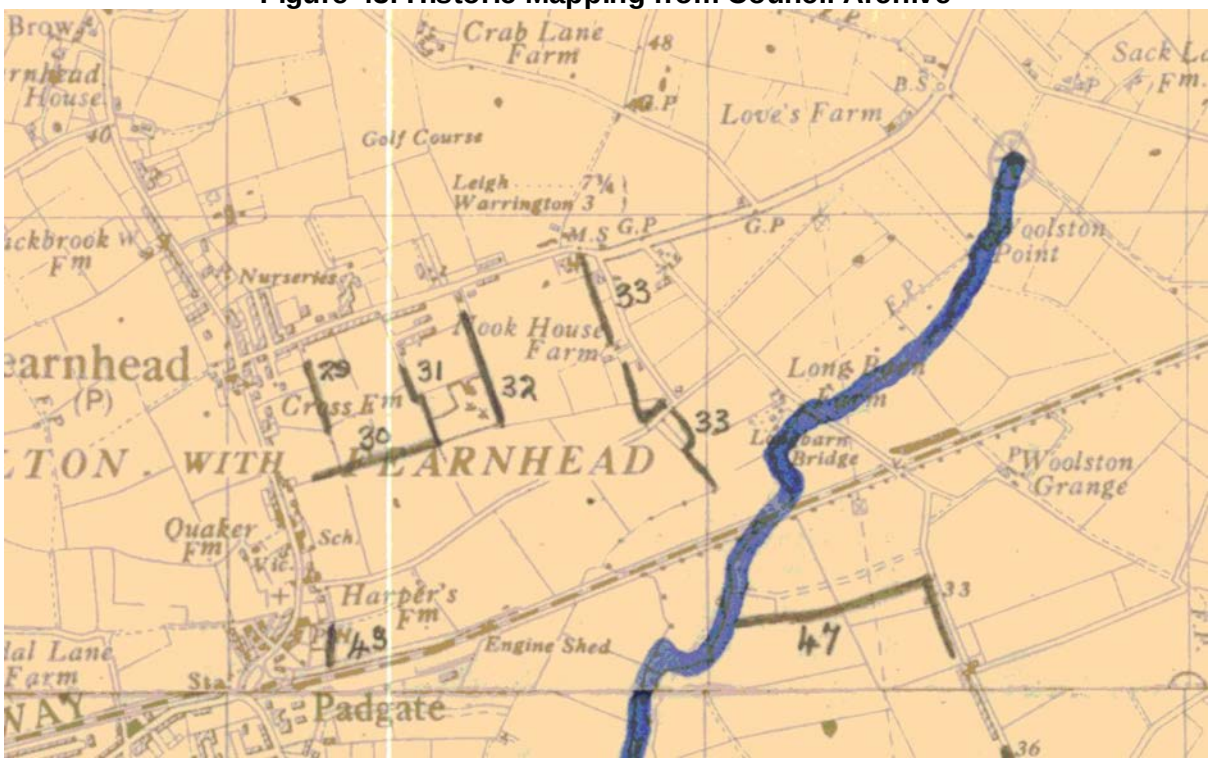
4.6.2 Flood History

Archived correspondence between Warrington Borough Council and The University of Chester, Warrington Campus indicate that there is history of drainage problems in the area since 2004.

