WARRINGTON
Borough Council

Environment & Transport

S19 Flood Investigation Report

Storm Christoph
18th to 21st January 2021

Engineering & Flood Risk Management Team
Warrington Borough Council – Lead Local Flood Authority
Date: Monday 18 January 2021 – Thursday 21 January 2021
Location: Borough Wide Event
Flood Investigation Reference Number: 2021/001/001
Version: Final 02

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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	Position Asset & Flood Risk Engineer	Position Engineering & Flood Risk Manager	Position
Document Status: Final01 - issued to the following for comment: • United Utilities • Environment Agency			

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Document Status: Final02 - Document amended following comments from: • United Utilities • Environment Agency **Approved at Cabinet Meeting – 11 April 2022 (Ref: CAB153).**			

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 (FWMA 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	2021/001/001
Location	Borough Wide
Date(s) of Incident(s)	Monday 18th January 2021 – Thursday 21st January 2021
Reason for Investigation	Flooding across multiple locations across Warrington
Identified Cause	Pluvial & Fluvial Flooding

2.1 Affected Areas

Warrington Borough Council is aware that flooding occurred between Monday 18th January 2021 and Thursday 21st January 2021.

At the time of writing this report it is estimated that approximately 438 properties were internally flooded and a further 605 properties externally flooded.

Where possible areas that have been affected by flooding have been grouped together to create flood clusters for ease of reporting.

Table 2.2: Summary of Affected Locations

Flood Cluster Reference	Affected areas	Internal	External
APPLETON	FIRS LANE	1	
	WOODBRIDGE CLOSE		2
BEWSEY & WHITECROSS	BARDSLEY AVENUE		1
	CHARTER AVENUE	15	
	GRAFTON STREET		1
	HAWLEYS CLOSE	2	
	HAWLEYS LANE	2	1
	HIGHAM AVENUE	11	1
	HODGKINSON AVENUE	9	1
	LEWIS AVENUE		8
	LONGSHAW STREET	23	1
	MASSEY AVENUE		3
	MOLYNEUX AVENUE	4	1
	MULLEN CLOSE	17	
	PALMYRA SQUARE SOUTH	1	
	REID AVENUE	8	
	RUTTER AVENUE		9
	SOUTHWORTH AVENUE	52	25
	SUMMERFIELD AVENUE		2
	TAVLIN AVENUE	27	5
BIRCHWOOD	DOVE CLOSE		1
WESTBROOK	BRECON COURT	4	3
	CALLANDS ROAD		1
	CHEPSTOW CLOSE	25	14
	COLWYN CLOSE	41	7
	EUROPA BOULEVARD	13	
	GRANT CLOSE	1	2
	KILFORD CLOSE	1	6
	SAUNDERSFOOT CLOSE		15
	ST DAVIDS DRIVE	25	25
	TENBY CLOSE		18
CROFT	HEATH LANE		2
	KINGSWAY NORTH		1

Flood Cluster Reference	Affected areas	Internal	External
FAIRFIELD AND HOWLEY	SALISBURY STREET	1	
	WELLINGTON STREET		1
GRAPPENHALL	CHESTER ROAD		1
GREAT SANKEY	ALDERBANK ROAD		1
	BELMONT CRESCENT		1
	BROADHURST AVENUE		12
	CALIFORNIA CLOSE		2
	EVELYN STREET		53
	HEPHERD STREET		13
	HESKETH STREET NORTH		4
	HIGHFIELD AVENUE		1
	LIVERPOOL ROAD	34	1
	MOSSDALE CLOSE		1
	OLD LIVERPOOL ROAD	3	18
	PRINCESS STREET		2
	ROSTHERNE CLOSE	50	2
	ROUGHLEY AVENUE		12
	SUNFLOWER DRIVE		1
LYMM	DANE BANK ROAD	1	
	REDDISH LANE	6	
	WARRINGTON LANE	4	
ORFORD	DENSHAM AVENUE	22	34
	GOUGH AVENUE	6	22
	HALLOWS AVENUE		1
	LONG LANE		34
	NORBURY AVENUE		15
	NORTHWAY	13	51
	ROSCOE AVENUE		31
	SMITH DRIVE		33
	TOMLINSON AVENUE		43
	WINWICK ROAD	13	31
PENKETH	FARNWORTH ROAD	3	
	STANSTEAD AVENUE		1
	WIDNES ROAD		1
POULTON-WITH-FEARNHEAD	HILDEN ROAD		1
	PASTURE LANE		2
	WESTDALE ROAD		2
STOCKTON HEATH	BARTON AVENUE		1
	FAIRFIELD ROAD		1
WINWICK	CAMERON COURT		1
	HOLLINS LANE		18
Total		**438**	**605**

3 Flood Incident Details

This section of the report details the meteorological conditions, rainfall and weather warnings during the period 18th to 21st January 2021.

The following information has been used to help provide an overall picture of the conditions that led to the flooding events in Warrington during January 2021:

- 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 National context of Storm Christoph

Storm Christoph brought some exceptionally wet weather to North Wales and northern England from 18th to 20th January 2021. 100mm of rain or more fell across upland areas, and parts of Cheshire, Greater Manchester and Lancashire received around the January whole-month long-term average rainfall from this event. For north-west England and North Wales this was one of the wettest 3-day periods on record. Storm Christoph also brought some strong winds, particularly across eastern England and Scotland, and as the storm cleared eastwards, it brought some significant snowfalls with blizzard conditions across upland in the north-east.

3.1.1 Impacts

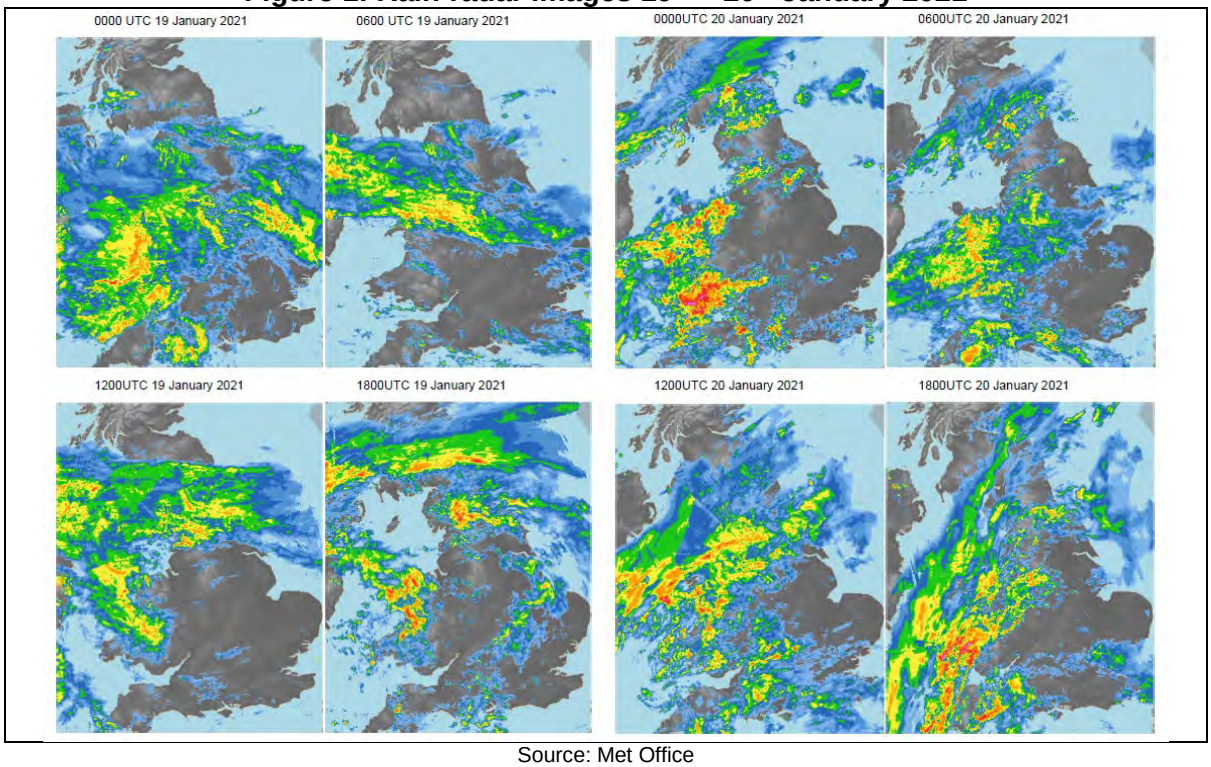
A number of homes were flooded in Cheshire, much of Northwich town centre was under water and residents of two care homes were evacuated by dinghy. Homes were also evacuated in Warrington, Chester, Didsbury and Northenden in Manchester, Ruthin and Bangor-on-Dee in North Wales, and Maghull in Merseyside due to rising floodwater, while some properties were also flooded in South Wales. Evacuations were made more difficult by both the ongoing coronavirus pandemic and falling snow.

A bridge over the River Clwyd in Denbighshire was swept away by floodwater, and the East Coast Main Line was affected by floods between York and Darlington. The snowfalls caused travel disruption, with many roads affected by snow, the A9 closed south of Inverness and the Queensferry crossing closed for a time due to the risk of falling ice. Icy conditions on the M5 near Bristol caused multiple crashes including an overturned lorry. Avalanche debris was spotted in the Pentland Hills south-west of Edinburgh.

3.1.2 Weather Data

The rain-radar images below at 6 hourly intervals through 19th and 20th January 2021 show the heavy and persistent nature of the rainfall from Storm Christoph, with the wettest weather focussed across upland areas of Wales and northern England through this 48-hour period.

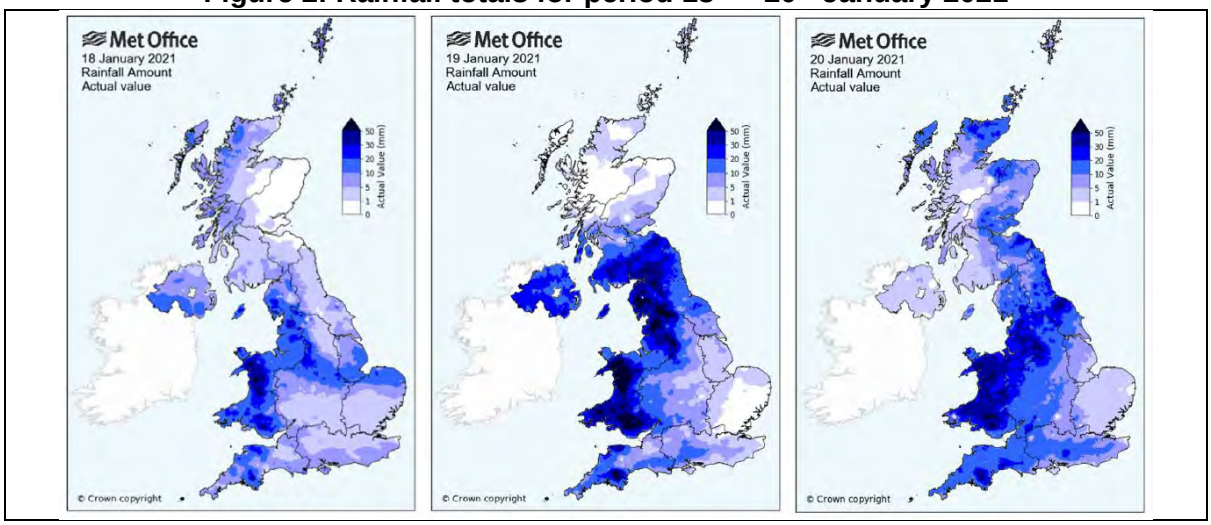
Figure 1: Rain-radar images 19th – 20th January 2021

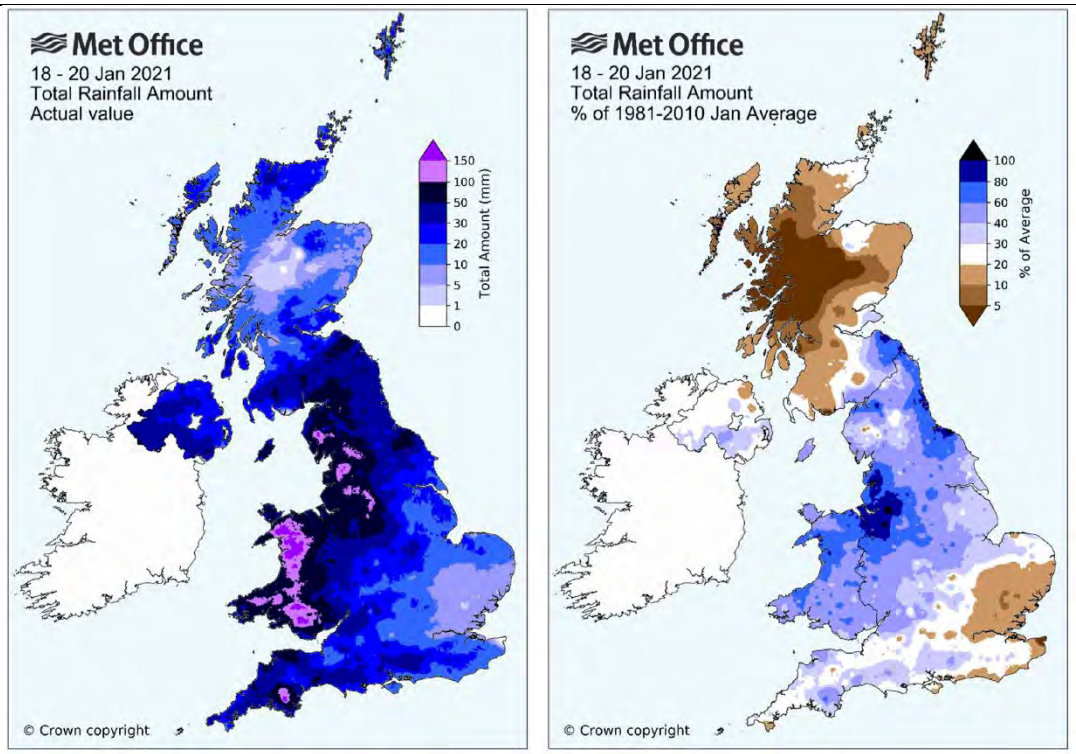


Source: Met Office

The maps below show rainfall totals from 18th January to 21st January 2021. 50 to 100mm of rain fell widely across Wales and north-west England, with over 100mm across upland areas of Wales, south-west England, the Lake District and the Pennines, and locally 150 to 200mm across the higher ground. Half of the January full-month average rain fell widely across Wales and northern England, with the whole-month average falling across parts of Cheshire, Greater Manchester, Lancashire and parts of north-east England and East Lothian.

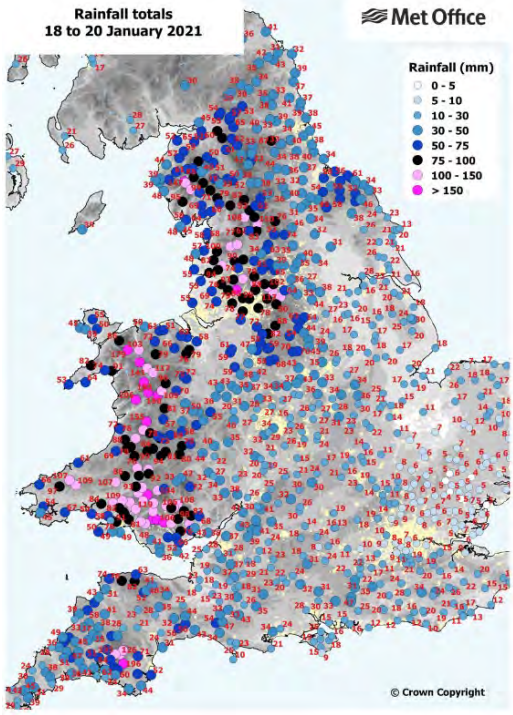
Figure 2: Rainfall totals for period 18th – 20th January 2021





Source: Met Office

Figure 3: Gauge network rainfall totals for period 18th to 20th January 2021



Source: Met Office

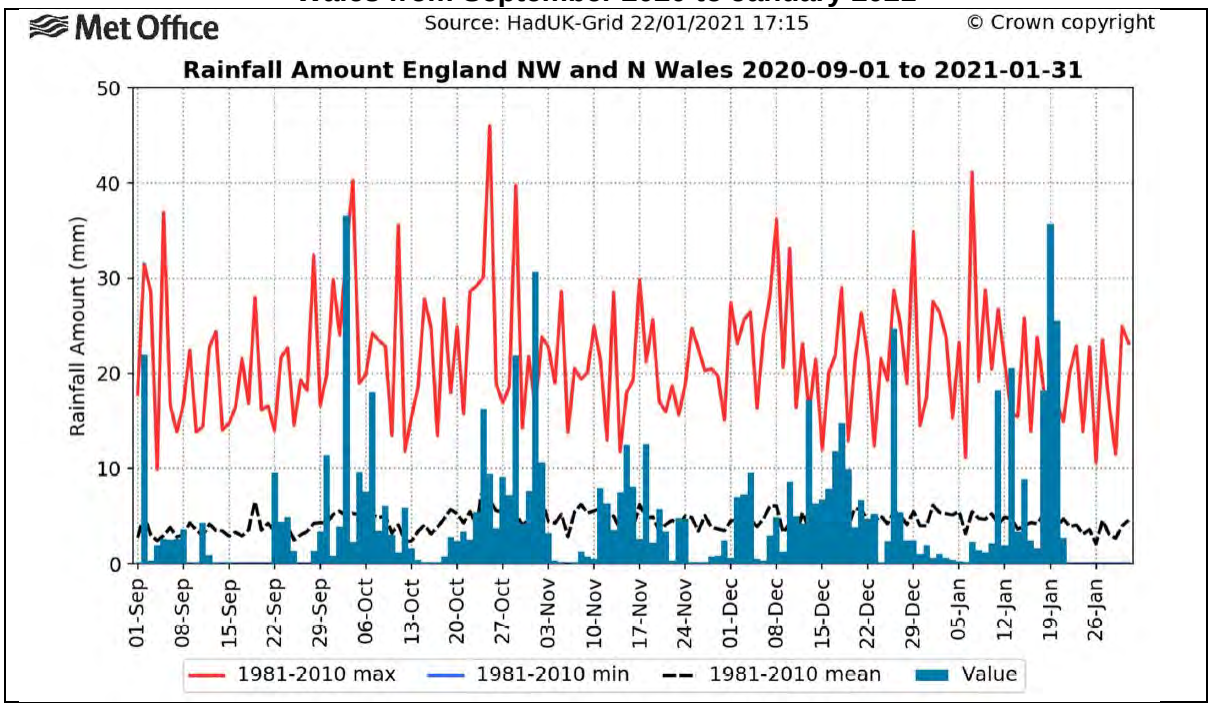
Table 3.1: Rainfall totals at selected stations for Storm Christoph

Station	Rainfall total 18th to 20th January (mm)	January 1981-2010 long-term monthly average (mm)	Percentage of average
Derwent Bridge, County Durham	86.6	75.3	115
Worleston S Wks, Cheshire	61.2	54.2	113
Preston Moor Park, Lancashire	94.4	93.4	101
Sale, Carrington Lane, Greater Manchester	76.6	77.2	99
Audlem, Mere Farm, Cheshire	59.1	60.1	98
Nantwich, Reaseheath Hall, Cheshire	59.2	61.9	96
Denton Resr, Greater Manchester	78.2	82.8	94
Prestbury S Wks, Cheshire	71.9	77.4	93
Myerscough, Lancashire	87.0	96.8	90
Rochdale, Greater Manchester	98.6	112.2	88
Ruthin, Clywd	65.6	75.1	87
Westerdale, North Yorkshire	66.4	7.1	86

Source: Met Office

The chart below shows area-average daily rainfall totals across north-west England and North Wales from September 2020 to January 2021. This region experienced three consecutive very wet days from 18th to 20th January with area-average rainfall totals of 18.2mm, 35.7mm and 25.5mm – overall 79.4mm making this provisionally the wettest 3-day period on record for this region in a series from 1891 – marginally wetter than 3rd to 5th December 2015 (78.2mm) – the latter including the record-breaking rainfall from Storm Desmond.

Figure 4: Area-average daily rainfall totals across north-west England and North Wales from September 2020 to January 2021



Source: Met Office

3.1.3 Weather Warnings

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 Christoph was officially named by the Met Office at 12:50 on Monday 18th January 2021. The tables below provide a timeline when warnings were issued and description of level.

Table 3.2: National Severe Weather Warning Service (NSWWS) – Issued Warning Levels for Central England

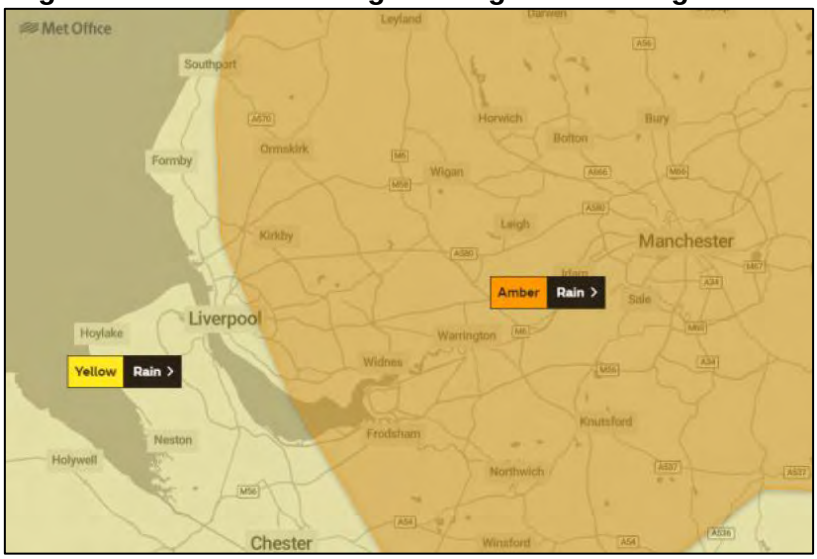
Warning Level	Between	Issued	Updated	Reason for update
Yellow warning Rain	00:00 Tue 19 Jan 2021 and 12:00 Thu 21 Jan 2021	11:05 Sat 16 Jan, 2021	11:46 Mon 18 Jan, 2021	The warning has been extended southwards to encompass more of the Midlands.
Yellow warning Rain	00:00 Tue 19 Jan 2021 and 12:00 Thu 21 Jan 2021	11:05 Sat 16 Jan, 2021	14:18 Mon 18 Jan, 2021	The warning has been extended southwards to encompass more of the Midlands.
Yellow warning Rain	00:00 Tue 19 Jan 2021 and 06:00 Thu 21 Jan 2021	11:05 Sat 16 Jan, 2021	12:13 Wed 20 Jan, 2021	Warning end time shortened to 0600 Thursday and the area adjusted slightly, particularly by removing Norfolk. Mention of possible snow as rain clears.
Amber warning Rain	06:00 Tue 19 Jan 2021 and 12:00 Thu 21 Jan 2021	11:45 Sun 17 Jan, 2021	11:46 Mon 18 Jan, 2021	The area of the warning has been extended south-eastwards and parts of the northern edge trimmed. Areas removed from this warning will be covered by a different NSWWS warning.
Amber warning Rain	06:00 Tue 19 Jan 2021 and 06:00 Thu 21 Jan 2021	11:45 Sun 17 Jan, 2021	12:13 Wed 20 Jan, 2021	Warning end time brought forward to 0600, with warning area adjusted, particularly a reduction in the eastward extent. Mention of possible snow as rain begins to clear.

Table 3.3: Met Office Warning Levels

Warning level	Comment
Red warning	Dangerous weather is expected and, if you haven't already done so, you should take action now to keep yourself and others safe from the impact of the severe weather. It is very likely that there will be a risk to life, with substantial disruption to travel, energy supplies and possibly widespread damage to property and infrastructure. You should avoid travelling, where possible, and follow the advice of the emergency services and local authorities.
Amber warning	There is an increased likelihood of impacts from severe weather, which could potentially disrupt your plans. This means there is the possibility of travel delays, road and rail closures, power cuts and the potential risk to life and property. You should think about changing your plans and taking action to protect yourself and your property. You may want to consider the impact of the weather on your family and your community and whether there is anything you need to do ahead of the severe weather to minimise the impact.
Yellow warning	Yellow warnings can be issued for a range of weather situations. Many are issued when it is likely that the weather will cause some low level impacts, including some disruption to travel in a few places. Many people may be able to continue with their daily routine, but there will be some that will be directly impacted and so it is important to assess if you could be affected. Other yellow warnings are issued when the weather could bring much more severe impacts to the majority of people but the certainty of those impacts occurring is much lower. It is important to read the content of yellow warnings to determine which weather situation is being covered by the yellow warning.

Source: Met Office

Figure 5: Weather Warning coverage for Warrington Area



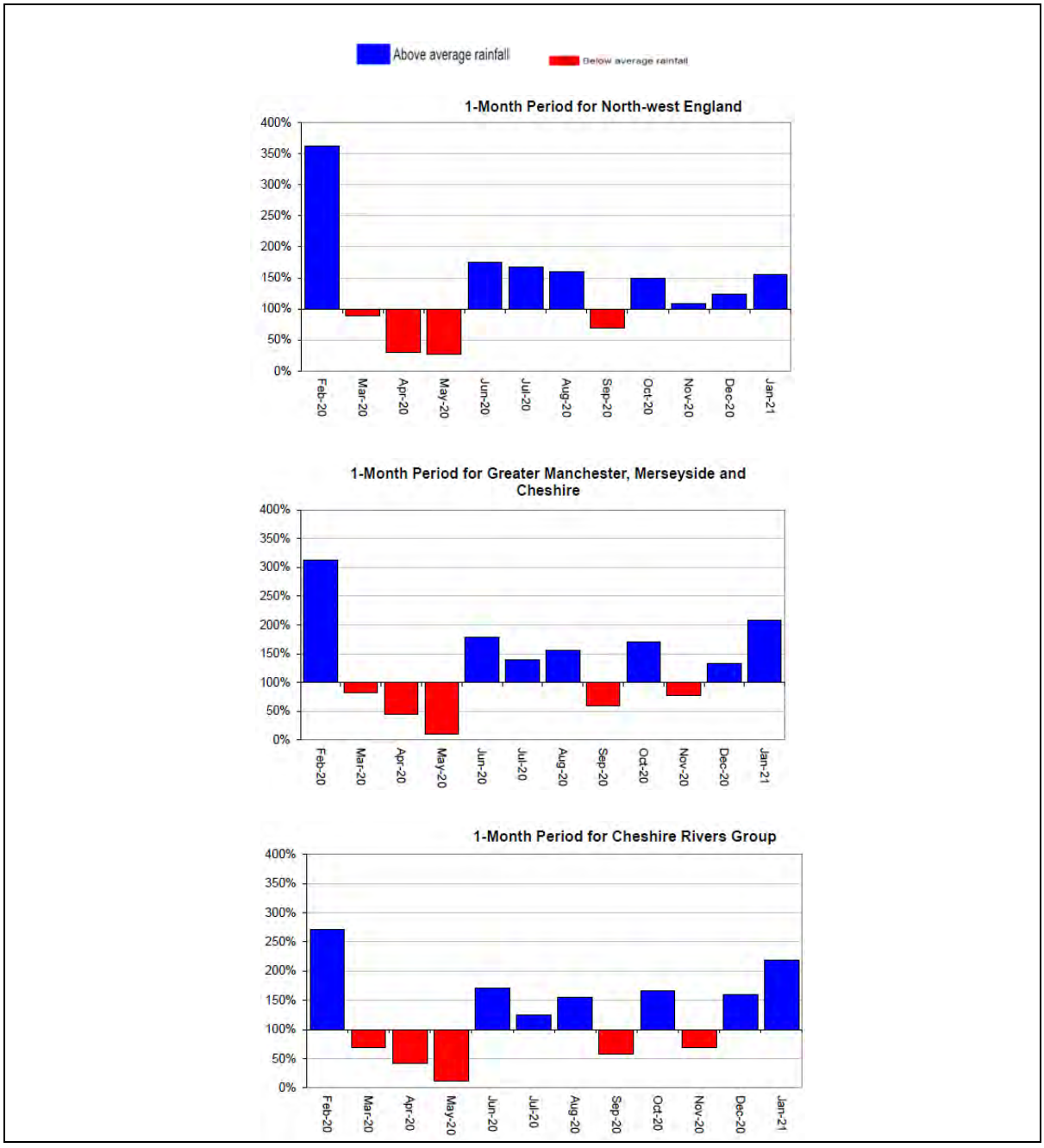
Source: Met Office

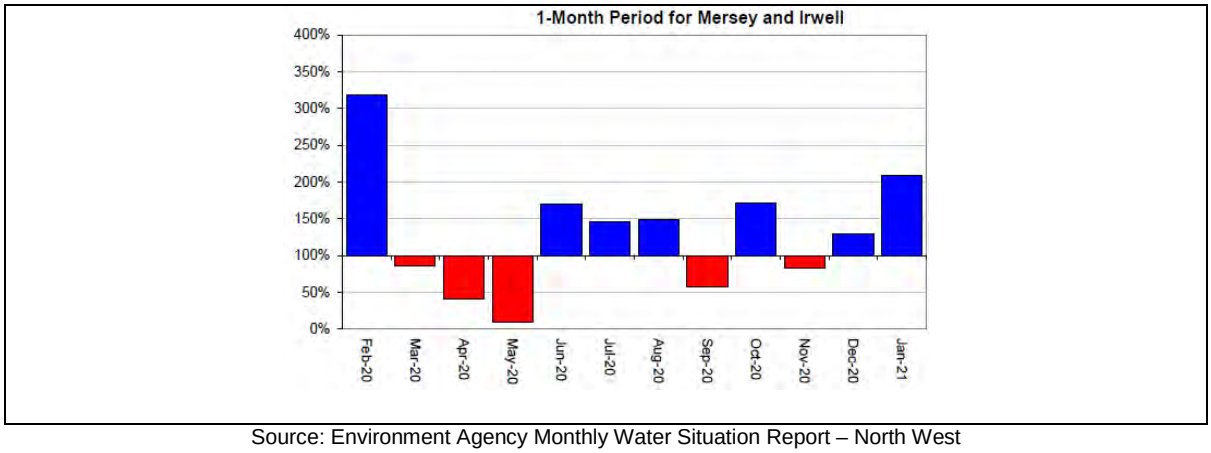
3.2 Antecedent Conditions

Rainfall for North West England as a whole was classed as 'Notably high' for January (155% of the Long Term Average (LTA)), with monthly rainfall totals for Lancashire and Greater Manchester, Merseyside and Cheshire (GMC) in particular by the arrival of Storm Christoph. The final monthly totals for January for these two areas were classed as 'Exceptionally high', and in the case of GMC was more than twice the average for the time of year (208% of the LTA for January).

During January some of the observed precipitation fell as snow, causing some travel disruption. Although some headlines drew attention to the relatively high daily total recorded at the Honister raingauge in Cumbria during Storm Christoph (123.8mm on 19th January), many of the more severe impacts of the heavy rainfall were experienced in GMC. Over 60 flood warnings/alerts were issued in GMC, including 5 severe flood warnings (meaning an endangerment to life). All ten hydrological areas observed above average monthly rainfall totals. Monthly totals for Lancashire and GMC were generally classed as 'Exceptionally high', with the exception of the Wyre and Lune area where rainfall was classed at 'Notably high'. The highest rainfall in January (in terms of percentage of the LTA) was observed in the Cheshire Rivers Group which recorded more than double the monthly average for January (219% of the LTA for January). A few raingauges in GMC recorded over a month's worth of rainfall (relative to the LTA for January) over the 3 days from 18th to 20th January e.g. Folly Gates (Gowy), Cholmondeley (Weaver) and Worleston (Weaver).

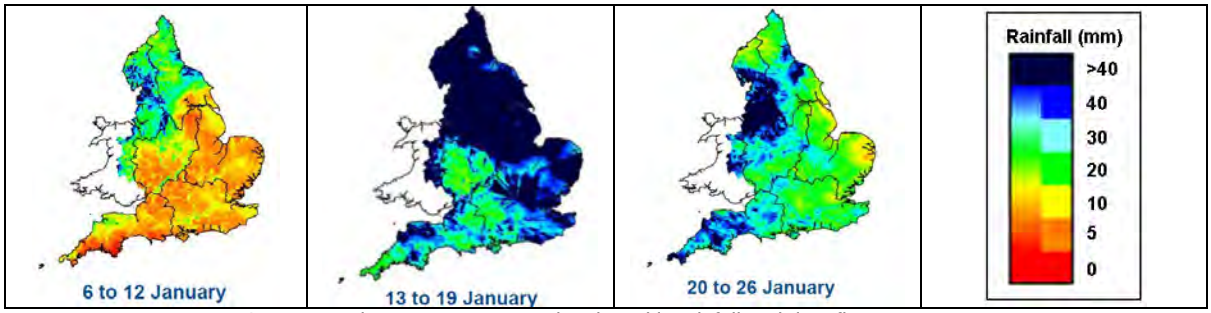
Figure 6: Total rainfall (as a percentage) for hydrological areas across North West England for the current month (January 2021), the last three months, the last six months, and the last 12 months, classed relative to an analysis of respective historic totals.





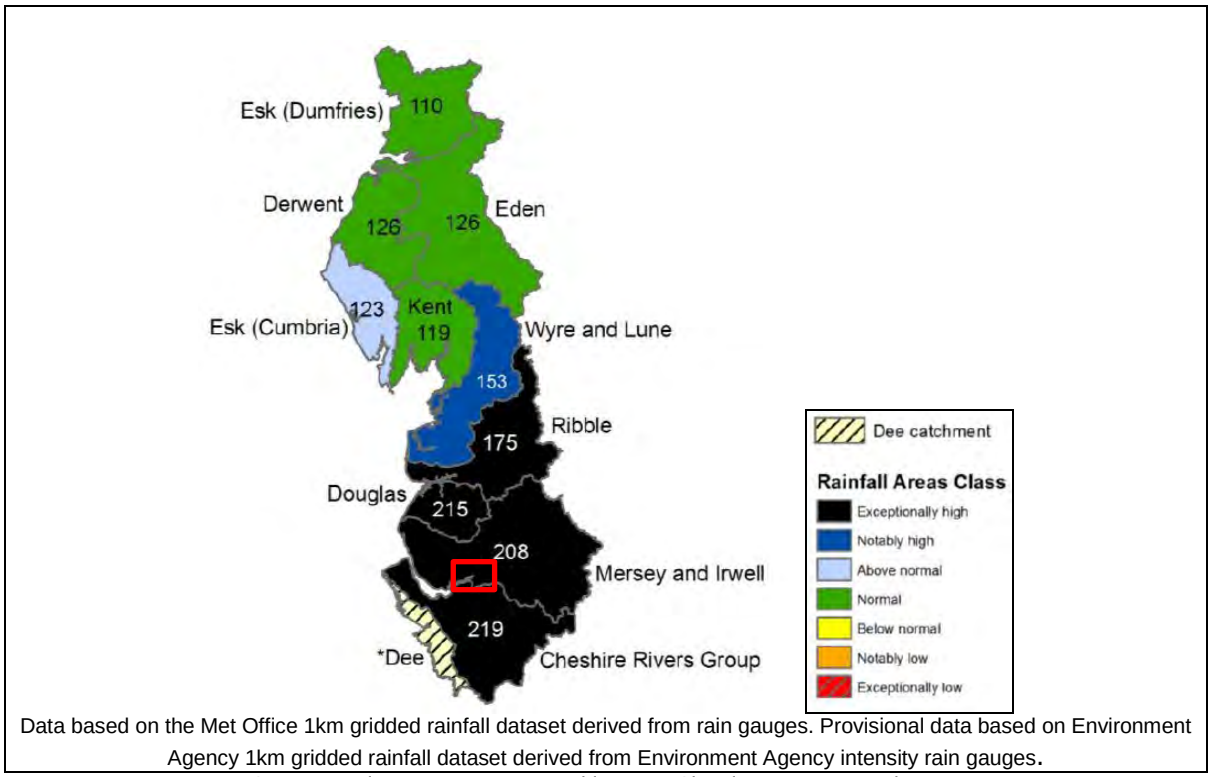
Source: Environment Agency Monthly Water Situation Report – North West

Figure 7: Weekly precipitation across England and Wales. UKPP radar data. EA Weekly rainfall and river flow summary 6th – 26th January 2021



Source: Environment Agency national weekly rainfall and river flow summary

Figure 8: Total rainfall (as a percentage) for hydrological areas across North West England for January 2021



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

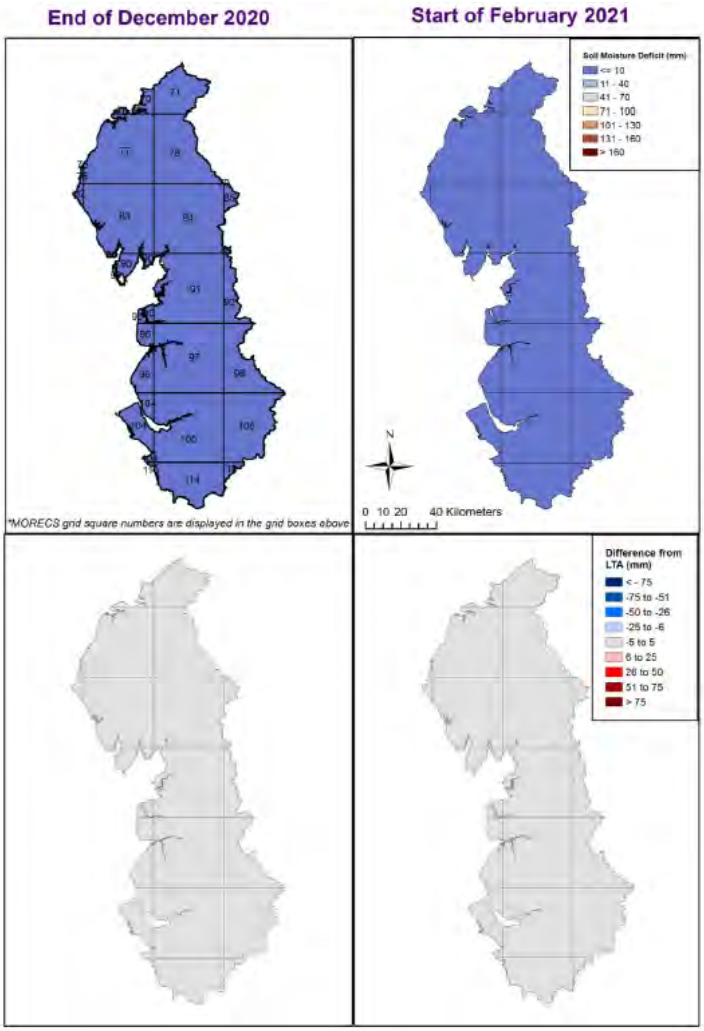
Source: Environment Agency Monthly Water Situation Report – North West

3.2.1 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.

In response to the rainfall observed in January, SMD levels remained very low with almost no change throughout the month. All areas were recording a zero deficit by the end of January and were as expected for the time of year.

Figure 9: Soil Moisture Deficits for North West: December 2020 - February 2021



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

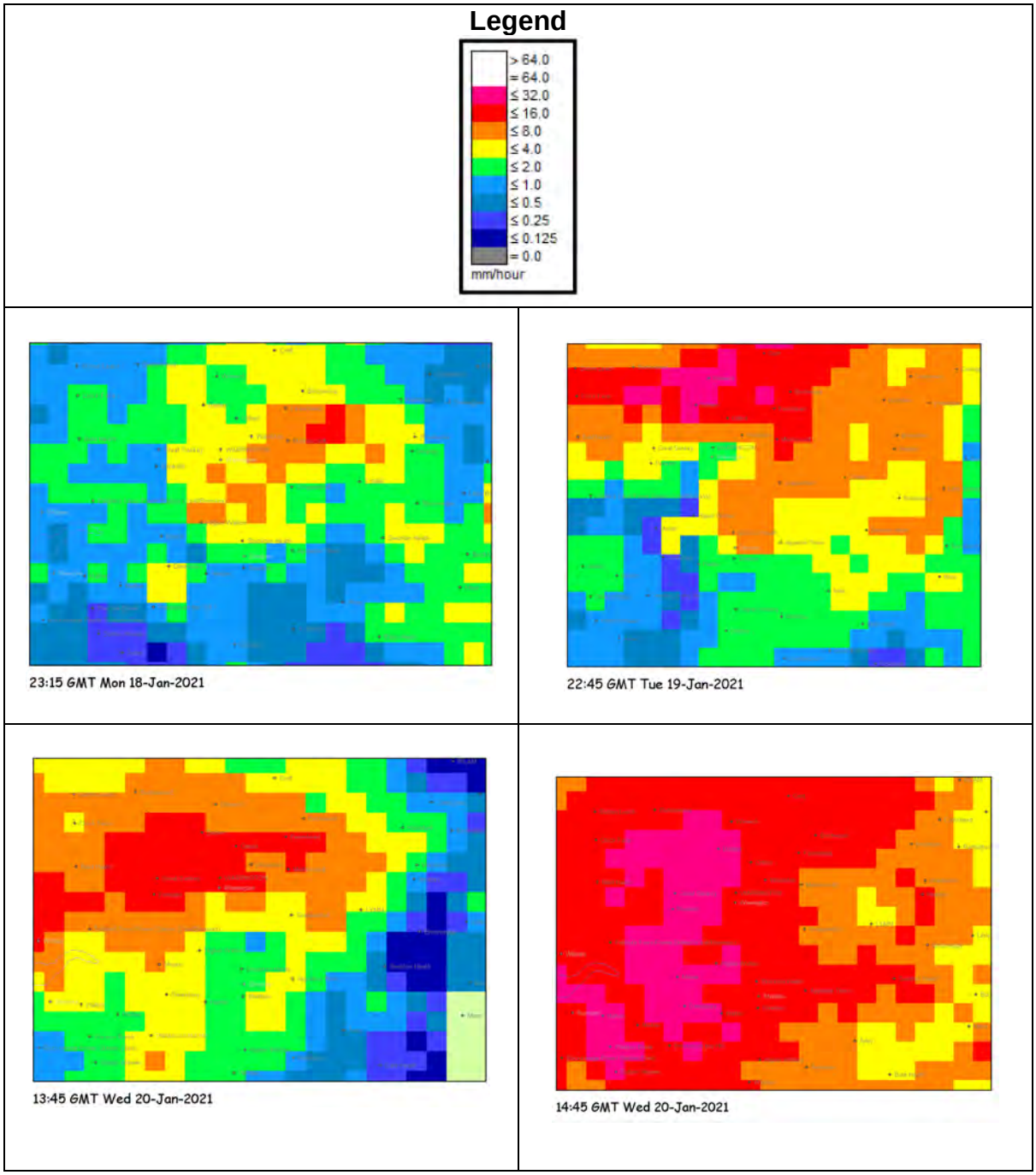
3.3 Rainfall Data

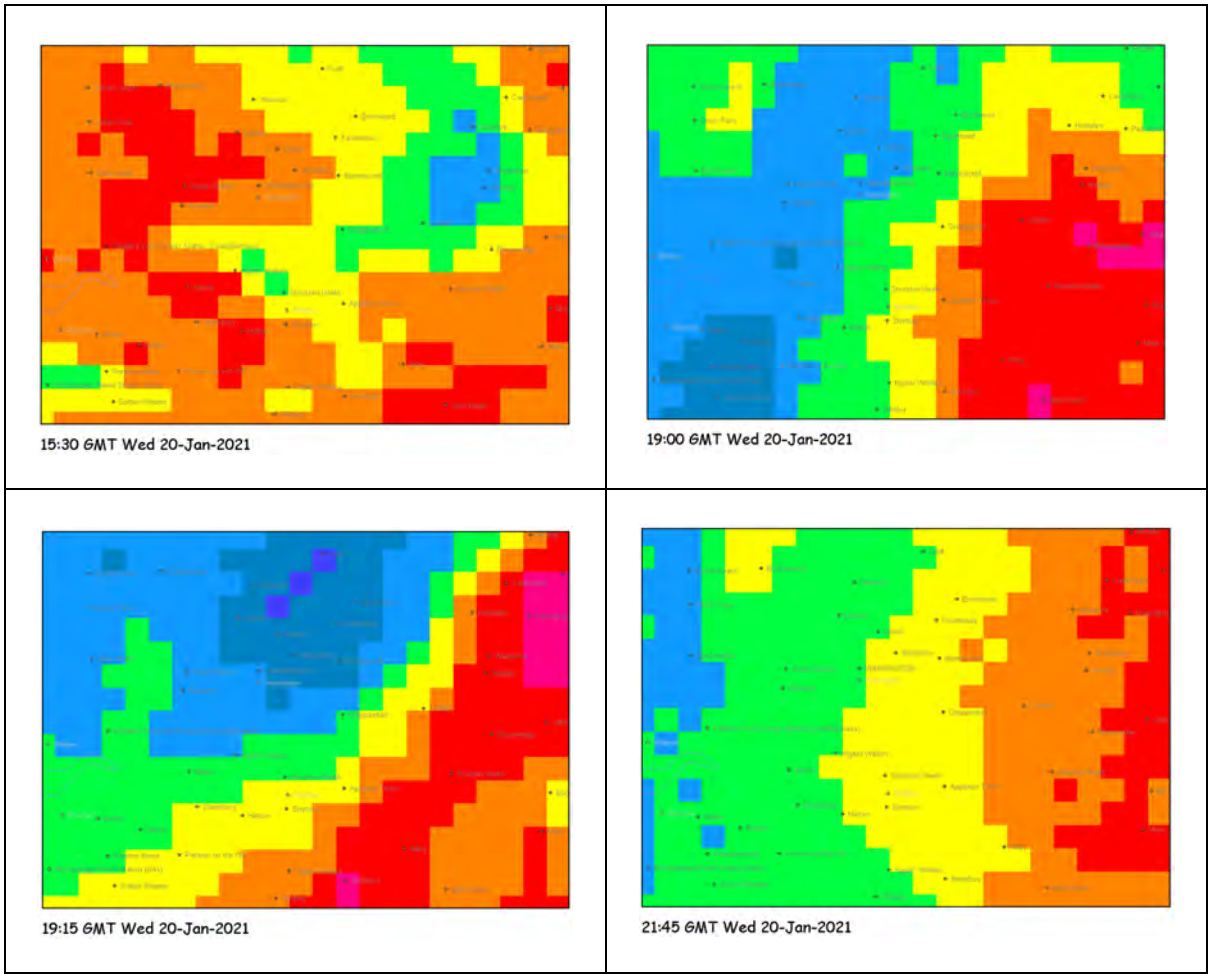
At the local level HYRAD (HYdrological RADar) provided real time information to show the precipitation movement and patterns and intensities. This information enables forecasters to raise, or amend, weather / flood alerts thus enabling the appropriate action to be taken.

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

The figure below provides a summary to the main periods of rainfall during Storm Christoph.

Figure 10: HYRAD Information 18th – 20th January 2021





Source: Environment Agency

The following Environment Agency rain gauges are situated within the vicinity of Warrington.

Table 3.4 – Location of Rain Gauges within Administrative Boundary

Monitor name and Reference	Description	Co-ordinates	Comment
Billinge Hill Auto - 570099	15 minute recording intervals	352263 , 401791	Environmental Agency rain gauge - Operational
Langley Bottoms TEL - 564595		394897 , 371424	
Prestbury S.Wks TEL - 564769		389738 , 378186	
Richard Fairclough House TEL - 564160		362124 , 387278	
Sale Carrington Lane TEL - 560557		376614 , 392651	

Figure 11 - Location of rain gauges and area coverage

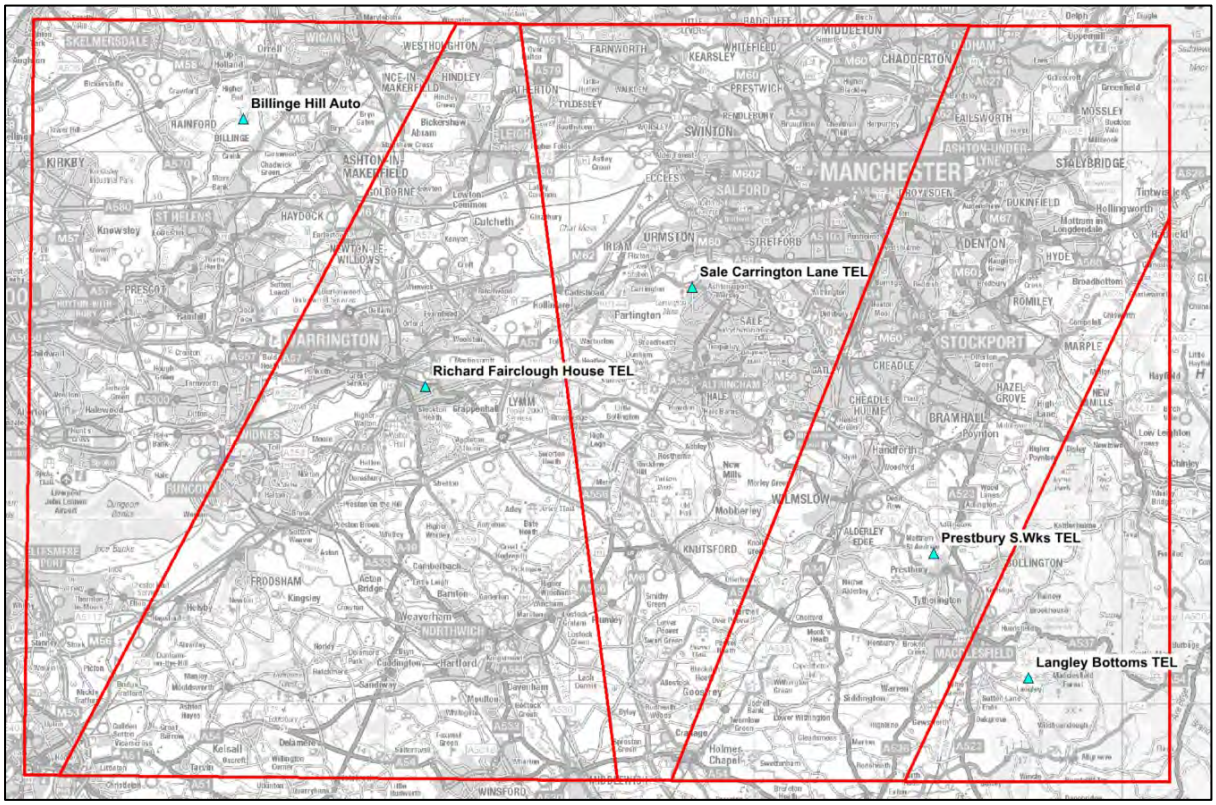


Table 3.5: Summary of Storm Christoph

Monitor name and Reference	Rainfall Duration	Drainfall Depth (mm)	Peak Intensity (mm/hr)	Biham Event Return Period	
				Entire event	Peak of event
Billinge Hill Auto - 570099	96 hours	76.09	6.8	4.60 years	2.79 years
Langley Bottoms TEL - 564595		64.20	9.6	2.57 years	1.03 years
Prestbury S.Wks TEL - 564769		70.25	11.68	3.50 years	3.37 years
Richard Fairclough House TEL - 564160		71.48	8.16	3.71 years	3.31 years
Sale Carrington Lane TEL - 560557		77.33	10.6	4.7 years	5.05 years

Referring to Table 3.5 with respect to rain gauges Prestbury S.Wks and Sale Carrington Lane, it can be concluded that the recorded depths during Storm Christoph at the remaining rain gauges were in the 93 – 99% range of the January 1981-2010 long-term average (mm).

Figure 12: Rainfall Intensity (mm/hr) at Environment Agency rain gauges

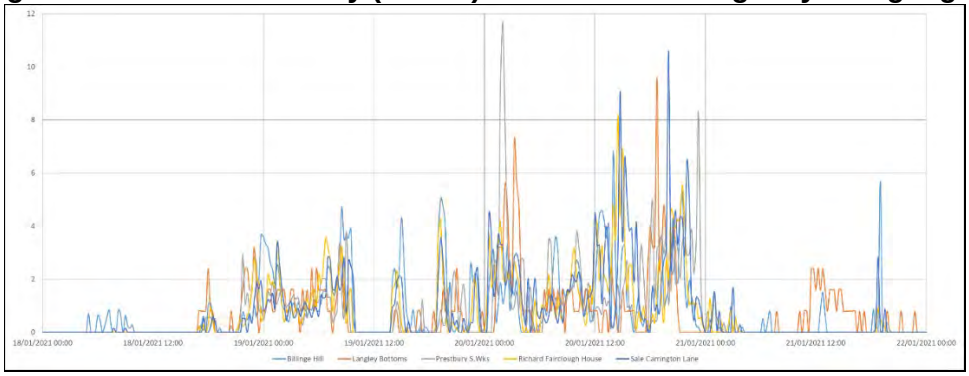


Figure 13: Cumulative rainfall depth (mm) at Environment Agency rain gauges

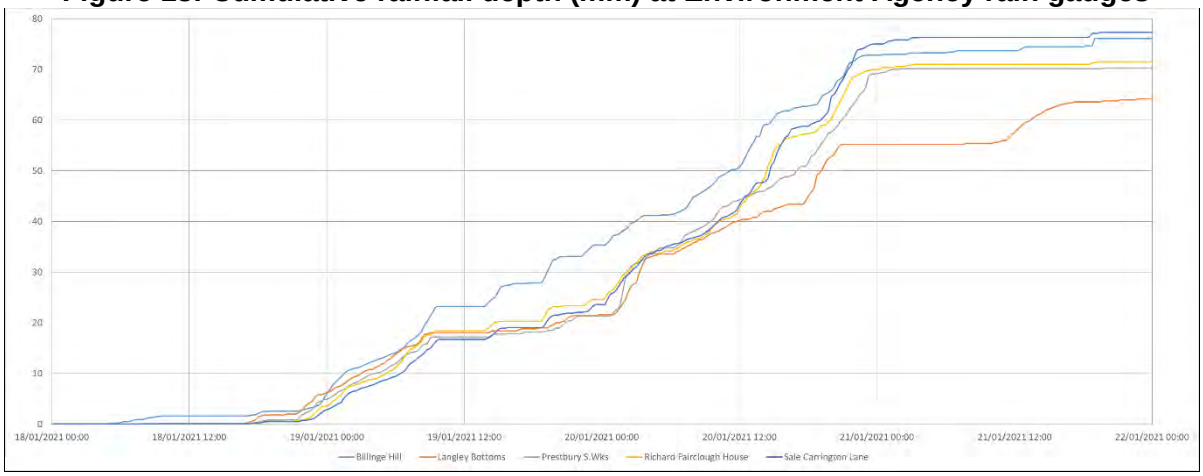


Figure 14: Rainfall depth (mm) at Environment Agency rain gauges

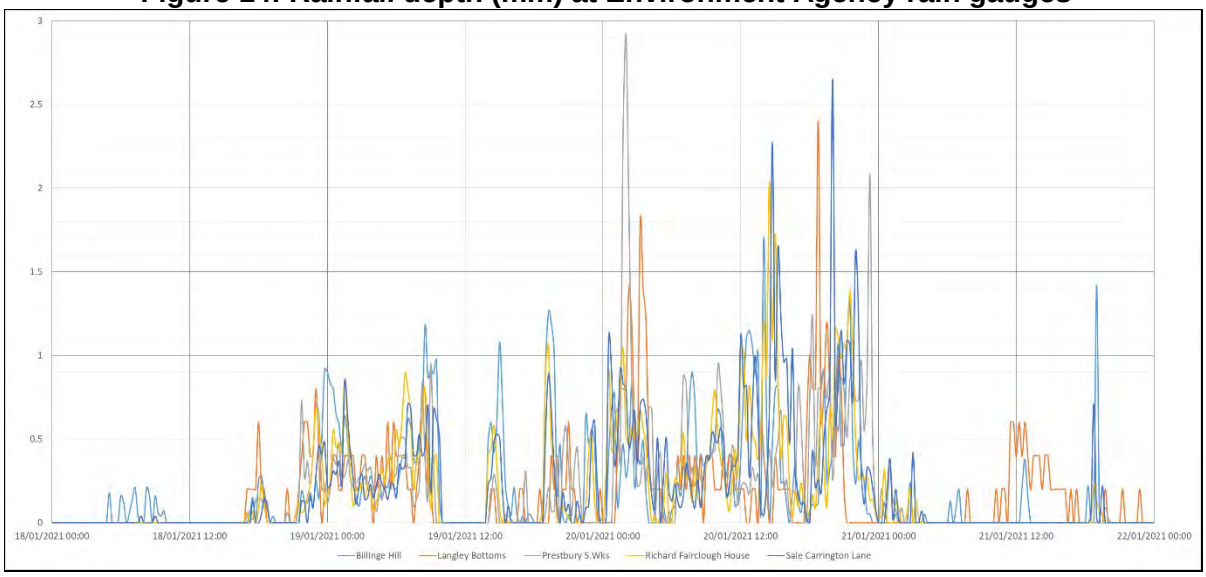
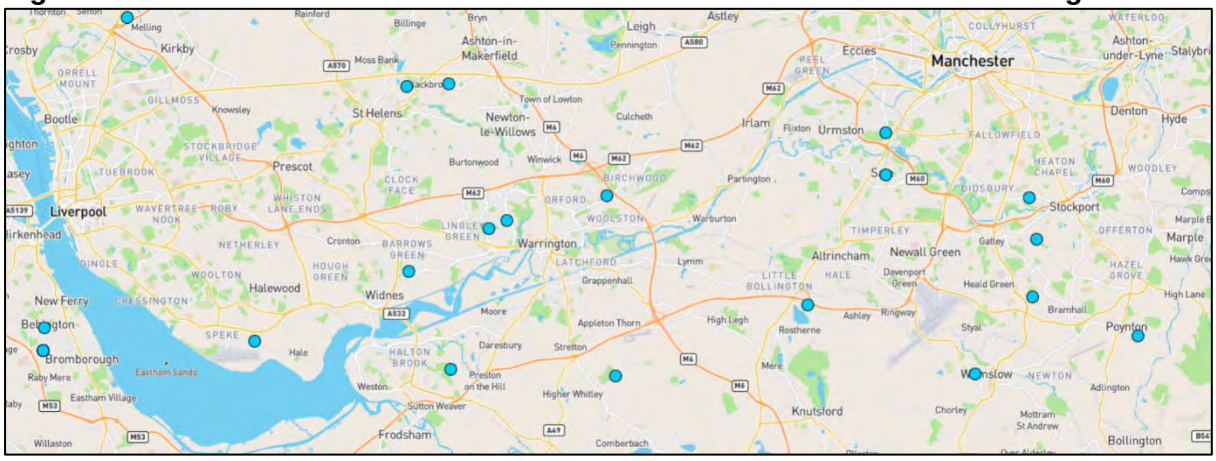


Figure 10 (HYRAD information) illustrates spatial variation was evident during the storm event. With the rain gauges recording depth at 15 minute intervals, each covering a relative large area, there is a high probability of variation in rainfall intensity in certain areas which may have gone unrecorded.

Met Office Weather Observation Website (WOW) provides a platform to share information recorded on Automatic Weather Stations (AWS). There are a number AWS in and around the area of Warrington. This information has been utilised to provide supplementary evidence to that supplied by the Environment Agency. The AWS information provides similar rainfall depths and intensity to the information supplied by the Environment Agency.

Figure 15: Location of Automatic Weather Stations in and around the Warrington area.



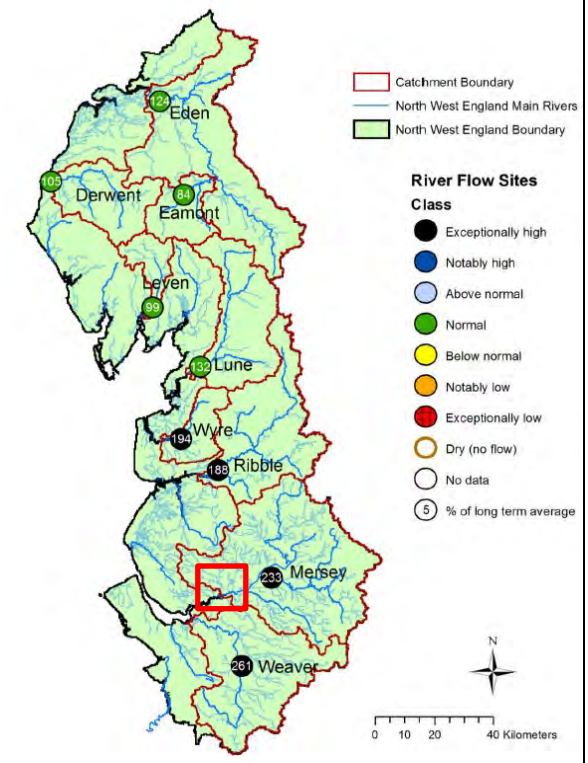
The rainfall experience during Storm Christoph was heavy and persistent and covered a significantly wide area of the country. The water levels in the receiving watercourses remained high for a prolonged period, consequently impacting the performance of adjacent drainage systems which led to flooding in a number of locations.

3.4 Watercourse Data

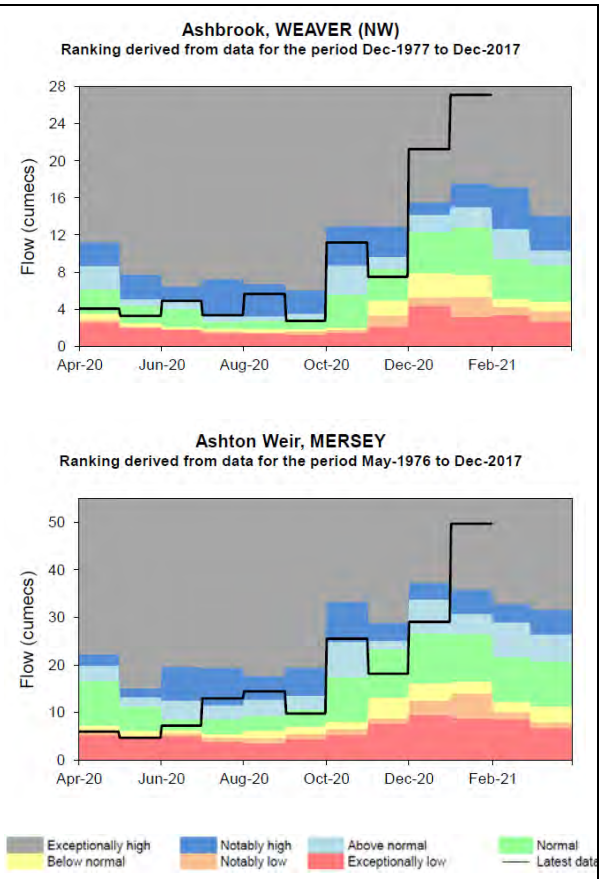
Monthly mean flows increased in Lancashire and GMC reflecting the relatively high rainfall observed in this area, dramatically so in the Mersey catchment. Similarly, river flows in Cumbria and North Lancashire flows were generally classed as 'Normal' whereas flows in GMC and South Lancashire were classed as 'Exceptionally high' (when compared to the LTA for January). River flows were highest (in terms of percentage of the LTA) in the Weaver catchment (261% of LTA, classed as 'Exceptionally high') and lowest in the Eamont (84% of LTA, classed as 'Normal').

The antecedent SMD conditions resulted in many rivers responding rapidly and strongly to the heavy rainfall that fell during Storm Christoph, with several gauging stations across the whole of the North West recording daily mean flows above Q1 as the storm passed through (i.e. flow has been exceeded at these gauging stations for less than 1% of the time during their periods of record). Thirteen gauging stations (flow and/or level) in GMC recorded their highest water levels (for their respective periods of record) during this event e.g. Hayhurst Bridge (Weaver), Ashbrook (Weaver) and Higham Avenue (Sankey Brook); and the highest spot flow gaugings on record for various sites in GMC (for the periods of record for the relevant sites) were carried out by the Hydrometry and Telemetry Teams from GMC and Cumbria and Lancashire e.g. Rudheath (River Weaver), Marshfield Bridge (Valley Brook) and Little Woolden Hall (Glaze Brook).

Figure 16: Regional River Flows



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 3.6 – Location of Watercourse Level Gauges within Warrington area

Monitor name and Reference	Description	Co-ordinates	Watercourse	Comment
Bollington Mill - 693515	15 minute recording interval	373065 , 387044	River Bollin	Surface water level (including tide and lake level) - continuous - Operational
Causey Bridges - 694039	15 minute recording interval	358747, 392212	Sankey Brook	River flow – continuous - Operational
Fiddlers Ferry - 694063	15 minute recording interval	356605, 386761	River Mersey	Surface water level (including tide and lake level) - continuous - Operational
Grosvenor Grange - 693700	15 minute recording interval	363913, 390145	Spittle Brook	Surface water level (including tide and lake level) - continuous - Operational
Higham Avenue - 694042	15 minute recording interval	359607, 390213	Sankey Brook	Surface water level (including tide and lake level) - continuous - Operational
Hilden Road - 693750	15 minute recording interval	362154 390123	Padgate Brook	Surface water level (including tide and lake level) - continuous - Operational
Little Woolden Hall Ultrasonic - 693032	15 minute recording interval	368489, 393888	Glaze Brook	River flow - continuous - Operational

Monitor name and Reference	Description	Co-ordinates	Watercourse	Comment
Liverpool Road - 694041	15 minute recording interval	358573, 387642	Sankey Brook	Surface water level (including tide and lake level) - continuous - Operational
Longford Bridge - 694045	15 minute recording interval	360605, 390070	Longford Brook	Surface water level (including tide and lake level) - continuous - Operational
Morris Brook - 693555	15 minute recording interval	364253, 386690	Morris Brook	Surface water level (including tide and lake level) - continuous - Operational

Figure 17 - Location of Watercourse Level Gauges within Administrative Boundary

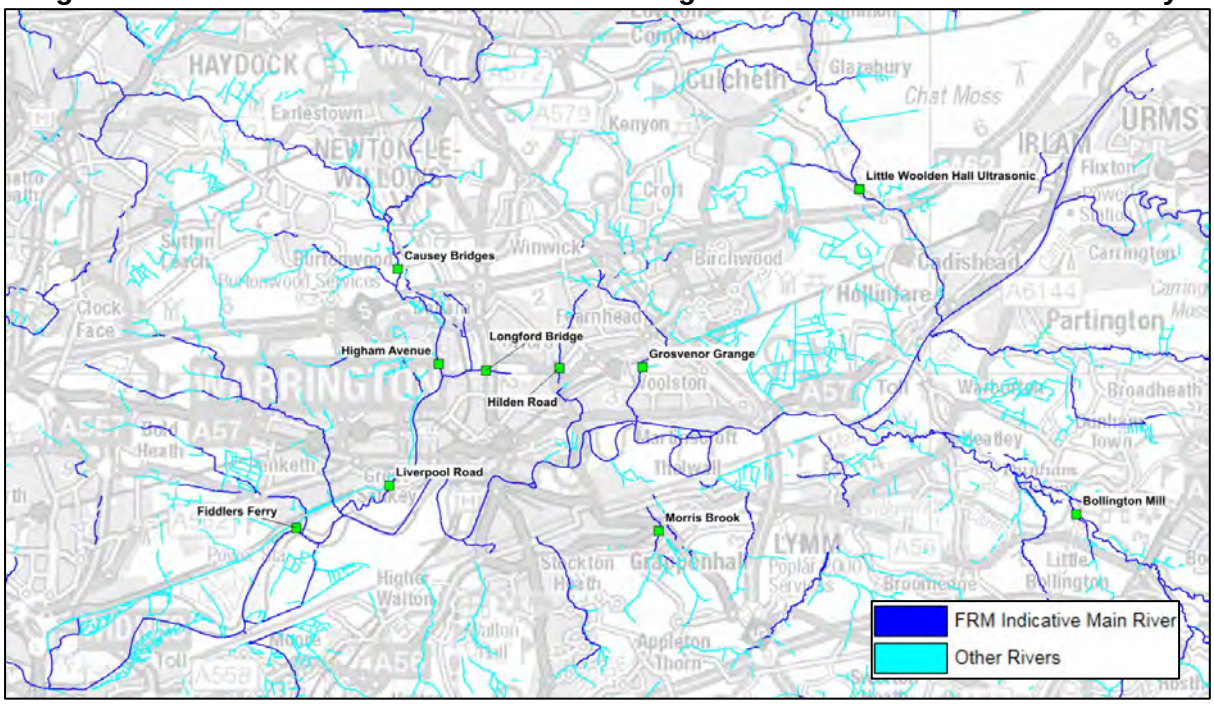


Figure 18: Depth of water (m) at monitor locations for period 11th – 25th January 2021

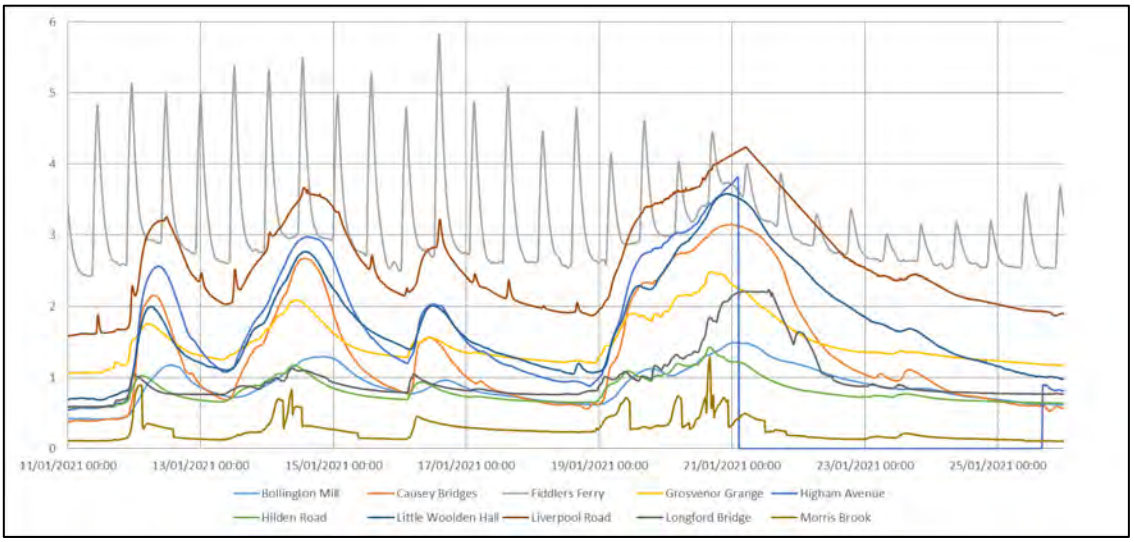


Table 3.7: Environment Agency comments to river level gauge data

Higham Avenue			Liverpool Road		
		Comment			Comment
Start Date	11/01/2021 00:00:00	Data left unchecked. Unable to QA as site was flooded on 21/01/2021 and sensor failed due to water ingress into the lightening barrier box.	Start Date	11/01/2021 00:00:00	Levels ok before Storm Christoph arrives.
End Date	21/01/2021 00:00:00		End Date	20/01/2021 08:15:00	
Start Date	21/01/2021 00:15:00	Data left unchecked. Unable to QA as site was flooded on 21/01/2021 and sensor failed due to water ingress into the lightening barrier box. Sensor failed during Storm Christoph failed due to water inundation into lightening arrestor box. Replaced on the 25/01/21. Peak estimated from wrack marks. Peak could be higher treat with caution.	Start Date	20/01/2021 17:30:00	Radar failed during Storm Christoph due to debris collecting on bridge. Rack mark surveyed
End Date	25/01/2021 16:15:00		End Date	22/01/2021 15:45:00	

Note: Other river level gauges were operational during Storm Christoph as intended.

Figure 18 illustrates watercourse levels increased between 1.5m and 2m as a consequence of Storm Christoph compared to normal dry weather levels during the winter period. Reviewing the long term data for all locations the recorded peak depths are beyond the typical depth range, and in most cases broke all-time records. This is evident for gauges situated at Higham Avenue and Liverpool Road where the sensors failed to record as a consequence of equipment being flooded.

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

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

3.5 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.

Flood Warning Areas are geographical areas where the Environment Agency expect flooding to occur and where the Environment Agency provide a Flood Warning Service. They generally contain properties that are expected to flood from rivers or the sea and in some areas, from groundwater.

Specifically, Flood Warning Areas define locations within the Flood Warning Service Limit that represent a discrete community at risk of flooding. A discrete community is a recognised and named geographical community, which can be an urban area, a significant suburb of a large city or a village or a hamlet.

The purpose of Flood Warnings is to alert people that flooding is expected and they should take action to protect themselves and their property. Flood Warnings are issued when flooding is expected to occur, Severe Flood Warnings are issued to similar areas when there is a danger to life or widespread disruption is expected.

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).

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.

Table 3.8: 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 two hours in advance of flooding.
	Severe flooding. Danger to life.	When flooding poses a significant threat to life.

Figure 19: Area Coverage of Flood Warning Areas for Warrington

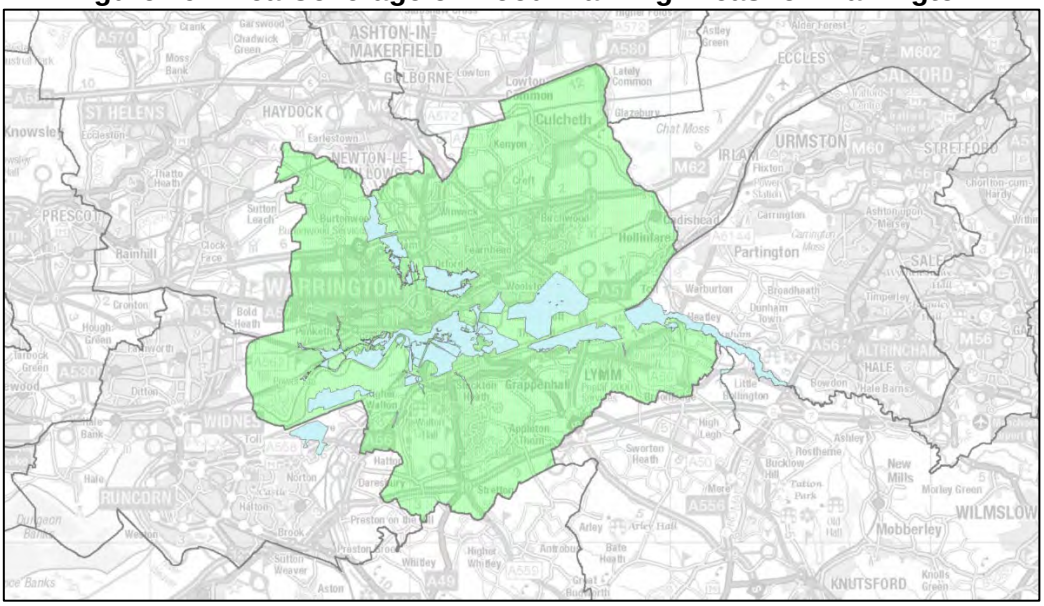


Table 3.9: Flood Warning Area Information covering Warrington

Flood Warning Area Code	Parent Flood Warning Code	Flood Warning Area Name	Description	Local Authority name	Associated Watercourse
013FWFCH29	013WAFSA	Wider area at risk from Sankey Brook at Dallam	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	Warrington	Sankey Brook
013FWTTCH18	013WATMEW	Mersey Estuary at Victoria Park, Knutsford Road, Warrington	Victoria Park including the car park, bowling greens, running track, allotments, playground, skatepark and sports pitches.	Warrington	Mersey Estuary
013FWFCH35	013WAFBO	River Bollin and Agden Brook at Little Bollington	Areas at risk include properties at and around Bollington Mill and Bollington Hall farm. Also at risk property on Lymm Road adjacent to Agden Brook	Cheshire East, Trafford, Warrington	River Bollin
013FWFCH17	013WAFSA	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	St. Helens, Warrington	Sankey Brook
013FWTTCH6	013WATMEW	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 Mary's Street.	Warrington	Mersey Estuary
013FWFCH28	013WAFSA	Areas closest to Sankey Brook at Dallam	Areas at risk include Chepstow Close, Colwyn Close, properties on and around Higham Avenue, Tavlin Avenue, Hodgkinson Avenue, Marshall Avenue, Hawleys Lane and Mullen Close	Warrington	Sankey Brook
013FWFCH1	013WAFLM	Manchester Ship Canal at Lymm and Thelwall	Areas potentially at risk from Manchester Ship Canal. Including properties between the Ship Canal and Thelwall New Road, Lymm Road and Warrington Road. Also includes properties along Ferry Lane	Warrington	Manchester Ship Canal
013FWTTCH8	013WATMEW	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.	Warrington	Mersey Estuary
013FWTTCH4	013WATMEW	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	Warrington	Mersey Estuary

Flood Warning Area Code	Parent Flood Warning Code	Flood Warning Area Name	Description	Local Authority name	Associated Watercourse
013FWFGM77	013WAFBO	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	Trafford, Warrington	River Bollin
013FWTTCH3	013WATMEW	Mersey Estuary at Arpley Bridge, Warrington	Chester Road between Brian Bevan Island and Arpley Railway Bridge; and Arpley Road in Warrington	Warrington	Mersey Estuary
013FWTTCH1	013WATMEW	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.	Warrington	Irish Sea
013FWTTCH5	013WATMEW	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	Warrington	Mersey Estuary
013FWFCH30	013WAFSA	Areas closest to Sankey Brook at Sankey Bridges	Areas at risk include Liverpool Road from Kent Road to Beaufort Street, Rostherne Close, Evelyn Street and Huntley Street	Warrington	Sankey Brook
013FWFCH31	013WAFSA	Wider area at risk from Sankey Brook at Sankey Bridges	Areas at risk include the Sankey Recreation ground, Samuel St, Booth St, Dale Close, Bond Close and parts of Hepherd St and Marina Avenue	Warrington	Sankey Brook
013FWFCH14	013WAFSA	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.	Warrington	Sankey Brook
013FWTTCH10B	013WATMEW	Mersey Estuary at Centre Park, Warrington	The Arpley Meadows and Centre Park areas of Warrington including Lakeside Drive, Slutchers Lane and The Village Hotel.	Warrington	Mersey Estuary
013FWTTCH11	013WATMEW	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	Warrington	Mersey Estuary
013FWTTCH9	013WATMEW	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	Warrington	Mersey Estuary
013FWTTCH7	013WATMEW	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	Warrington	Mersey Estuary

Flood Warning Area Code	Parent Flood Warning Code	Flood Warning Area Name	Description	Local Authority name	Associated Watercourse
013FWTTCH12	013WATMEW	River Mersey from Runcorn to Woolston	Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also parts of Howley, Wilderspool, Latchford, Westy, Paddington and Woolston.	Halton, Warrington	Mersey Estuary
013FWTTCH10A	013WATMEW	Mersey Estuary at Spectra Business Park at Slutchers Lane	Industrial units at Spectra Business Park on Slutchers Lane, Warrington.	Warrington	Mersey Estuary

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

Figure 20: Area Coverage of Flood Alert Areas for Warrington

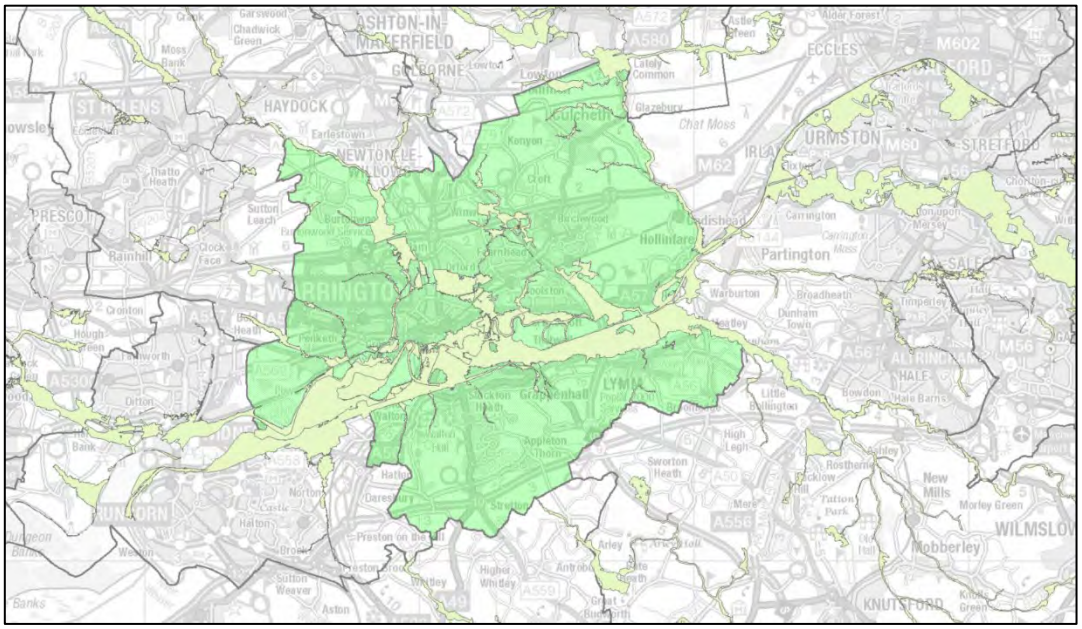


Table 3.10: Flood Alert Area Information covering Warrington

Flood Alert Area Code	Flood Alert Area Name	Description	Local Authority name	Associated Watercourse
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	Cheshire East, Halton, Salford, Trafford, Warrington	River Mersey
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	Bolton, Salford, Trafford, Warrington, Wigan	Glaze Brook
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	Cheshire East, Manchester, Stockport, Trafford, Warrington	River Bollin
013WAFDA	River Dane catchment including Kidsgrove, Sandbach, Congleton, Middlewich and Northeast Crewe	The Dane catchment includes the River Wheelock, Arclid, Smoker and Fowle Brooks and their tributaries	Cheshire East, Cheshire West and Chester, Derbyshire, Halton, Staffordshire, Warrington	River Dane

Flood Alert Area Code	Flood Alert Area Name	Description	Local Authority name	Associated Watercourse
013WATMEW	Mersey Estuary at Warrington	Areas at risk include Fiddlers Ferry, Eastford Road, Arpley Bridge, Knutsford Road, Howley, Kingsway North and Westy.	Halton, Warrington	Mersey Estuary
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	Cheshire East, Manchester, Salford, Stockport, Tameside, Trafford, Warrington	River Mersey
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	Halton, Knowsley, Liverpool, St. Helens, Warrington	River Ditton
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	Lancashire, St. Helens, Warrington, Wigan	River Sankey

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

For the period 18th – 21st January 2021, 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 (see page 8). The locally issued flood alerts and warnings are summarised in Table 3.11 below.

Table 3.11: Summary of Warnings / Alerts raised during Storm Christoph for the Warrington area

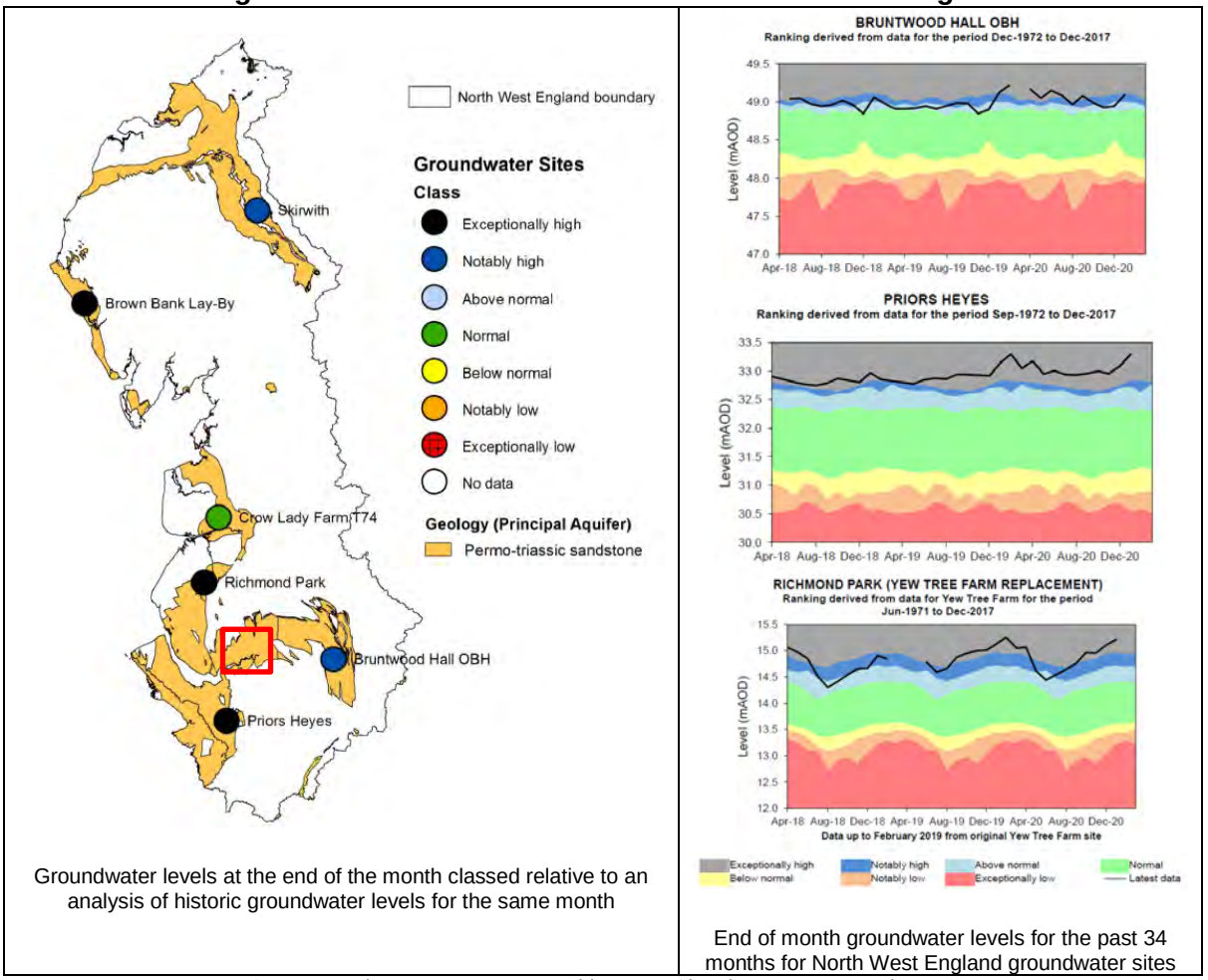
Code	Type	Date and Time Issued	Authority Area	Name	Watercourse
013WAFSA	Flood Alert	18/01/2021 19:38	Warrington	River Sankey catchment with St Helens and Warrington	Sankey
013WAFBO	Flood Alert	18/01/2021 19:44	Warrington	River Bollin catchment, including Knutsford, Wilmslow, Macclesfield and Bollington	Bollin
013WAFGL	Flood Alert	20/01/2021 10:01	Warrington	River Glaze catchment including Leigh and East Wigan	Glaze
013FWFCH14	Flood Warning	20/01/2021 10:42	Warrington	Sankey Brook at Gemini	Sankey
013FWFCH28	Flood Warning	20/01/2021 02:10	Warrington	Areas closest to Sankey Brook at Dallam	Sankey
013FWFCH29	Flood Warning	20/01/2021 15:43	Warrington	Wider area at risk from Sankey Brook at Dallam	Sankey
013FWFCH30	Flood Warning	20/01/2021 14:58	Warrington	Areas closest to Sankey Brook at Sankey Bridges	Sankey

Code	Type	Date and Time Issued	Authority Area	Name	Watercourse
013FWFCH17	Flood Warning	20/01/2021 15:51	Warrington / St Helens	Sankey Brook around areas of Gemini, Dallam, Bewsey, Longford, Orford, Great Sankey and Penketh	Sankey
013FWFCH35	Flood Warning	20/01/2021 09:22	Warrington	River Bollin and Agden Brook at Little Bollington	Bollin
013FWFCH35	Severe Flood Warning	21/01/2021 01:30	Warrington	River Bollin and Agden Brook at Little Bollington	Bollin
013FWFGM77	Flood Warning	20/01/2021 17:28	Warrington	River Bollin at Heatley	Bollin
013FWFGM77	Severe Flood Warning	21/01/2021 01:29	Warrington	River Bollin at Heatley	Bollin

3.6 Groundwater Conditions

Groundwater levels continued to rise during January, ending the month higher than at the end of December, and were classed between 'Normal' and 'Exceptionally high'. There was only one change in classification, with levels at Bruntwood Hall being classed as 'Notably high' compared to 'Above normal' the previous month. Crow Lady Farm remained classed as 'Normal', Skirwith as 'Notably high' and Brown Bank Lay-By, Richmond Park and Priors Heyes as 'Exceptionally high'. The levels at Priors Heyes remain high compared to historic levels because the aquifer is recovering from the effects of historically high abstractions.

Figure 21: 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 22: Location of Groundwater Monitors within Warrington

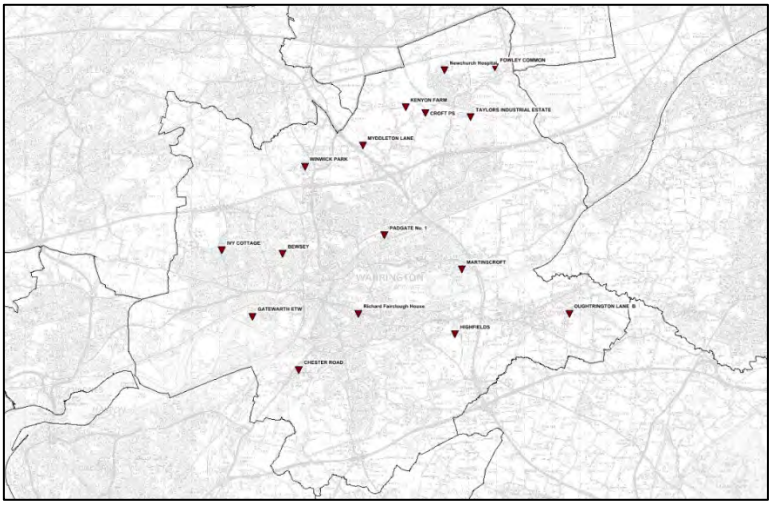


Table 3.12: Location of Groundwater Monitors within Warrington

Monitor name and Reference	Co-ordinates	Manual / continuous recording	Catchment area	Comment
Bewsey - SJ58/162	359259 , 389480	Manually read	Sankey	Data not available at time of request
Chester Road - SJ58/117	359839 , 385299	Continuous recording	Weaver Lower	-
Croft Ps - SJ69/129C	364400 , 394550	Continuous recording	Glaze	-
Fowley Common - SJ69/130	366919 , 396199	Manually read	Glaze	Data not available at time of request
Gatewarth Etw - SJ58/150	358170 , 387219	Manually read	Sankey	Data not available at time of request
Highfields - SJ68/42	365479 , 386580	Continuous recording	Weaver Lower	-
Ivy Cottage - SJ58/127	357070 , 389610	Manually read	Sankey	Data not available at time of request
Kenyon Farm - SJ69/37B	363699 , 394760	Manually read	Glaze	Data not available at time of request
Martinscroft - SJ68/78	365719 , 388920	Manually read	Glaze	Data not available at time of request
Myddleton Lane - SJ69/133	362149 , 393379	Continuous recording	Glaze	-
Newchurch Hospital - SJ69/31	365100 , 396099	Manually read	Glaze	Data not available at time of request
Oughtrington Lane B - SJ68/54	369599 , 387320	Manually read	Bollin, Dean, Upper Mersey	Data not available at time of request
Padgate No. 1 - SJ69/149A	362929 , 390149	Manually read	Glaze	Data not available at time of request
Richard Fairclough House - SJ68/87	361989 , 387320	Continuous recording	Glaze	-
Taylors Industrial Estate - SJ69/39	366040 , 394400	Manually read	Glaze	Data not available at time of request
Winwick Park - SJ69/46	360067 , 392619	Continuous recording	Sankey	-

Note: Monitors record in 1 hour intervals

Figure 23: Ground water levels within Warrington

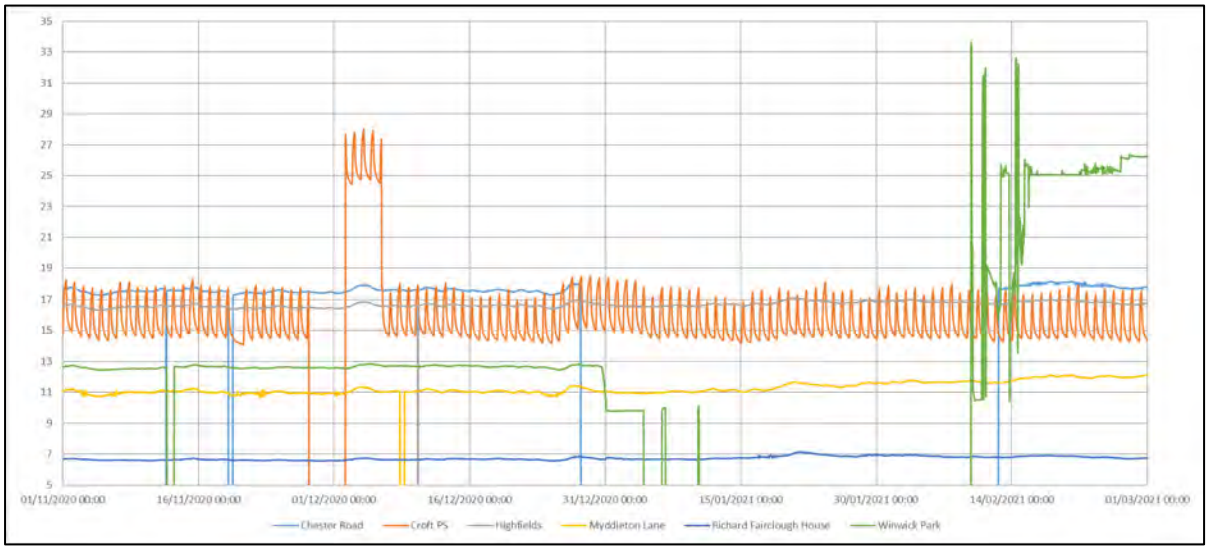


Figure 23 illustrates there is a noticeable increase in ground water conditions as a consequence of Storm Christoph. Reviewing the long term data for all locations with respect to the North West region, ground water levels were considered 'Notably high' to 'Exceptionally high' for the time of year.