4.6.3 Historic Mapping

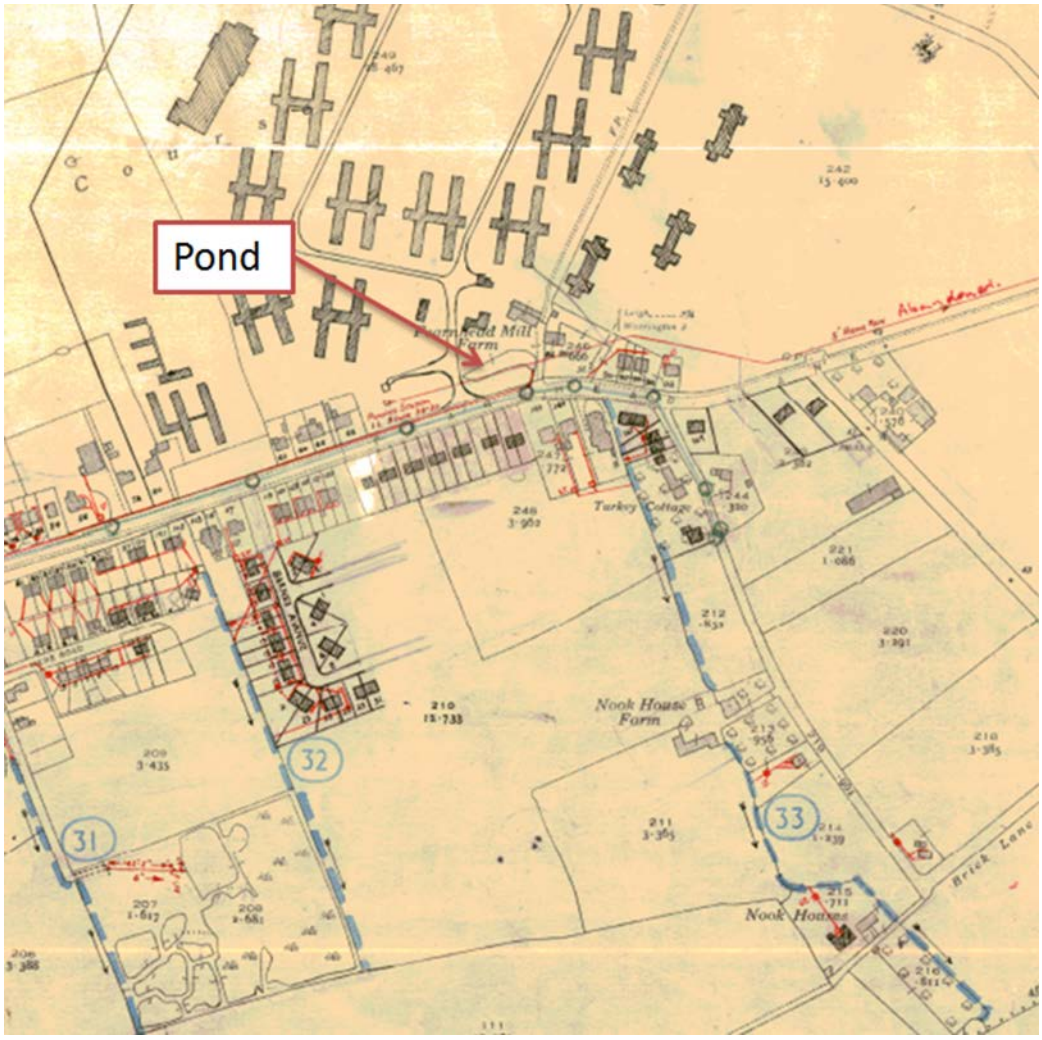
The Engineering & Flood Risk Team have consulted the Councils archives. The earliest map shows a watercourse (number 33 on Figure 43) in the vicinity of the Barnes Avenue. The watercourse appears to flow towards Spittle Brook before it was realigned most likely as a result of the construction of the M6 motorway.

Figure 43: Historic Mapping from Council Archive



A later map also shows a pond where a new car park has been constructed on the University Campus (Figure 44). The pond is also shown on historical mapping available from the National Library of Scotland.

Figure 44: Historic Mapping from Council Archive



4.6.4 United Utilities Statutory Sewer Map

The mapping shows a 450mm diameter surface water system leaving the University Campus site adjacent to the western boundary of 90 Fearnhead Lane.

The system is shown to cross the road and runs generally along the eastern boundary of the Risley Independent Methodist Church before becoming an open watercourse to the rear of 7 Nook Lane.

The watercourse is shown as being open for a distance of approx. 55m before becoming culverted to the rear of 21 & 19 Nook Lane via a 300mm diameter pipe for a distance of approx. 18m.

The system is shown as discharging into a watercourse in Longbarn Park. The watercourse is open for approx. 30m before becoming culverted again via a 300mm diameter pipe. The system runs in a general south east direction under Birchwood Way via a 600mm diameter pipe before discharging into an open watercourse to the rear of 39 Anderson Close.

The watercourse is open for approx. 20m before becoming culverted again via a 300mm diameter pipe. The system continues to run in a general south east direction gradually increasing in size to 675mm diameter before discharging into Spittle Brook to the rear of

properties on Freshfields Drive near to the Liverpool – Manchester railway line (Southern route - Cheshire Lines Committee).

Figure 45: Extract from United Utilities Statutory Sewer Map

4.6.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Barnes Avenue and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Therefore Sankey Street is considered as having a low probability of flooding from rivers or the sea.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Barnes Avenue is shown as being at medium risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 46: Flood Risk from Surface Water Mapping

The area shown by the mapping appears to contradict the discussion with customers and the correspondence from 2004.

Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Fairfield Road is not at risk of flooding from reservoirs.

4.6.6 Flooding Mechanism Conclusion

Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Barnes Avenue was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.

The extent of flooding does not appear to match the available mapping. It is thought that additional flows are being brought to the area by another mechanism.

4.6.7 Actions

Warrington Borough Council to undertake further investigation into the drainage system to the rear of properties on Nook Lane.

4.7 Oughtrington Lane, Lymm

Oughtrington Lane is a predominantly rural residential area in Lymm South ward which is within the administrative area of Warrington Borough Council.