Warrington Borough Council received several reports of surface water flows from adjacent fields being received on the highway. Evidence suggests the ground was significantly saturated thus reducing the effective infiltration capacity, consequently 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 partially contribute to flooding due to water levels being higher than average for the time of year.

Groundwater Flood Warning Areas

Groundwater flood warning areas are properties based, usually containing a discrete urban area, suburb, city, village or hamlet and were created in various ways. In general technical specialists used the national groundwater dataset, historical maps, bedrock geology and records of properties affected by groundwater flooding in the past to create the groundwater flood warning areas. Additional data sources, including groundwater susceptibility maps, borehole data, local modelling and LiDAR may also have been used depending on the location of the area.

The triggers for Flood Warnings for groundwater flooding are based on actual observed groundwater levels. There are currently no flood risk maps for groundwater so Environment Agency flood warning areas for groundwater tend to cover properties which are known to have been previously flooded by groundwater. Within the North West there are some level sites on Telemetry with alarms, but the alarms are out of range alarms and only be activated if there was an issue onsite.

4 Appleton Flood Cluster

Flooding to 3 properties occurred in this cluster as set out in Table 4.1 below:

Table 4.1 Flooded Properties Summary – Appleton Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
FIRS LANE	1	
WOODBRIDGE CLOSE		2
Grand Total	**1**	**2**

Due to the distance between these two locations, they have been split into two separate clusters as follows:

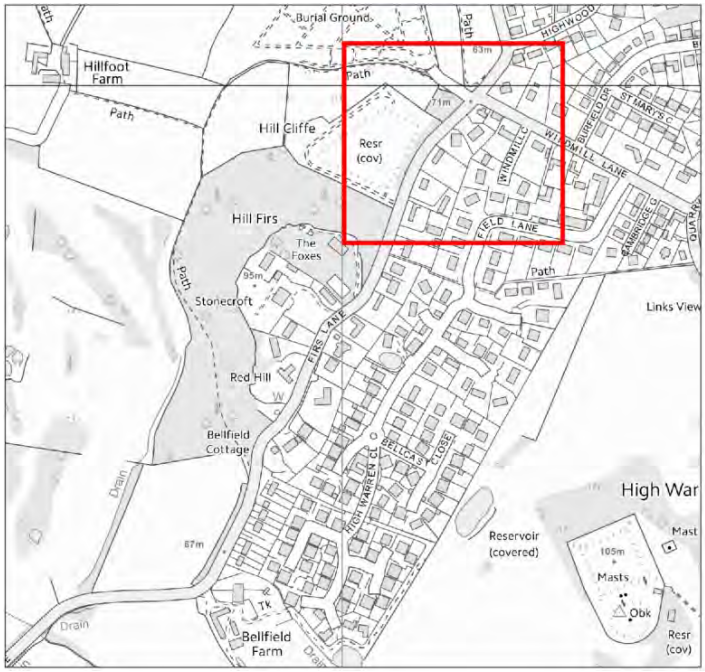
- Appleton Flood Cluster A – Firs Lane
- Appleton Flood Cluster B – Woodbridge Close

4.1 Appleton Flood Cluster A – Firs Lane

Internal flooding occurred to 1 property on Firs Lane, Appleton.

Firs Lane, Appleton is a residential area located in Appleton Ward within the administrative area of Warrington Borough Council. It is approximately 2.2 miles to the south of Warrington town centre

Figure 24: Approx. Location of Flooding to Firs Lane, Appleton



4.1.1 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.

4.1.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through the area.

Figure 25: Extract of Historic Mapping – Published 1898 (National Library of Scotland)

Figure 26: Extract of Historic Mapping – Map Date 1847 (Cheshire Archives)

4.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Firs Lane. The mapping shows a 225mm diameter combined public sewer running to the rear of several properties on Firs Lane and Windmill Close.

Two number gullies are identified on the UU Statutory Sewer Map in red indicating that they may be connected to the combined system, however no further connectivity information is shown.

Figure 27: Extract from United Utilities Statutory Sewer Map

4.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Firs 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 Firs 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.

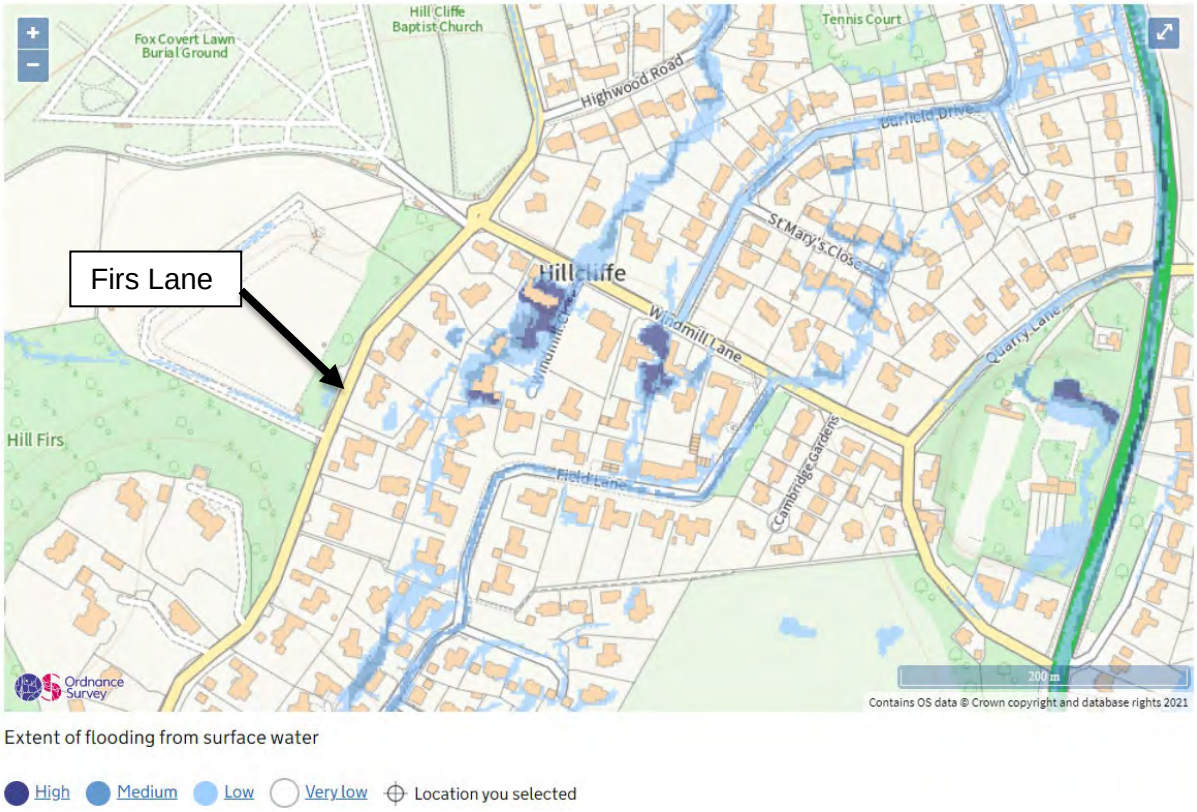
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping 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 or 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, the properties within this section of Firs Lane are generally shown as being at low risk of surface water flooding. A number of pockets of flooding are observed which may be localised depressions in the topography. It should be noted that a significant flow path is present on Windmill Close although this doesn't appear to affect properties on Firs Lane.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 28: 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 Firs Lane is not at risk of flooding from reservoirs.

4.1.5 Flooding Mechanism Conclusion & Risk Management Authority
United Utilities confirmed that they attended site and found this to be a private issue.

4.1.6 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Consider contacting resident regarding private matter, if not already done by others.

4.2 Appleton Flood Cluster B – Woodbridge Close
External flooding occurred to 2 properties on Woodbridge Close, Appleton.

Firs Lane, Appleton is a residential area located in Appleton Ward within the administrative area of Warrington Borough Council. It is approximately 3 miles to the south of Warrington town centre

Figure 29: Approx Location of Flooding to Woodbridge Close, Appleton

4.2.1 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.

4.2.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. The earlier map from Cheshire Archives appears to show two ponds in the vicinity of Woodbridge Close as oppose to one pond shown on the later mapping from National Library of Scotland.

Figure 30: Extract of Historic Mapping – Published 1898 (National Library of Scotland)

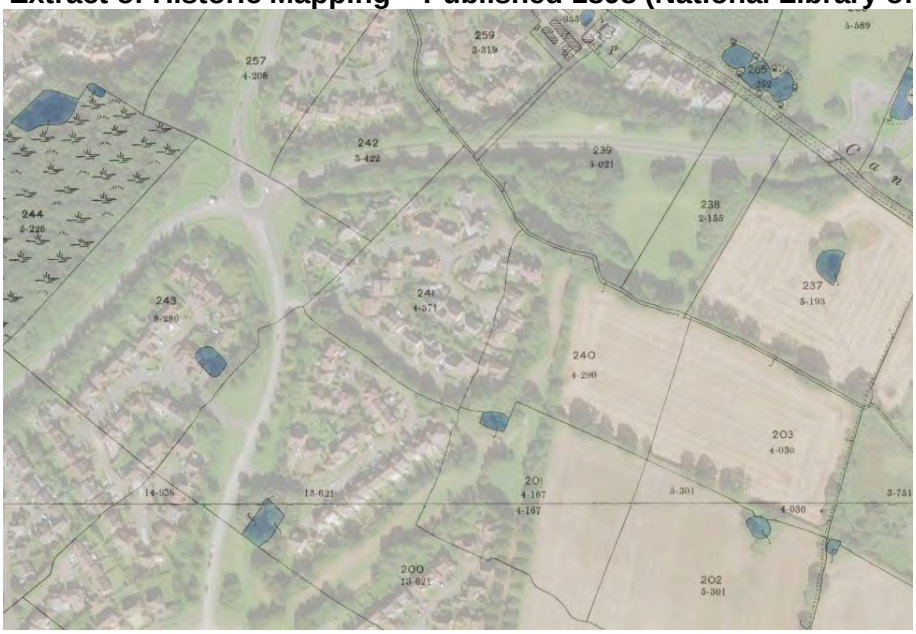


Figure 31: Extract of Historic Mapping – Map Date 1847 (Cheshire Archives)

4.2.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Woodbridge Close. The mapping shows the Woodbridge Close Estate as being served by separate foul and surface water drainage systems.

Figure 32: Extract from United Utilities Statutory Sewer Map

4.2.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Woodbridge Close 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 Woodbridge Close 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.

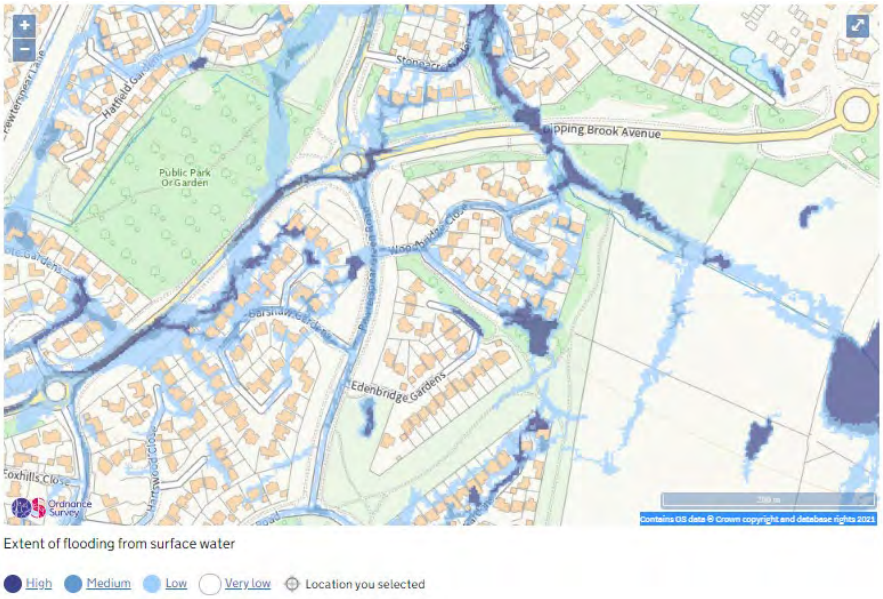
It is important to note that this is national mapping product and does not represent or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

According to the Environment Agency Risk of Flooding from Surface Water mapping, there are significant flow paths running through the estate.

The mapping also shows an area at high risk of surface water flooding at Woodbridge Close indicating a localised depression which corresponds with the pond shown on the 1847 mapping obtained from Cheshire Archives.

Figure 33: 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 this area is not at risk of flooding from reservoirs.

4.2.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council that the flooding to Woodbridge Close between the 18th and 21st January 2021 was due to intense rainfall exceeding the available infiltration capacity and/or the drainage capacity leading to overland flows and surface water flooding of localised depressions.

In this regard, United Utilities and Warrington Borough Council are jointly the appropriate risk management authorities.

Warrington Borough Council is responsible as Highways Authority for the highway gullies.

United Utilities are responsible for the public sewers serving the area.

4.2.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- Provide a copy of this Section 19 Report to Warrington Borough Council Highways Department as notification that Warrington Borough Council considers them to be the appropriate risk management authority in respect of this flooding incident.
- Follow up with UU in respect of management of flood risk in this area going forward.

5 Bewsey & Whitecross Flood Cluster

Flooding to 230 properties occurred in this cluster as set out in Table 5.1 below:

Table 5.1: Flooded Properties Summary – Bewsey & Whitecross Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
BARDSLEY AVENUE		1
CHARTER AVENUE	15	
GRAFTON STREET		1
HAWLEYS CLOSE	2	
HAWLEYS LANE	2	1
HIGHAM AVENUE	11	1
HODGKINSON AVENUE	9	1
LEWIS AVENUE		8
LONGSHAW STREET	23	1
MASSEY AVENUE		3
MOLYNEUX AVENUE	4	1
MULLEN CLOSE	17	
PALMYRA SQUARE SOUTH	1	
REID AVENUE	8	
RUTTER AVENUE		9
SOUTHWORTH AVENUE	52	25
SUMMERFIELD AVENUE		2
TAVLIN AVENUE	27	5
Grand Total	**171**	**59**

Following a review of the flooding information, Bewsey & Whitecross Flood Cluster has been split into five separate clusters based on flood mechanism / spatial separation as follows:

- Bewsey & Whitecross Flood Cluster A – Area West of Longshaw Street
- Bewsey & Whitecross Flood Cluster B – Area in Vicinity of Hawleys Lane Underbridge
- Bewsey & Whitecross Flood Cluster C – Charter Avenue
- Bewsey & Whitecross Flood Cluster D – Grafton Street
- Bewsey & Whitecross Flood Cluster E – Palmyra Square South

5.1 Bewsey & Whitecross Flood Cluster A – West of Longshaw Street

A summary of flooding to Bewsey & Whitecross Flood Cluster A is provided in Table 5.2 below.

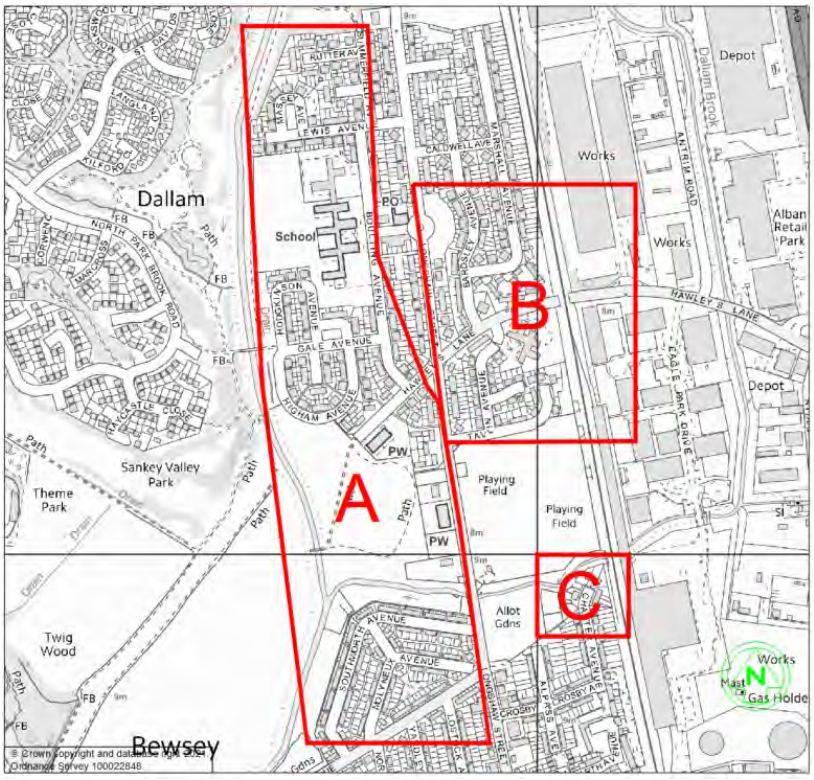
Table 5.2: Flooded Properties Summary – Bewsey & Whitecross Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
HAWLEYS CLOSE	2	
HIGHAM AVENUE	11	1
HODGKINSON AVENUE	9	1
LEWIS AVENUE		8
LONGSHAW STREET	23	1
MASSEY AVENUE		3

Location	Count of Internally Flooded	Count of Externally Flooded
MOLYNEUX AVENUE	4	1
REID AVENUE	8	
RUTTER AVENUE		9
SOUTHWORTH AVENUE	52	25
SUMMERFIELD AVENUE		2
Grand Total	**109**	**51**

Flood cluster A is primarily a residential area located in Bewsey & Whitecross Ward within the administrative area of Warrington Borough Council. It is approximately 1.3 miles north west of Warrington town centre

Figure 34: Bewsey & Whitecross Flood Cluster A



5.1.1 Flood History

The Engineering and Flood Risk Team is aware of historic flooding to:

- Higham Avenue
- Lewis Avenue
- Southworth Avenue
- Massey Avenue

5.1.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. It is apparent when compared to modern mapping that the watercourses in this area have been heavily modified. This is most likely as a result of the construction of Sankey Canal / St Helens Canal which was opened in 1757 and its subsequent closure in 1963.

Figure 35: Extract of Historic Mapping – Published 1907 (National Library of Scotland)

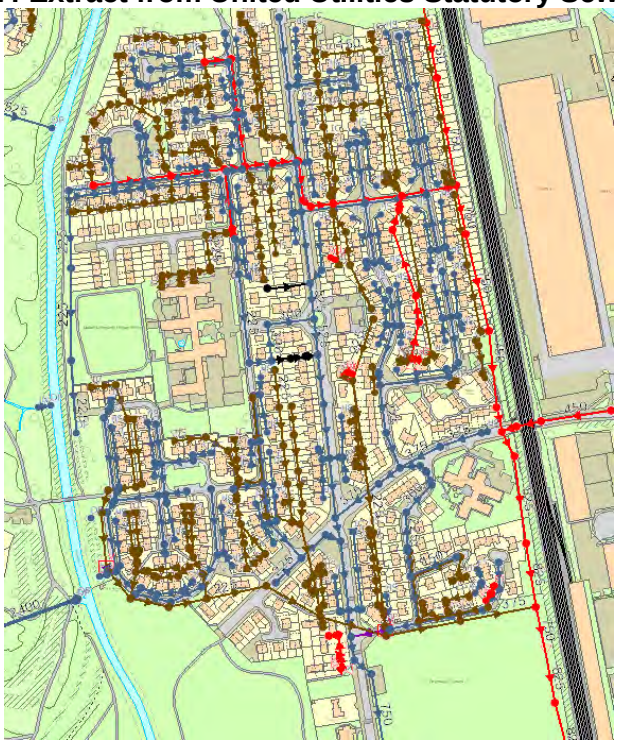
Figure 36: Extract of Historic Mapping – Map Date 1950's (National Library of Scotland)

5.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the general Bewsey and Whitecross area.

The mapping shows that the Dallam Area is generally served by a series of United Utilities public foul and surface water sewers. The foul and combined sewers are shown as connected to a large diameter combined sewer running parallel with the west coast mainline.

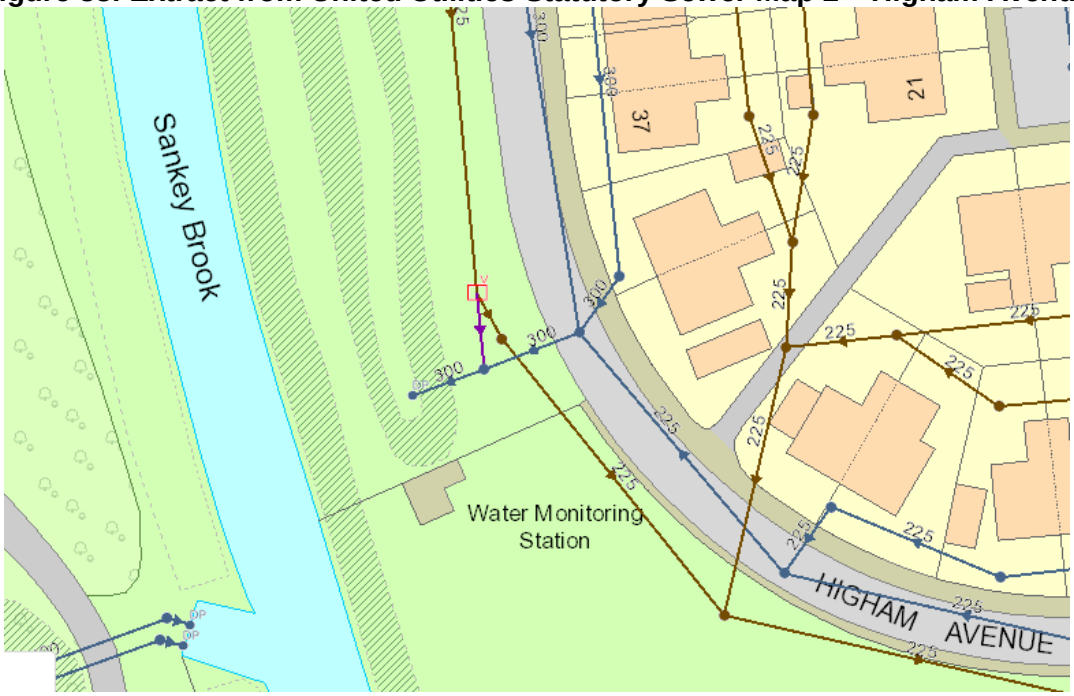
Figure 37: Extract from United Utilities Statutory Sewer Map 1



The surface water systems discharge to Sankey Brook / Dallam Brook. It is understood that the surface water outfalls for the area operate by gravity with the exception of the surface water outfall at Higham Avenue. 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.

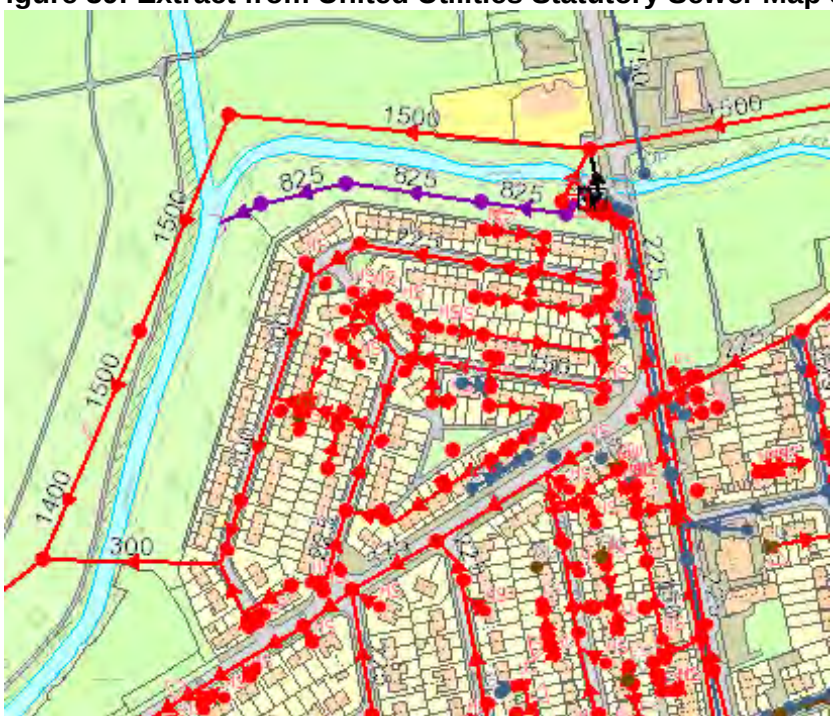
The UU surface water system at Higham Avenue and Lewis Avenue flow to a pump station operated by Warrington Borough Council at Higham Avenue which discharges to Sankey Brook. Further investigation has been undertaken into this area and the findings are covered in section 5.1.6 below.

Figure 38: Extract from United Utilities Statutory Sewer Map 2 – Higham Avenue



The mapping shows that the Bewsey area is generally served by a series of United Utilities public combined sewers. The combined sewers are shown as connected to a large diameter combined sewer running parallel with Dallam Brook / Sankey Brook.

Figure 39: Extract from United Utilities Statutory Sewer Map 3



The large diameter combined system serving the area is connected to Bewsey Bridge Pumping Station (A United Utilities asset).

5.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Dallam and Bewsey at varying levels of risk.

The observed flood extents during Storm Christoph generally correspond with the "medium risk" flood outline. Medium risk is defined as "Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area."

It should be noted that a number of properties in Higham Avenue / Southworth Avenue and on Longshaw Street are shown as being at high risk of flooding from rivers or the sea. High risk is defined as High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited.

Figure 40: Flood Risk from Rivers or the Sea Mapping 1

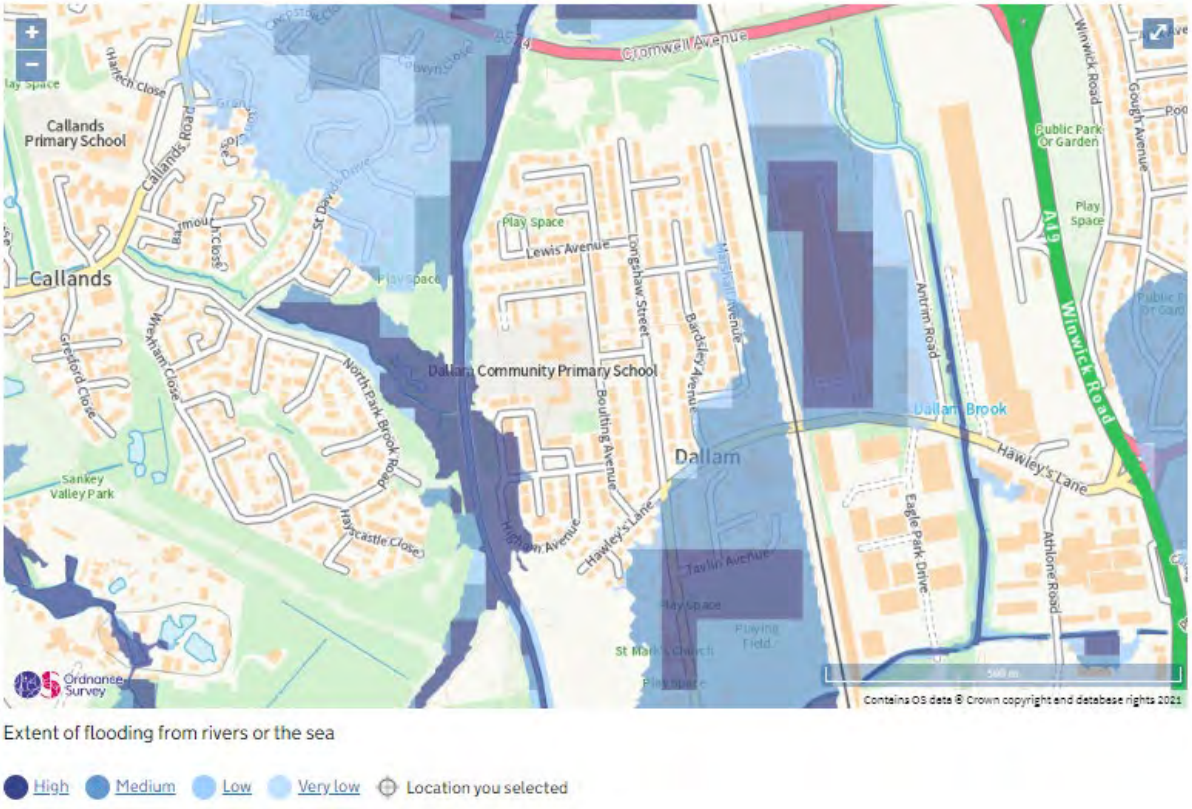


Figure 41: Flood Risk from Rivers or the Sea Mapping 2

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 or 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, the properties within Dallam and Bewsey are at varying levels of risk from surface water flooding. A number of pockets of flooding are observed which may be localised depressions in the topography.

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 1

Figure 43: Flood Risk from Surface Water Mapping 2

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 Dallam and Bewsey are at risk of flooding from reservoirs.

Figure 44: Maximum Extent of Flooding from Reservoirs 1

Figure 45: Maximum Extent of Flooding from Reservoirs 2

5.1.5 Watercourse Level Information

Two significant watercourses run through the Dallam / Bewsey area these are:

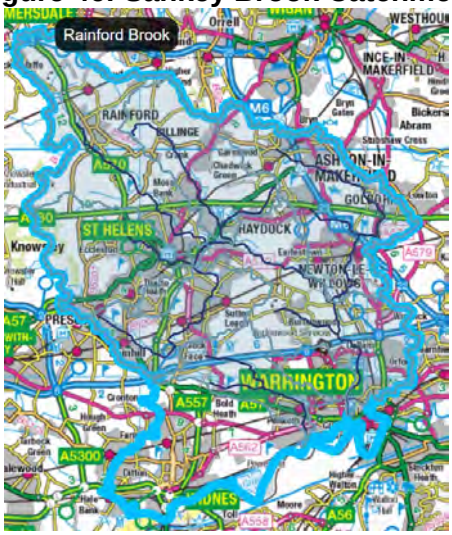
- Sankey Brook

- Dallam Brook (Tributary to Sankey Brook)

Both of the above watercourses are classified as 'Main River' meaning that they are under the regulatory control of the Environment Agency.

The Sankey Catchment covers approximately 179km^2 and has 126km of Main River flowing, generally in a west to east orientation, through a mixture of open agricultural land and urban settlements. The Sankey Brook originates at the confluence of Sutton and Hardshaw Brooks in St Helens and flows into the River Mersey at Sankey Bridges in Warrington.

Figure 46: Sankey Brook Catchment



Source: Environment Agency

The nearest watercourse telemetry station to the affected area is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

Tributary watercourses including Dallam Brook will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded.

5.1.6 Investigation Undertaken

Following Storm Christoph and the completion of temporary repairs to the pump station at Higham Avenue, Warrington Borough Council has undertaken an assessment of the existing pump setup and the area which it serves.

A significant investigation and study has been undertaken to understand the types, number, and connectivity of all drainage systems connected into the pump station at Higham Avenue.

The surface water catchment of the pump station is mostly urban, comprising a significant number of houses.

The UU surface water systems for the following drain to this pump station:

- Massey Avenue
- Lewis Avenue
- Gale Avenue
- Higham Avenue
- Hindle Avenue

It was found that a United Utilities Combined Sewer Overflow or Bifurcation Chamber is connected to the UU surface water system which drains to the pump station.

The connectivity of United Utilities drainage systems was previously unknown.

The pump station is therefore considered a critical asset to the drainage of the area.

5.1.7 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Bewsey & Whitecross Flood Cluster A that the primary flood mechanism was water overtopping the banks of Sankey Brook and Dallam Brook.

It is understood that the surface water system which discharges to Sankey Brook via the pumps located at Higham Avenue were effective until overwhelmed by water overtopping the banks of the Sankey and subsequent power failure.

Gravity surface water outfalls would most likely have experienced hydraulic restriction due to the raised watercourse levels in receiving watercourses.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

5.1.8 Future Project

Environment Agency are looking at the flood risk associated with Sankey Brook, Dallam Brook and Longford Brook. The planning for this scheme was underway before Storm Christoph and they are looking to develop a confirmed plan for this area by March 2022.

Flood risk measures under consideration include:

- Linear Defences (defences set back from the river edge where possible)
- Flood attenuation (where flooding is captured and released slowly)

- Improved channel conveyance (maintaining good condition of water channels)
- Upstream natural flood management (when the natural environment and processes are used to support flood management)
- Flood relief channels (channels which are made to help divert water around or from important locations)
- Connection of Sankey Brook to the canal
- Reviewing Longford Barrage, which is an existing tidal barrage asset on Longford Brook.

This scheme will look at flooding from all water sources (surface water, river and sewer), and will involve partnership and collaborative working between the Environment Agency, Warrington Borough Council and United Utilities.

Further information on the Sankey Brook Proposed Flood Risk Management Scheme is available at https://thefloodhub.co.uk/sankeybrookfrmswarrington/#section-1

5.1.9 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Discuss connectivity and ownership arrangements in respect of Higham Avenue Pumping Station with United Utilities.
- Follow up with UU and EA in respect of management of flood risk in this area going forward.
- Engage with UU and EA in respect of ensuring surface water assets continue to function when levels are high in receiving watercourses.

5.2 Bewsey & Whitecross Flood Cluster B – Area in Vicinity of Hawleys Lane Underbridge

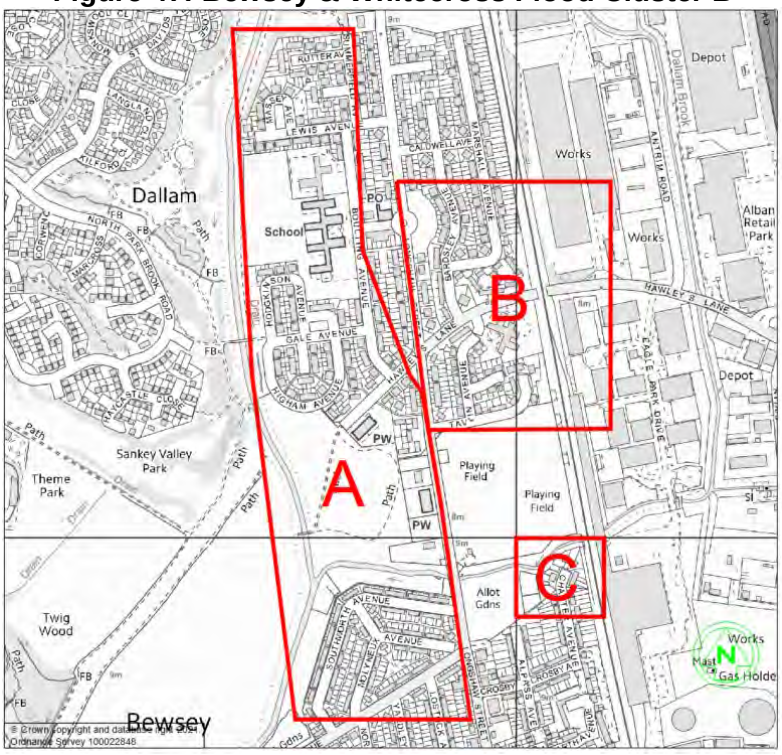
A summary of flooding to Bewsey & Whitecross Flood Cluster B is provided in Table 5.3 below.

Table 5.3: Flooded Properties Summary – Bewsey & Whitecross Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
BARDSLEY AVENUE		1
HAWLEYS LANE	2	1
MULLEN CLOSE	17	
TAVLIN AVENUE	27	5
Grand Total	**46**	**7**

Flood cluster B is primarily a residential area located in Bewsey & Whitecross Ward within the administrative area of Warrington Borough Council. It is approximately 1.3 miles North West of Warrington town centre.

Figure 47: Bewsey & Whitecross Flood Cluster B



5.2.1 Flood History

The Engineering and Flood Risk Team is aware of historic flooding to:

- Hawleys Lane

Hawleys Lane bridge carries the West Coast Mainline. The railway line runs north to south through Warrington, The bridge is located approximately half way along the length of Hawleys Lane which runs east to west. Due to the location of the railway line access to the Dallam Estate is fairly restricted.

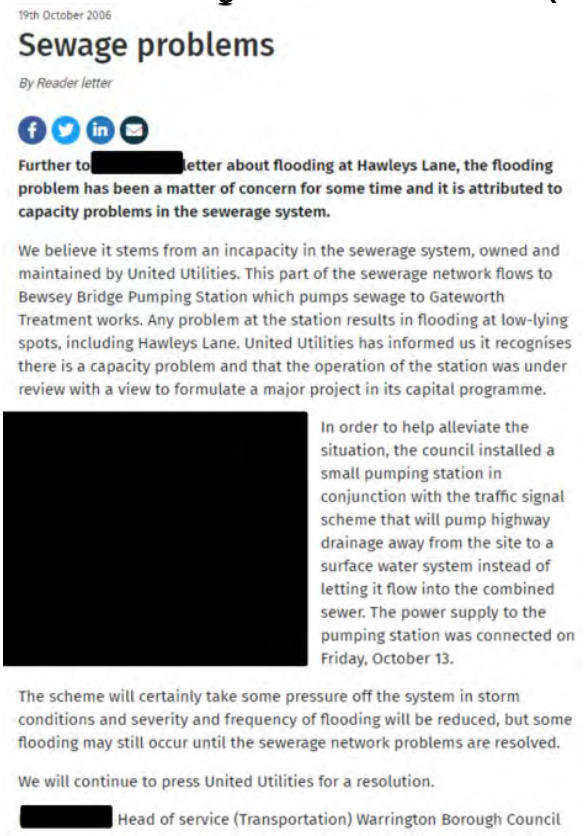
Hawleys Lane is utilised as a primary access route for local residents and businesses, linking the A49 Winwick Road with the Dallam Estate. A secondary route also exists via Longshaw Street and Folly Lane, however this route is quite lengthy in comparison (heading south and then east towards the town centre) and prone to flooding when water levels within Dallam Brook are high.

When flooding does occur under the bridge section there is a significant risk of pedestrians being tempted to climb over protective fencing and crossing the railway line due to the distance and time required to cover the secondary access route.

Due to the risk, there is an emphasis on managing the flood risk at this location.

It is understood that flooding has occurred previously on numerous occasions at this location. A summary of Warrington Borough Council's historical understanding of the problem is as contained in a letter dated 19 October 2006 posted on the Warrington Guardian website by former Head of Service for Warrington Borough Council as shown in Figure 48 below.

Figure 48: Extract from Warrington Guardian Website (19 October 2006)



19th October 2006

Sewage problems

By Reader letter

Further to [redacted] letter about flooding at Hawleys Lane, the flooding problem has been a matter of concern for some time and it is attributed to capacity problems in the sewerage system.

We believe it stems from an incapacity in the sewerage system, owned and maintained by United Utilities. This part of the sewerage network flows to Bewsey Bridge Pumping Station which pumps sewage to Gateworth Treatment works. Any problem at the station results in flooding at low-lying spots, including Hawleys Lane. United Utilities has informed us it recognises there is a capacity problem and that the operation of the station was under review with a view to formulate a major project in its capital programme.

[redacted]

In order to help alleviate the situation, the council installed a small pumping station in conjunction with the traffic signal scheme that will pump highway drainage away from the site to a surface water system instead of letting it flow into the combined sewer. The power supply to the pumping station was connected on Friday, October 13.

The scheme will certainly take some pressure off the system in storm conditions and severity and frequency of flooding will be reduced, but some flooding may still occur until the sewerage network problems are resolved.

We will continue to press United Utilities for a resolution.

[redacted] Head of service (Transportation) Warrington Borough Council

https://www.warringtonguardian.co.uk/yoursay/letters/978763.sewage-problems/

It is the understanding of Warrington Borough Council that Bewsey Bridge Wastewater Pumping Station was rebuilt in 2013. It is reported in a case study for Water Projects Online website that it was rebuilt due to its age, the pumping station being costly to run, difficult to operate and unsafe to maintain. Pump blockages and failure of the control system cause upstream flooding and contribute to pollution of the nearby Sankey Brook.

The rebuilding of the pumping station is detailed in a case study for Water Projects Online website available at:
http://www.ukwaterprojectsonline.com/case_studies/2013/UU_Bewsey_2013.pdf

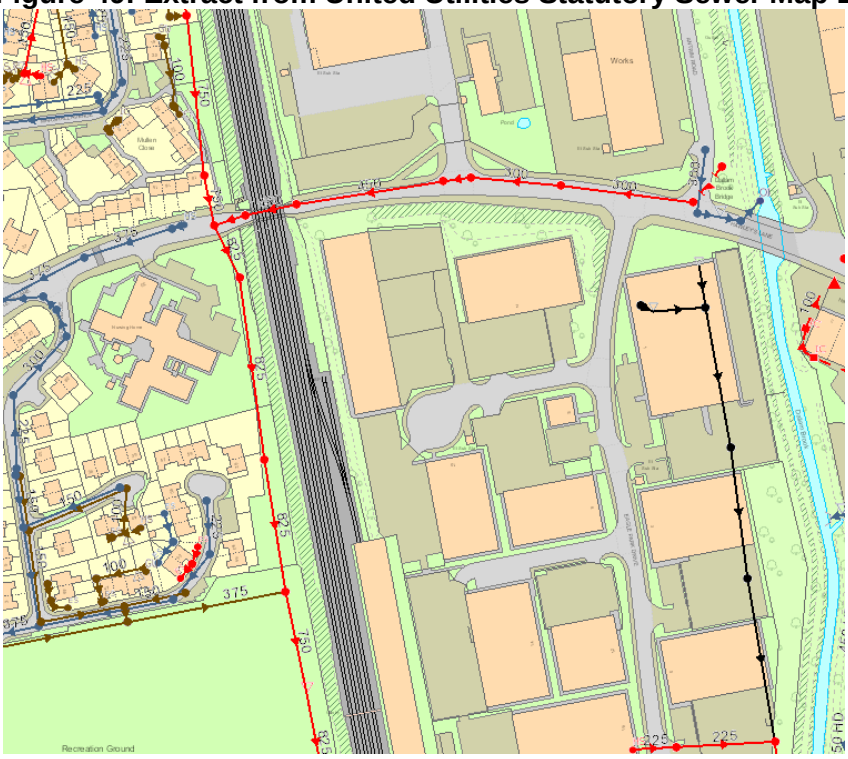
It is recognised by United Utilities that operational issues at Bewsey Bridge Pump station can contribute to flooding at Hawleys Lane.

5.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Hawley's Lane underbridge. The mapping shows a combined public sewer and surface water system in the area.

The combined sewer runs to Bewsey Bridge pumping station and the surface water system outfalls to Dallam Brook which is a tributary to Sankey Brook.

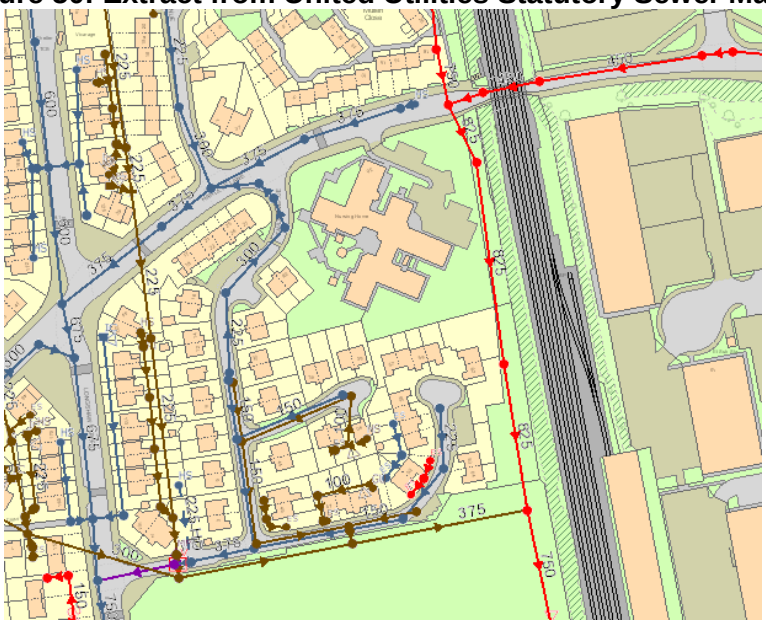
Figure 49: Extract from United Utilities Statutory Sewer Map 1



The mapping shows that the Tavlin Avenue Area is generally served by a series of United Utilities public foul and surface water sewers. The foul sewers are shown as connected to a large diameter combined sewer running parallel with the west coast mainline which runs to Bewsey Bridge pumping station.

The surface water sewers are shown as discharging to Dallam Brook to the south.

Figure 50: Extract from United Utilities Statutory Sewer Map 2



5.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea mapping shows Hawleys Lane and Tavlin Avenue area as being at medium / high risk of flooding.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Figure 51: Flood Risk from Rivers or the Sea Mapping

The observed flood extents during Storm Christoph generally correspond with the “medium risk” flood outline. Medium risk is defined as “Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area.”

It should be noted that a number of properties in Tavlin Avenue shown as being at high risk of flooding from rivers or the sea. High risk is defined as High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited

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.

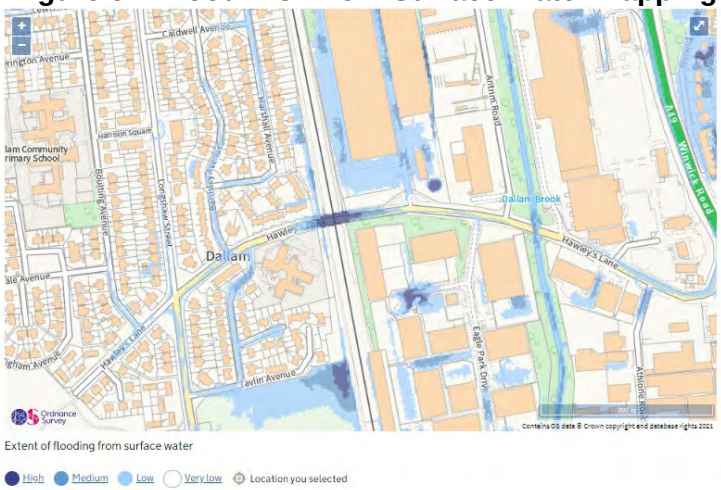
It is important to note that this is national mapping product and does not represent or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, Hawleys Lane is generally shown as being at risk of surface water flooding but differing in degrees of risk across the area. The underbridge is shown as being at high risk of surface water flooding.

Properties on Tavlin Avenue are shown as being at very low risk of surface water flooding and the road is shown as being at medium risk.

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.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Bewsey & Whitecross Flood Cluster B – Area in Vicinity of Hawleys Lane Underbridge is not at risk of flooding from reservoirs.

5.2.4 Watercourse Level Information

Two significant watercourses run through the Dallam / Bewsey area these are:

- Sankey Brook
- Dallam Brook

Both of the above watercourses are classified as ‘Main River’ meaning that they are under the regulatory control of the Environment Agency.

The nearest watercourse telemetry station is approximately 450m west of the affected area and is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

Tributary watercourses including Dallam Brook will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded.

5.2.5 Investigation Undertaken

Investigation by Warrington Borough Council into flooding at Hawleys Lane underbridge confirmed that during periods of heavy rainfall, water surcharges the United Utilities combined drainage system in Hawleys lane and flows downhill to rest at the underbridge. This water volume then builds up to a level depending on the storm event. It is fair to say that this water volume is further increased by surface water falling directly onto the adjacent road surface.

To reduce the risk of flooding to the highway, this water is pumped along a WBC surface water system which discharges into a United Utilities surface water system. This then drains under gravity and discharges to Dallam Brook watercourse.

5.2.6 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Bewsey & Whitecross Flood Cluster B that the primary flood mechanism was a combination of sewer flooding and water overtopping the banks of Sankey Brook.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

In respect of the ongoing management of the public sewer network, United Utilities are the appropriate risk management authority. Flooding occurring in the vicinity of the underbridge at Hawleys Lane from their combined public sewer when Sankey Brook and Dallam Brook remains in bank is the responsibility of United Utilities.

5.2.7 Future Project

Environment Agency are looking at the flood risk associated with Sankey Brook, Dallam Brook and Longford Brook. The planning for this scheme was underway before Storm Christoph and they are looking to develop a confirmed plan for this area by March 2022.
Flood risk measures under consideration include:

- Linear Defences (defences set back from the river edge where possible)
- Flood attenuation (where flooding is captured and released slowly)
- Improved channel conveyance (maintaining good condition of water channels)
- Upstream natural flood management (when the natural environment and processes are used to support flood management)
- Flood relief channels (channels which are made to help divert water around or from important locations)
- Connection of Sankey Brook to the canal
- Reviewing Longford Barrage, which is an existing tidal barrage asset on Longford Brook.

This scheme will look at flooding from all water sources (surface water, river and sewer), and will involve partnership and collaborative working between the Environment Agency, Warrington Borough Council and United Utilities.

Further information on the Sankey Brook Proposed Flood Risk Management Scheme is available at https://thefloodhub.co.uk/sankeybrookfrmswarrington/#section-1

5.2.8 Actions

Warrington Borough Council will:

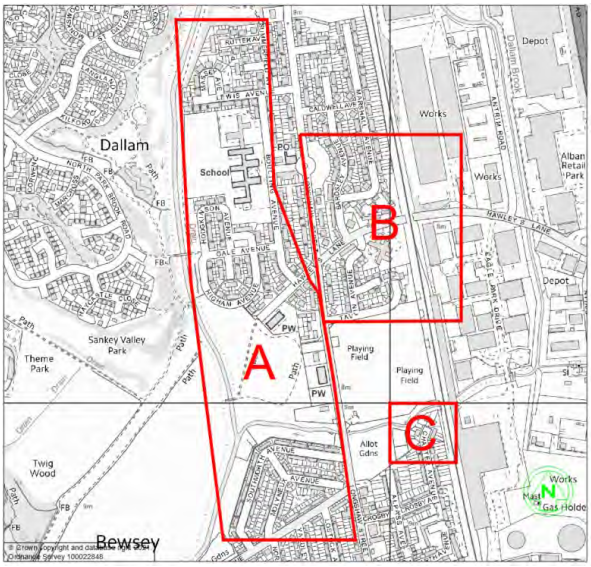
- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities & Environment Agency as notification that Warrington Borough Council considers United Utilities & Environment Agency to be the appropriate risk management authorities in respect of this flooding incident.
- Discuss with United Utilities to confirm UU solution to remove future flood risk to Hawleys Lane and to prevent pollution to Dallam Brook.
- Follow up with UU and EA in respect of management of flood risk in this area going forward.

5.3 Bewsey & Whitecross Flood Cluster C – Charter Avenue

Internal flooding occurred to 15 properties on Charter Avenue, Bewsey.

Flood cluster C is a residential area located in Bewsey & Whitecross Ward within the administrative area of Warrington Borough Council. It is approximately 1.3 miles north west of Warrington town centre.

Figure 53: Bewsey & Whitecross Flood Cluster C



5.3.1 Flood History

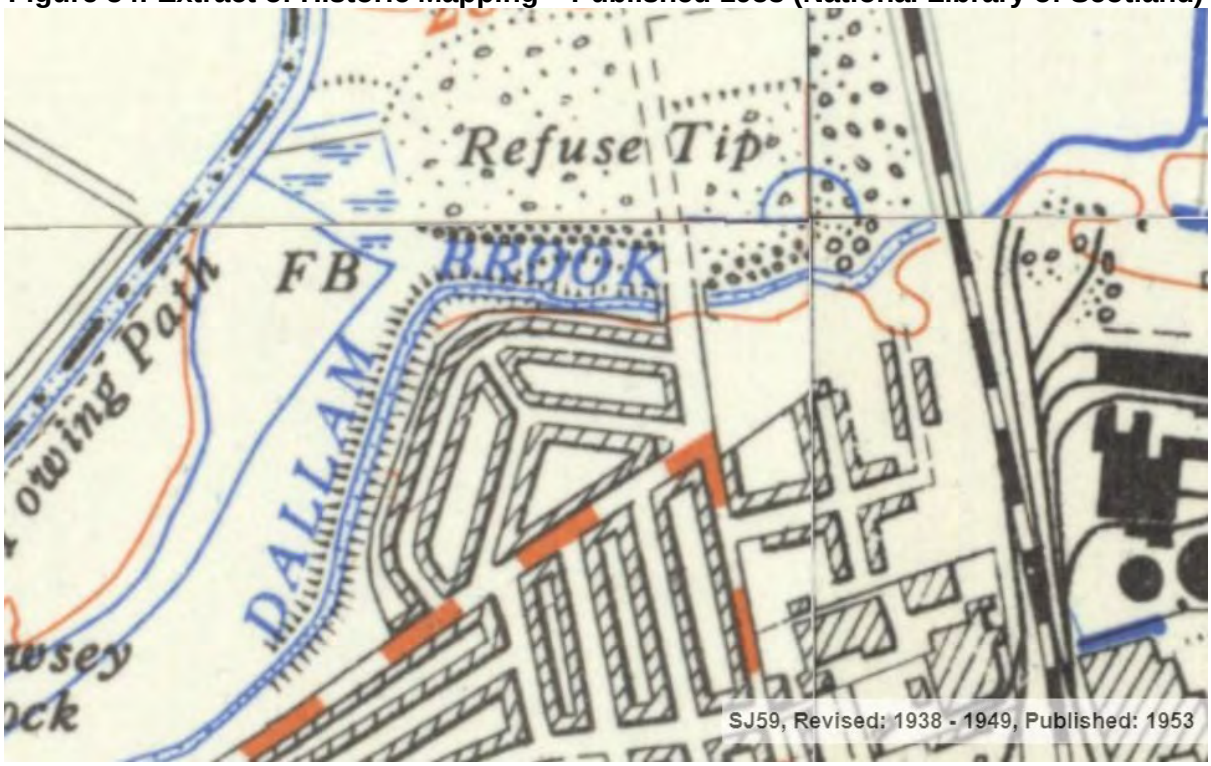
The Engineering and Flood Risk Team is aware of historic flooding to Charter Avenue.

There have been many 'near misses' at this location including garden flooding in September 2019. It is believed this has been an ongoing problem for many years.

5.3.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. Mapping published in 1953 shows the northern section of Charter Avenue had not yet been constructed and Dallam Brook.

Figure 54: Extract of Historic Mapping – Published 1953 (National Library of Scotland)

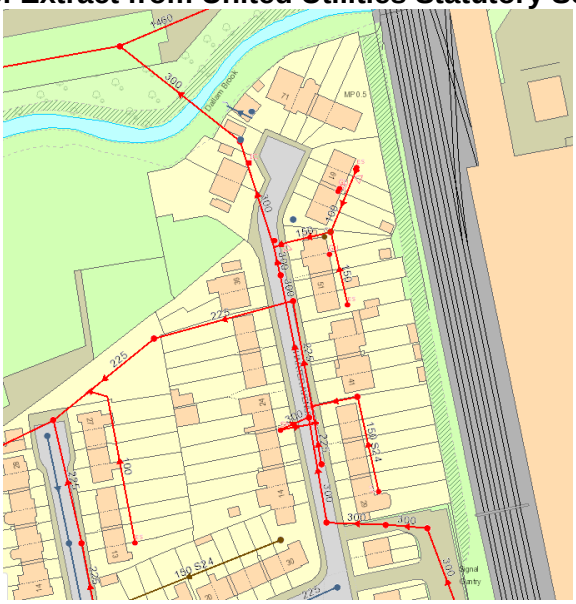


5.3.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Charter Avenue. The mapping shows a 300mm diameter combined public sewer running south to north along charter avenue which crosses Dallam Brook to join with a 1450mm diameter combined sewer which runs to Bewsey Bridge Pumping Station.

A very short section of public surface water sewer is shown on the Statutory Sewer Map discharging to Dallam Brook. Further investigation into this system has been undertaken by Warrington Borough Council which is covered in section 5.3.6 below.

Figure 55: Extract from United Utilities Statutory Sewer Map



5.3.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows the northern section of Charter Avenue as being at high risk of flooding. High risk is defined as High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

The observed flood extents during Storm Christoph generally correspond with the “medium risk” flood outline. Medium risk is defined as “Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area.”

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited.

It should be noted that the Environment Agency constructed a flood defence in August 2019 at Charter Avenue to reduce the risk of fluvial flooding, the below mapping has not been updated to reflect this.

The defence was designed to increase the standard of protection to Charter Avenue from 1 in 10 year fluvial event (10% probability) to 1 in 75year fluvial event (1.33% probability).

Figure 56: Flood Risk from Rivers or the Sea Mapping

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

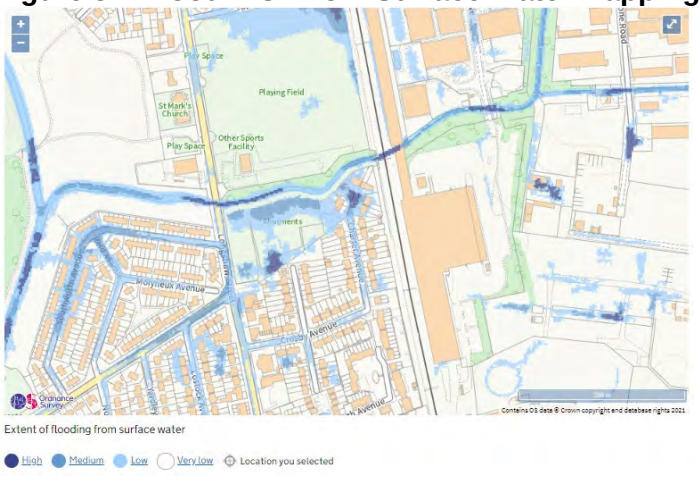
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas 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 or 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, the properties within the northern section of Charter Avenue are generally shown as being at low risk of surface water flooding. The carriageway is shown as being at high risk of flooding.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 57: 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 Charter Avenue is at risk of flooding from reservoirs.

Figure 58: Maximum Extent of Flooding from Reservoirs

5.3.5 Watercourse Level Information

There are two significant watercourses which are in the vicinity of Charter Avenue, they are:

- Sankey Brook
- Dallam Brook

Dallam Brook is adjacent to the properties at the head of Charter Avenue cul de sac.

Both of the above watercourses are classified as 'Main River' meaning that they are under the regulatory control of the Environment Agency.

The nearest watercourse telemetry station is approximately 550m north west of the affected area and is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

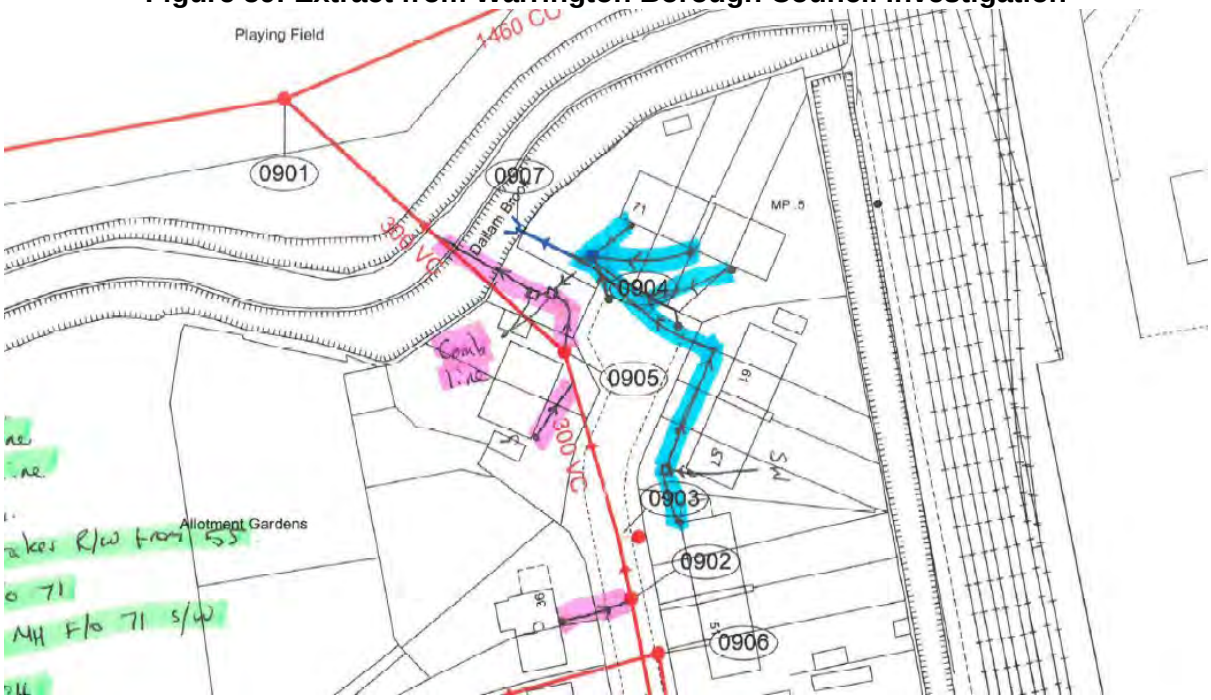
Outfalls situated at low levels would have experienced hydraulic restriction due to the raised watercourse levels, therefore affecting the performance of the surface water drainage systems.

Tributary watercourses including Dallam Brook will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded.

5.3.6 Investigation Undertaken

Investigation was undertaken into the short section of public surface water sewer by Warrington Borough Council. It appears that an uncharted public surface water sewer is present. As this system is connected to multiple residential properties as outlined in the sketch below, it is the responsibility of United Utilities.

Figure 59: Extract from Warrington Borough Council Investigation



It is understood from discussions with affected residents that water surcharged via the highway gullies prior to overtopping of the flood defences on Dallam Brook. The highway gullies at the head of the cul de sac are connected to the previously uncharted public surface water sewer. United Utilities subsequently undertook their own investigation on 25 November 2021 to verify the findings of Warrington Borough Council.

UU carried out extensive CCTV surveys and dye testing and identified a surface water drain serving approx. 16 properties. There is a 100mm pipe which runs within the property boundaries – this is now classed as a transferred sewer (UU Responsibility under The private sewers transfer regulations 2011.)

This pipe is in good condition and does discharge to the watercourse – it also serves 2 highway gullies which tap into the surface water drains, this has never been mapped onto the UU corporate system before and therefore UU had no knowledge of this asset. Prior to 2011 this would have been the responsibility of the customer.

For further information see the Water UK Guide to Transfer of Private Sewers Regulations 2011 available at the following link:
https://www.water.org.uk/wp-content/uploads/2019/03/Private-Sewer-Transfer-Water-UK-Template.pdf

UU are currently liaising with the EA to investigate options to reduce the risk of the River inundating the surface water sewers and causing flooding to Charter Avenue.

Figure 60: Extract from United Utilities Investigation

5.3.7 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Bewsey & Whitecross Flood Cluster C – Charter Avenue that the flood mechanism was a combination of flooding from the previously uncharted public surface water sewer and overtopping of the flood defences on Dallam Brook.

On this basis, it is the opinion of Warrington Borough Council that both Environment Agency and United Utilities have relevant flood risk management functions and are the appropriate risk management authorities for managing this flood risk issue going forward.

5.3.8 Future Project

Environment Agency are looking at the flood risk associated with Sankey Brook, Dallam Brook and Longford Brook. The planning for this scheme was underway before Storm Christoph and they are looking to develop a confirmed plan for this area by March 2022.

Flood risk measures under consideration include:

- Linear Defences (defences set back from the river edge where possible)
- Flood attenuation (where flooding is captured and released slowly)

- Improved channel conveyance (maintaining good condition of water channels)
- Upstream natural flood management (when the natural environment and processes are used to support flood management)
- Flood relief channels (channels which are made to help divert water around or from important locations)
- Connection of Sankey Brook to the canal
- Reviewing Longford Barrage, which is an existing tidal barrage asset on Longford Brook.

This scheme will look at flooding from all water sources (surface water, river and sewer), and will involve partnership and collaborative working between the Environment Agency, Warrington Borough Council and United Utilities.

Further information on the Sankey Brook Proposed Flood Risk Management Scheme is available at https://thefloodhub.co.uk/sankeybrookfrmswarrington/#section-1

5.3.9 Actions

Warrington Borough Council will:

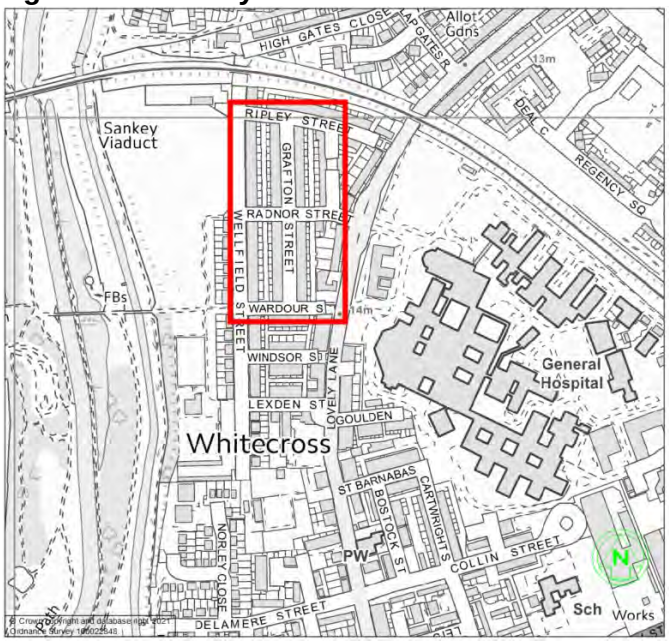
- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities & Environment Agency as notification that Warrington Borough Council considers United Utilities & Environment Agency to be the appropriate risk management authorities in respect of this flooding incident.
- Discuss these matters at future meetings with Environment Agency and United Utilities to determine short term contingency measures and long term solutions and timescales where possible.

5.4 Bewsey & Whitecross Flood Cluster D – Grafton Street

External flooding occurred to 1 properties on Grafton Street, Bewsey.

Flood cluster D is primarily a residential area located in Bewsey & Whitecross Ward within the administrative area of Warrington Borough Council. It is approximately 1 miles north west of Warrington town centre

Figure 61: Bewsey & Whitecross Flood Cluster D



5.4.1 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.

5.4.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through Grafton Street.

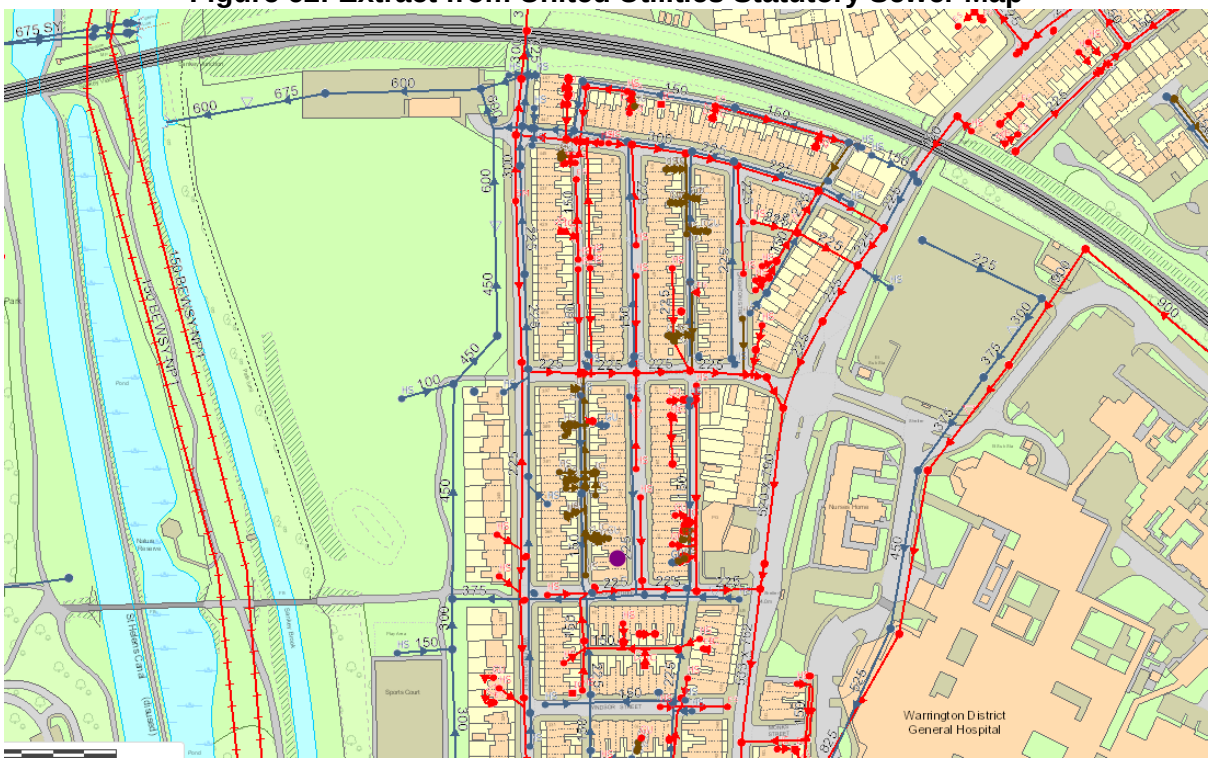
5.4.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Grafton Street. The mapping shows Grafton Street is served by a combination of public surface water sewers and public combined sewers.

The public surface water sewers discharge to Sankey Brook approx 200m to the west of Grafton Street.

The public combined sewers drain to Warrington North Wastewater Treatment Works (Gatewarth) which is a United Utilities asset.

Figure 62: Extract from United Utilities Statutory Sewer Map



5.4.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Map for Planning shows Grafton 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 Grafton 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.

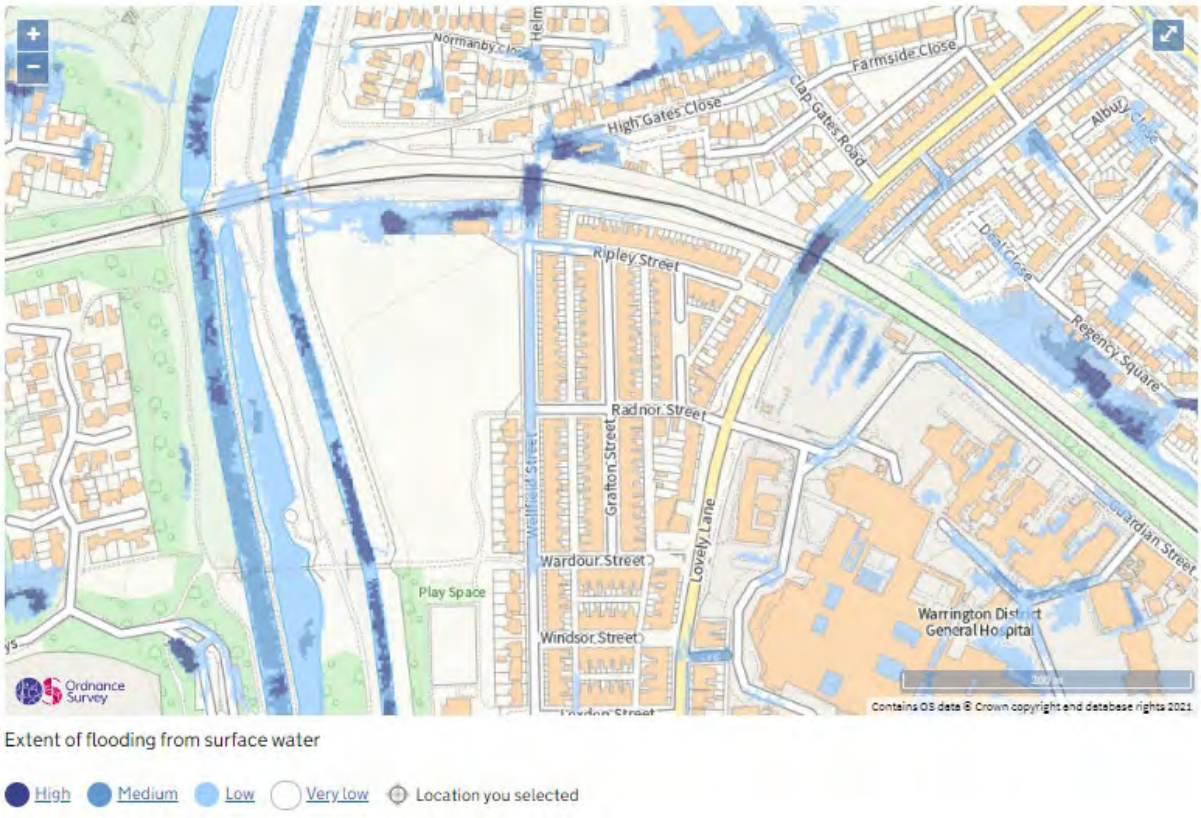
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping 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 or 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, Grafton Street is shown as being at very 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 63: 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 Grafton Street is not at risk of flooding from reservoirs.

5.4.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is not possible to state the most likely cause of flooding to Grafton Street.

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

5.4.6 Actions

Warrington Borough Council will:

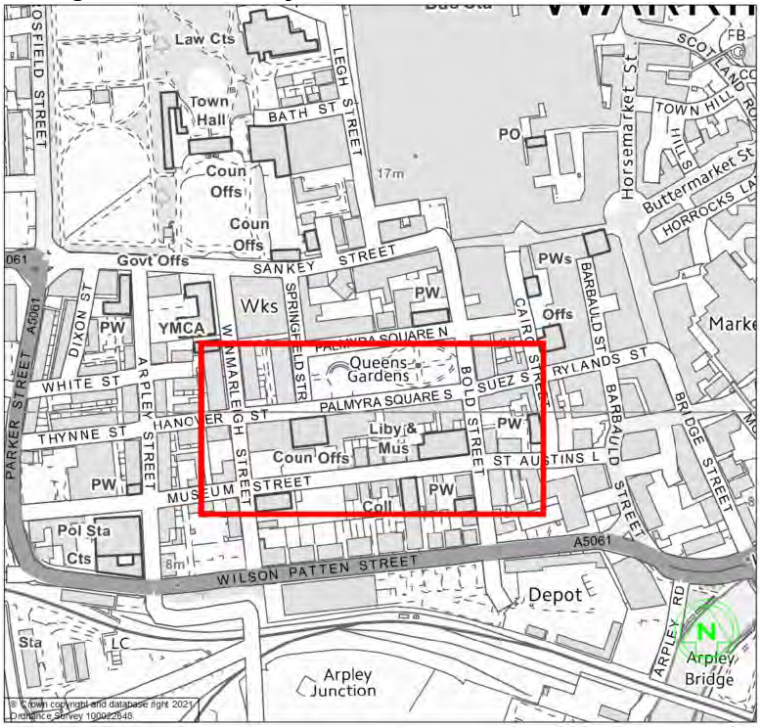
- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

5.5 Bewsey & Whitecross Flood Cluster E – Palmyra Square South

Internal flooding occurred to 1 property on Palmyra Square South.

Flood cluster E is primarily a commercial area located in Bewsey & Whitecross Ward within the administrative area of Warrington Borough Council. It is located within the town centre

Figure 64: Bewsey & Whitecross Flood Cluster E



5.5.1 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.

5.5.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through the area.

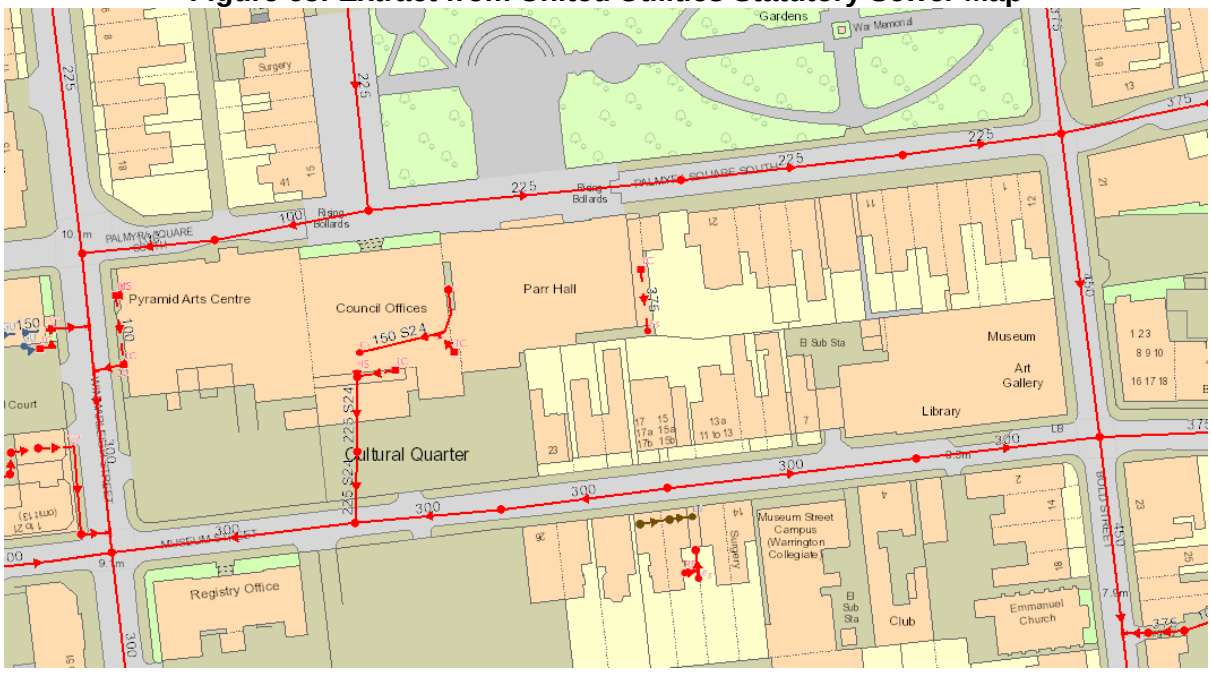
5.5.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Palmyra Square South. The mapping shows that the area is served by a series of combined public sewers.

The public combined sewers drain to Warrington North Wastewater Treatment Works (Gatewarth) which is a United Utilities asset.

Information provided by United Utilities confirmed that this flooding incident was reported to them and that internal flooding had occurred. The affected property was located within a basement.

Figure 65: Extract from United Utilities Statutory Sewer Map



5.5.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Palmyra Square South 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 Palmyra Square South 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 or 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, the properties within Palmyra Square South are shown at varying levels of risk of surface water flooding. A number of pockets of flooding are observed which may be localised depressions in the topography.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 66: 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 Palmyra Square South is not at risk of flooding from reservoirs.

5.5.5 Flooding Mechanism Conclusion & Risk Management Authority

United Utilities confirmed that they attended site and found this to be flooding due to other causes e.g. fat, oil and grease.

In this regard, United Utilities are the appropriate risk management authority as they are responsible for the public sewers serving the area.

5.5.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.

6 Birchwood Flood Cluster

External flooding to 1 property occurred in this cluster as set out in Table 6.1 below:

Table 6.1: Flooded Properties Summary – Birchwood Flood Cluster

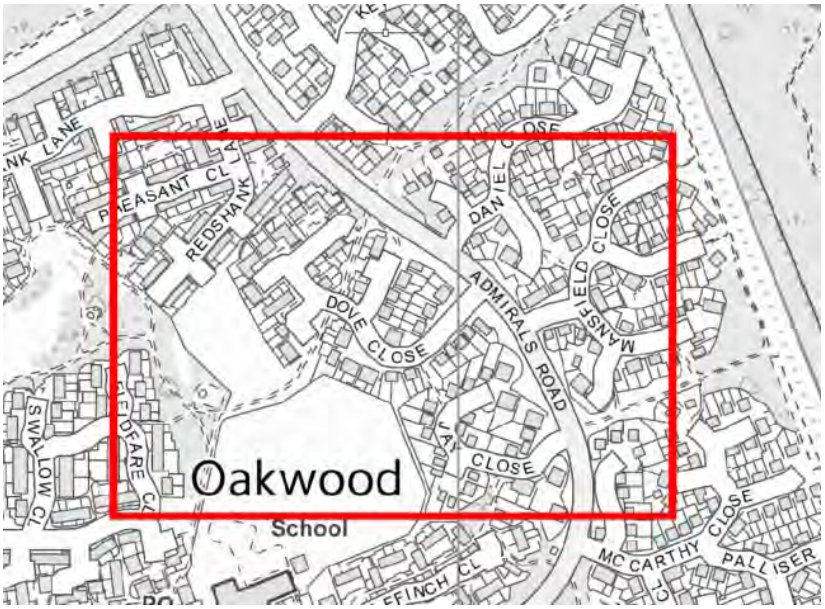
Location	Count of Internally Flooded	Count of Externally Flooded
DOVE CLOSE		1
Grand Total		**1**

6.1 Birchwood Flood Cluster – Dove Close

External flooding occurred to 1 property on Dove Close, Birchwood.

Dove Close, Birchwood is a residential area located in Birchwood Ward within the administrative area of Warrington Borough Council. It is approximately 4 miles north east of Warrington town centre.

Figure 67: Approx Location of Flooding to Dove Close, Birchwood



6.1.1 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.

6.1.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There appears to be a historical watercourse passing through Dove Close, Birchwood.

Figure 68: Extract of Historic Mapping – Published 1908 (National Library of Scotland)

6.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Dove Close. The mapping shows Dove Close is served by separate public foul and surface water systems.

The public surface water system discharges to Birchwood Brook approximately 500m south of Dove Close.

The public foul sewers drain to Warrington North Wastewater Treatment Works (Gatewarth) which is a United Utilities asset.

Information provided by United Utilities confirmed that this flooding incident was reported to them and that external flooding had occurred.

Figure 69: Extract from United Utilities Statutory Sewer Map

6.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Dove Close 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 Dove Close 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 or 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, Dove Close is shown as being at varying levels of surface water flooding. An area of high risk is located on the carriageway at the entrance to Dove Close.

A number of properties are 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 70: 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 Dove Close is not at risk of flooding from reservoirs.

6.1.5 Flooding Mechanism Conclusion & Risk Management Authority

United Utilities confirmed that they attended site and found this to be flooding due to other causes e.g. fat, oil and grease.

In this regard, United Utilities are the appropriate risk management authority as they are responsible for the public sewers serving the area.

6.1.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.

7 Westbrook Flood Cluster

Flooding to 201 properties occurred in this cluster as set out in Table 7.1 below:

Table 7.1: Flooded Properties Summary – Westbrook Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
BRECON COURT	4	3
CALLANDS ROAD		1
CHEPSTOW CLOSE	25	14
COLWYN CLOSE	41	7
EUROPA BOULEVARD	13	
GRANT CLOSE	1	2
KILFORD CLOSE	1	6
SAUNDERSFOOT CLOSE		15
ST DAVIDS DRIVE	25	25
TENBY CLOSE		18
Grand Total	**110**	**91**

Following a review of the flooding information, Westbrook Flood Cluster has been split into two separate clusters based on flood mechanism / spatial separation as follows:

- Westbrook Flood Cluster Flood Cluster A – Callands
- Westbrook Flood Cluster Flood Cluster B – Grant Close

7.1 Westbrook Flood Cluster Flood Cluster A – Callands

A summary of flooding to Westbrook Flood Cluster A is provided in Table 7.2 below.

Table 7.2: Flooded Properties Summary – Burtonwood & Westbrook Flood Cluster Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
BRECON COURT	4	3
CALLANDS ROAD		1
CHEPSTOW CLOSE	25	14
COLWYN CLOSE	41	7
EUROPA BOULEVARD	13	
KILFORD CLOSE	1	6
SAUNDERSFOOT CLOSE		15
ST DAVIDS DRIVE	25	25
TENBY CLOSE		18
Grand Total	**109**	**89**

Westbrook Flood cluster A is primarily a residential area located in Westbrook Ward within the administrative area of Warrington Borough Council. It is approximately 1.7 miles North West of Warrington town centre.

Figure 71: Westbrook Flood Cluster A – Callands

7.1.1 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.

7.1.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. It is apparent when compared to modern mapping that the watercourses in this area have been heavily modified. This is most likely as a result of the construction of Sankey Canal / St Helens Canal which was opened in 1757 and its subsequent closure in 1963.

Figure 72: Extract of Historic Mapping – Published 1907 (National Library of Scotland)

Figure 73: Extract of Historic Mapping – Map Date 1950's (National Library of Scotland)

7.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the general Callands area.

The mapping shows that the area is generally served by a series of United Utilities public foul and surface water sewers.

The public surface water sewers appear to either discharge to Sankey Brook or an unnamed tributary to Sankey Brook. 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.

The large diameter combined system serving the area to which the foul systems appear to be connected to Bewsey Bridge Pumping Station (A United Utilities asset).

Figure 74: Extract from United Utilities Statutory Sewer Map

7.1.4 Long Term Flood Risk

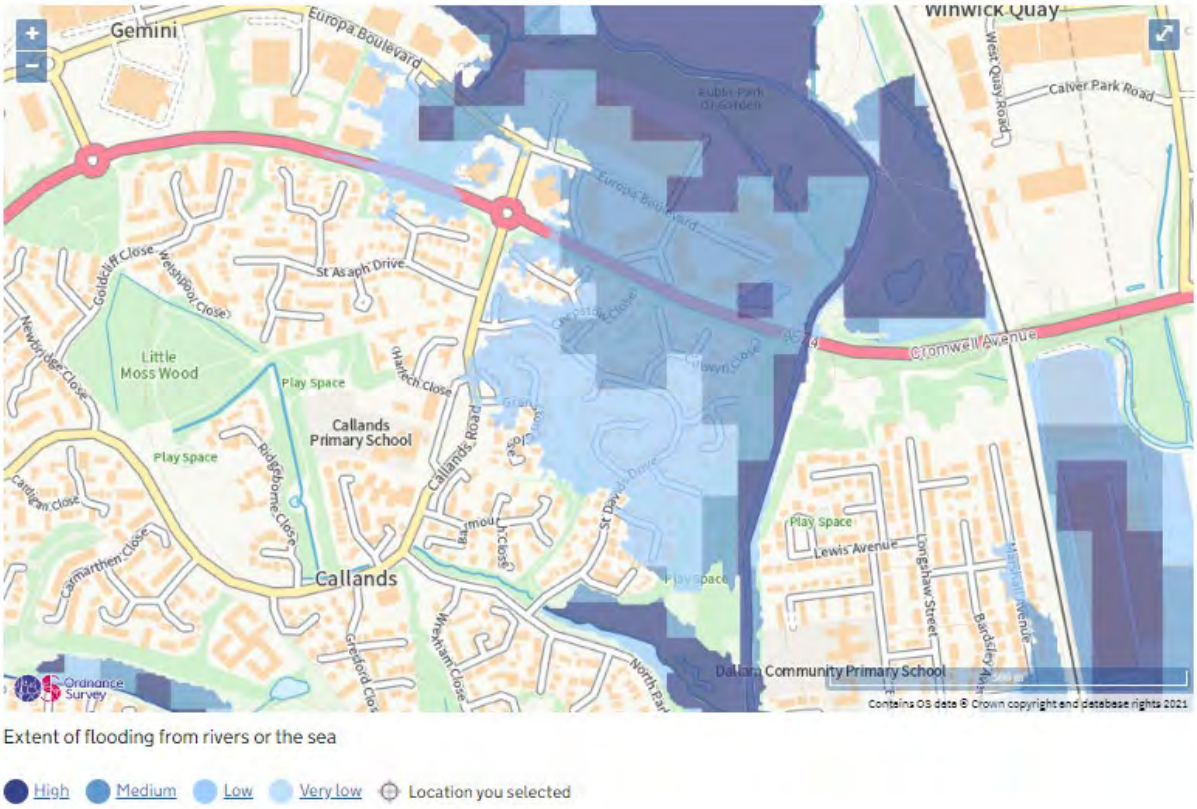
Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Callands at varying levels of risk.

The observed flood extents during Storm Christoph generally correspond with the "medium risk" flood outline. Medium risk is defined as "Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area."

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited

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 75: Flood Risk from Rivers or the Sea Mapping



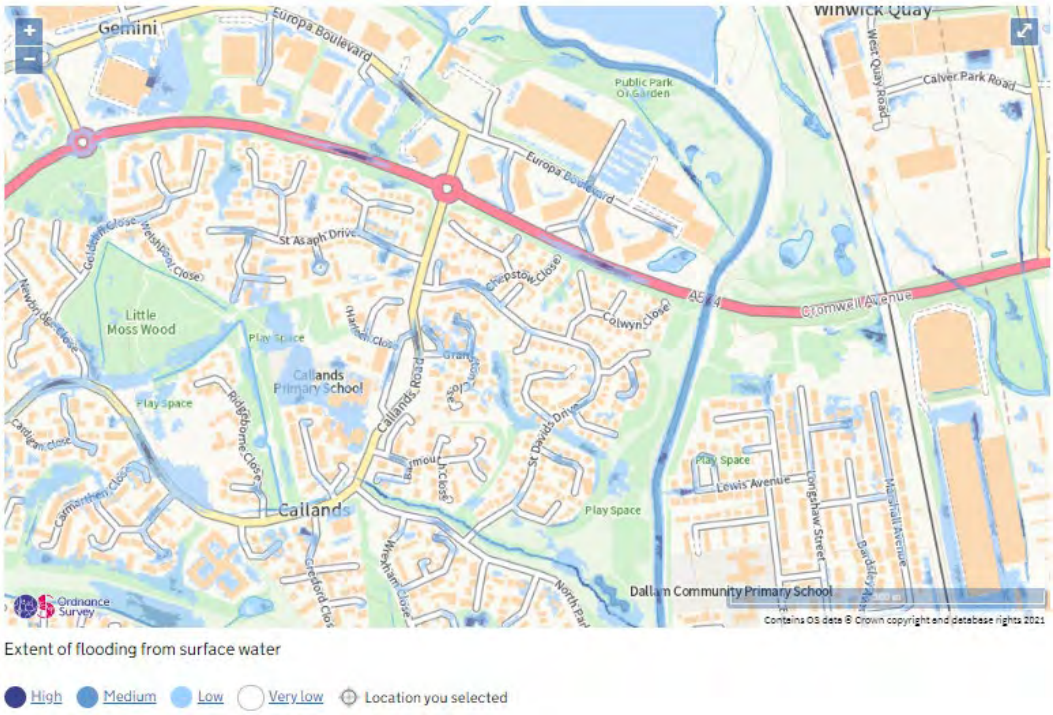
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping 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 or 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, properties within Callands are generally at low risk from surface water flooding. A number of pockets of flooding with increased risk are observed which may be localised depressions in the topography. These appear to mainly affect carriageway.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 76: 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 generally the Callands area is not at risk of flooding from reservoirs with the exception of Kilford Close.

Figure 77: Maximum Extent of Flooding from Reservoirs

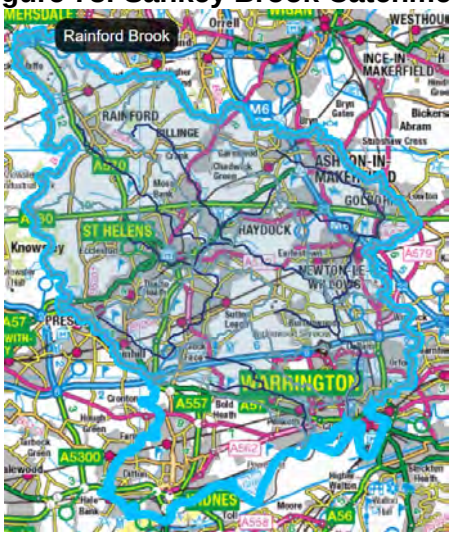
7.1.5 Watercourse Level Information

The main significant watercourse which runs through the Callands area is Sankey Brook.

Sankey Brook is classified as 'Main River' meaning that it is under the regulatory control of the Environment Agency.

The Sankey Catchment covers approximately 179km^2 and has 126km of Main River flowing, generally in a west to east orientation, through a mixture of open agricultural land and urban settlements. The Sankey Brook originates at the confluence of Sutton and Hardshaw Brooks in St Helens and flows into the River Mersey at Sankey Bridges in Warrington.

Figure 78: Sankey Brook Catchment



Source: Environment Agency

The nearest watercourse telemetry station to the affected area is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

An unnamed tributary to Sankey Brook is also present which runs adjacent to Callands Road and North Park Brook Road. This tributary is classified as 'Ordinary Watercourse meaning that it is under the regulatory control of Warrington Borough Council as Lead Local Flood Authority.

Tributary watercourses will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded.

7.1.6 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Westbrook Flood Cluster Flood Cluster A – Callands that the primary flood mechanism was water overtopping the banks of Sankey Brook.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

7.1.7 Future Project

Environment Agency are looking at the flood risk associated with Sankey Brook, Dallam Brook and Longford Brook. The planning for this scheme was underway before Storm Christoph and they are looking to develop a confirmed plan for this area by March 2022.

Flood risk measures under consideration include:

- Linear Defences (defences set back from the river edge where possible)
- Flood attenuation (where flooding is captured and released slowly)
- Improved channel conveyance (maintaining good condition of water channels)
- Upstream natural flood management (when the natural environment and processes are used to support flood management)
- Flood relief channels (channels which are made to help divert water around or from important locations)
- Connection of Sankey Brook to the canal
- Reviewing Longford Barrage, which is an existing tidal barrage asset on Longford Brook.

This scheme will look at flooding from all water sources (surface water, river and sewer), and will involve partnership and collaborative working between the Environment Agency, Warrington Borough Council and United Utilities.

Further information on the Sankey Brook Proposed Flood Risk Management Scheme is available at https://thefloodhub.co.uk/sankeybrookfrmswarrington/#section-1

7.1.8 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.

- Continue to raise this issue with Environment Agency at future meetings to determine solutions and timescales where possible.

7.2 Westbrook Flood Cluster Flood Cluster B – Grant Close

A summary of flooding to Westbrook Flood Cluster B is provided in Table 7.3 below.