Oughtrington Lane is approximately 5 miles east of the town centre

4.7.1 Effects of the Flood Event

It is understood that Oughtrington Lane was affected south of its junction with Longbutt Lane affecting access to Lymm High School.

Figure 47: Image of Flooding at Oughtrington Lane on 21 September 2018.

Figure 48: Screenshot of Twitter

4.7.2 Flood History

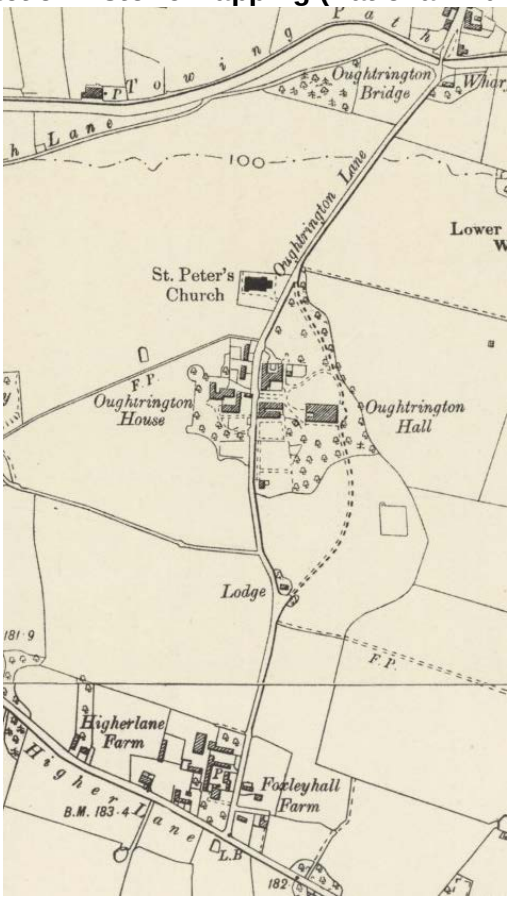
The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.7.3 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland.

With the exception of the Bridgewater River Mersey (approx. 500m to the south west), no drainage features are visible in the area.

Figure 49: Extract of Historic Mapping (National Library of Scotland)

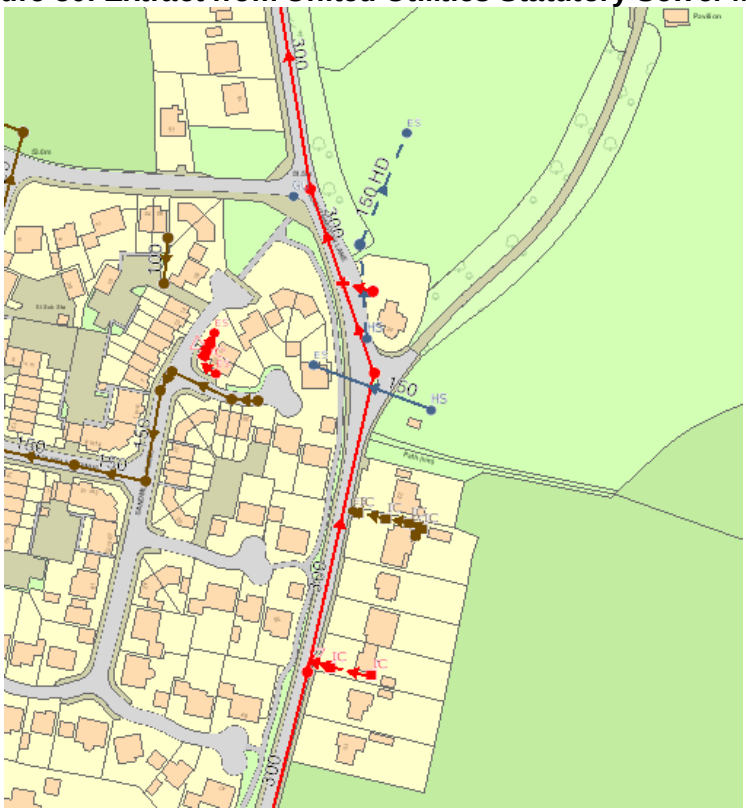


4.7.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities. The mapping shows a 300mm diameter combined United Utilities system and 150mm diameter public surface water sewer serving the affected area.

A 150mm highway drain is also shown on the Statutory Sewer Map.

Figure 50: Extract from United Utilities Statutory Sewer Map



4.7.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Oughtrington Lane and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Therefore Oughtrington Lane is considered as having a low probability of flooding from rivers or the sea.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Oughtrington Lane is shown as being at high risk of surface water flooding to the carriageway. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 51: Flood Risk from Surface Water Mapping

The area shown by the mapping as being at high risk of surface water flooding on Oughtrington Lane is comparable with the affected area observed during the flood event in on 21 September 2019 in figure 51 above.

Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Fairfield Road is not at risk of flooding from reservoirs.

4.7.6 Highway Maintenance Records
Highway Maintenance Records indicate Warrington Borough Council Gully crew attended site and cleared blockages on Friday 21 September 2019.

The defect was recorded as “gully blocked causing flooding.”

4.7.7 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Oughtrington Lane was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by an apparent blocked gully.

4.7.8 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.8 Highfield Avenue, Great Sankey

Highfield Avenue is a predominantly residential area in Great Sankey North & Whittle Hall ward which is within the administrative area of Warrington Borough Council.

Highfield Avenue is approximately 2 miles west of the town centre

4.8.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that external flooding occurred from the combined public sewer.

4.8.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.8.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Highfield Avenue as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk

Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Highfield Avenue is shown as being at low risk of surface water flooding to the carriageway. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 52: Flood Risk from Surface Water Mapping

Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

United Utilities believe there may be a hydraulic issue on the combined sewer serving Highfield Avenue with a possible influence from the nearby brook.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Highfield Avenue is not at risk of flooding from reservoirs.

4.8.4 Flooding Mechanism Conclusion

Review of the available data has indicated the flooding that was experienced on 21 September 2019 was due to an issue on the United Utilities combined sewer.

4.9 Bridge Street, Warrington Town Centre

Bridge Street is a predominantly commercial/retail area in Bewsey & Whitecross ward which is within the administrative area of Warrington Borough Council.

4.9.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that internal flooding occurred in the cellar of 2no. Properties.

4.9.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.9.3 Long Term Flood Risk

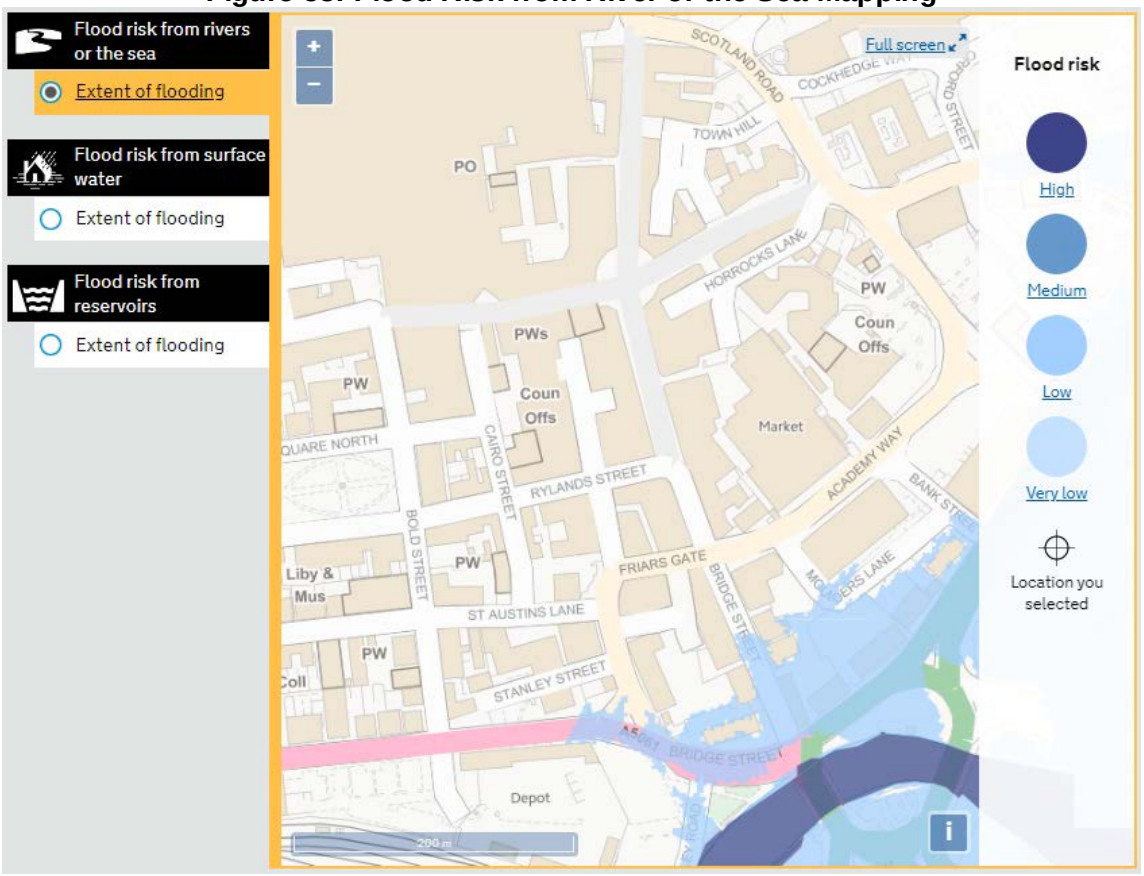
Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows the majority of Bridge Street as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

The lower section of Bridge Street is shown as being in Flood Zone 2. Flood Zone 2 is defined as medium probability and "Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding".