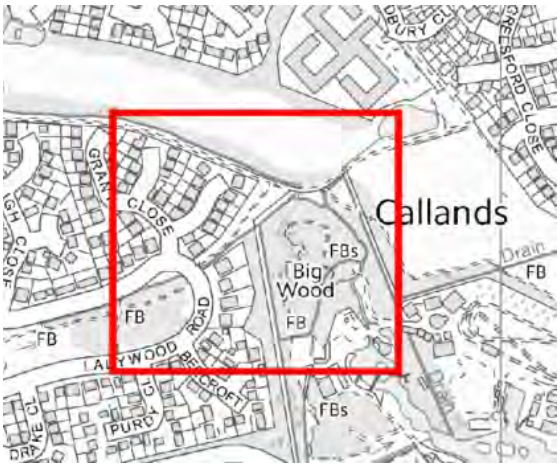
Table 7.3: Flooded Properties Summary –Westbrook Flood Cluster Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
GRANT CLOSE	1	2
Grand Total	**1**	**2**

Westbrook Flood cluster B is primarily a residential area located in Westbrook Ward within the administrative area of Warrington Borough Council. It is approximately 1.6 miles North West of Warrington town centre.

One residential property located within Grant Close (No.14) experienced internal flooding during Storm Christoph (18th – 20th January 2021) with two neighbouring properties experiencing external flooding. The residents at Grant Close had to be evacuated from their property with assistance from Cheshire Fire & Rescue and Warrington Borough Council.

Figure 79: Westbrook Flood Cluster B – Grant Close



7.2.1 Flood History

The Engineering and Flood Risk Team is aware that flooding has occurred historically at this location.

It is understood that remedial works have previously been undertaken to install a low level overflow pipe (approx. 20years ago).

7.2.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There appears to be many watercourses present in the area and they appear to generally match the modern day layout.

Figure 80: Extract of Historic Mapping – Published 1908 (National Library of Scotland)

Figure 81: Extract of Historic Mapping – Map Date 1950's (National Library of Scotland)

7.2.3 United Utilities Statutory Sewer Map

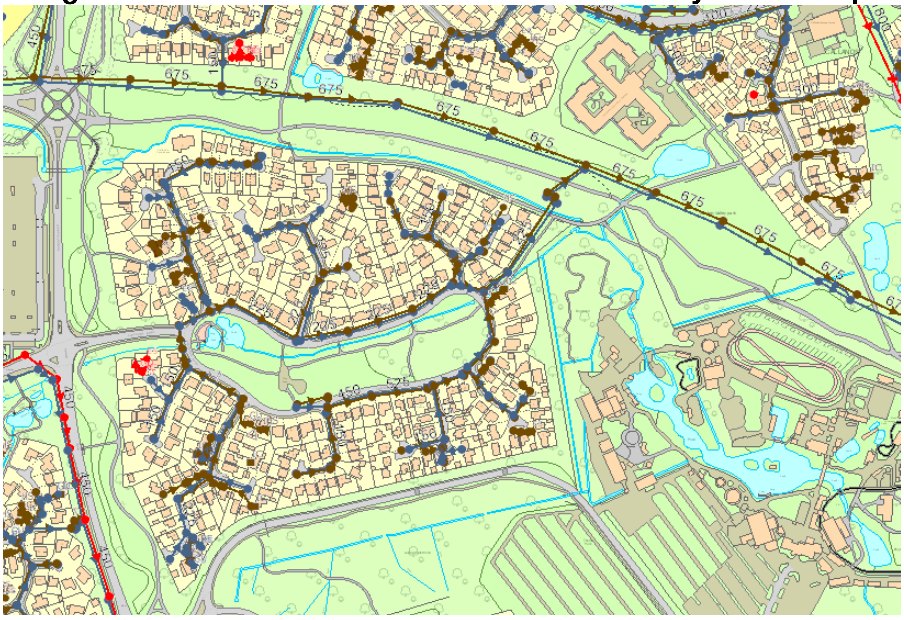
The Statutory Sewer Map was obtained from United Utilities showing the general Grant Close area.

The mapping shows that the area is generally served by a series of United Utilities public foul and surface water sewers.

The public surface water sewers appears to discharge to Sankey Brook. 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.

The foul systems appear to a large diameter foul sewer to the north of North Park Brook. This system appears to be connected to Bewsey Bridge Pumping Station (A United Utilities asset).

Figure 82: Extract from United Utilities Statutory Sewer Map



7.2.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows Grant Close at being at low risk of flooding from Rivers or the Sea varying levels of risk.

The observed flood extents during Storm Christoph generally correspond with the “medium risk” flood outline. Medium risk is defined as “Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area.”

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited

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.

Given that the Environment Agency mapping does not show the risk of flooding from watercourses with a catchment area of less than 3km^2, the effect of the smaller watercourse which runs west to east within the wooded area of Ladywood Road is unknown. It is likely that this tributary watercourses will have experienced hydraulic restriction and may have experienced back flow from North Park Brook which runs to the north of Grant Close due to the high levels recorded.

Figure 83: Flood Risk from Rivers or the Sea Mapping

Surface Water Long Term Flood Risk

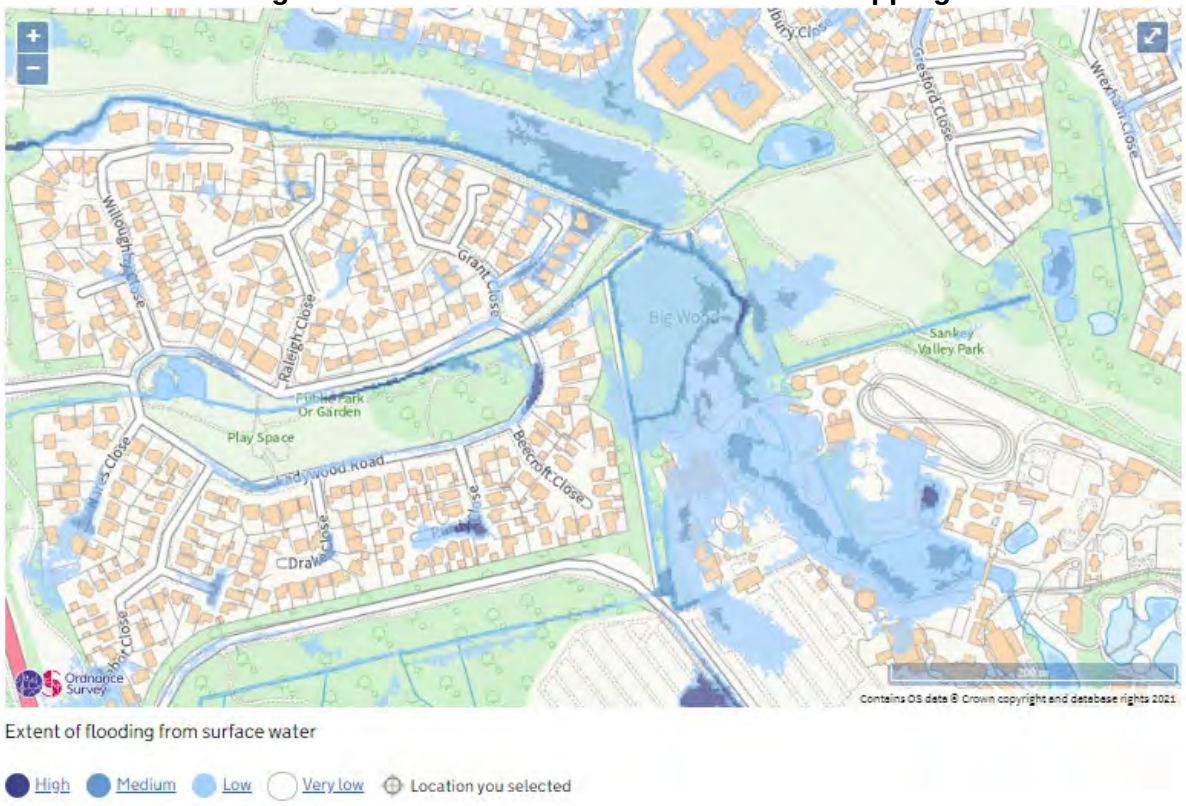
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping has been designed to indicate areas 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 or 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 properties within Grant Close are generally at medium / low risk from surface water flooding.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 84: 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 Grant Close is not at risk of flooding from reservoirs.

7.2.5 Watercourse Level Information

North Park Brook which runs west to east is located to the north of properties on Grant Close. It discharges into Sankey Canal approximately 900m south east of Grant Close.

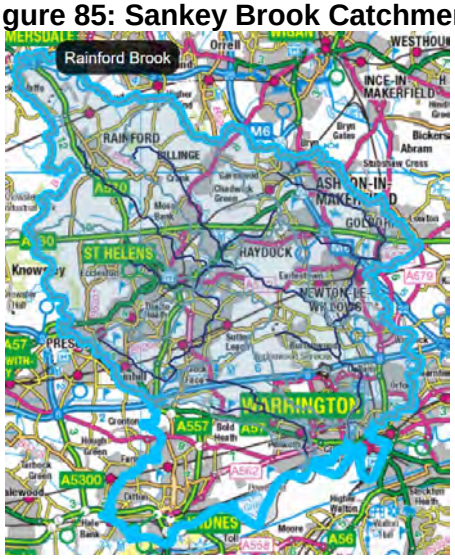
North Park Brook is classified as ‘Main River’ meaning that it is under the regulatory control of the Environment Agency.

It should be noted that when Sankey Brook is high, it becomes hydraulically linked to Sankey Canal via the previously redundant section of canal. Environment Agency have confirmed that this section of canal is classified as a flood overflow channel.

Sankey Brook is classified as ‘Main River’ meaning that it is under the regulatory control of the Environment Agency.

The Sankey Catchment covers approximately 179km^2 and has 126km of Main River flowing, generally in a west to east orientation, through a mixture of open agricultural land and urban settlements. The Sankey Brook originates at the confluence of Sutton and Hardshaw Brooks in St Helens and flows into the River Mersey at Sankey Bridges in Warrington.

Figure 85: Sankey Brook Catchment



Source: Environment Agency

The nearest watercourse telemetry station to the affected area is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

North Park Brook and the smaller watercourse which runs west to east within the wooded area of Ladywood Road may have experienced hydraulic restriction and may have experienced back flow from Sankey Canal which would have been linked to Sankey Brook during the flood event due to the high levels recorded.

7.2.6 Other Information

A culvert is located on North Park Brook which carries a public footway. Due to the magnitude of rainfall during Storm Christoph, in combination with vegetation litter and adjacent watercourses which join downstream causing hydraulic restriction, both the existing culvert and overflow pipe were unable to permit continuous flows which may have contributed to flooding at Grant Close.

The culvert was observed to be approx. 80% silted on 26 May 2021 despite cleaning undertaken by Environment Agency due to downstream silt levels. This severely reduces the ability of the culvert to allow water to pass unimpeded.

Figure 86: Image of Culvert on 26 May 2021.

7.2.7 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Westbrook Flood Cluster Flood Cluster B – Grant Close that the flood event was due to water leaving North Park Brook as a result of a combination of factors including:

- Extreme rainfall.
- Downstream hydraulic restriction due to high levels on Sankey Brook.
- Culvert blockage.

As North Park Brook and Sankey Brook are classified as ‘main rivers’, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward at this location.

Warrington Borough Council Environment Services as riparian land owners are responsible for ensuring that the culvert remains clear.

7.2.8 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to Warrington Borough Council Environment Services as notification that they are riparian land owners and responsible for ensuring that the culvert on North Park Brook remains clear.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with Environment Agency at future meetings to determine solutions and timescales where possible.

8 Croft Flood Cluster

External flooding to 2 properties occurred in this cluster as set out in Table 8.1 below:

Table 8.1: Flooded Properties Summary – Croft Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
HEATH LANE		2
Grand Total		**2**

8.1 Croft Flood Cluster Flood Cluster – Heath Lane

External flooding to 2 properties occurred in this cluster.

Croft Flood Cluster is primarily a residential area located in Culcheth, Glazebury & Croft Ward within the administrative area of Warrington Borough Council. It is approximately 4.5 miles East of Warrington town centre.

Figure 87: Croft Flood Cluster – Heath Lane

8.1.1 Flood History

The Engineering and Flood Risk Team is aware of historic flooding at this location.

Historically, it was the conclusion of Warrington Borough Council that the flood events which have occurred historically were due to surface water runoff and overland flow as a result of heavy rainfall combined with saturated rural and agricultural land within the catchment area due to previous rainfall events. The saturation of land within the catchment will have reduced its ability to absorb and retain rainfall, resulting in higher runoff flows.

Heath Lane receives run-off from a significant catchment taking in rural and agricultural land in the wider Croft area. The total catchment area contributing to a point in the carriageway outside 116 Heath Lane is substantial at approximately 0.72km2 / 72 hectares (Reference: Flood Estimation Handbook Software)

The primary flooding mechanism was identified as surface water runoff from agricultural land accumulating in the localised topographical depression.

8.1.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the general Heath Lane area.

The mapping shows that the area is generally served by a series of United Utilities public foul / combined / and surface water sewers.

The foul and combined sewers flow to a United Utilities pumping station located on a private road serving Beech Farm where it is pumped to a separate combined system that operates by gravity further south on Heath Lane as shown on the United Utilities Statutory Sewer Map.

The public surface water sewers flow to a culverted watercourse which runs east to west across Heath Lane from the farm track between 116 and 116a Heath Lane through to the ditch to the rear of 115 Stone Pit Lane where the culvert discharges.

Figure 88: Extract from United Utilities Statutory Sewer Map

8.1.3 Historic Watercourse Information and Schemes

A culverted watercourse is present which runs east to west across Heath Lane from the farm track between 116 and 116a Heath Lane through to the ditch to the rear of 115 Stone Pit Lane where the culvert discharges.

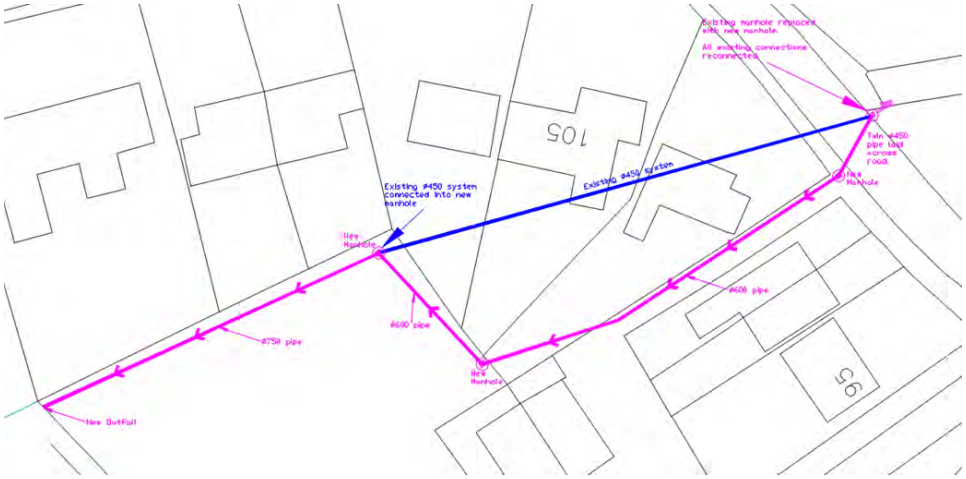
This watercourse runs for approximately 600m in a general westward direction before discharging to Cockshot Brook. Cockshot Brook is classified as ‘main river’ and therefore under the regulatory powers of Environment Agency. Warrington Borough Council are not aware of any telemetry information for this watercourse.

As a result of historic flooding at this location, a significant amount of work to improve the general drainage of the area and to reduce the risk to properties has been undertaken and in 2017, Warrington Borough Council was successful in obtaining grant funding from Environment Agency in order to realign and upsize the culverted watercourse which runs east

to west across Heath Lane from the access track adjacent to 116 Heath Lane through to the outfall located to the rear of properties on Stone Pit Lane.

The scheme was completed in December 2017 as shown on the diagram below.

Figure 89: Scheme Diagram



The large amount of work undertaken in the area to date is of benefit in reduction of risk to the properties in the area, however due to the nature of the local topography it is impossible to eliminate all flood risk including the risk from direct overland flow from the fields.

In recognition of this, additional property level drainage was installed to the properties at highest risk, this would mean that the properties may flood externally but the risk of internal flooding was greatly reduced. The scheme appears to have operated as intended during Storm Christoph.

The properties at greatest risk at Heath Lane have also been provided with Property Level Resilience (PLR) measures to reduce residual risk following completion of the above scheme.

As part of the above scheme, United Utilities in collaboration with Warrington Borough Council installed a new section of surface water system to reduce the amount of surface water entering the United Utilities combined network which historically has caused the UU pump station to trip out and in turn reduces the risk of foul flooding to the area.

8.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows Heath 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 Heath 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. Therefore the flood risk from the culverted watercourse which runs through Heath Lane will not be considered by the 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 or 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, properties within Heath Lane at this location are generally at high risk from surface water flooding with a number of significant flow paths present in the area.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 90: 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 Heath Lane is not at risk of flooding from reservoirs.

8.1.5 Rainfall Information
Rain gauge information was obtained for January 2021 from 4 nearest functioning rain gauges (Met Office Weather Observations Website). They are located at:

- Chapelford (Approx 4.8miles south west of Heath Lane)
- Old Hall (Approx 4.3miles south west of Heath Lane)
- Black Brook (Approx 4.3miles west of Heath Lane)
- Antrobus (Approx 9.2miles south of Heath Lane)

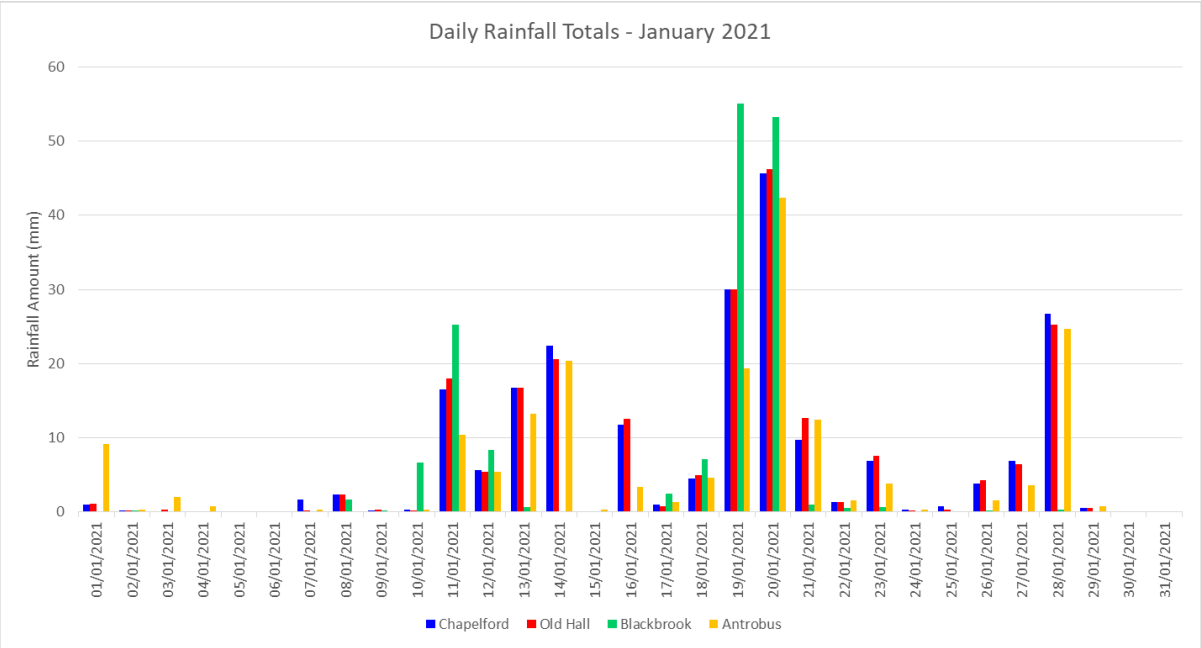
It is clear from the rainfall data, that significant rainfall had occurred prior to Storm Christoph which would had led to the ground becoming saturated and high levels in watercourses. The main significant rainfall events prior to Storm Christoph for the above rain gauges are as follows:

- Chapelford – 11th January 2021 – 16th January 2021: 72.9mm
- Old Hall – 11th January 2021 – 16th January 2021: 73.2mm
- Black Brook – 10th January 2021 – 12th January 2021: 40.1mm
- Antrobus – 11th January 2021 – 14th January 2021: 49.3mm

The following rainfall totals were observed for Storm Christoph between 18th January 2021 and 21 January 2021:

- Chapelford: 89.9mm
- Old Hall: 93.8mm
- Black Brook: 116.5mm
- Antrobus: 78.7mm

Figure 91: Daily Rainfall Totals – January 2021

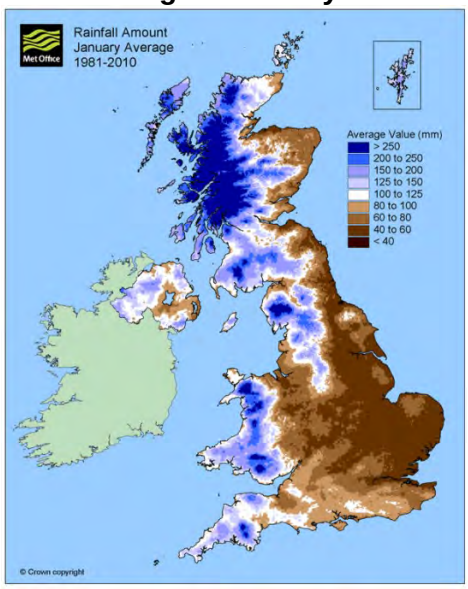


The following rainfall totals were observed for January 2021:

- Chapelford – 216.4mm
- Old Hall – 218.1mm
- Black Brook – 163.3mm
- Antrobus – 181.6mm

These are very high rainfall figures when compared to the average amount of rainfall which Warrington would expect to receive for the whole of January between 1981-2010 was 60-80mm (Met Office).

Figure 92: Rainfall Average – January 1981-2010 (Met Office)



8.1.6 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Croft Flood Cluster Flood Cluster – Heath Lane that the primary flood mechanism was surface water runoff and overland flow as a result of heavy rainfall combined with saturated rural and agricultural land within the catchment area due to previous rainfall events.

On this basis, it is the opinion of Warrington Borough Council that Warrington Borough Council as Lead Local Flood Risk Authority has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

8.1.7 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.

9 Fairfield & Howley Flood Cluster

Flooding to 3 properties occurred in this cluster as set out in Table 9.1 below:

Table 9.1: Flooded Properties Summary – Fairfield & Howley Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
KINGSWAY NORTH		1
SALISBURY STREET	1	
WELLINGTON STREET		1
Grand Total	**1**	**2**

Due to the distance between these three locations, they have been split into three separate clusters as follows:

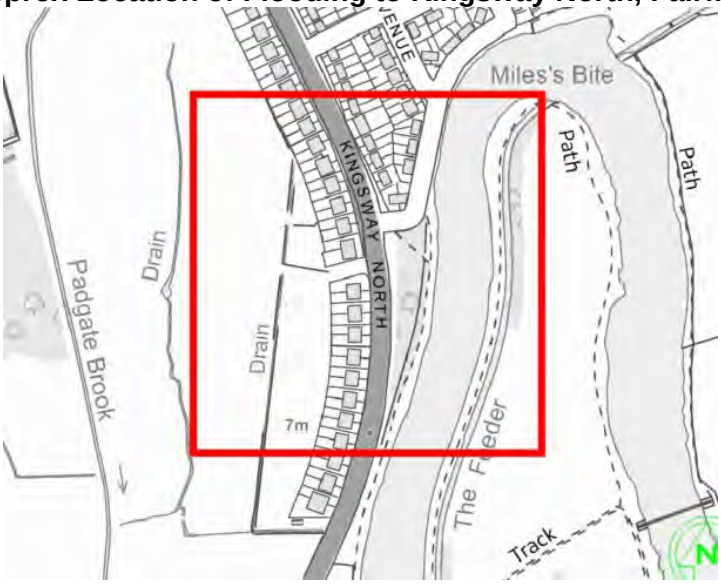
- Fairfield & Howley Flood Cluster A – Kingsway North
- Fairfield & Howley Flood Cluster B – Salisbury Street
- Fairfield & Howley Flood Cluster C – Wellington Street

9.1 Fairfield & Howley Flood Cluster A – Kingsway North

External flooding occurred to 1 property on Kingsway North.

Kingsway North is a residential area located in Fairfield & Howley Ward within the administrative area of Warrington Borough Council. It is approximately 1.5 miles to the east of Warrington town centre

Figure 93: Approx Location of Flooding to Kingsway North, Fairfield & Howley



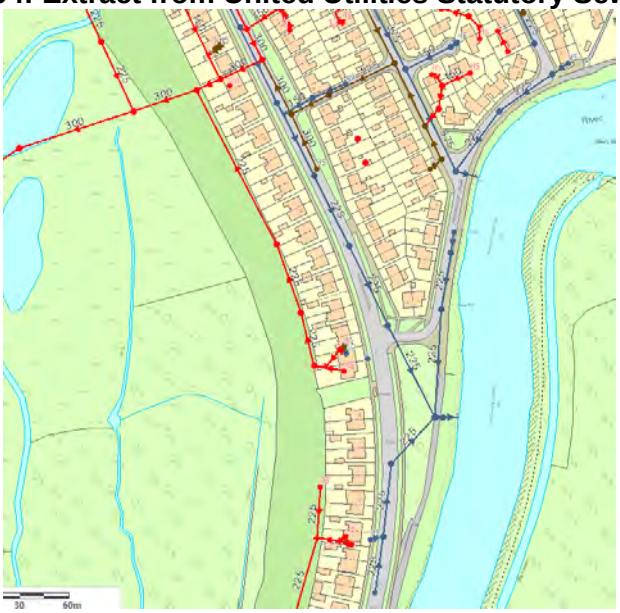
9.1.1 Flood History

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.

9.1.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Kingsway North. The mapping shows a 225mm diameter combined public sewer running to the rear of properties on the west side of Kingsway North and a 225mm diameter public surface water sewer running within Kingsway North which appears to discharge to the River Mersey.

Figure 94: Extract from United Utilities Statutory Sewer Map



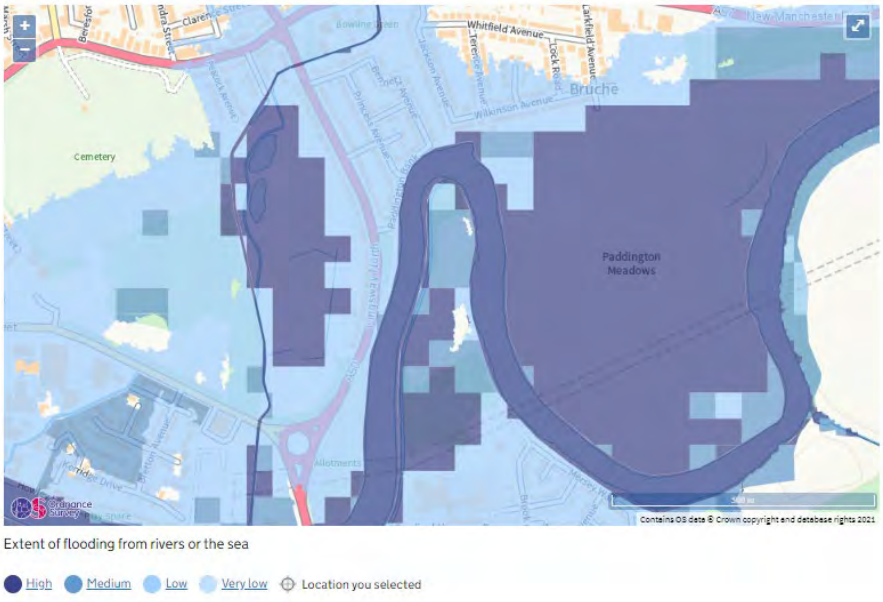
9.1.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows properties on Kingsway North as being at low risk of flooding from Rivers or the Sea. Low Risk is defined as "Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail."

To the rear of properties on the west side of Kingsway North is a significant area (the Twiggeries) at high risk of flooding from Rivers or the Sea. This appears to be risk associated with Padgate Brook. Padgate Brook is classified as 'main river' and therefore under the regulatory powers of Environment Agency.

Figure 95: Flood Risk from Rivers or the Sea Mapping



At the time of writing this report, the fluvial return periods were unavailable from Environment Agency.

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.

A significant flood risk scheme has recently been completed by the Environment Agency to reduce the risk of flooding to properties in this area from both River Mersey and Padgate Brook.

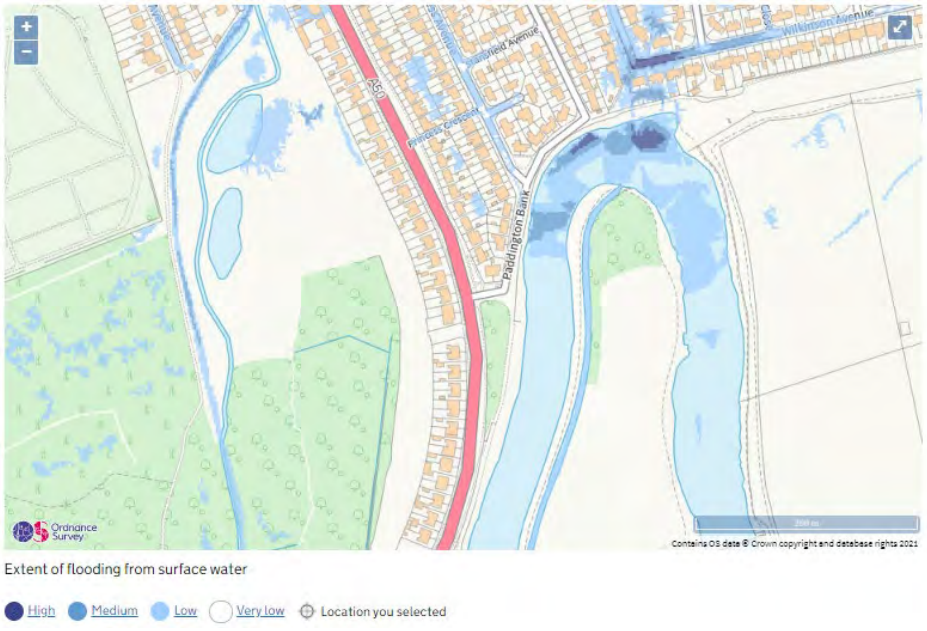
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping 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 or 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, the properties within this section of Kingsway North are generally shown as being at very low risk of surface water flooding. A number of pockets of flooding are observed to the rear of properties on the west side of Kingsway North which may be localised depressions in the topography.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 96: 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 this section of Kingsway North is not at risk of flooding from reservoirs.

9.1.4 Other Information
Due to the recent completion of the Flood Risk Management Scheme at this location, Environment Agency were asked to look into the issue.

The Environment Agency's River Mersey Warrington Flood Risk Management Scheme included the construction of an earth flood defence embankment within the Twiggeries site, which runs along the rear of the properties on Kingsway North. The purpose of the embankment is to reduce the risk of flooding to properties on Kingsway North from Padgate Brook. The defences were set back from the watercourse to maximise the use of the natural flood plain within the Twiggeries site.

In developing and designing the defences, the Environment Agency was very conscious of the existing high natural ground water level and the existing localised surface water ponding issues within the Twiggeries. Accordingly, the scheme works included the installation of a stone filter drain / soakaway along the property side of the new embankment to mitigate this surface water issue. The drain was not initially as effective as anticipated and the drainage was subsequently supplemented with a small pumping station at the north end of the Twiggeries site to discharge the water from the drainage system directly into Padgate Brook.

Environment Agency have arranged for remedial works to address the residual surface water flooding problem at the rear of Kingsway North and they are to be included in the works programme for 2021/22.

9.1.5 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is the opinion of Warrington Borough Council that the flooding to Kingsway North was due to a localised surface water issue.

In this regard, Warrington Borough Council are the appropriate risk management authority.

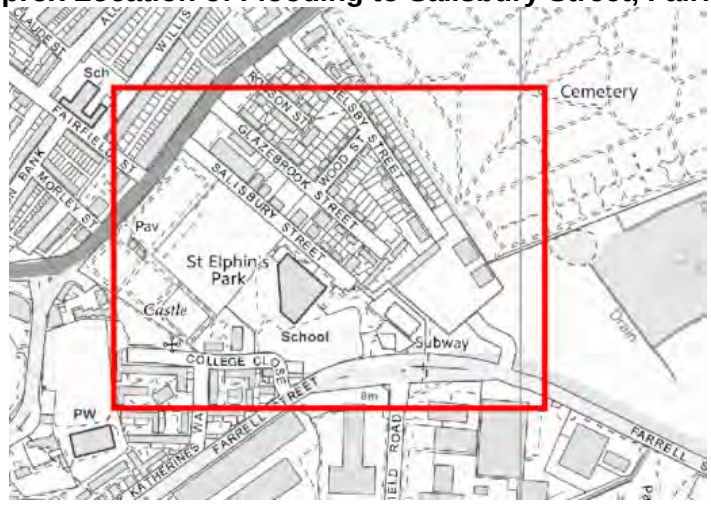
9.1.6 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding following completion of remedial works by Environment Agency.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding issue.
- Continue to raise this issue with Environment Agency at future meetings.

9.2 Fairfield & Howley Flood Cluster B – Salisbury Street
Internal flooding occurred to 1 property on Salisbury Street.

Salisbury Street is a residential area located in Fairfield & Howley Ward within the administrative area of Warrington Borough Council. It is approximately 1 miles to the east of Warrington town centre

Figure 97: Approx Location of Flooding to Salisbury Street, Fairfield & Howley



9.2.1 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.

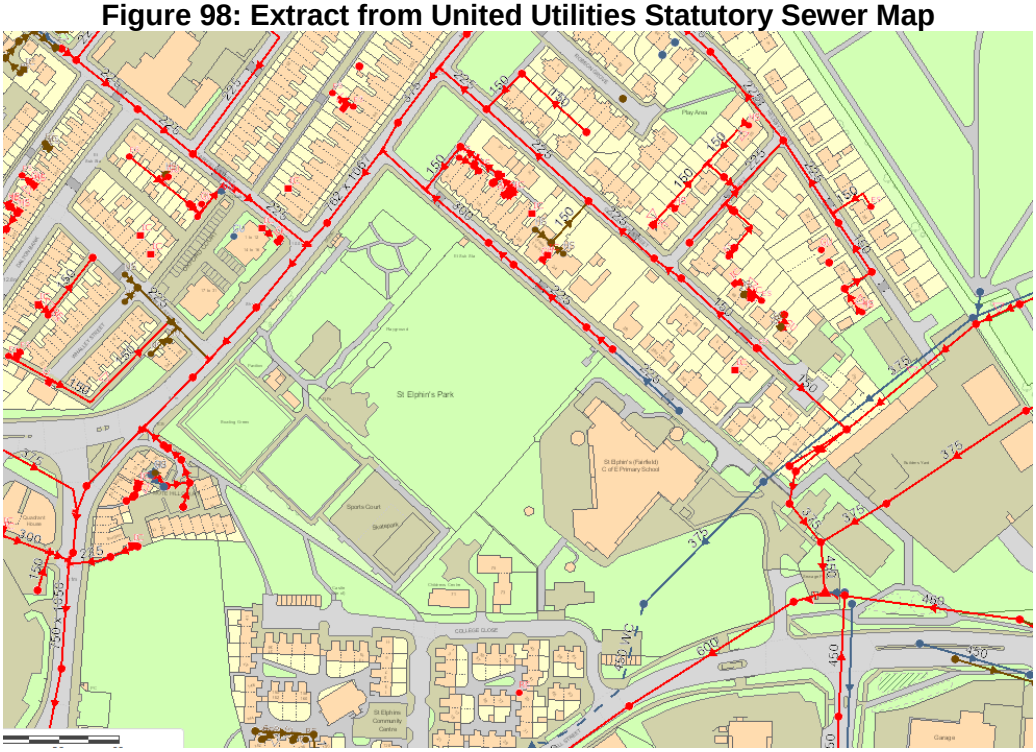
9.2.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through Salisbury Street.

9.2.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Salisbury Street. The mapping shows a 225mm diameter combined public sewer serving the street with a short section of 225mm diameter public surface water sewer connecting into the combined sewer at the head of the system.

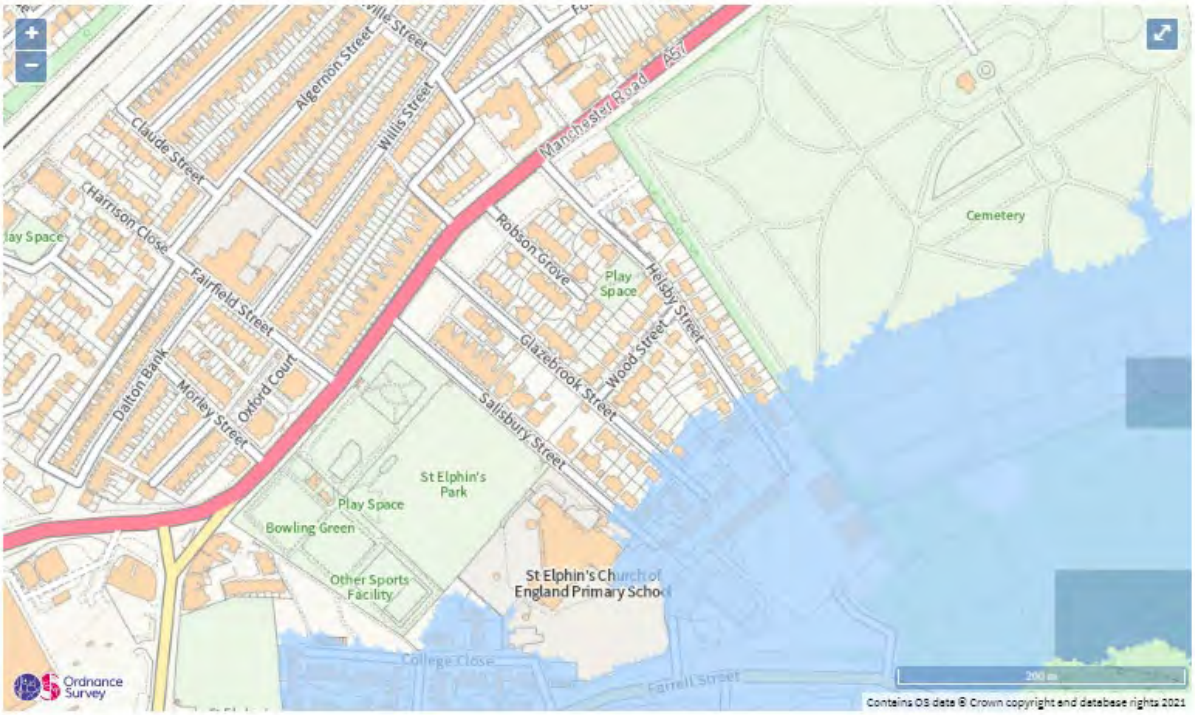
Figure 98: Extract from United Utilities Statutory Sewer Map



9.2.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows properties on Salisbury Street as being as generally being at very low risk of flooding from Rivers or the Sea with the exception of properties located at the south east end of the road which are shown as Low Risk. Low Risk is defined as "Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail."

Figure 99: Flood Risk from Rivers or the Sea Mapping



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.

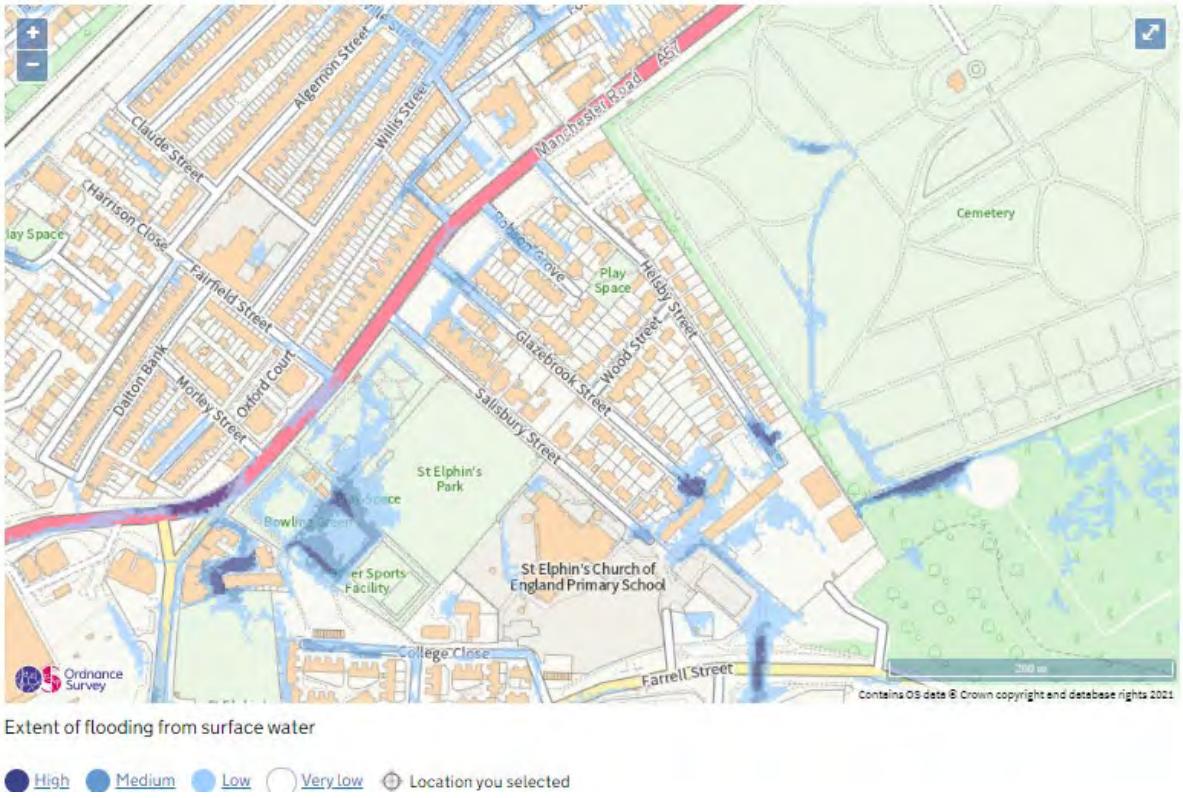
It is important to note that this is national mapping product and does not represent or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

According to the Environment Agency Risk of Flooding from Surface Water mapping, the properties on Salisbury Street are generally shown as being at either low or very low risk of

surface water flooding. A number of pockets of flooding are observed at either end of Salisbury Street which may be localised depressions in the topography.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 100: 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 Salisbury Street is not at risk of flooding from reservoirs.

9.2.5 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to Salisbury Street.

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

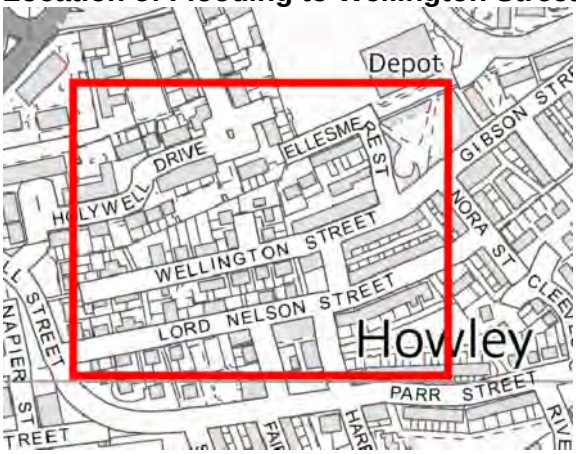
9.2.6 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.

9.3 Fairfield & Howley Flood Cluster C – Wellington Street
External flooding occurred to 1 property on Wellington Street.

Wellington Street is a residential area located in Fairfield & Howley Ward within the administrative area of Warrington Borough Council. It is approximately 0.8 miles to the east of Warrington town centre

Figure 101: Approx Location of Flooding to Wellington Street, Fairfield & Howley



9.3.1 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.

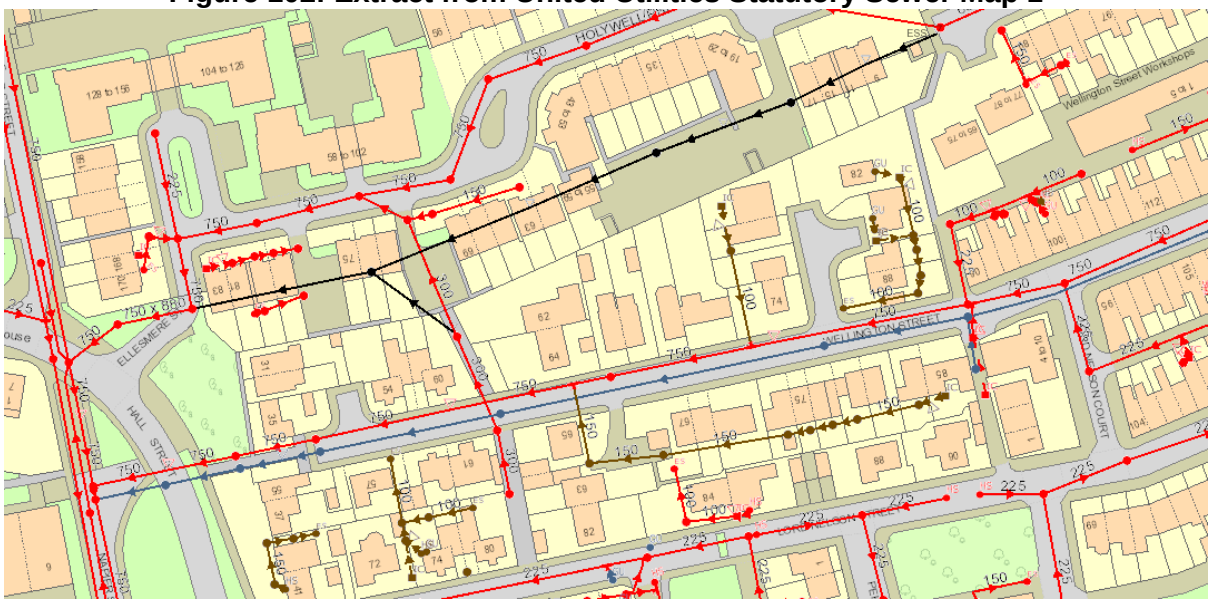
9.3.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through Wellington Street.

9.3.3 United Utilities Statutory Sewer Map

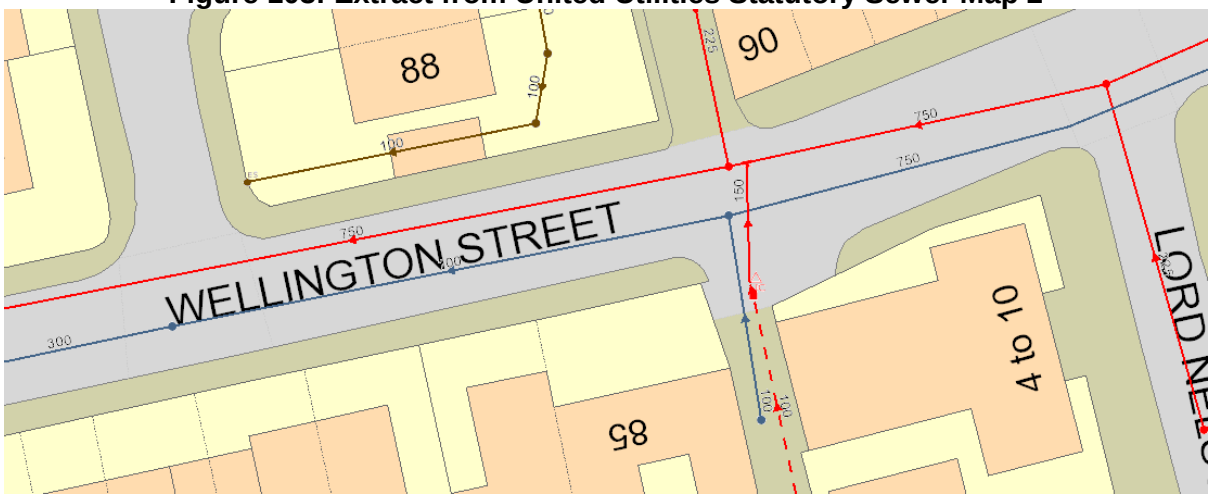
The Statutory Sewer Map was obtained from United Utilities showing Wellington Street. The mapping shows a 750mm diameter combined public sewer serving the street and a 300mm diameter public surface water sewer.

Figure 102: Extract from United Utilities Statutory Sewer Map 1



It appears from the mapping that a 750mm diameter surface water system is connected into the 300mm diameter surface water sewer via a 100mm diameter section of pipe. This indicates a possible constriction and reduction in size of surface water systems in the area.

Figure 103: Extract from United Utilities Statutory Sewer Map 2

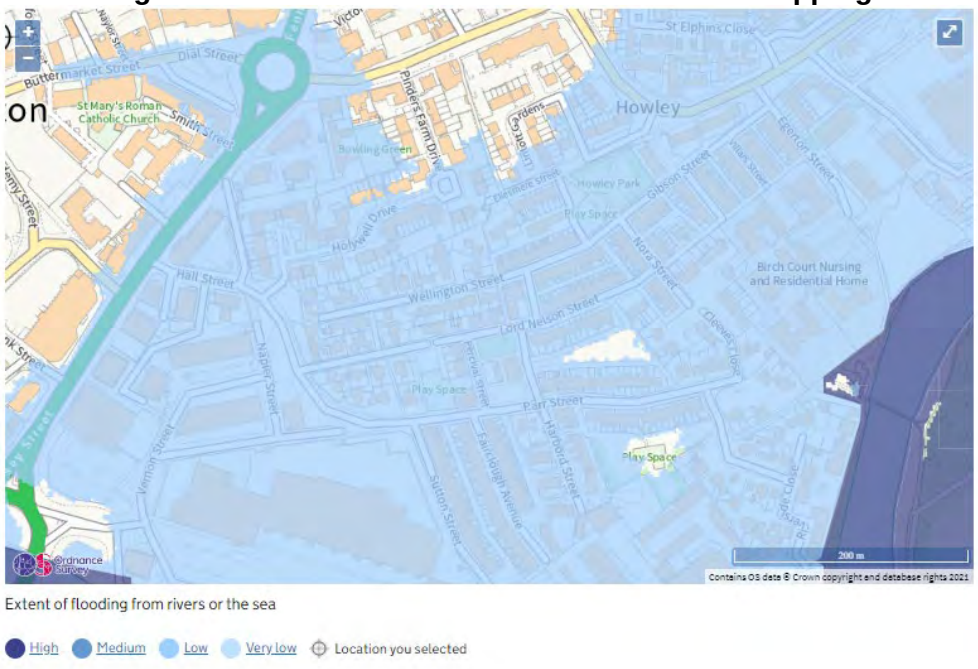


9.3.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows properties on Wellington Street as being as generally being at low risk of flooding from Rivers or the Sea. Low Risk is defined as "Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail."

Figure 104: Flood Risk from Rivers or the Sea Mapping



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 or 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, the properties on Wellington Street are generally shown as being at low risk of surface water flooding. The carriageway at the west end of Wellington Street is shown as being at medium risk.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 105: 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 Wellington Street is not at risk of flooding from reservoirs.

9.3.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council that the flooding to Wellington Street may be due to a constriction / reduction in size of the public surface water system.

In this regard, United Utilities are deemed to be the appropriate risk management authority.

9.3.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- United Utilities to investigate possible constriction / reduction in size of the public surface water system.
- Continue to raise this issue with United Utilities at future meetings to determine solutions and timescales where possible.

10 Grappenhall Flood Cluster

External flooding to 1 property occurred in this cluster as set out in Table 10.1 below:

Table 10.1: Flooded Properties Summary – Grappenhall Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
CHESTER ROAD		1
Grand Total		**1**

10.1 Grappenhall Flood Cluster – Chester Road

External flooding occurred to 1 property on Chester Road, Grappenhall.

Chester Road is a residential area located in Grappenhall Ward within the administrative area of Warrington Borough Council. It is approximately 2.5 miles to the south east of Warrington town centre

Figure 106: Approx Location of Flooding to Chester Road, Grappenhall

10.1.1 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.

10.1.2 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and Cheshire Archives. There are no obvious signs of a watercourse flowing through Chester Road.

10.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Chester Road. The mapping shows the area is served by a combination of combined public sewer and public surface water sewer.

Figure 107: Extract from United Utilities Statutory Sewer Map

10.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows this section of Chester Road 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 Chester Road 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 3km2 and does not provide information on flood depth, speed or volume of flow.

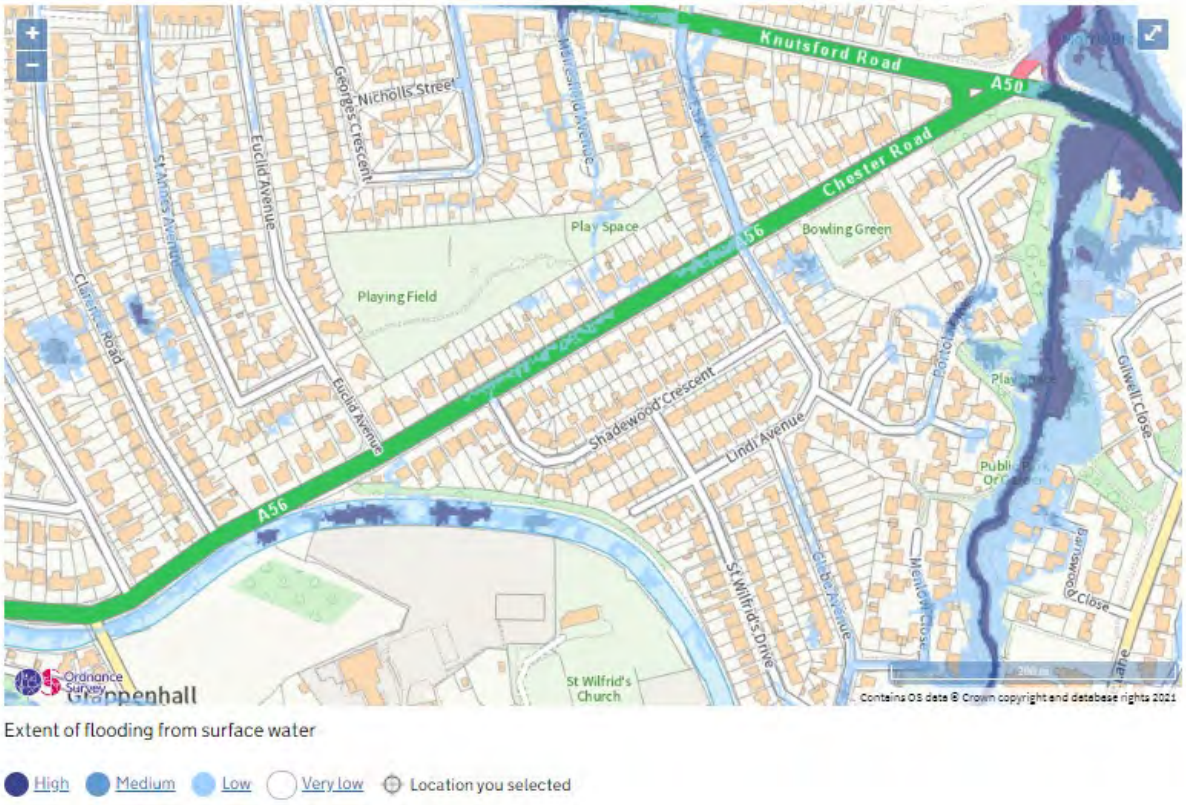
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This mapping 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 or 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, the properties within this section of Chester Road are generally shown as being at very low risk of surface water flooding. A number of pockets of flooding are observed to the rear of properties on the north side of Chester Road which may be localised depressions in the topography.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 108: 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 this section of Chester Road is not at risk of flooding from reservoirs.

10.1.5 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to Chester Road.

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

10.1.6 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.

11 Great Sankey Flood Cluster

Flooding to 190 properties occurred in this cluster as set out in Table 11.1 below:

Table 11.1: Flooded Properties Summary – Great Sankey Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
ALDERBANK ROAD		1
BELMONT CRESCENT		1
BROADHURST AVENUE		12
CALIFORNIA CLOSE		2
EVELYN STREET		53
HEPHERD STREET		13
HESKETH STREET NORTH		4
HIGHFIELD AVENUE		1
LIVERPOOL ROAD	34	1
MOSSDALE CLOSE		1
PRINCESS STREET		2
ROSTHERNE CLOSE	50	2
ROUGHLEY AVENUE		12
SUNFLOWER DRIVE		1
Grand Total	**84**	**106**

Following a review of the flooding information, Great Sankey Flood Cluster has been split into five separate clusters based on flood mechanism / spatial separation as follows:

- Great Sankey Flood Cluster A – Sankey Bridges
- Great Sankey Flood Cluster B – Highfield Avenue
- Great Sankey Flood Cluster C – East of Whittle Hall Lane
- Great Sankey Flood Cluster D – Sunflower Drive
- Great Sankey Flood Cluster E – California Close

11.1 Great Sankey Flood Cluster A – Sankey Bridges

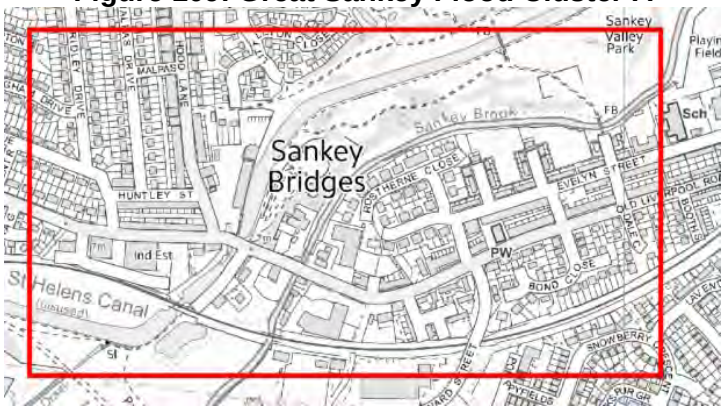
A summary of flooding to Great Sankey Flood Cluster A is provided in Table 11.2 below.

Table 11.2: Flooded Properties Summary – Great Sankey Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
BROADHURST AVENUE		12
EVELYN STREET		53
HEPHERD STREET		13
HESKETH STREET NORTH		4
LIVERPOOL ROAD	34	1
PRINCESS STREET		2
ROSTHERNE CLOSE	50	2
ROUGHLEY AVENUE		12
Grand Total	**84**	**99**

Flood cluster A – Sankey Bridges is primarily a residential area located in Great Sankey South Ward within the administrative area of Warrington Borough Council. It is approximately 1 mile south west of Warrington town centre

Figure 109: Great Sankey Flood Cluster A



11.1.1 Flood History

The Engineering and Flood Risk Team is aware of historic flooding to:

- Liverpool Road

It is understood that Liverpool Road has a significant flood history and last flooded on 21 September 2018.

Figure 110: Image of Liverpool Road (estimated 1960's)

Figure 111: Image of Liverpool Road (estimated 1960's)

Figure 112: Image of Liverpool Road (date unknown)

Figure 113: Image of Liverpool Road (04 July 2007)

Figure 114: Image of Liverpool Road (04 July 2007)

Figure 115: Images of Liverpool Road (21 September 2018)

The following extract is from correspondence dated October 2008 between United Utilities and Helen Jones (MP for Warrington North at the date of correspondence) in respect of a flood event which occurred on 5th / 6th September 2008 the following was noted:

Figure 116: Extract from Letter Dated October 2008

External flooding of Liverpool Road occurred during the heavy rainfall. At this time there was also a failure at Sankey Bridges Pumping Station, which will have contributed to the problem. We have also agreed to investigate the network further. We are aware of a need for long-term investment in the sewer network, but it is not believed that this would contribute to an

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incapacity problem. We have agreed however to re-survey the sewer to ensure there is no unexpected deterioration.

Following flooding which occurred in 2019, United Utilities confirmed the following:

"United Utilities are aware that the pumping station serving the area, experienced an issue on 31 July 2019. The station is designed to send alarms into our central response centre and our teams are then dispatched to remedy the issue. Our teams attended to find a blockage on the pumps. Resulting in a reduction in the pass forward flow, compared to normal. It is acknowledged that this reduction in flow contributed towards the flooding on Liverpool Road."

11.1.2 Historic Mapping

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

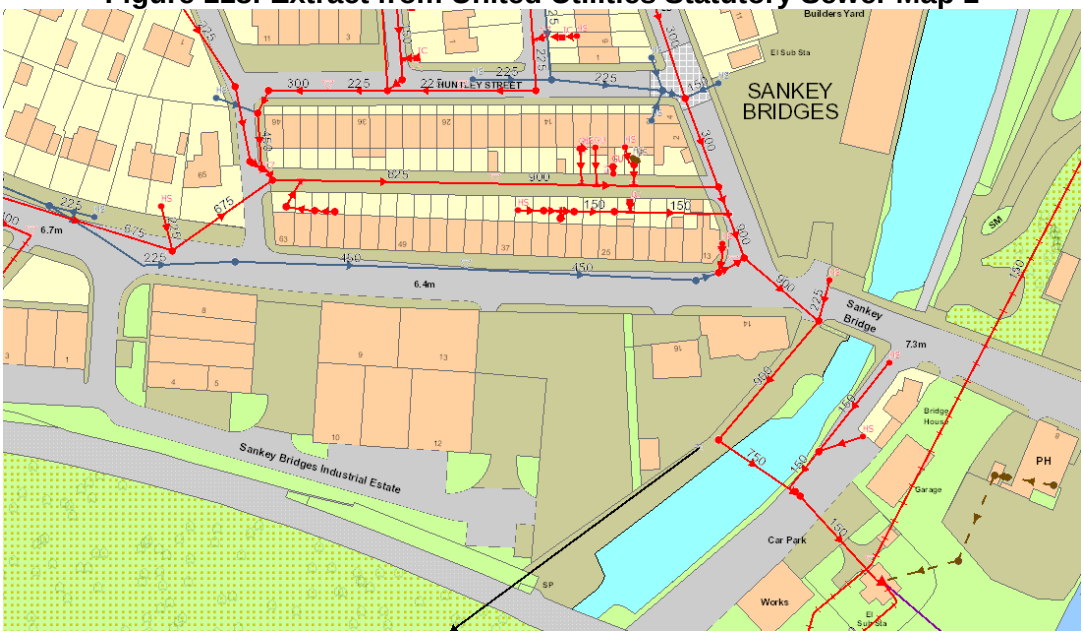
Figure 117: Extract of Historic Mapping – Published 1907 (National Library of Scotland)

11.1.3 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the general Sankey Bridges area.

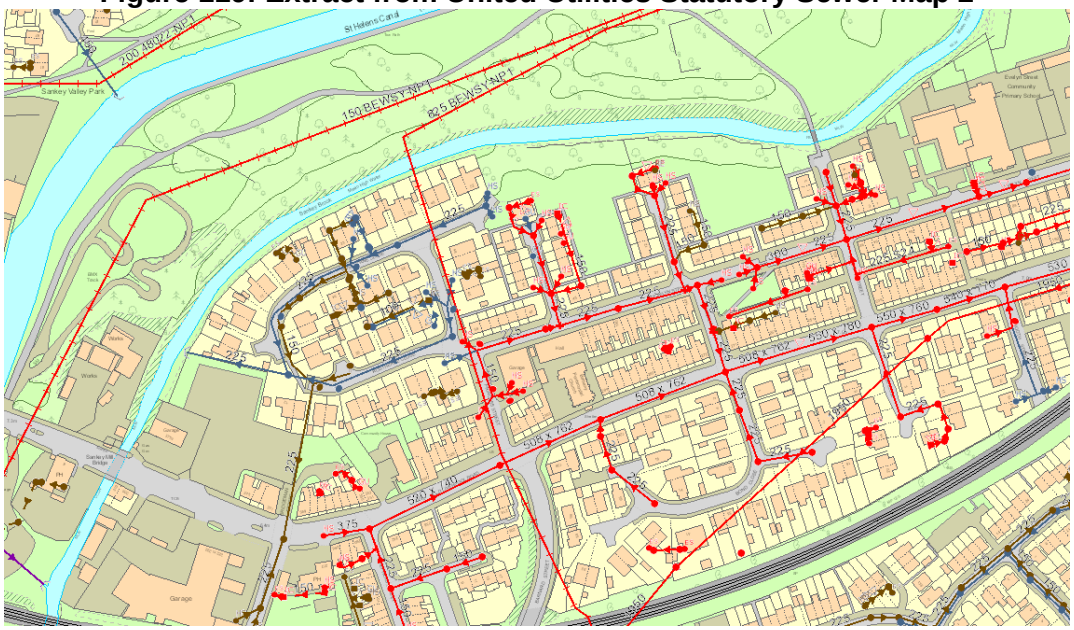
For the area of Sankey Bridges to the west of Sankey Canal, the mapping shows a 450mm diameter surface water sewer running along Liverpool Road which discharges to a 900mm diameter combined drainage system.

Figure 118: Extract from United Utilities Statutory Sewer Map 1



For the area of Sankey Bridges to the east of Sankey Canal, the mapping shows that the area is generally served by a combined system. The public combined sewers drain to Warrington North Wastewater Treatment Works (Gatewarth) which is a United Utilities asset. The exception being Rostherne Close which is served by separate public foul and surface water sewers. The Public surface water sewer is shown as discharging to Sankey Brook.

Figure 119: Extract from United Utilities Statutory Sewer Map 2



It is likely that the outfall for the public surface water sewer serving Rostherne Close would have experienced hydraulic restriction due to the raised watercourse levels, therefore affecting the performance of the surface water drainage systems.

11.1.4 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Sankey Bridges at varying levels of risk. Generally it is considered at high risk.

The observed flood extents during Storm Christoph generally correspond with the "medium risk" flood outline. Medium risk is defined as "Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area."

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited.

Figure 120: Flood Risk from Rivers or the Sea Mapping

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

For the area of Sankey Bridges to the west of Sankey Canal, Liverpool Road and Hood Lane are considered as being at high risk of surface water flooding. Surface water flood risk appears to decrease the further west of Sankey Canal.

For the area of Sankey Bridges to the east of Sankey Canal there are a number of pockets of at risk of surface water flooding but generally the risk is lower than that to the west of Sankey Canal.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 121: 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 the areas closest to Sankey Canal are at risk of flooding from reservoirs.

Figure 123: Maximum Extent of Flooding from Reservoirs

11.1.5 Watercourse Level Information

Two significant watercourses run through the Sankey Bridges area these are:

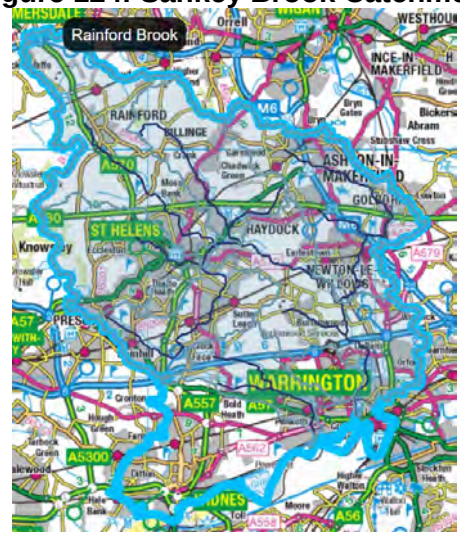
- Sankey Brook
- Sankey Canal

Sankey Canal is classified as 'Ordinary Watercourse' meaning that it is under the regulatory control of Warrington Borough Council as Lead Local Flood Authority.

Sankey Brook is classified as 'Main River' meaning that it is under the regulatory control of the Environment Agency.

The Sankey Catchment covers approximately 179km^2 and has 126km of Main River flowing, generally in a west to east orientation, through a mixture of open agricultural land and urban settlements. The Sankey Brook originates at the confluence of Sutton and Hardshaw Brooks in St Helens and flows into the River Mersey at Sankey Bridges in Warrington.

Figure 124: Sankey Brook Catchment



Source: Environment Agency

The nearest watercourse telemetry station to the affected area is located on Sankey Brook at Liverpool Road.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Liverpool Road was 4.24m on 21 January 2021.

The highest level previously recorded for this gauge station since it became operation was 3.98m which occurred on 05 December 2013.

According to Environment Agency, when the water level reaches 3.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 1.21m and 3.80m.

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.

11.1.6 Other Information

The following information was provided by Environment Agency:

- Liverpool Road, Sankey Bridges has a long standing history of surface water/sewer flooding when Sankey brook is still in channel.

- EA Site controller notes on 21st January –
    - Brook overtopped bank but this was after area had flooded first from other sources.
    - At between 6.40pm and 7pm - Flooding of Liverpool road was coming from the grids and there was no sign of the river being out of channel at this stage.
    - 15 properties flooded at this point and 20 more properties without power.

Post event data collection from residents at Rostherne close reported flooding from surface water and sewer first during the evening, in the early hours the brook overtopped and made the flooding much worse.

11.1.7 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Great Sankey Flood Cluster A – Sankey Bridges that the primary flood mechanism was a combination of sewer flooding and water overtopping the banks of Sankey Brook.

On this basis, it is the opinion of Warrington Borough Council that United Utilities and Environment Agency have relevant flood risk management functions in this respect and are the appropriate risk management authorities for managing this flood risk issue going forward.

11.1.8 Future Project

Environment Agency are looking at the flood risk associated with Sankey Brook, Dallam Brook and Longford Brook. The planning for this scheme was underway before Storm Christoph and they are looking to develop a confirmed plan for this area by March 2022.

Flood risk measures under consideration include:

- Linear Defences (defences set back from the river edge where possible)
- Flood attenuation (where flooding is captured and released slowly)
- Improved channel conveyance (maintaining good condition of water channels)
- Upstream natural flood management (when the natural environment and processes are used to support flood management)
- Flood relief channels (channels which are made to help divert water around or from important locations)
- Connection of Sankey Brook to the canal
- Reviewing Longford Barrage, which is an existing tidal barrage asset on Longford Brook.

This scheme will look at flooding from all water sources (surface water, river and sewer), and will involve partnership and collaborative working between the Environment Agency, Warrington Borough Council and United Utilities.

Further information on the Sankey Brook Proposed Flood Risk Management Scheme is available at https://thefloodhub.co.uk/sankeybrookfrmswarrington/#section-1

11.1.9 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.

- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority for cluster A as far as the public sewerage network is concerned.
- Continue to raise this issue with United Utilities and Environment Agency at future meetings to determine solutions and timescales where possible.

11.2 Great Sankey Flood Cluster B – Highfield Avenue

A summary of flooding to Great Sankey Flood Cluster B is provided in Table 11.3 below.

Table 11.3: Flooded Properties Summary – Great Sankey Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
HIGHFIELD AVENUE		1
Grand Total		**1**

Flood cluster B – Sankey Bridges is primarily a residential area located in Great Sankey North & Whittle Hall Ward within the administrative area of Warrington Borough Council. It is approximately 2 mile west of Warrington town centre.

Figure 125: Great Sankey Flood Cluster B

11.2.1 Flood History

Warrington Borough Council has historically been notified by United Utilities that external flooding occurred from the combined public sewer on Highfield Avenue on 21 September 2019.

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

11.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the Highfield Avenue area.

Highfield Avenue is served by separate public foul and surface water sewers.

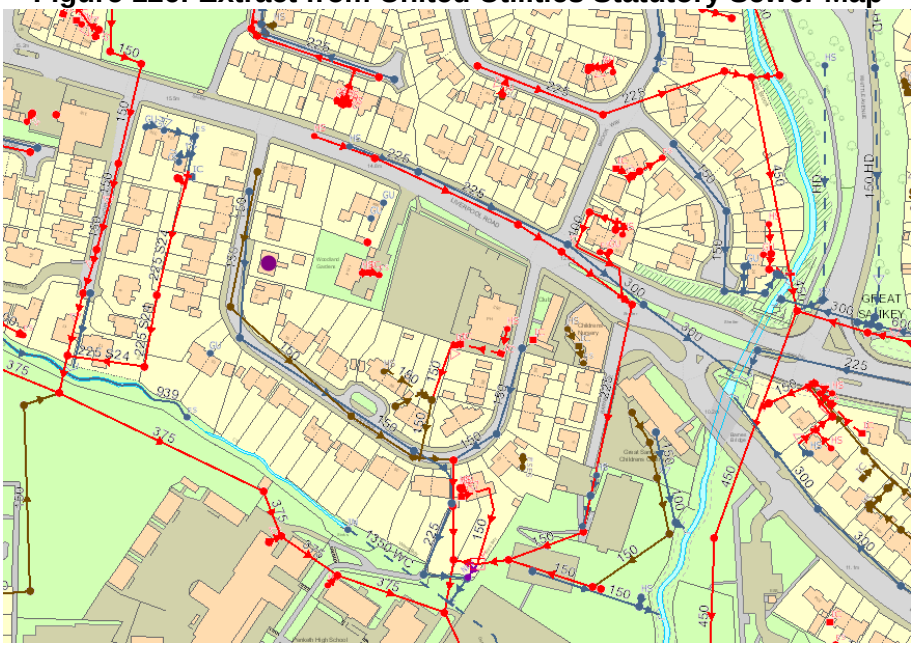
The foul sewer runs to a combined sewer between 39 and 41 Highfield Avenue which runs to a United Utilities pump station near to Shoreham Drive. A consented sewer overflow is present to the rear of 43 Highfield Avenue which discharges into an unnamed watercourse which runs to the south of Highfield Avenue. The unnamed watercourse discharges to Whittle Brook.

The Public surface water sewer split at Highfield Avenue. The system serving west of 39 Highfield Avenue is shown as discharging to the unnamed watercourse which runs to the south of Highfield Avenue.

The system serving east of 39 Highfield Avenue is shown to discharge to the combined sewer described above.

It is likely that the outfalls for the public surface water sewer and consented sewer overflow which serve Highfield Avenue would have experienced hydraulic restriction due to raised watercourse levels following the significant amount of rainfall, therefore affecting the performance of the systems.

Figure 126: Extract from United Utilities Statutory Sewer Map



11.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Highfield Avenue as being not at risk from flooding from rivers or the sea.

As Environment Agency mapping does not show the risk of flooding from watercourses with a catchment area of less than 3km^2, the risk from the unnamed watercourse to the south of Highfield Avenue may not be considered and the level of risk posed may be underestimated.

Figure 127: Flood Risk from Rivers or the Sea Mapping

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Highfield Avenue is generally shown as being at low risk of surface water flooding, however the mapping does appear to show a level of risk to the rear gardens which bound the unnamed watercourse to the south of Highfield Avenue.
A flow path is also present which appears to pass between 39 and 41 Highfield Avenue.

The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 128: 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 Highfield Avenue is not within the maximum extent of flooding from reservoirs.

11.2.4 Watercourse Level Information

Two watercourses run near to Highfield Avenue, these are:

- Whittle Brook
- Unnamed watercourse to south of Highfield Avenue (Tributary to Whittle Brook)

The unnamed watercourse is classified as 'Ordinary Watercourse' meaning that it is under the regulatory control of Warrington Borough Council as Lead Local Flood Authority.

Whittle Brook is classified as 'Main River' meaning that it is under the regulatory control of the Environment Agency.

Warrington Borough Council is not aware of the presence of a river gauging station on either of the above watercourses.

Given the amount of rainfall received during Storm Christoph, it is likely that 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.

11.2.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Great Sankey Flood Cluster B – Highfield Avenue that the primary flood mechanism is flooding from public sewers.

On this basis, it is the opinion of Warrington Borough Council that United Utilities has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

11.2.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with United Utilities at future meetings to determine solutions and timescales where possible.

11.3 Great Sankey Flood Cluster C – East of Whittle Hall Lane

A summary of flooding to Great Sankey Flood Cluster C is provided in Table 11.4 below.

Table 11.4: Flooded Properties Summary – Great Sankey Flood Cluster C

Location	Count of Internally Flooded	Count of Externally Flooded
ALDERBANK ROAD		1
BELMONT CRESCENT		1
MOSSDALE CLOSE		1
Grand Total		**3**

Flood cluster C – East of Whittle Hall Lane is primarily a residential area located in Great Sankey North & Whittle Hall Ward within the administrative area of Warrington Borough Council. It is approximately 2 mile west of Warrington town centre.

Figure 129: Great Sankey Flood Cluster C

11.3.1 Flood History

The Engineering and Flood Risk Team has no records of any historic flooding at Belmont Crescent or Mossdale Close but that is not to say flooding has not occurred.

Warrington Borough Council was notified historically by United Utilities in respect of external flooding which occurred on 21 September 2019 to a residential property on Alderbank Road.

United Utilities understood the issue to be a possible root infestation of the private drainage system, amplified by severe rainfall.

It was concluded that the flooding experienced on 21 September 2019 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.

11.3.2 United Utilities Statutory Sewer Map

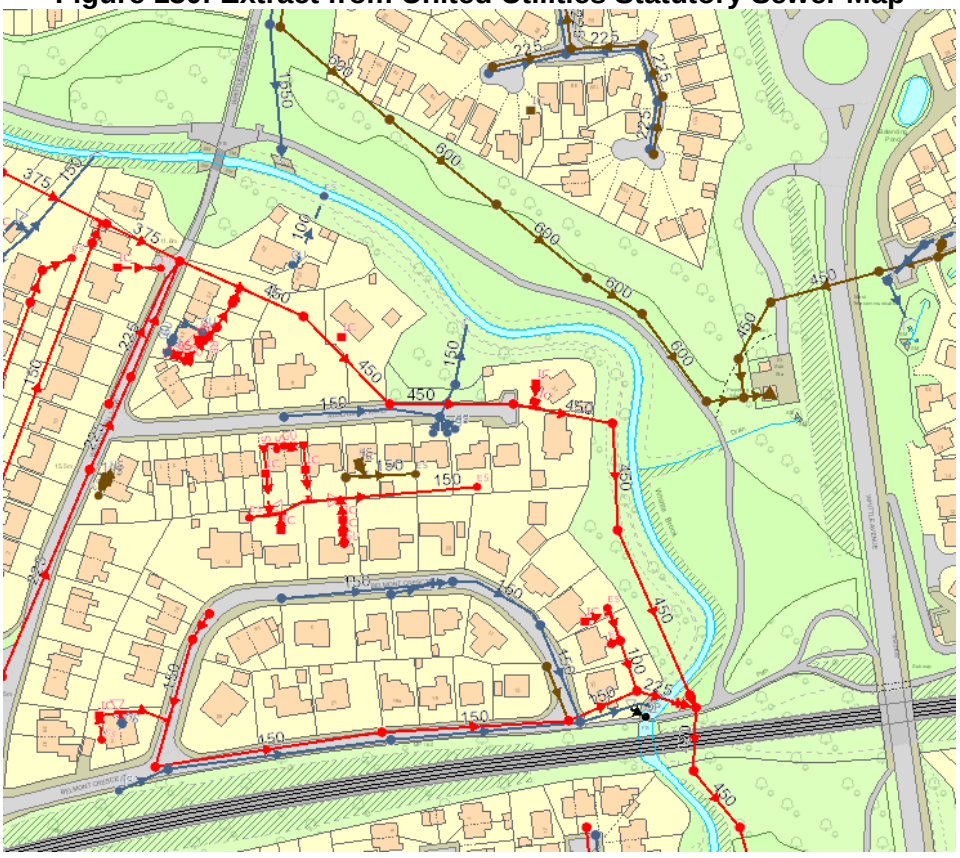
The Statutory Sewer Map was obtained from United Utilities showing the Great Sankey Flood Cluster C area.

Mossdale Close is served by separate public foul and surface water sewers. The public surface water sewer is shown as discharging to Whittle Brook.

Alderbank Road and Belmont Crescent are shown as being served by a combination of public surface water and combined sewers. The public surface water sewers for both roads are shown as discharging to Whittle Brook.

It is likely that the outfalls for the public surface water sewer which serve Alderbank Road and Belmont Crescent would have experienced hydraulic restriction due to raised watercourse levels following the significant amount of rainfall, therefore affecting the performance of the systems.

Figure 130: Extract from United Utilities Statutory Sewer Map



11.3.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Mossdale Close as not at risk from flooding from rivers or the sea.

Various properties located on Alderbank Road and Belmont Crescent are shown as being at medium or high risk of flooding from rivers or the sea.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Figure 131: Flood Risk from Rivers or the Sea Mapping

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on Mossdale Close, Alderbank Road and Belmont Crescent are generally shown as being either at low or very low risk of surface water flooding.

Figure 132: 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 Great Sankey Flood Cluster C is not within the maximum extent of flooding from reservoirs.

11.3.4 Watercourse Level Information

Whittle Brook runs near to properties on Mossdale Close, Alderbank Road and Belmont Crescent.

Whittle Brook is classified as 'Main River' meaning that it is under the regulatory control of the Environment Agency.

Warrington Borough Council is not aware of the presence of a river gauging station on Whittle Brook.

Given the amount of rainfall received during Storm Christoph, it is likely that 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.

11.3.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Great Sankey Flood Cluster C – East of Whittle Hall Lane that the primary flood mechanism for each road is as follows:

- Alderbank Road – External flooding due to Whittle Brook.
- Belmont Crescent – External flooding due to Whittle Brook.
- Mossdale Close – In the absence of further information, it is not possible to state the most likely cause of flooding to Mossdale Close.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in respect to Alderbank Road and Belmont Crescent and are the appropriate risk management authority for managing this flood risk issue going forward.

11.3.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with Environment Agency at future meetings to determine solutions and timescales where possible.

11.4 Great Sankey Flood Cluster D – Sunflower Drive

A summary of flooding to Great Sankey Flood Cluster D is provided in Table 11.5 below.

Table 11.5: Flooded Properties Summary – Great Sankey Flood Cluster D

Location	Count of Internally Flooded	Count of Externally Flooded
SUNFLOWER DRIVE		1
Grand Total		**1**

Flood cluster D – Sunflower Drive is primarily a residential area located in Great Sankey South Ward within the administrative area of Warrington Borough Council. It is approximately 1 mile south west of Warrington town centre.

Figure 133: Great Sankey Flood Cluster D

11.4.1 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.

11.4.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the Great Sankey Flood Cluster D area.

Sunflower Drive appears to be served by separate public foul and surface water sewers.

Information regarding the public foul sewers appears to be incomplete.

The public surface water sewer appears to consist of a number of large diameter pipes which may serve as a storm water attenuation facility for the rest of the housing estate. The surface water system appears to discharge to the River Mersey.

Figure 134: Extract from United Utilities Statutory Sewer Map

11.4.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows Sunflower Drive as not at risk from flooding from rivers or the sea despite its proximity to the River Mersey.

Figure 135: Flood Risk from Rivers or the Sea Mapping

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.

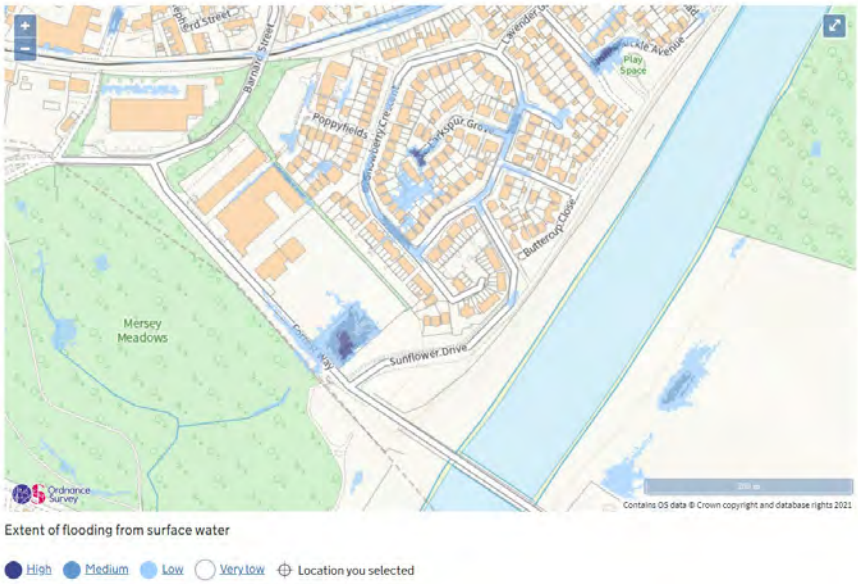
Surface Water Long Term Flood Risk

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on Sunflower Close are generally shown as being at very low risk of surface water flooding. A Small pocket of surface water risk is present on the carriageway approximately half way along the length of Sunflower Close.

Figure 136: 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 Great Sankey Flood Cluster D is not within the maximum extent of flooding from reservoirs.

11.4.4 Flooding Mechanism Conclusion & Risk Management Authority
United Utilities confirmed that they attended site and found this to be flooding due to a blockage caused by concrete in the drainage system.

In this regard, United Utilities are the appropriate risk management authority as they are responsible for the public sewers serving the area.

11.4.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.

11.5 Great Sankey Flood Cluster E – California Close
A summary of flooding to Great Sankey Flood Cluster E is provided in Table 11.6 below.

Table 11.6: Flooded Properties Summary – Great Sankey Flood Cluster E

Location	Count of Internally Flooded	Count of Externally Flooded
CALIFORNIA CLOSE		2
Grand Total		**2**

Flood cluster E – California Close is primarily a residential area located in Chapelford & Old Hall Ward within the administrative area of Warrington Borough Council. It is approximately 1.5 mile north west of Warrington town centre.

Figure 137: Great Sankey Flood Cluster E

11.5.1 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.

11.5.2 United Utilities Statutory Sewer Map

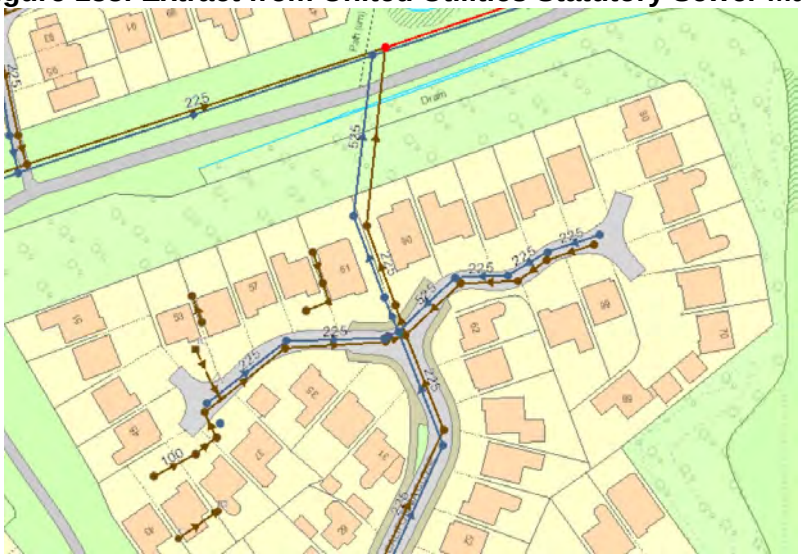
The Statutory Sewer Map was obtained from United Utilities showing the Great Sankey Flood Cluster E area.

California Close is served by separate public foul and surface water sewers.

Both systems are shown flowing in a general south to north direction and run between 61 and 90 California Close before joining the main carrier systems.

The public surface water sewer is shown as discharging to Sankey Brook.

Figure 138: Extract from United Utilities Statutory Sewer Map



11.5.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows California Close as not at risk from flooding from rivers or the sea.

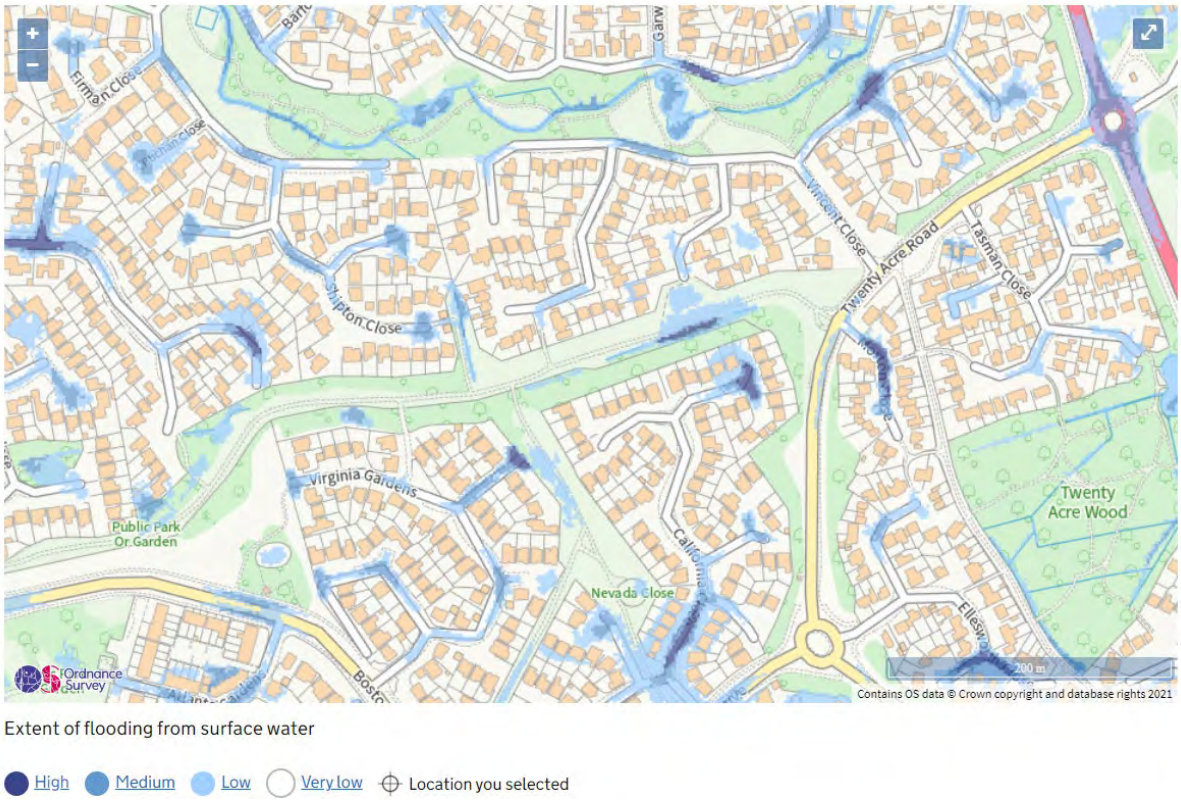
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on California Close are generally shown as being either at low or very low risk of surface water flooding. The exception being the eastern turning head which is shown as a localised pocket of high risk.

Figure 139: 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 Great Sankey Flood Cluster E is not within the maximum extent of flooding from reservoirs.

11.5.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to California Close.

11.5.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

12 Lymm Flood Cluster

Flooding to 11 properties occurred in this cluster as set out in Table 12.1 below:

Table 12.1: Flooded Properties Summary – Lymm Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
DANE BANK ROAD	1	
REDDISH LANE	6	
WARRINGTON LANE	4	
Grand Total	**11**	

Following a review of the flooding information, Lymm Flood Cluster has been split into three separate clusters based on flood mechanism / spatial separation as follows:

- Lymm Flood Cluster A – Reddish Lane
- Lymm Flood Cluster B – Dane Bank Road
- Lymm Flood Cluster C – Warrington Lane

12.1 Lymm Flood Cluster A – Reddish Lane

A summary of flooding to Lymm Flood Cluster A is provided in Table 12.2 below.

Table 12.2: Flooded Properties Summary –Lymm Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
REDDISH LANE	6	
Grand Total	**6**	

Lymm Flood cluster A – Reddish Lane is Reddish Lane is a predominantly rural residential area located in Lymm North & Thelwall ward which is within the administrative area of Warrington Borough Council.

It is approximately 6 miles to the east of Warrington town centre.

Figure 140: Lymm Flood Cluster A

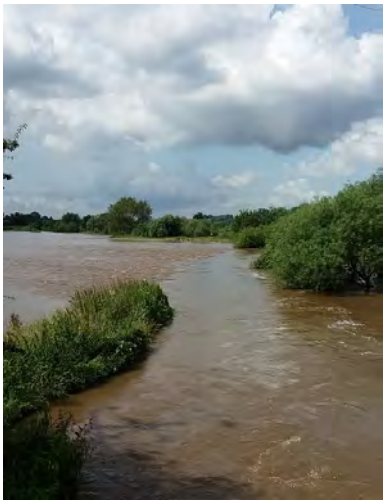
12.1.1 Flood History

Flooding is known to have occurred to the Reddish Lane area previously in July/August 2019. A Section 19 report has been completed previously for this flood event (reference 2019/019/001Reddish).

During the event in July/August 2019, significant flooding was recorded on the Bollin upstream of Lymm at Bramhall and Poynton and extensive flooding occurred on the A555 Manchester Airport Relief Road.

Cheshire Fire and Rescue Service declared a major incident amid widespread problems in Poynton on Wednesday 31st July 2019 at Poynton (approx. 14miles to the East of Reddish Lane).