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Figure 53: Flood Risk from River or the Sea Mapping

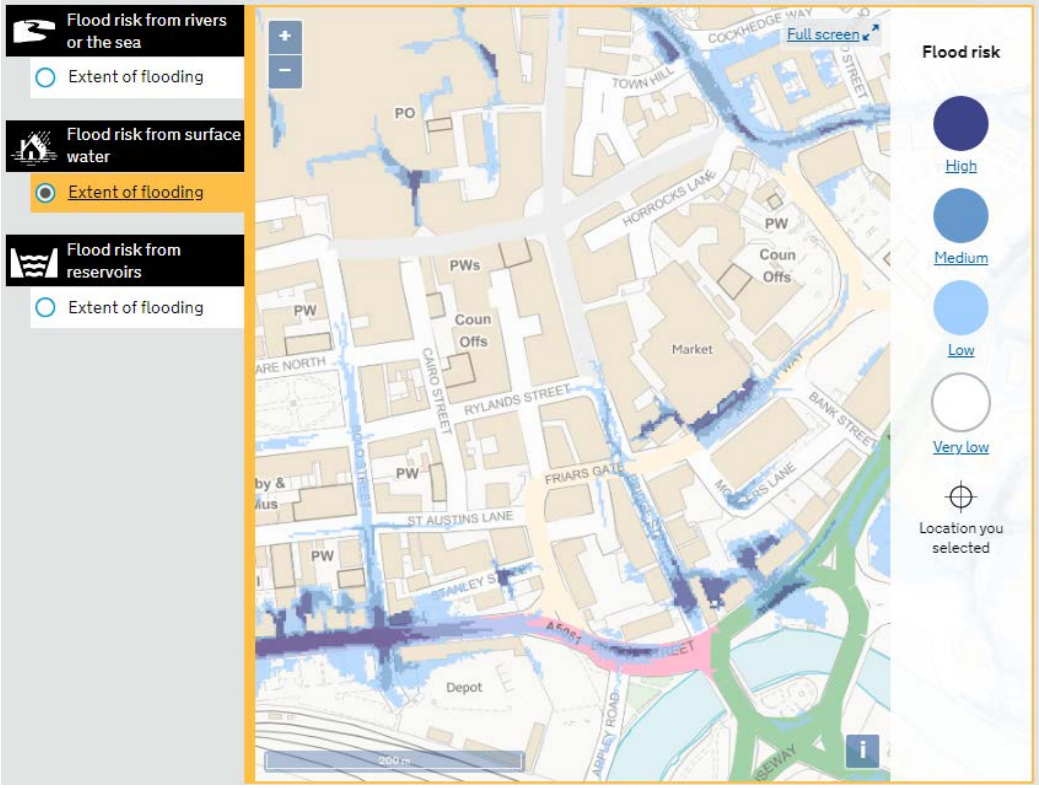


Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Bridge Street is shown as being at varying levels of risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 54: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Bridge Street is not at risk of flooding from reservoirs.

4.9.4 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2019 at Bridge Street was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.

4.10 Fox Street, Bewsey & Whitecross

Fox Street is a predominantly residential area in Bewsey & Whitecross ward which is within the administrative area of Warrington Borough Council.

Fox Street is approximately 0.7 miles west of the town centre

4.10.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that external flooding occurred due to a partially blocked surface water gully amplified by severe rainfall.

4.10.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.10.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Fox Street and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as “Land having less than a 1 in 1000 annual probability of river or sea flooding”.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk

Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Fox Street is shown as being at very low risk of surface water flooding to the carriageway. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Sewer Long Term Flood Risk

Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk

The Environment Agency Flood Risk from Reservoirs map indicates that Fox Street is not at risk of flooding from reservoirs.

4.10.4 Highway Maintenance Records

Highway Maintenance Records indicate that a defect was recorded on 05 December 2018 as “gully blocked causing flooding”

Maintenance records indicate that cleaning of the gully and jetting of the connection was undertaken on 07 December 2018.

The defect was recorded as “gully blocked causing flooding.”

4.10.5 Flooding Mechanism Conclusion

Review of the available data has indicated the flooding that was experienced on 21 September 2018 at Fox Street was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by an apparent partially blocked gully.

4.10.6 Actions

Warrington Borough Council will continue to monitor this area for flooding.

4.11 Duncansby Crescent, Great Sankey

Duncansby Crescent is a predominantly residential area in Great Sankey North & Whittle Hall ward which is within the administrative area of Warrington Borough Council.

Duncansby Crescent is approximately 2.5 miles west of the town centre

4.11.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that external and highway flooding occurred on 21 September 2019.