Figure 141: Image of River Bollin taken from Mill Lane Bridge (01 August 2019)

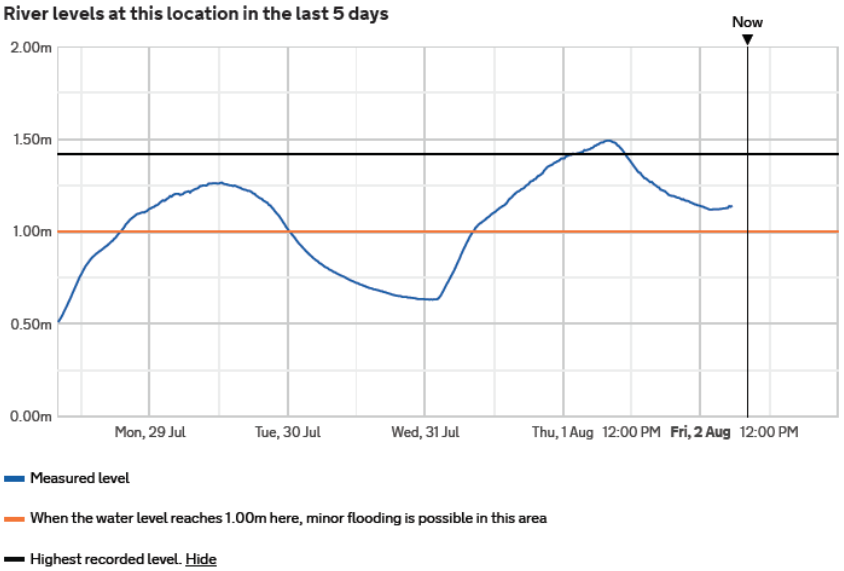


Source: United Utilities

Watercourse level data was obtained from Environment Agency following the flood event in July/August 2019 which shows that the maximum water level reached during the event for the River Bollin at Bollington Mill was 1.49m on 01 August 2019 as shown in Figure 142 below. Environment Agency have confirmed that: "The return period analysis for the Bollin shows this was a 1 in 100 year event (1% chance of occurring in any given year)."

Prior to the flood event in 2019, the highest level previously recorded for this gauge station since it was opened in 2000 was 1.42m which occurred on 06 November 2000.

Figure 142: River Level Data for River Bollin at Bollington Mill



12.1.2 Flood Extents / Depths

Flood depths and extents observed during the flooding as a result of Storm Christoph appeared to be the same as those observed during the flooding in July 2019 which were approximated based on an observed flood level of 11.850m AOD as shown in Figures 143 and 144.

Figure 143: Reddish Lane Approximate Flood Extents / Depths (01 August 2019 – approx. 11:00)

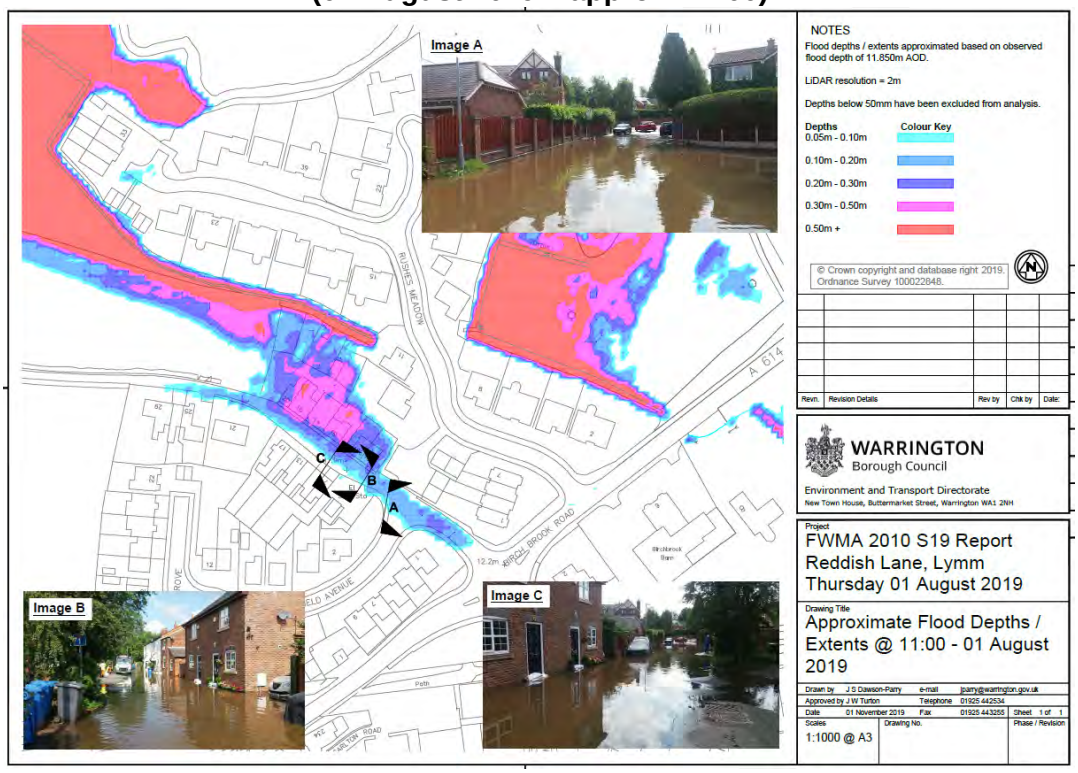
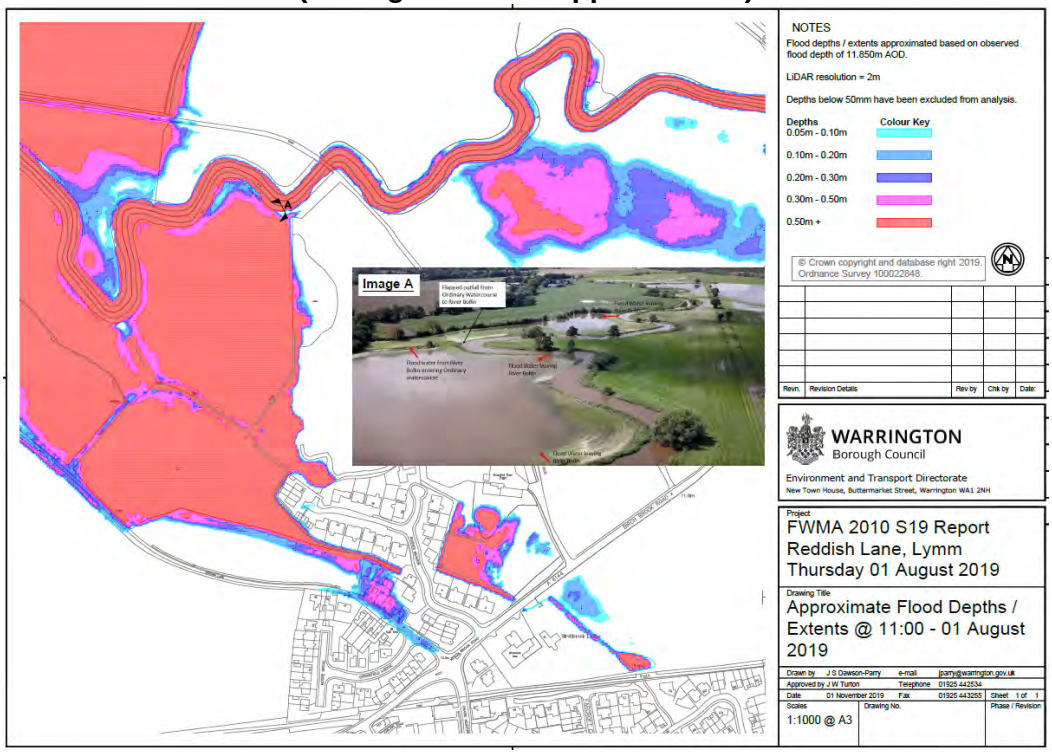


Figure 144: Reddish Lane (wider area) Approximate Flood Extents / Depths (01 August 2019 – approx. 11:00)



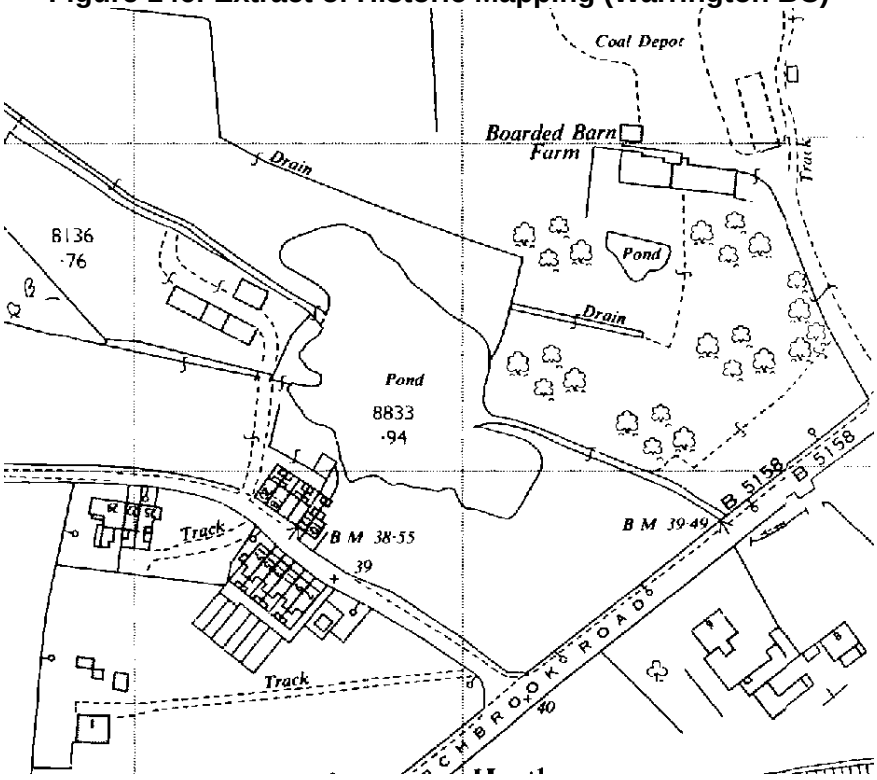
12.1.3 Historic Mapping

Historic mapping was obtained for the area from the National Library of Scotland and the Council's archives.

The mapping shows a large pond to north east of Reddish Lane and a watercourse.

Figure 145: Extract of Historic Mapping (National Library of Scotland)

Figure 146: Extract of Historic Mapping (Warrington BC)

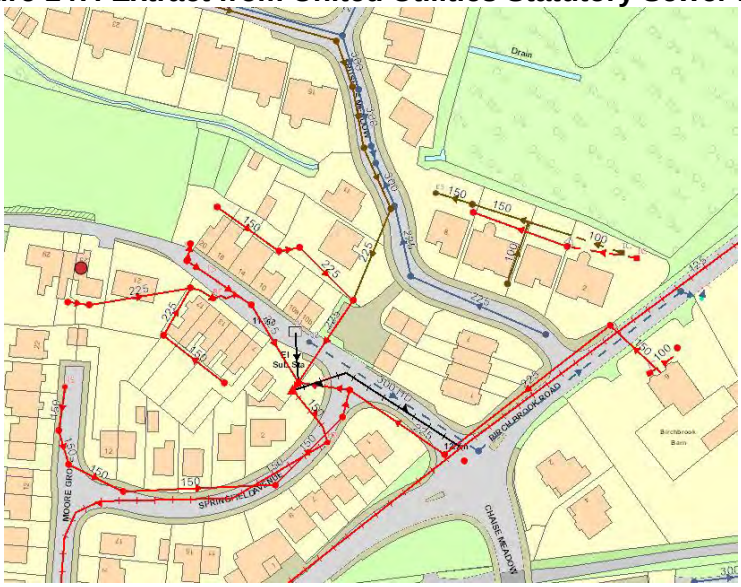


12.1.4 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities. The mapping shows a combined United Utilities system serving Reddish Lane.

No foul flooding was reported by residents. However due to the volume of water present, evidence of foul flooding may not be obvious.

Figure 147: Extract from United Utilities Statutory Sewer Map

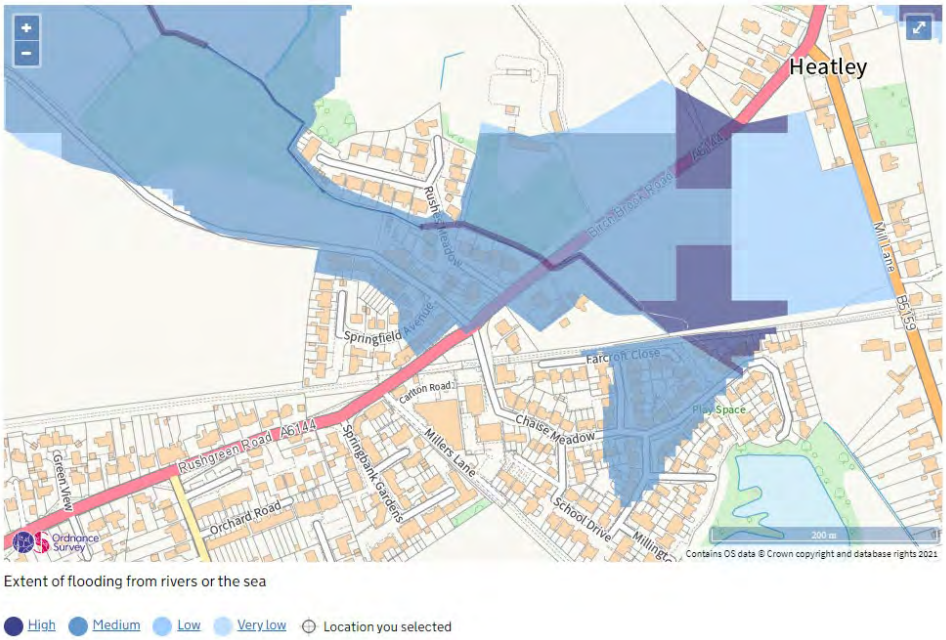


12.1.5 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea mapping shows Reddish Lane and surrounding area as generally being at medium risk of flooding. Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Figure 148: Flood Risk from Rivers or the Sea



Therefore Reddish Lane is considered as having a medium risk of flooding from rivers or the sea.

Note: The Environment Agency Flood Map 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 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, parts of Reddish Lane are 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 149: 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 Reddish Lane is not at risk of flooding from reservoirs.

12.1.6 River Bollin Catchment Characteristics
The nearest significant watercourse to Reddish Lane is the River Bollin.

According to the Bollin Valley Partnership "The River Bollin is 49km in length running from the hills surrounding Macclesfield Forest to where it joins the Manchester Ship Canal at Bollin Point near Lymm.

The main source of the River Bollin is on Toot Hill in the Hamlet of Forest Chapel on the edge of Macclesfield Forest. Half way down its length the Bollin is joined by the River Dean. The catchment area of the two rivers combined is 273 square kilometres."

Figure 150: Bollin / Dean Catchment

Source: Environment Agency

12.1.7 Watercourse Level Information – Storm Christoph

On Tuesday 19 January 2021, the area was flooded again. Greater Manchester Police declared a major incident amid widespread problems on the evening of Tuesday 19 January 2021 and significant flooding was recorded on the Bollin upstream of Lymm and extensive flooding occurred on the A555 Manchester Airport Relief Road.

The nearest watercourse telemetry station to Reddish Lane is located on the River Bollin at Brickkiln Lane, Little Bollington (approximately 2.15miles to the East of Reddish Lane).

Figure 151: Telemetry location

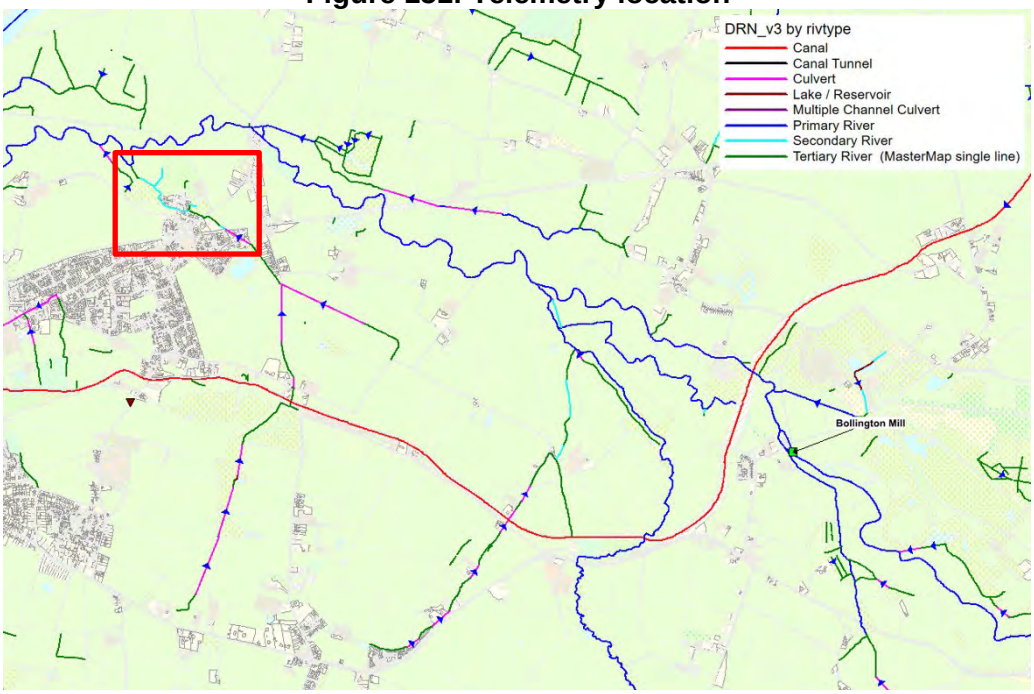
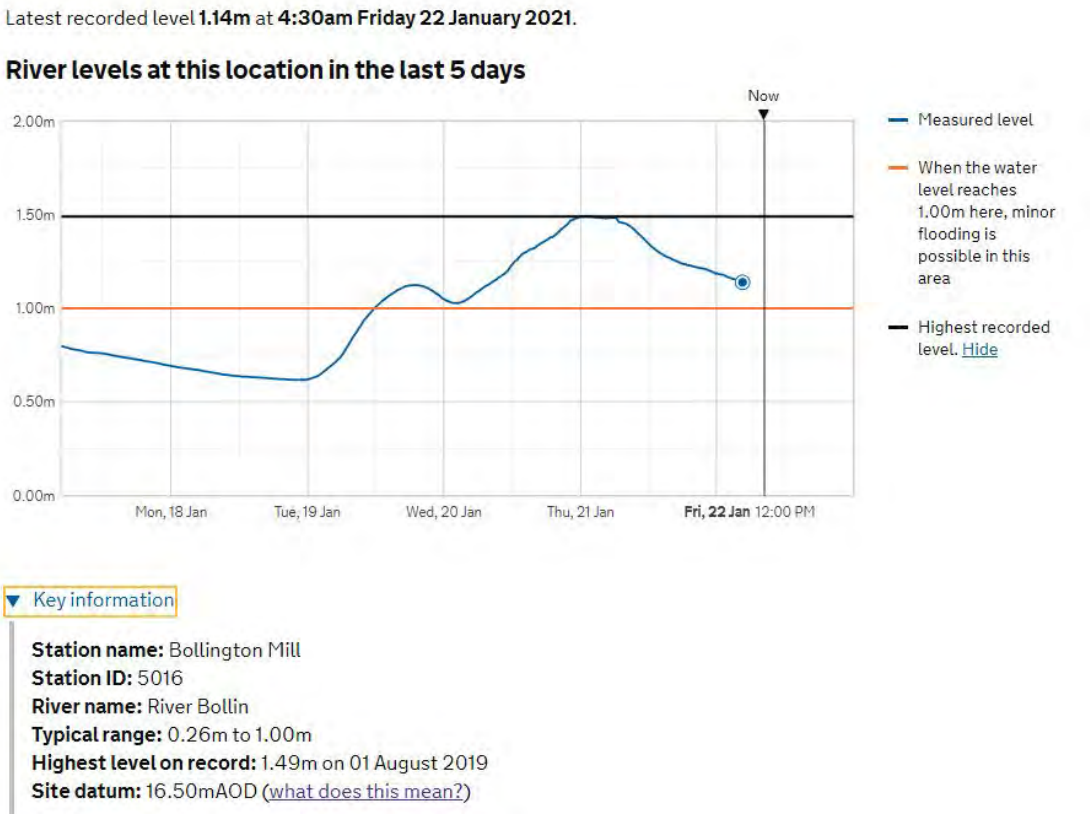


Figure 152: River Level Data for River Bollin at Bollington Mill



Watercourse level data was obtained from Environment Agency. The maximum water level reached during the event for the River Bollin at Bollington Mill was 1.49m on Thursday 21 January 2021 as shown in Figure 152 above.

This equalled the highest level previously recorded for this gauge station since it was opened in 2000 which occurred on 01 August 2019 (The last known flood event).

According to Environment Agency, when the water level reaches 1.00m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for the River Bollin at this location is between 0.26m and 1.00m.

Environment Agency estimate that the return period for the flood event is between a 1.3% (1in75) and 1% (1 in 100) probability.

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.

Minor tributary watercourses will have experienced hydraulic restriction and may have experienced back flow from the River Bollin due to the high levels recorded.

Several flood warning / alerts were raised across the Bollin catchment.

A tributary to the River Bollin flows to the rear of properties affected on Reddish Lane.

12.1.8 Flooding Mechanism Conclusion & Risk Management Authority

The flooding mechanism observed by WBC Officers on 21 January 2021 appeared to match the flooding mechanism for the flood event in 2019 as summarised below.

Flooding Mechanism July / August 2019

During site investigation undertaken following the flood event in 2019, discussion was held with a farmer who provided a link to drone video footage of the River Bollin at Warburton / Heatley which was recorded on 02 August 2019 (day after watercourse peak).

https://www.youtube.com/watch?v=0zQxsLKbiIc

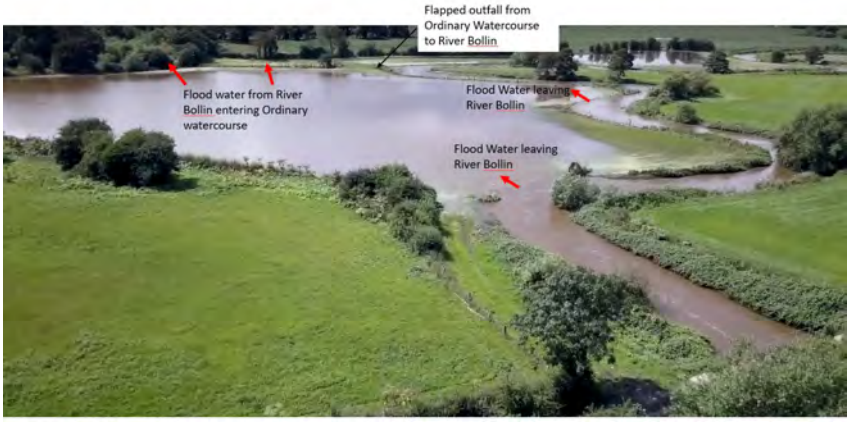
The drone video footage clearly shows the River Bollin leaving its banks and inundating the ordinary watercourse which flows to the rear of affected properties at Reddish Lane. It is worth noting that water levels had reduced to the levels seen below and were significantly higher the previous day.

A tide-flap is present at the outfall of the ordinary watercourse to the River Bollin. The tide flap would have been closed during the event meaning discharge would have been restricted.

The water levels observed in the fields adjacent to the Bollin correspond with the flood level observed at Reddish Lane indicating that the Reddish Lane area was inundated with water from the River Bollin.

Figure 153: Extract of Drone Footage 1

Figure 154: Extract of Drone Footage 2



Direction / Source of Flooding to Property on Reddish Lane

Based on observations on site, available mapping, levels comparison and LiDAR information, the water flowed from the watercourse to the rear of the affected property around the sides and flooded low areas of the carriageway (See Figure 155 below).

Figure 155: Flow paths

Flooding Mechanism Conclusion
Review of the available data has indicated the flooding experienced on 21 January 2021 at Reddish Lane appears to be a result or consequence of:

- Extensive rainfall in the upper catchment of the River Bollin appears to have prevented normal discharge from the watercourse to the rear of properties on Reddish Lane to the River Bollin. This in turn resulted in increased water levels in the watercourse preventing any drainage systems connected to this to discharge.

- Flood level reached approximately 11.850m AOD. This was observed at Reddish Lane and in the fields adjacent to River Bollin. The levels adjacent to the properties are at around 11.46m AOD. The difference indicates that the properties are lower than the water level reached by the River Bollin. This confirms why properties are considered to be at risk on the Environment Agency Flood Maps.

- Environment Agency estimate that the return period is between a 1.3% (1in75) and 1% (1 in 100) probability.

- The tributary watercourse running to the rear of properties on Reddish Lane will have experienced hydraulic restriction before the Bollin breached as the tide-flap would have been shut.

- Flood water from the River Bollin left its bank and entered the tributary watercourse running to the rear of properties on Reddish Lane.

- Outfalls from surface water drainage systems situated at low levels which discharge to the watercourse would have experienced hydraulic restriction due to the raised watercourse levels, therefore affecting the performance of the surface water drainage systems in the area. The surface water drainage systems would have become operational when levels in the Bollin reduced allowing the flap valve to open and drain surrounding watercourse.

- The surface water drainage system at the low spot of Reddish Lane drains to a United Utilities combined pumped system. Given the large volumes of water, the pump most likely would have been overwhelmed and not able to deal with the water.

Appropriate Risk Management Authorities
Based on the information set out above, it appears that the primary flood mechanism was water leaving the River Bollin and backflowing up the tributary which runs to the rear of properties on Reddish Lane. There are also a number of restrictions within the ordinary watercourse adjacent to the affected area which may have been a contributing factor during this flood event.

It is recognised that Environment Agency estimate that the return period is between a 1.3% (1in75) and 1% (1 in 100) probability., the highest ever flood event according to Environment Agency records.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward. Warrington Borough Council will continue to manage the watercourse and highway drainage systems in Reddish Lane.

Going forward all key partners will continue to work with the Local Community and where possible collaborate to reduce the flood risk in this area.

12.1.9 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Continue to engage with the local flood group.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.

12.1.10 Project

Following the flooding during Storm Christoph, Warrington Borough Council applied for funding from Environment Agency to construct a scheme to reduce the risk of flooding to properties on Reddish Lane.

The funding bid was successful in late August and at the time of writing, the scheme is currently under construction.

The £258,000 project at Reddish Lane involves installing a large diameter piped drainage system to replace the existing open watercourse. The area to the rear of the properties will be closed by the construction of a partition wall to control the flow of water from the watercourse and to prevent other natural flow paths from flooding the area at risk from the side.

12.2 Lymm Flood Cluster B – Dane Bank Road

A summary of flooding to Lymm Flood Cluster B is provided in Table 12.3 below.

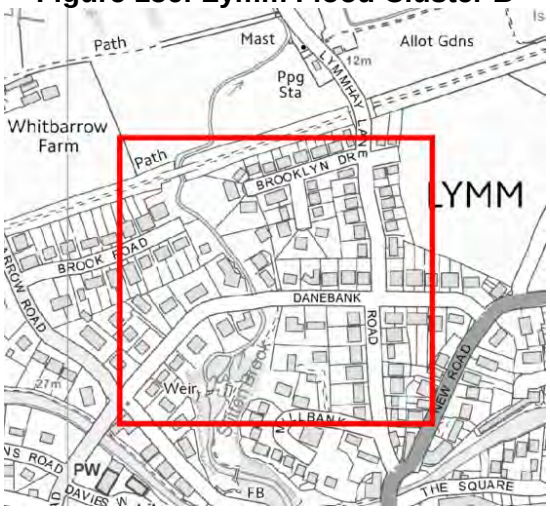
Table 12.3: Flooded Properties Summary – Lymm Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
DANE BANK ROAD	1	
Grand Total	**1**	

Lymm Flood cluster B – Dane Bank Road is a predominantly residential area located in Lymm North & Thelwall ward which is within the administrative area of Warrington Borough Council.

It is approximately 5 miles to the east of Warrington town centre.

Figure 156: Lymm Flood Cluster B



12.2.1 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.

12.2.2 United Utilities Statutory Sewer Map

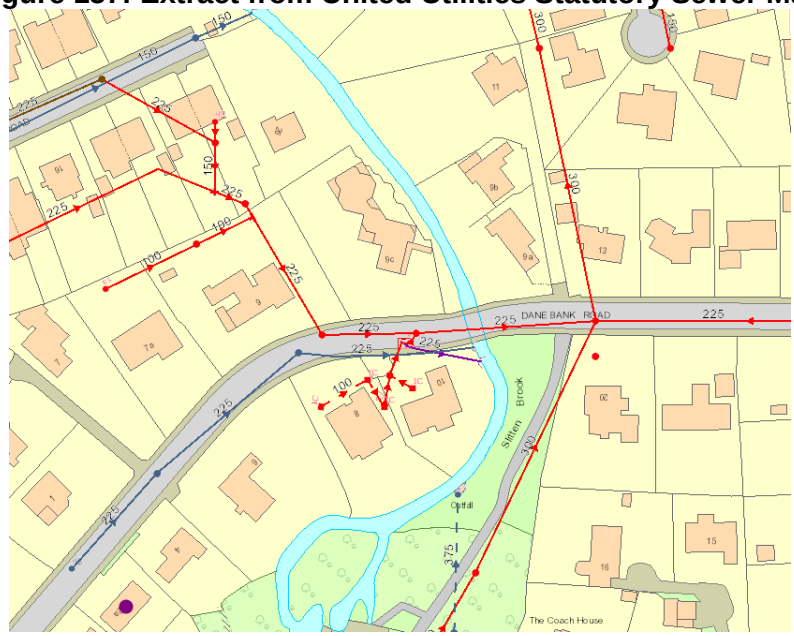
The Statutory Sewer Map was obtained from United Utilities showing the Lymm Flood Cluster B area.

Dane Bank Road is shown as being served by a combined public sewer and surface water public sewer.

The public surface water sewer is shown as discharging to Sankey Brook.

A combined sewer overflow is present on the combined system which appears to discharge to Slitten Brook.

Figure 157: Extract from United Utilities Statutory Sewer Map



12.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows a number of properties at medium risk from flooding from rivers or the sea. The flood risk appears to be related to Slitten Brook which is classified as 'main river' and therefore under the regulatory powers of Environment Agency.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

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 158: Flood Risk from Rivers 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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on Dane Bank Road in the vicinity of Slitten Brook are shown as being at varying levels of risk of surface water flooding.

Figure 159: 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 numerous properties on Dane Bank Road are within the maximum extent of flooding from reservoirs.

Figure 160: Extent of Flooding from Reservoirs Mapping

12.2.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is the opinion of Warrington Borough Council in respect of Lymm Flood Cluster B – Dane Bank Road that the primary flood mechanism was water overtopping the banks of Slitten Brook.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

12.2.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with Environment Agency at future meetings to determine solutions and timescales where possible.

12.3 Lymm Flood Cluster C – Warrington Lane
A summary of flooding to Lymm Flood Cluster C is provided in Table 12.4 below.

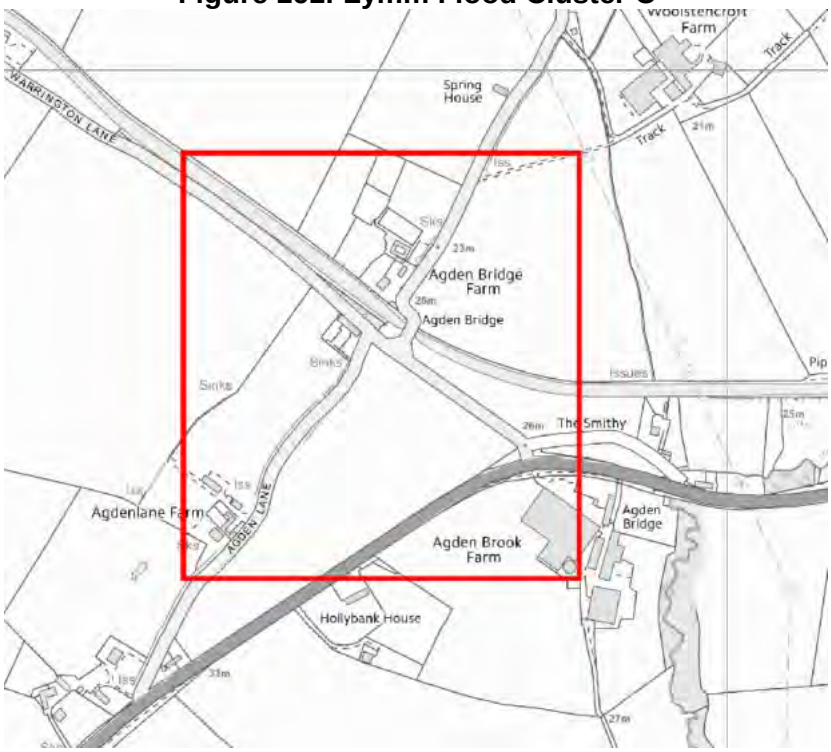
Table 12.4: Flooded Properties Summary –Lymm Flood Cluster C

Location	Count of Internally Flooded	Count of Externally Flooded
WARRINGTON LANE	4	
Grand Total	**4**	

Lymm Flood cluster C – Warrington Lane is a predominantly residential area located in Lymm South ward which is within the administrative area of Warrington Borough Council.

It is approximately 7 miles to the east of Warrington town centre.

Figure 161: Lymm Flood Cluster C



12.3.1 Flood History & Works

The Engineering and Flood Risk Team was aware of historical flooding to the carriageway only at Warrington Lane prior to this event but has no records of any historic internal flooding to properties at this location but that is not to say flooding has not occurred.

A 300m section of drainage system was installed to Warrington Lane by Warrington Borough Council to alleviate flooding to the carriageway.

12.3.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the Lymm Flood Cluster C area.

No United Utilities asset are shown for this area.

12.3.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows that Warrington Lane is not at risk of flooding from Rivers or the Sea.

However, a significant flood envelope is identified in respect of the River Bollin to the north of Warrington Lane and Agden Brook to the east of Warrington Lane.

The observed flood extents for the River Bollin during Storm Christoph generally correspond with the “medium risk” flood outline. Medium risk is defined as “Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area.”

There are significant number of minor watercourses / ditches located in the area which drain to the River Bollin. The flood risk from these watercourses is generally not shown as 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.

These smaller watercourse which may have experienced hydraulic restriction and may have experienced back flow from River Bollin during the flood event due to the high levels recorded.

Figure 162: Flood Risk from Rivers or the Sea Mapping

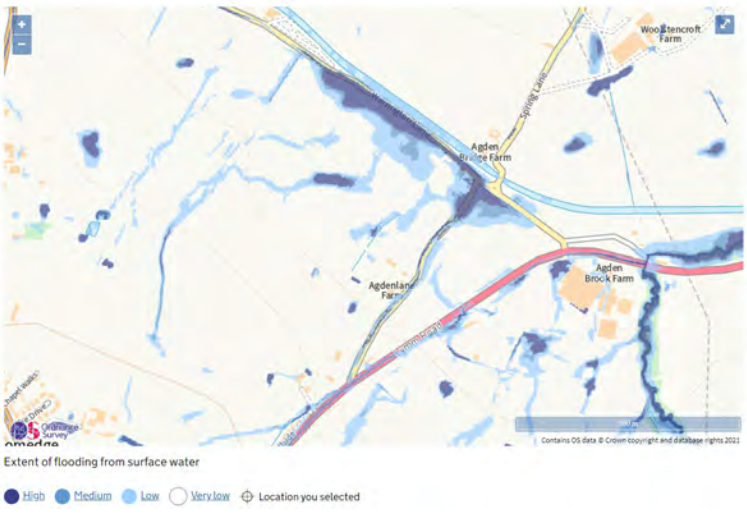
Surface Water Long Term Flood Risk

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Warrington Lane is shown as being at high risk of surface water with several significant flow paths flowing in a general south west to north east direction. There appears to be a significant catchment area flowing towards Warrington Lane.

Figure 163: Flood Risk from Surface Water Mapping



A number of drainage ditches / small watercourses in both open and culverted form lead to the junction of Agden Lane and Warrington Lane where they continue in a north east direction before passing via a siphon under the Bridgewater Canal. This watercourse network discharges to Agden Brook approximately 1000m north of the junction of Agden Lane and Warrington Lane.

Due to this location being at the administrative boundary of Warrington Borough Council, Cheshire East Council have been involved in the investigation.

These systems have been checked by both Warrington Borough Council and Cheshire East Council where applicable and confirmed to be functional.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates that Warrington Lane is not within the maximum extent of flooding from reservoirs.

12.3.4 Rainfall Information

Rain gauge information was obtained for January 2021 from 4 nearest functioning rain gauges (Met Office Weather Observations Website). They are located at:

- Chapelford (Approx 8.8miles north west of Warrington Lane)
- Old Hall (Approx 7.7miles north west of Warrington Lane)
- Black Brook (Approx 12miles north west of Warrington Lane)
- Antrobus (Approx 8.5miles south of Warrington Lane)

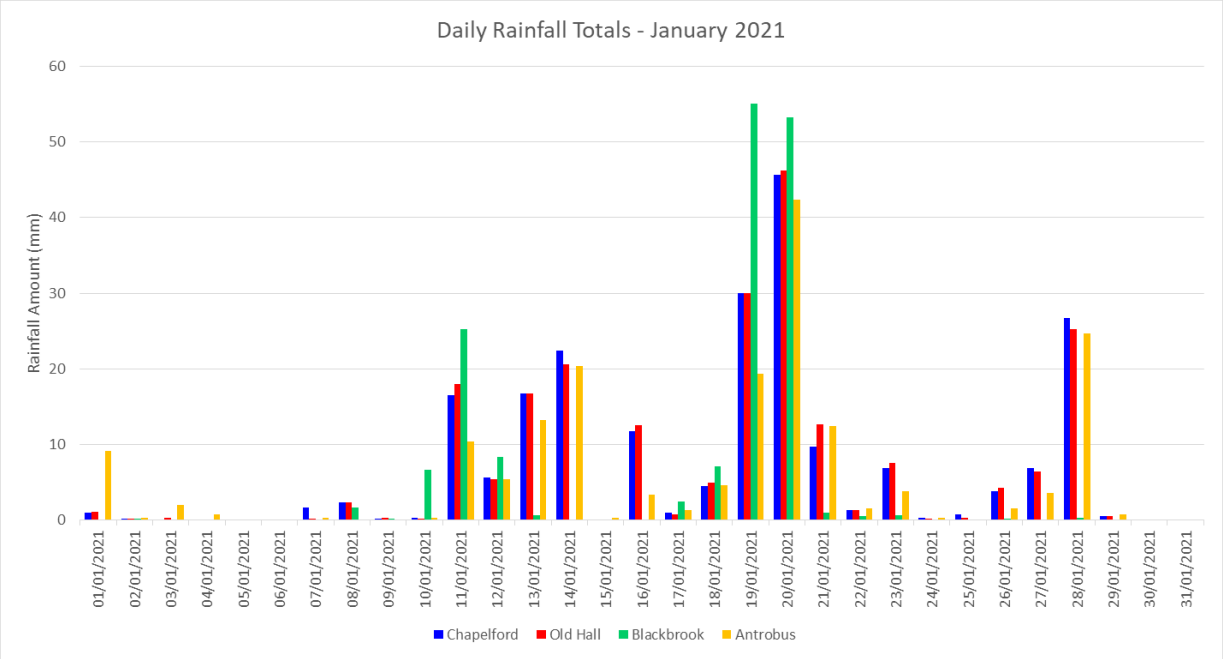
It is clear from the rainfall data, that significant rainfall had occurred prior to Storm Christoph which would had led to the ground becoming saturated and high levels in watercourses. The main significant rainfall events prior to Storm Christoph for the above rain gauges are as follows:

- Chapelford – 11th January 2021 – 16th January 2021: 72.9mm
- Old Hall – 11th January 2021 – 16th January 2021: 73.2mm
- Black Brook – 10th January 2021 – 12th January 2021: 40.1mm
- Antrobus – 11th January 2021 – 14th January 2021: 49.3mm

The following rainfall totals were observed for Storm Christoph between 18th January 2021 and 21 January 2021:

- Chapelford: 89.9mm
- Old Hall: 93.8mm
- Black Brook: 116.5mm
- Antrobus: 78.7mm

Figure 164: Daily Rainfall Totals – January 2021

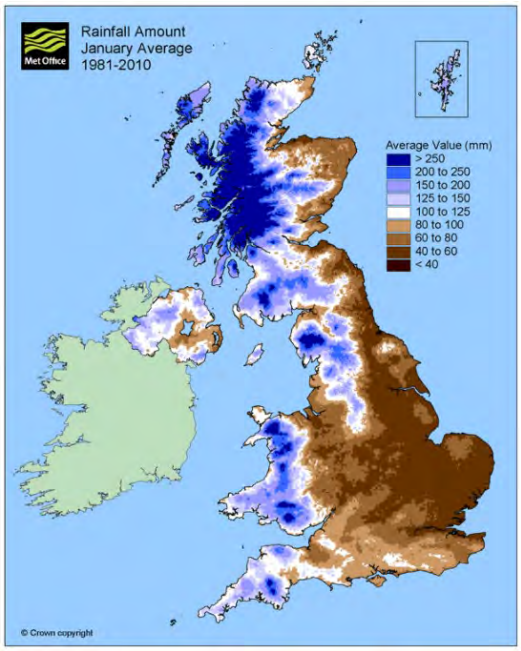


The following rainfall totals were observed for January 2021:

- Chapelford – 216.4mm
- Old Hall – 218.1mm
- Black Brook – 163.3mm
- Antrobus – 181.6mm

These are very high rainfall figures when compared to the average amount of rainfall which Warrington would expect to receive for the whole of January between 1981-2010 was 60-80mm (Met Office).

Figure 165: Rainfall Average – January 1981-2010 (Met Office)



12.3.5 Watercourse Level Information

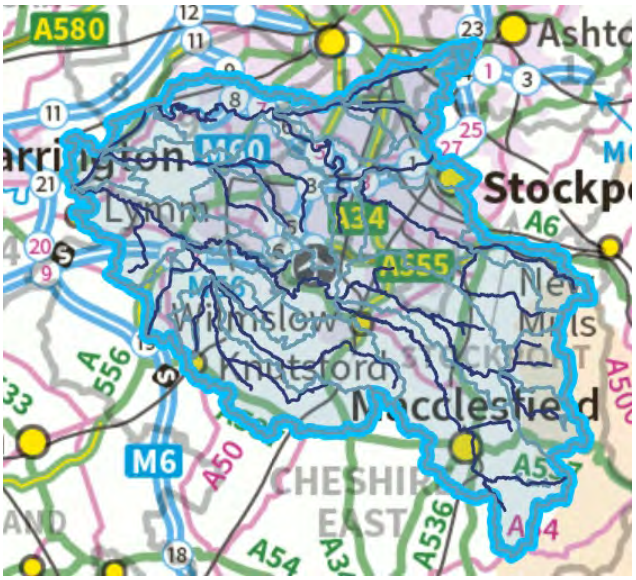
There are two significant watercourse near to Warrington Lane, they are:

- River Bollin
- Agden Brook (Tributary to River Bollin)

According to the Bollin Valley Partnership "The River Bollin is 49km in length running from the hills surrounding Macclesfield Forest to where it joins the Manchester Ship Canal at Bollin Point near Lymm.

The main source of the River Bollin is on Toot Hill in the Hamlet of Forest Chapel on the edge of Macclesfield Forest. Half way down its length the Bollin is joined by the River Dean. The catchment area of the two rivers combined is 273 square kilometres."

Figure 166: Bollin / Dean Catchment



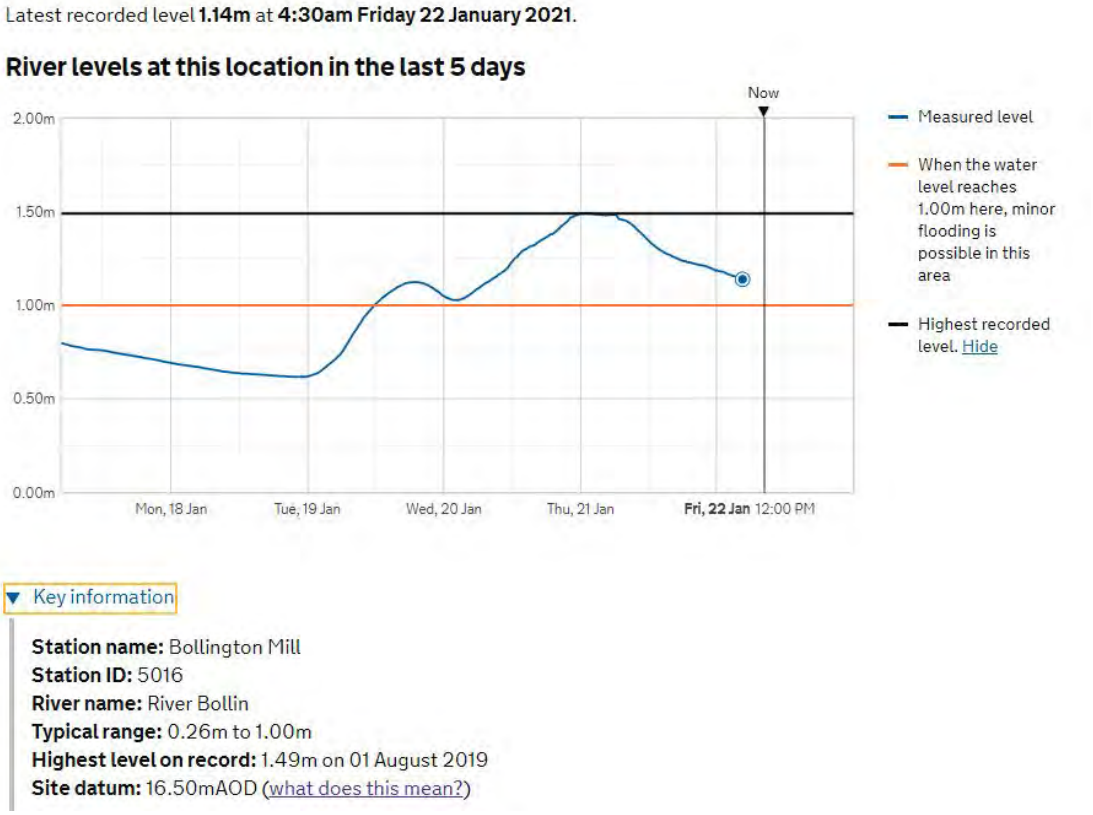
Source: Environment Agency

Significant flooding was recorded on the Bollin upstream of Lymm and extensive flooding occurred on the A555 Manchester Airport Relief Road.

Greater Manchester Police declared a major incident amid widespread problems on the evening of Tuesday 19 January 2021.

The nearest watercourse telemetry station to Warrington Lane is located on the River Bollin at Brickkiln Lane, Little Bollington (approximately 1 mile to North East of Warrington Lane).

Figure 167: River Level Data for River Bollin at Bollington Mill



Watercourse level data was obtained from Environment Agency. The maximum water level reached during the event for the River Bollin at Bollington Mill was 1.49m on Thursday 21 January 2021 as shown in Figure 167 above.

This equalled the highest level previously recorded for this gauge station since it was opened in 2000 which occurred on 01 August 2019.

According to Environment Agency, when the water level reaches 1.00m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for the River Bollin at this location is between 0.26m and 1.00m.

Environment Agency estimate that the return period for the above event is between a 1.3% (1in75) and 1% (1 in 100) probability.

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.

Minor tributary watercourses will have experienced hydraulic restriction and may have experienced back flow from the River Bollin due to the high levels recorded.
Several flood warning / alerts were raised across the Bollin catchment.

12.3.6 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Lymm Flood Cluster C – Warrington Lane that the primary flood mechanism was surface

water runoff and overland flow as a result of heavy rainfall combined with saturated rural and agricultural land within the catchment area due to previous rainfall events.