United Utilities responded to this flood event but by the time they arrived the flooding had dissipated.

4.11.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.11.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Duncansby Crescent and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as "Land having less than a 1 in 1000 annual probability of river or sea flooding".

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

Surface Water Long Term Flood Risk

Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Duncansby Crescent is shown as being at low risk of surface water flooding to the carriageway. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Sewer Long Term Flood Risk

Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk

The Environment Agency Flood Risk from Reservoirs map indicates that Duncansby Crescent is not at risk of flooding from reservoirs.

4.11.4 Highway Maintenance Records

No Highway Maintenance Records were recorded for this location around 21 September 2018.

4.11.5 Flooding Mechanism Conclusion

United Utilities believe that there may be a severe weather hydraulic issue in the area.

4.11.6 Actions

Warrington Borough Council will continue to monitor this area for flooding.

4.12 Milner Street, Bewsey & Whitecross

Milner Street is a predominantly commercial / industrial area in Bewsey & Whitecross ward which is within the administrative area of Warrington Borough Council.

Milner Street is approximately 0.35 miles west of the town centre

4.12.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that surface water flooding occurred to a car park on Milner Street.

United Utilities understand the issue to be a possible siltation issue or problem with private drains; amplified by severe rainfall.

4.12.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.12.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Milner Street and surrounding area as being in Flood Zone 1. Flood Zone 1 is defined as “Land having less than a 1 in 1000 annual probability of river or sea flooding”.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

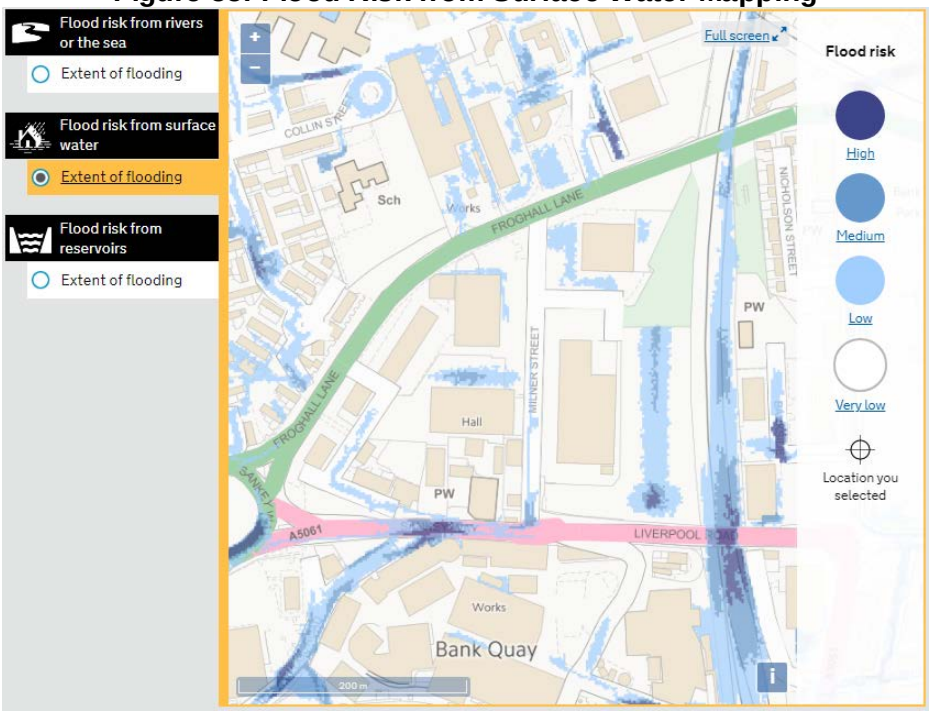
Surface Water Long Term Flood Risk

Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, a number of the car parks on Milner Street are shown at varying risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 55: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Milner Street is not at risk of flooding from reservoirs.

4.12.4 Highway Maintenance Records
No Highway Maintenance Records were recorded for this location around 21 September 2018.

4.12.5 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2018 at Milner Street was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by issues with private drainage arrangements.

4.12.6 Actions
Warrington Borough Council will continue to monitor this area for flooding.

4.13 Alderbank Road, Great Sankey

Alderbank Road is a predominantly residential area in Great Sankey North & Whittle Hall ward which is within the administrative area of Warrington Borough Council.

Alderbank Road is approximately 2 miles west of the town centre

4.13.1 Effects of the Flood Event

Warrington Borough Council was notified by United Utilities that external flooding occurred to a residential property.

United Utilities understand the issue to be a possible private issue with roots, amplified by severe rainfall.

4.13.2 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at this location but that is not to say flooding has not occurred.

4.13.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows varying levels of fluvial / tidal flood risk to Alderbank Road ranging from Flood Zone 1 to Flood Zone 3.

Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

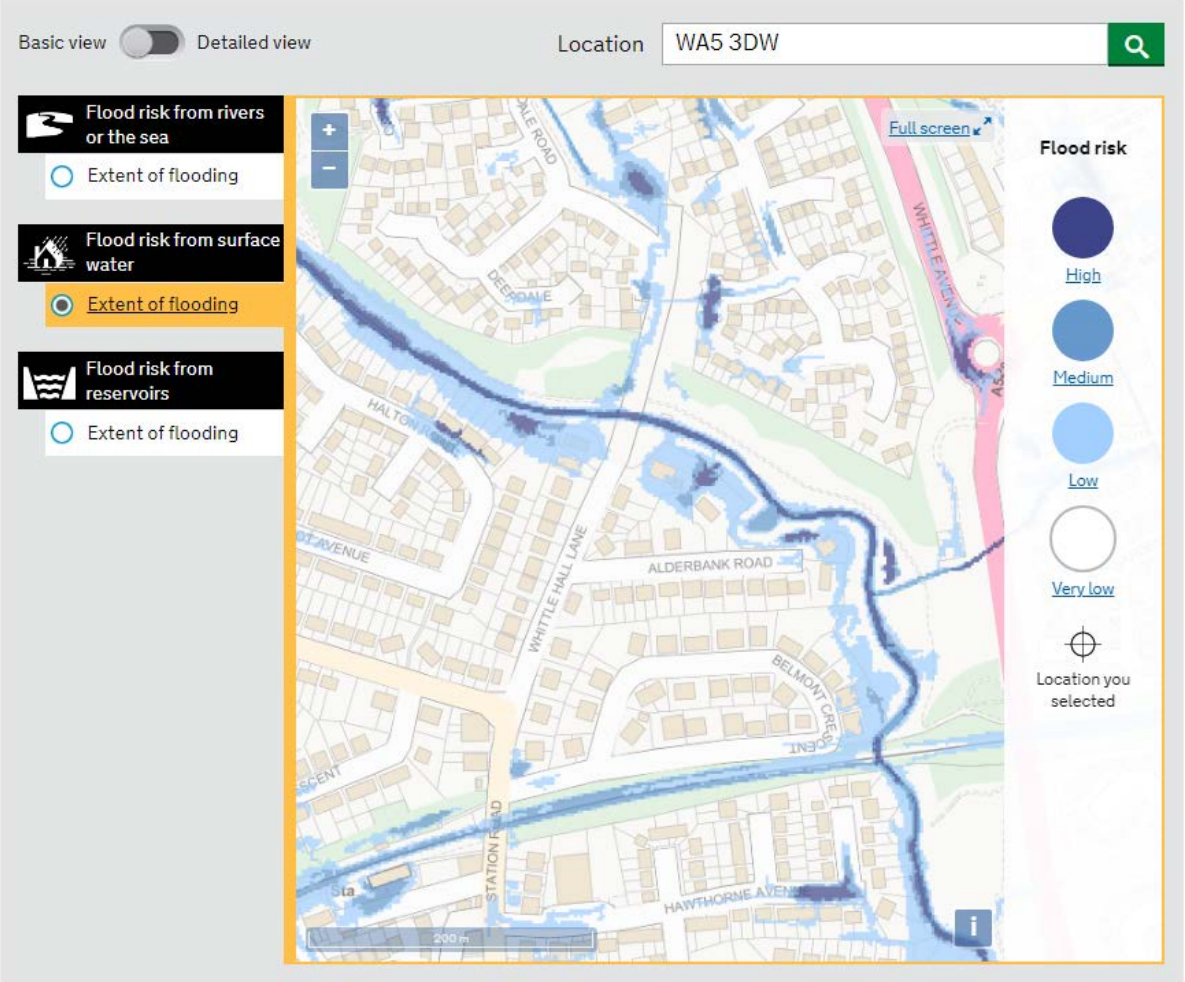
Surface Water Long Term Flood Risk

Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas that may be at risk of surface water flooding for 30 year (high risk), 100 year (medium risk) and 1000 year (low risk) storms.

It is important to note that this is national mapping product and does not represent reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Alderbank Road is shown as being at varying levels of risk of surface water flooding. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 56: Flood Risk from Surface Water Mapping



Sewer Long Term Flood Risk
Warrington Borough Council is not aware of the condition / capacity etc. of the United Utilities drainage system in the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Alderbank Road is not at risk of flooding from reservoirs.

4.13.4 Highway Maintenance Records
No Highway Maintenance Records were recorded for this location around 21 September 2018.

4.13.5 Flooding Mechanism Conclusion
Review of the available data has indicated the flooding that was experienced on 21 September 2018 at Alderbank Road was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding highlighted by issues with private drainage arrangements.

4.13.6 Actions
Warrington Borough Council will continue to monitor this area for flooding.

5 Conclusions

In the absence of further information, the following conclusions have been made:

- It is the opinion of the Engineering & Flood Risk Team that the flood mechanism which led to flooding across Warrington on 21 September 2018 was primarily pluvial (extreme rainfall).

- As we have no knowledge of UU systems, or other public sewers in the area, it is possible that this type of flooding event may be repeated.

Appendix A – Glossary

The table below defines some of the frequently used terminology / abbreviations within the flood risk management industry and this document.

Table A1: Definition of Terms

Term	Definition
Annual Probability	Flood events are defined according to their likelihood of a particular flood occurrence in any one year. For example, a flood with an annual probability of 1 in 100 can also be referred to as a flood with a 1% annual probability. This means that every year there is a 1% chance that this magnitude flood could occur.
EA	Environmental Agency
Flooding Asset Register	The register is a record of all structures or features designated by the EA, the LLFA, the district and borough councils or the IDB which have an effect on flood risk as part of Section 21 for the Flood and Water Management Act (2010).
Flood Risk Management Function	A function listed in the Act (or related Acts) which may be exercised by a risk management authority for a purpose connected with flood risk management.
FWMA (2010)	Flood and Water Management Act 2010
Very Low Flood Risk	Area with a very low probability of flooding from rivers (< 1 in 1,000 annual chance of flooding or <0.1%).
Low Flood Risk	Area with a low probability of flooding from rivers (between a 1 in 1000 and 1 in 100 annual chance of flooding or between 0.1% and 1%)
Medium Flood Risk	Area with a medium probability of flooding from rivers (between a 1 in 100 and 1 in 30 annual chance of flooding or between 1% and 3.33%).
High Flood Risk	Area with a high probability of flooding from rivers (> 1 in 30 annual chance of flooding or greater than 3.3%).
IDB	Internal Drainage Board
Instances of property flooding	This is a count of the reported incidents of internal property flooding that occurred across the event. Properties which were flooded twice are accounted for twice and therefore not a count of the number of properties.
LLFA	Lead Local Flood Authority – Warrington Borough Council as designated under by the Flood and Water Management Act 2010.
Main River	Main rivers are usually larger streams and rivers, but some of them are smaller

Term	Definition
	watercourses of local significance. Main Rivers indicate those watercourses for which the Environment Agency is the relevant risk management authority.
Ordinary Watercourse	An ordinary watercourse includes every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than public sewer) and passage through which water flows which does not from part of a Main River. The Lead Local Flood Authority, District/Borough Council or Internal Drainage Board is the relevant risk management authority.
Riparian Owner	Owner of land adjoining, above or with a watercourse running through it who has certain rights and responsibilities, i.e. maintenance of the watercourse to prevent restrictions thus leading to fluvial flooding.
RMA	Risk Management Authority
UU	United Utilities

Appendix B – Sources of Flooding

The table below identifies the different sources of flooding. The flood event may only experience one source or a combination.

Table B1: Sources of Flooding

Source	Description
Fluvial flooding	Exceedance of the flow capacity of river channels (whether this is a Main River or an Ordinary Watercourse), leading to overtopping of the river banks and inundation of the surrounding land.
Tidal flooding	Propagation of high tides and storm surges up tidal river channels, leading to overtopping of the river banks and inundation of the surrounding land.
Surface water flooding (aka pluvial flooding)	Intense rainfall exceeds the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding.
Groundwater flooding	Emergence of groundwater at the surface (and subsequent overland flows) or into subsurface voids as a result of abnormally high groundwater flows, the introduction of an obstruction to groundwater flow and/or the rebound of previously depressed groundwater levels.
Sewer flooding	Flooding from sewers is caused by the exceedance of sewer capacity and/or a blockage in the sewer network. In areas with a combined sewer network system, there is a risk that land and infrastructure could be flooded with contaminated water. In cases where a separate sewer network is in place, sites are not sensitive to flooding from the foul sewer system.
Other sources of flood risk	Flooding from canals, reservoirs (breach or overtopping) and failure of flood defences.

Appendix C – DCLG Definitions of Affected and Flooded Properties

According to the Department for Communities and Local Government:
The definition of a “flooded property” is a property (includes both homes and businesses), where flood water has internally entered the fabric of a building, this definition includes:

- Basements and below ground level floors;
- Garages, if they form part of the fabric of a building. However, garages adjacent to, or separate from the main building are not included;
- Occupied caravans and park homes, but not tents.

According to the Department for Communities and Local Government:
The definition of an “affected property” is one where:

- Water has entered gardens or surrounding areas restricting access to a property; and/or
- Flooding has disrupted essential services to the property, such as utility services e.g. sewage, drinking water, gas, electricity etc;
- And for businesses, this includes those businesses where flood waters are preventing an enterprise from trading as usual.