It should be noted that receiving 'main river' watercourses such as River Bollin / Agden Brook were at high level with flooding reported elsewhere within the catchment. Smaller watercourses may have experienced hydraulic restriction and may have experienced back flow from these main rivers due to the high levels recorded. This is considered a significant contributing factor.

On this basis, it is the opinion of Warrington Borough Council that Warrington Borough Council as Lead Local Flood Risk Authority has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

12.3.7 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Investigate and clean existing drainage systems.
- Undertake minor works to clean watercourse on Spring Lane.

13 Orford Flood Cluster

Flooding to 305 properties occurred in this cluster as set out in Table 13.1 below:

Table 13.1: Flooded Properties Summary – Orford Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
DENSHAM AVENUE	22	34
GOUGH AVENUE	6	22
HALLOWS AVENUE		1
LONG LANE		34
NORBURY AVENUE		15
NORTHWAY	13	51
ROSCOE AVENUE		31
SMITH DRIVE		33
TOMLINSON AVENUE		43
Grand Total	**41**	**264**

Following a review of the flooding information, Orford Flood Cluster has been split into two separate clusters based on flood mechanism / spatial separation as follows:

- Orford Flood Cluster A – Longford
- Orford Flood Cluster B – Area to the east of Hallfields Road

13.1 Orford Flood Cluster A – Longford

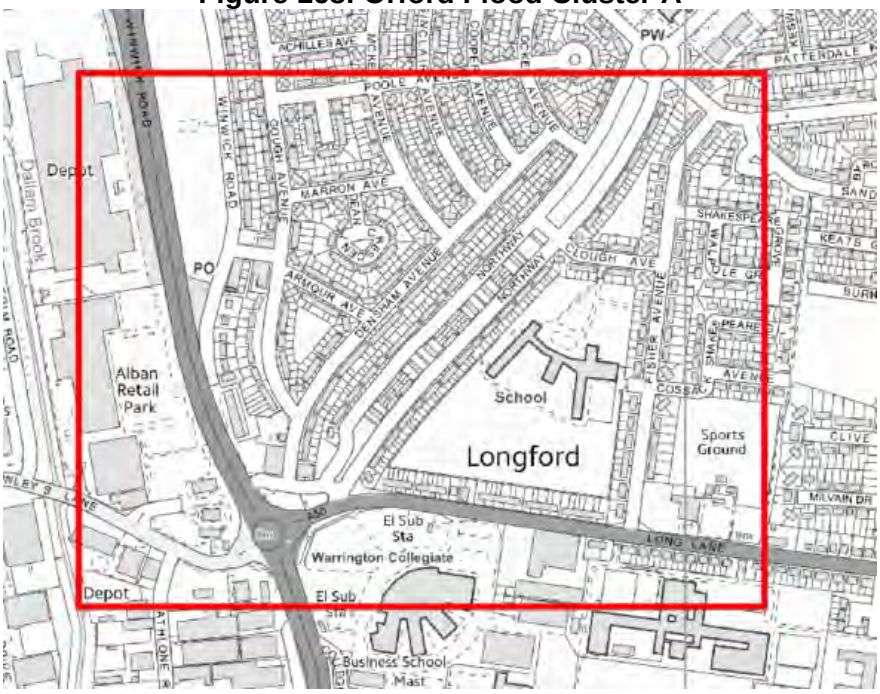
A summary of flooding to Orford Flood Cluster A is provided in Table 13.2 below.

Table 13.2: Flooded Properties Summary – Orford Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
DENSHAM AVENUE	22	34
GOUGH AVENUE	6	22
LONG LANE		34
NORTHWAY	13	51
Grand Total	**41**	**141**

Orford Flood Cluster A – Longford is a predominantly residential area located in Orford ward within the administrative area of Warrington Borough Council. It is approximately 2 miles to the north of Warrington town centre.

Figure 168: Orford Flood Cluster A



13.1.1 Flood History

This area has an extensive history of flooding. The earliest records, Warrington Borough Council holds regarding flooding in the Orford area is a newspaper cutting dated 7th December 1979. It reported "Long suffering residents of Densham Avenue in Longford, amongst the worst hit by the flood disaster a year ago this month were again faced with deep flood water" this indicates Longford has suffered previously before this date.

An undated newspaper clipping estimated to be from the early 1980's due to references made in the surrounding articles has the headline "Densham Avenue Swamped Again". The story states "[The] most badly hit area was Densham Avenue in Longford, where the road looked more like a river and in parts water was more than 12inches deep".

Flooding is also known to have occurred in January 2008 as evidenced in the photograph and extract from Warrington Guardian website dated 10 January 2008 below.

Between 24th and 26th September 2012, the areas of Densham Avenue, Gough Avenue, Old Winwick Road and Long Lane experienced both foul and surface water flooding due to hydraulic incapacity of the receiving drainage systems, in particular the surface water drainage system.

Warrington Borough Council deployed approximately 1,000 sandbags to affected residents to minimise the risk of internal flooding, and enforced road closures. Approximately 70 residential properties were affected during the incident which triggered the threshold for the production of a Section 19 report.

The area was also affected during significant rainfall on 26th December 2015 and in September 2019 in which road closures were enforced.

Figure 169: Newspaper Article (07 December 1979)

1979

07 DEC 1979

HOUR OF TENSION THEN THE FLOODS ROLLED BACK

IN an hour of high-tide drama on Wednesday, police, Water Authority men and anxious householders held their corporate breath as the rain-swollen waters of notorious Sankey Brook threatened a repeat of last winter's Warrington flood disaster.

But, as water began oozing over the banks of the Mersey tributary, the tide turned just after the "zero hour" of 1·0 p.m. and thousands of householders in waterlogged Warrington exhaled a deep sigh of relief.

In other parts of the town, however, torrential rain had already taken its toll. Although newly-sandbagged homes in Sankey Bridges escaped flooding, roads in upstream Dallam and Longford were blocked and some houses evacuated.

And the soggy picture was repeated in some of the remote rural areas on the outskirts of the town.

North West Water Authority workers struggled through the night to clear leaf-blocked drains so that excess water could run off flooded land.

Police monitored closely the steadily-rising water levels and precautionary flood warnings were given to householders in some flooding black-spots.

By Wednesday morning Hawley's Lane in Dallam, beneath the main Euston-Glasgow rail line, had been sealed off, and a handful of residents of nearby Tavin Avenue packed their bags and left.

Long suffering residents of Densham Avenue in neighbouring Longford — among the worst hit by the flood disaster a year ago this month — were yet again faced with deep flood water outside their homes.

But it was the high tide at Wednesday lunchtime that worried-looking officials feared could cause the most severe problems.

Slowly, the water-level in fiercely-flowing Sankey Brook rose as high tide approached.

But, with flood water seeping over the playing fields of Evelyn Street Primary School — the tide reached its peak and receded.

Warrington Borough

The contents of a water-bound house in Tavin Avenue, Dallam, are loaded into a waiting van. (Photo No. M1171/3)

Figure 170: Newspaper Article (estimated 1980's)

1980's

DENSHAM AVENUE SWAMPED AGAIN

NON-STOP torrential rain on Sunday and Monday caused [illegible] of Warrington and firemen were kept busy pumping out water in [illegible], homes and shops were sandbagged to keep out the [illegible].

Several roads were closed to traffic as swollen brooks and streams caused drains to back up and flood. And on Monday some people were too frightened to sleep in case water burst into their homes.

Most badly hit area was Densham Avenue in Longford, where the road looked more like a river and in parts water was more than 12 inches deep. Also hit was Hawley's Lane, Dallam, with floods caused by the overflow of Dallam Brook.

PUMPS OUT

Flood calls were also made from Culcheth, Burtonwood, Orford and other parts of Dallam and Great Sankey. Two Warrington factories were affected, Nestle Co. in Mill Lane, Winwick, and Redpath Dorman Long Ltd in Warrington, where the Fire Brigade were called to pump out water.

At Sankey Bridges — in the past one of the most notorious flooding areas in Warrington — residents were keeping their fingers crossed and a watchful eye on Sankey Brook.

But although the brook filled to street level and water flowed at high speeds, it did not flood. It proved a successful test of the £101,000 worth of flood prevention equipment which the NW Water Authority recently installed there.

It was in Densham Avenue though where most trouble was caused. Late on Monday, residents were rushing to move furniture and valuable items upstairs, in case their homes were flooded as happened two years ago. Several elderly people left their homes to stay with relatives.

Mr Stanley Green, of 2, Densham Avenue, said: "All the wallpaper and electrics were damaged and the walls are still damp from that flooding. We just hope it does not happen again."

Seventy - years - old Mrs [illegible]

was "annoyed" that the area was so prone to floods. He has five children and was worried for their safety if they went outside in the floods.

But for the youngsters themselves the floods proved a perfect playground during the half - term holidays. Several rode up and down the avenue on bikes, others paddled around in wellies or bare feet — and some even played with buckets.

One group indeed found a door near a disused house and used it as a raft.

A spokesman for the Borough Surveyor's department, said levels of some brooks in Warrington were much higher than in 1978 when there was extensive flooding in the town. He said flooding of homes at Sankey Bridges was prevented by the NWWA works.

"Work carried out to ensure the safety of Bewsey Bridge Pumping Stations since 1978, ensured the station continued working despite being completely surrounded by flood water," he said.

"Even with the extra pumps provided it was not possible to stop Densham Avenue flooding, but the water was kept down to a level that ensured no-one had to be evacuated."

He said that compared with other areas in the North West, flooding in Warrington was "not extensive." An emergency service was provided night and day by the council and protective measures ensured the effect on property was kept to the minimum.

Festival

Dutton Sunday School harvest festival was held in the Primary School when Mr L Rowland presided and speaker was Mr A. Stubbs. The lesson was read by Elizabeth Hargreaves, Karen Rutter and Janet Platt, and prayers were said by Kathryn Harvey, Tracey Threlfall, Michael Harvey, Rebecca Lewis and Julie Harvey. The pianist was Mrs A. Cope. Gifts of fruit and flowers were taken to Daresbury Hospital.

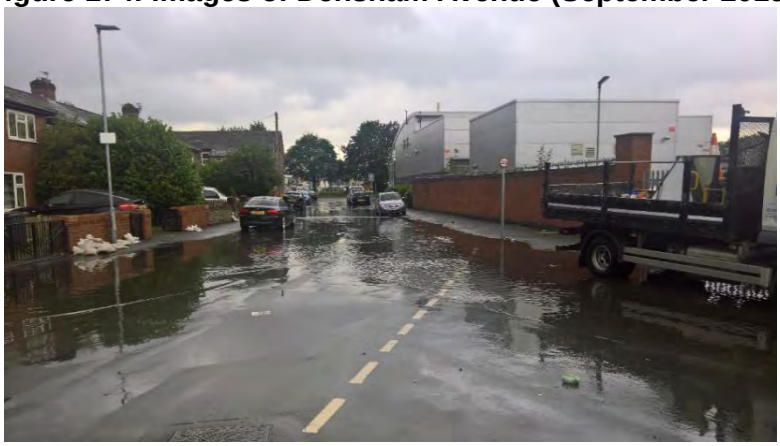
Billions Cec Mountford [illegible] almost 30 years ago, [illegible] played with Wigan and [illegible] signed schoolboy Parry [illegible] the New Zealand tourists [illegible] "Wire" so they met [illegible] match, which Warrington [illegible]

Figure 171: Images of Densham Avenue (2008)

Figure 172: Images of Densham Avenue (2012)

Figure 173: Images of Densham Avenue (2015)

Figure 174: Images of Densham Avenue (September 2019)

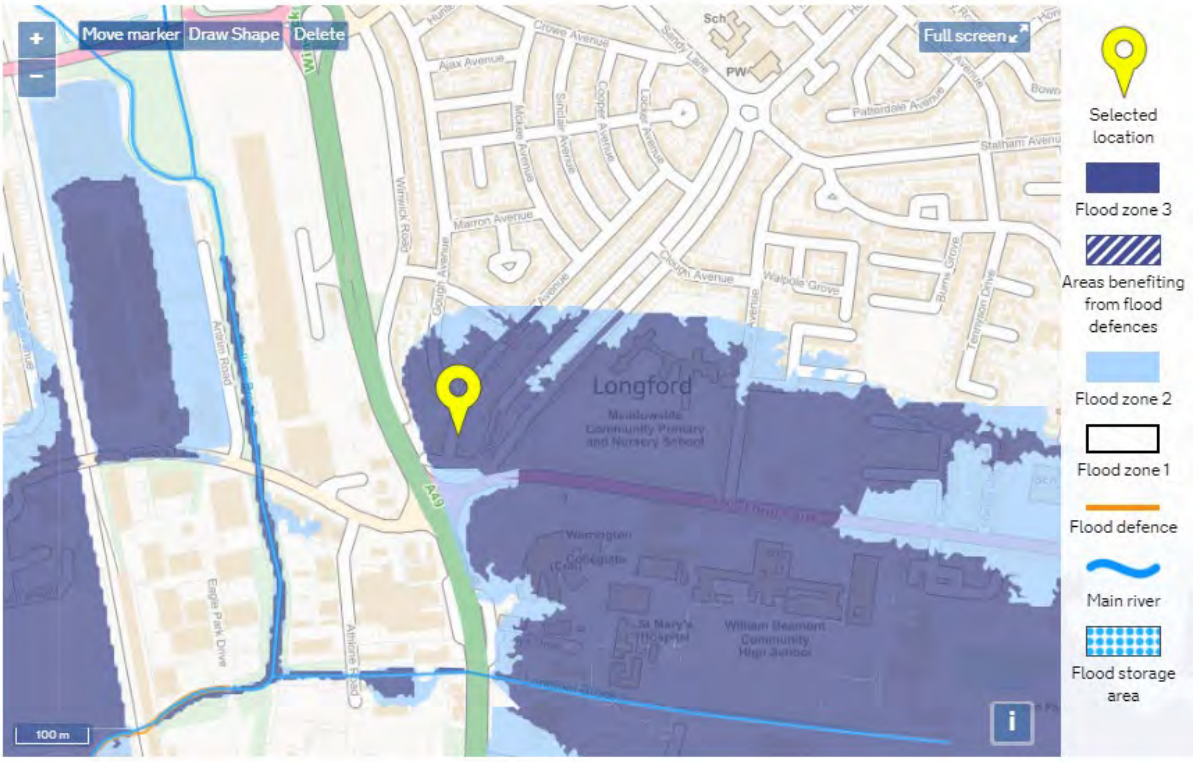


13.1.2 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Map for Planning shows the Longford area as being in 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."

Therefore this part of Longford is considered as having a high risk of flooding from rivers or the sea.

Figure 175: Flood Risk from Rivers or the Sea



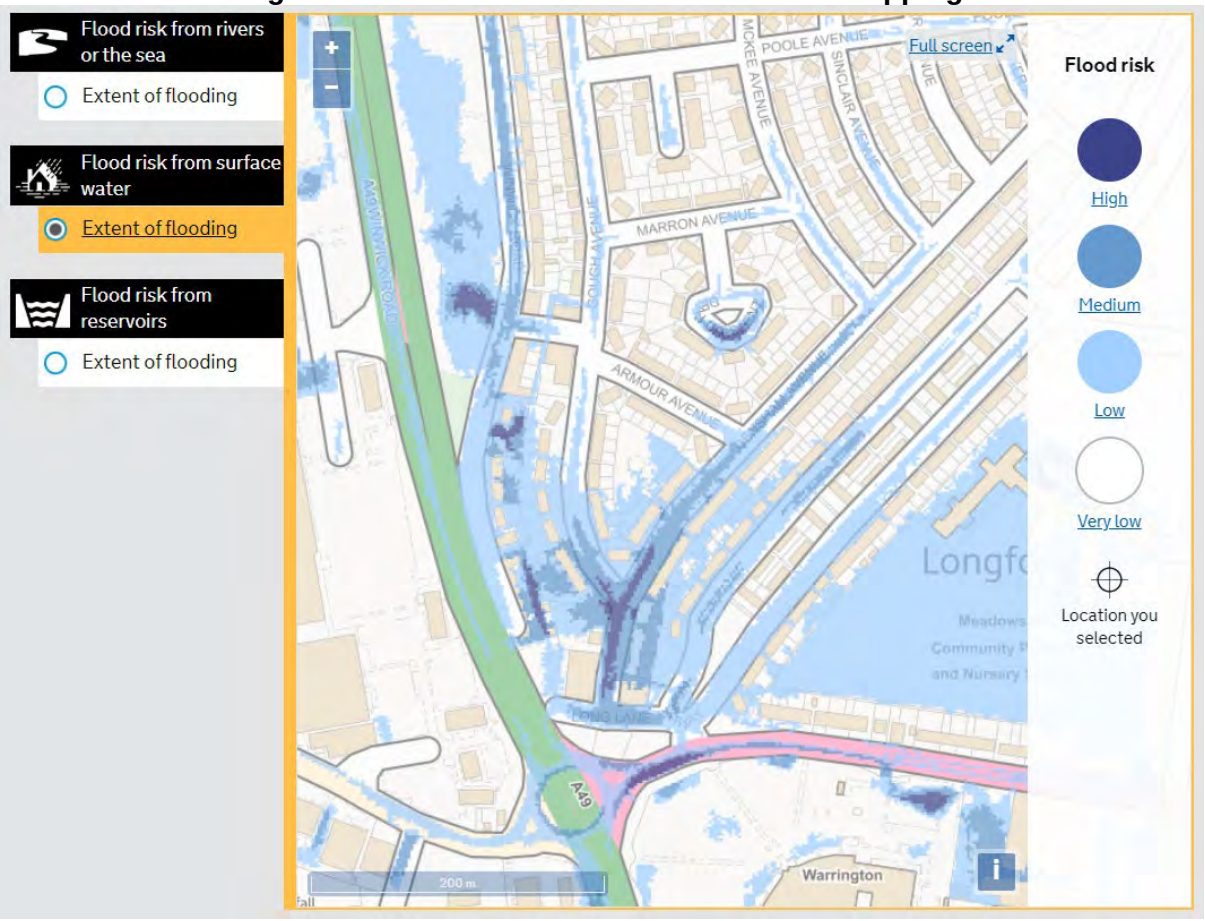
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

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 or 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, the Densham Avenue area is shown as being at risk of surface water flooding but differing in degrees of risk across the area. The carriageway at Densham Avenue itself is shown as at high risk. The Risk of Flooding from Surface Water Mapping is indicative of low lying areas or localised depressions in topography.

Figure 176: 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 Densham Avenue is not at risk of flooding from reservoirs.

13.1.3 Watercourse Level Information

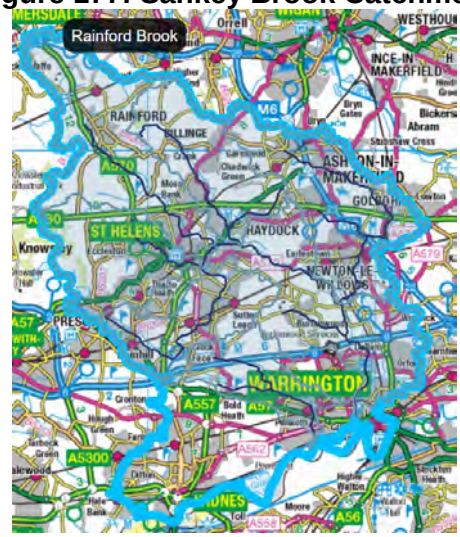
Two significant watercourses run near to the Longford area these are:

- Sankey Brook
- Dallam Brook (Tributary to Sankey Brook)

Both of the above watercourses are classified as ‘Main River’ meaning that they are under the regulatory control of the Environment Agency.

The Sankey Catchment covers approximately 179km^2 and has 126km of Main River flowing, generally in a west to east orientation, through a mixture of open agricultural land and urban settlements. The Sankey Brook originates at the confluence of Sutton and Hardshaw Brooks in St Helens and flows into the River Mersey at Sankey Bridges in Warrington.

Figure 177: Sankey Brook Catchment



Source: Environment Agency

The nearest watercourse telemetry station to the affected area is located on Sankey Brook at Higham Avenue (approximately 950m west of Longford).

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

At the time of writing this report, the fluvial return periods were unavailable from Environment Agency. This information is still awaited and production is ongoing. Consultants JBA have been appointed by Environment Agency to determine the fluvial return period for this and other flood events.

However, Environment Agency estimate the return period to be in the order of 1% or greater based on flood extents from their flood maps.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

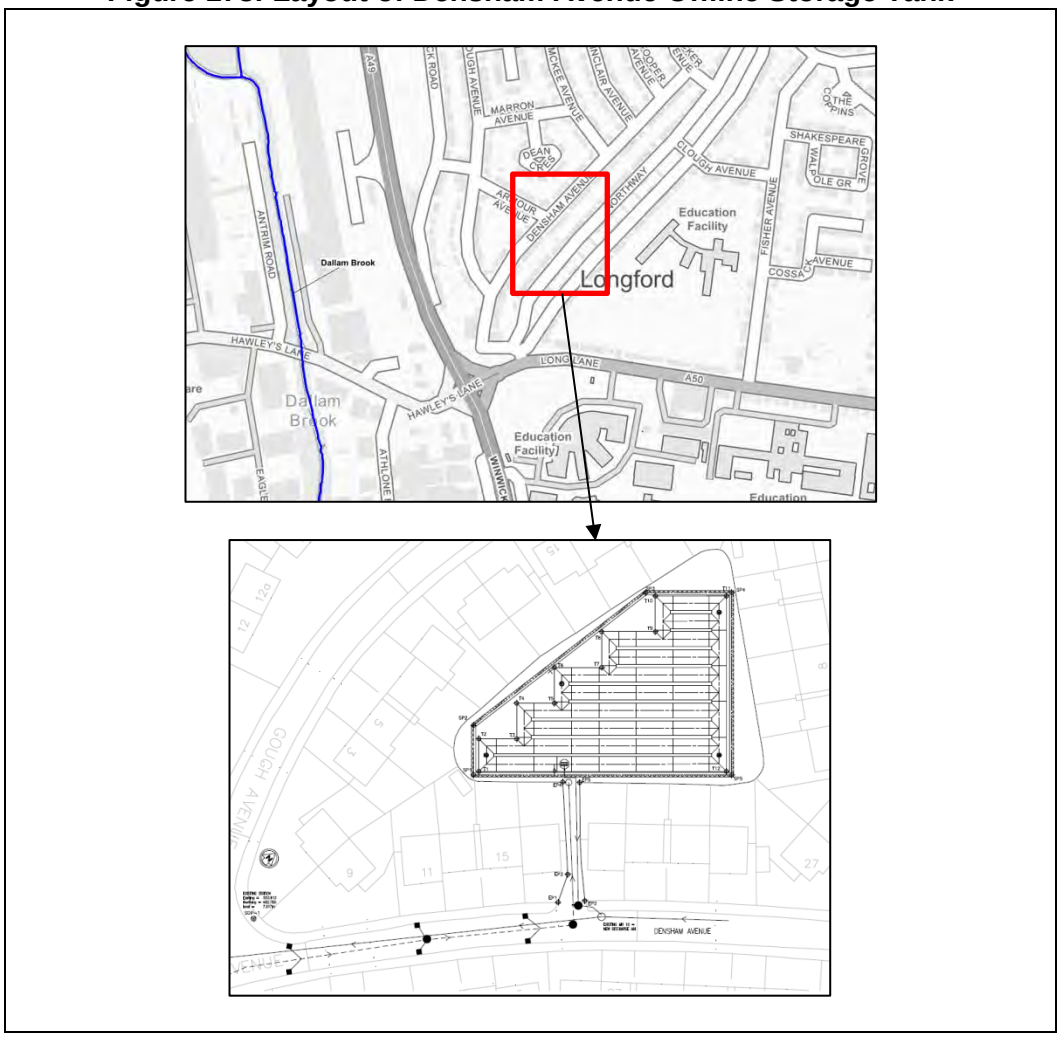
Tributary watercourses including Dallam Brook will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded

13.1.4 Previous Works

In July 2012, Warrington Borough Council installed an offline storage tank at Densham Avenue Park (2,000m^3 storage volume) to help reduce the risk of flooding to adjacent residential properties via the removal of excess surface water from the highway in the vicinity of Gough

Avenue / Densham Avenue (surface water flows intercepted via additional highway drainage as part of the scheme).

Figure 178: Layout of Densham Avenue Offline Storage Tank



Once flows in the 375mm diameter UU surface water system along Densham Avenue have subsided to a pre-determined level the storage tank is emptied via a pump operating on duty / standby basis (20l/s) to this system.

The scheme was designed to provide protection to 135 residential properties at a total cost of £765k.

During the flood events in 2012, 2015 and 2019 the tanks were full to capacity.

13.1.5 Previous S19 Investigation – July 2019

Following previous flood events, Warrington Borough Council completed extensive investigation into the cause of the flooding to Orford Flood Cluster A – Longford. The outcome of this investigation is summarised below:

Watercourse Level Information

The nearest watercourse telemetry station to Densham Avenue is located on Sankey Brook at Higham Avenue (approximately 950m to the west of Densham Avenue).

Watercourse level data was obtained from Environment Agency for the July 2019 flood event show the maximum level reached during the event was 3.008m at 11:15am on 31 July 2019.

Telemetry data was obtained from the storage tank at Densham Avenue, the data when compared to the river level data appears to show a correlation between watercourse levels and tank level indicating that the tank and nearby watercourses are directly linked.

Figure 179: Densham Avenue Tank Telemetry Data between 28 July 2019 and 02 August 2019

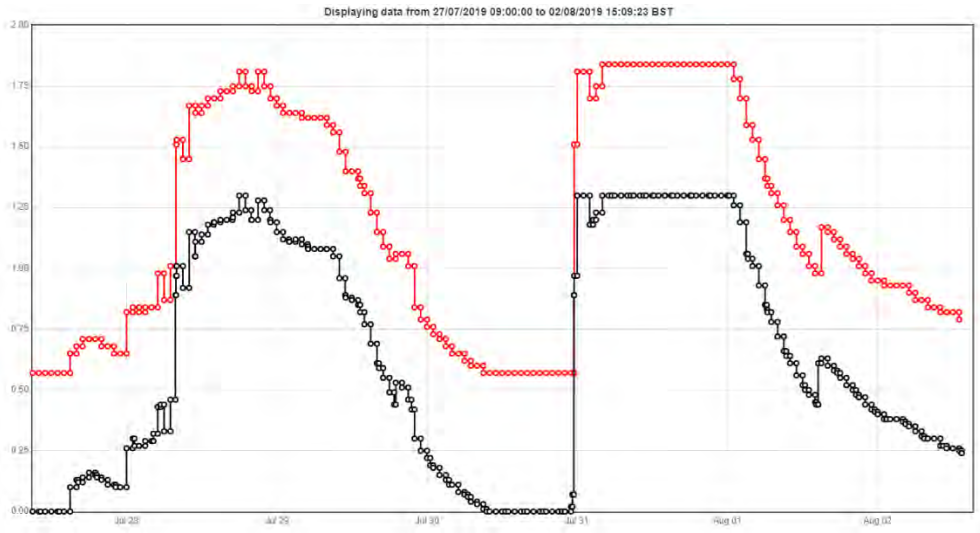
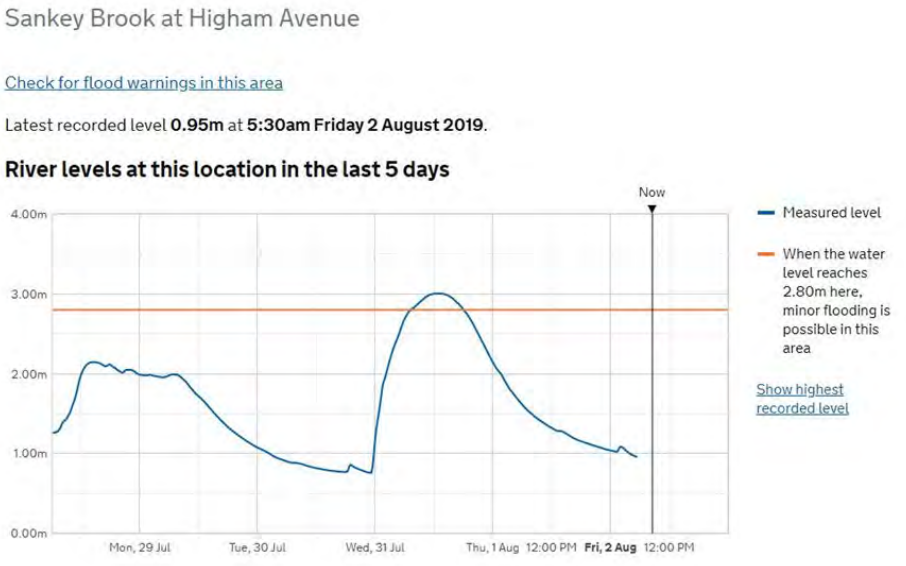


Figure 180: Environment Agency River Level Data for Sankey Brook at Higham Avenue between 29 July 2019 and 02 August 2019



Problem

The invert level of the public surface water sewer outfall which serves the Densham Avenue area is below the bed of Dallam Brook. The soffit of the public surface water sewer outfall drainage system is lower than the normal low water level of Dallam Brook (See Figure 181 below).

As a result, the outfall from the public surface water sewer is approx. 95% obstructed at low brook level. When Dallam Brook water level increases by approx. 300mm, the public surface water sewer is completely submerged and is not able to discharge into the brook.

As water levels continue to rise, water from Dallam Brook will start to flow from the brook into the public surface water sewer and the drainage system will start to surcharge via all gullies and chambers leading as far back as Densham Avenue etc. The attenuation tank at Densham Avenue begins to fill preventing flood water from showing on the surface.

After approximately 6 hours, the tanks will be full. Flood water from Dallam Brook will then surcharge the road gullies in Densham Avenue onto the road. Any additional rainfall in the urban catchment will not be able to enter the system and will flow overland.

Flood water from Dallam Brook will continue to flow into the surface water drainage system increasing flooding to properties and roads including Densham Avenue, Gough Avenue, Winwick Road, Long Lane and Northway properties.

Water levels will continue to increase until the tide / Sankey Brook watercourse levels reduce allowing Dallam Brook water levels to recede and the surface water system to discharge.

When water backflows into the Public sewer, a significant volume of silt is carried with the water which requires more frequent maintenance to undertake drain cleaning and gully emptying.

The above scenario has been confirmed by modelling undertaken by United Utilities and Jacobs Engineering.

Figure 181: Survey of Outfall Chamber to Dallam Brook

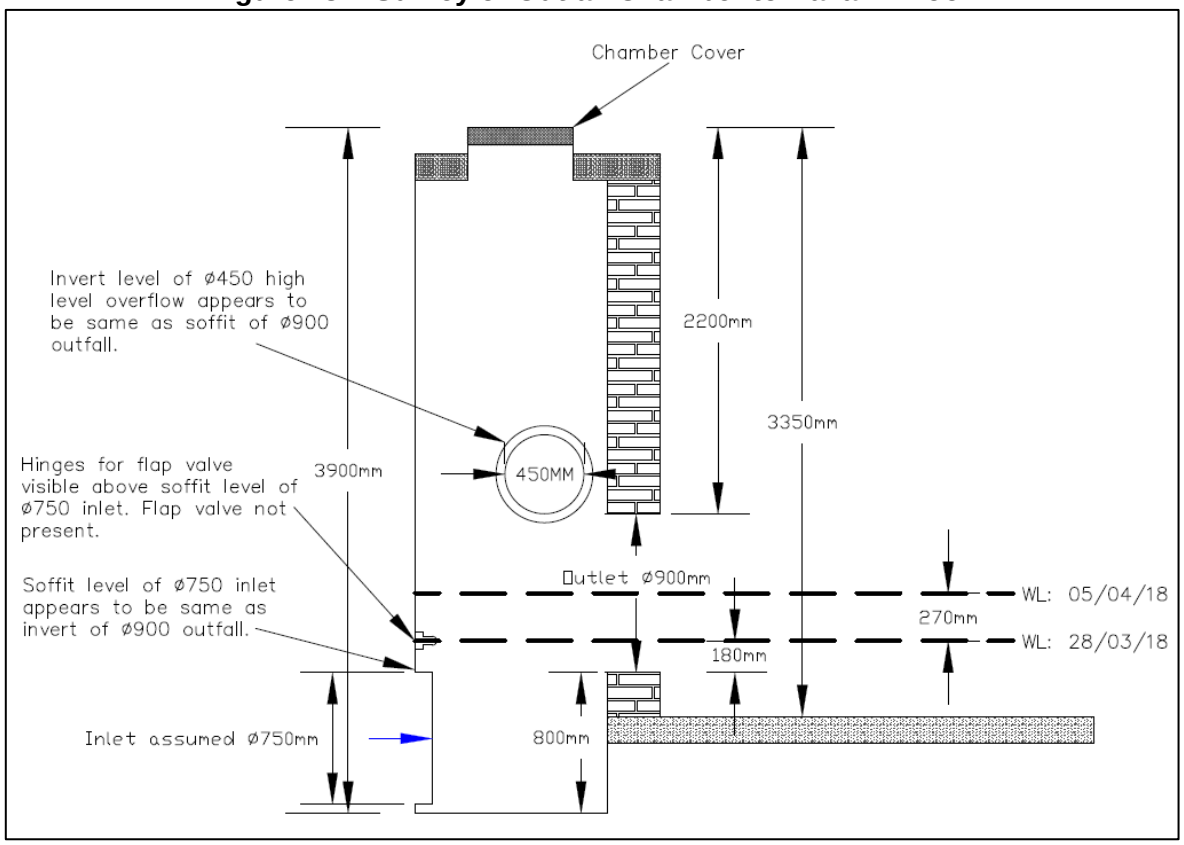


Figure 182: Image of Inside Outfall Chamber to Dallam Brook

The reasoning for the outfall and system design is unknown, however a review of the topography illustrates there is a significant low spot at Densham Avenue. Densham Avenue is lower than the top of bank at the outfall into Dallam Brook.

Figure 183: Long section illustrating low point in vicinity of Densham Avenue

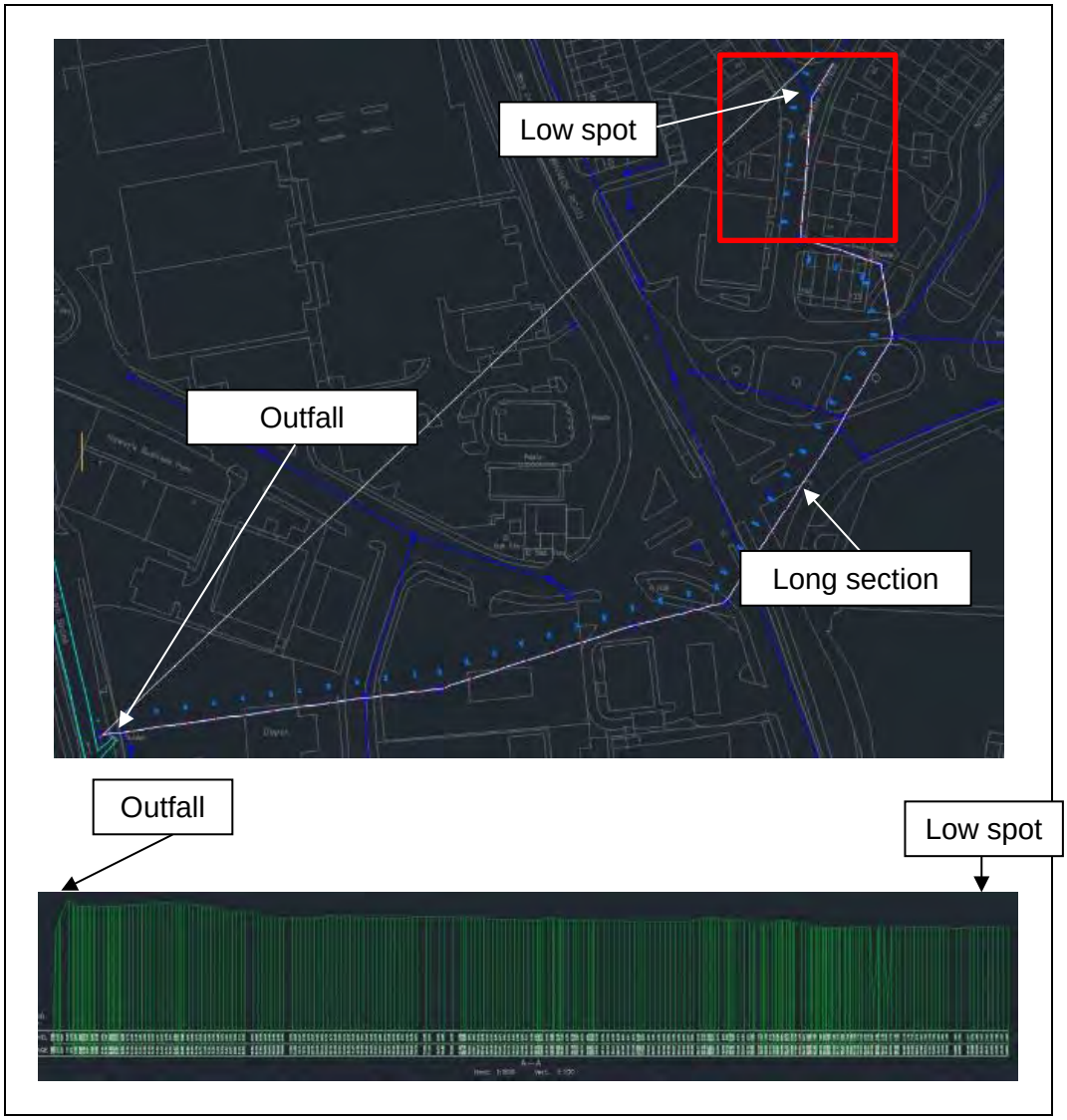
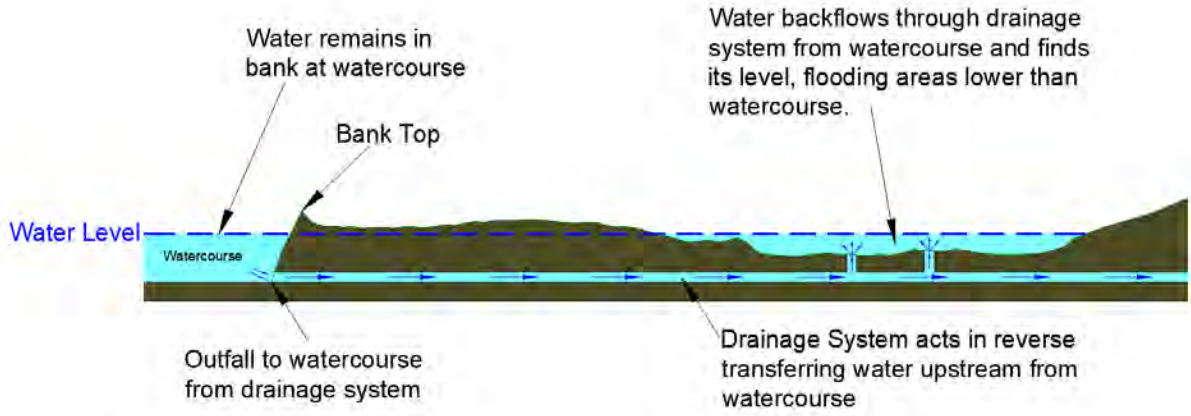


Figure 184: Diagram of backflow situation



13.1.6 Flooding Mechanism Conclusion & Risk Management Authority

It is the opinion of Warrington Borough Council that the configuration of the existing public surface water system outfall to Dallam Brook is the main issue resulting in flooding upstream at Densham Avenue.

The existing outfall arrangement results in the following:

- Existing large diameter outfall is severely obstructed even at times of minimal water levels in Dallam Brook resulting in extremely restricted discharge rates.
- The drainage system is permanently surcharged resulting in lack of storage capacity in the large diameter system.
- As water levels increase in the watercourse, it is not possible for the drainage system to discharge.
- When water levels in the brook increase to approx. 300mm, water begins to backflow up the public surface water sewer.
- Further increases in water levels in the brook will result in further backflow up the public sewer from Dallam Brook carrying silt along with it.
- As water back flows up the public sewer, this will result in surcharged public surface water drainage systems in Densham Ave and surrounding area.
- Dallam Brook remains in bank when flooding occurs at Densham Avenue (Densham Avenue is lower than the top of bank at the outfall into Dallam Brook) due to the water back flowing up the drainage system (The drainage system is acting as a conduit for fluvial flooding).

Based on the information set out above, it appears that the primary flood mechanism was:

1) High water levels within Dallam Brook caused water to backflow up the public sewer.
2) Backflow from the brook competed with discharging waters in the public sewer resulting in surcharging sewers.

On this basis, it is the opinion of Warrington Borough Council that both United Utilities and Environment Agency have relevant flood risk management functions in this respect and are the appropriate risk management authorities for managing this flood risk issue going forward.

13.1.7 Scheme in Construction

During Storm Christoph, a collaborative project involving Warrington Borough Council, United Utilities and Environment Agency was underway to demolish the existing surface water outfall structure to Dallam Brook for the drainage system which serves the Longford area.

The outfall structure was replaced with a 7m deep pump station chamber and installation of three pumps to increase efficiency of the drainage system and prevent backflow from Dallam Brook along the drainage system. The pumps will assist the discharge of surface water into Dallam Brook when water levels in the brook are high.

Construction of the pump station was complete in March 2021.

Figure 185: Images of Completed Pump Station (March 2021)

13.1.8 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding following completion of pump station.

13.2 Orford Flood Cluster B – Area to the east of Hallfields Road

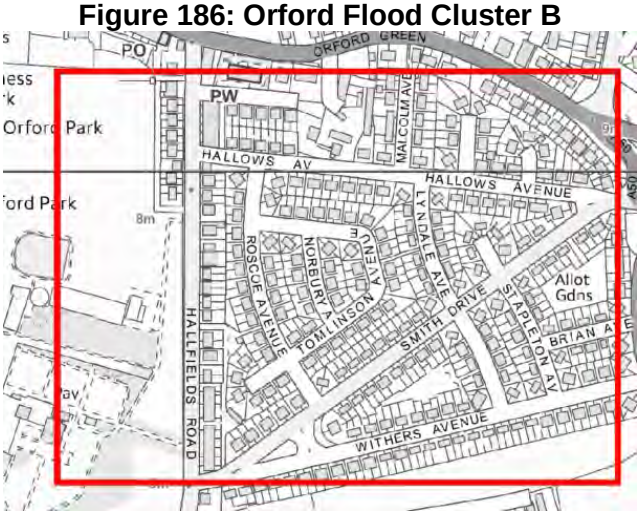
A summary of flooding to Orford Flood Cluster B is provided in Table 13.3 below.

Table 13.3: Flooded Properties Summary – Orford Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
HALLOWS AVENUE		1
NORBURY AVENUE		15
ROSCOE AVENUE		31
SMITH DRIVE		33
TOMLINSON AVENUE		43
Grand Total		**123**

Orford Flood Cluster B – Area to the east of Hallfields Road is a predominantly residential area located in Orford ward within the administrative area of Warrington Borough Council. It is approximately 1.4 miles to the north of Warrington town centre.

Figure 186: Orford Flood Cluster B



13.2.1 Flood History

The Engineering and Flood Risk Team is aware of flooding on numerous occasions to this area.

The following extract is from correspondence dated October 2008 between United Utilities and Helen Jones (MP for Warrington North at the date of correspondence) in respect of a flood event which occurred on 5th / 6th September the following was noted:

Figure 187: Extract from UU Letter dated October 2008

With regards to Tomlinson Avenue, this is connected to a combined sewer system that does not connect directly to the river system. However, during times of very heavy rainfall we do have overflows that allow the excess water to spill to watercourse. In this case our overflows were under water, due to high river levels, and could not function in the intended way.

The following extract is from correspondence dated 23 December 2010 between United Utilities and Helen Jones (MP for Warrington North at the date of correspondence) in respect of a flood event to Roscoe Avenue which occurred on 3rd October 2010 the following was noted:

Figure 188: Extract from UU Letter dated 23 December 2010

[redacted] **Roscoe Avenue, Orford, WA2 8DY**

Thank you for your letter dated 7 December 2010 addressed to our Chief Executive Mr [redacted] on behalf of your constituent [redacted] I have been asked to reply on this occasion as Mr [redacted] is currently away from the office. I am sorry to hear of the issues [redacted] has experienced with wastewater flooding at his property.

Please allow me to update you on the current situation with our pumping station. Bewsey Bridges Wastewater Pumping Station is located just off Lodge Lane, Bewsey on a parcel of land in between the St Helens Canal and Sankey Brook. It pumps flows to Warrington North Wastewater Treatment Works for full treatment and safe return to the environment. The station operates under consent from the Environment Agency and manages to meet this consent due to significant operational expenditure and manual intervention. A recent improvement on site to upgrade the control panels and operating system has provided better control and operation of the station.

However, the station is poorly designed and we have recognised the need to replace it. We are currently working on a solution which is at design stage at present and we will be spending just under £10 million to replace this station. The anticipated start date for this project is Autumn 2011 with construction taking around 12-15 months to complete. Once completed this new pumping station will provide a robust solution for years to come and has the approval of the Environment Agency.

13.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the Orford Flood Cluster B area.

The area is shown as being served by public combined sewers. These combined sewers flow to Bewsey Bridge Pumping Station (A United Utilities Asset).

Figure 189: Extract from United Utilities Statutory Sewer Map

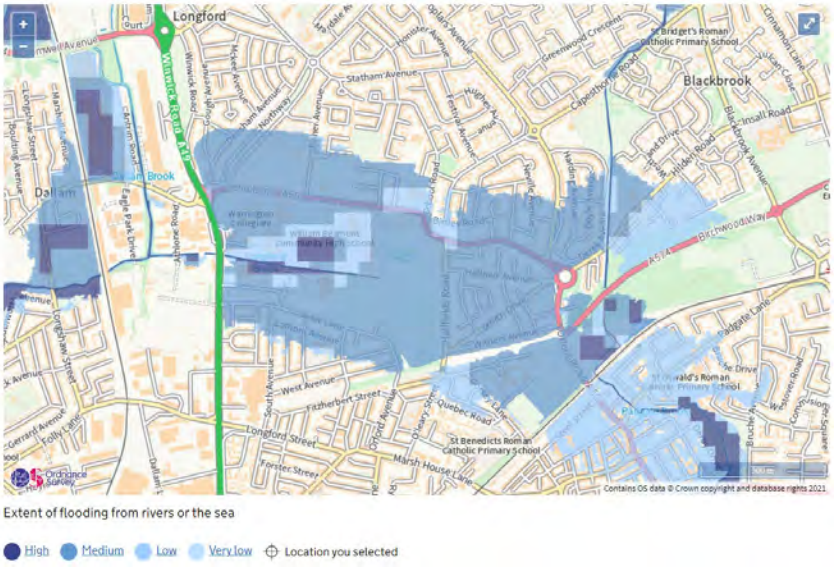
13.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map for Orford Flood Cluster B shows the area is generally at medium risk of flooding from rivers or the sea.

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

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 190: Flood Risk from Rivers and the Sea Mapping



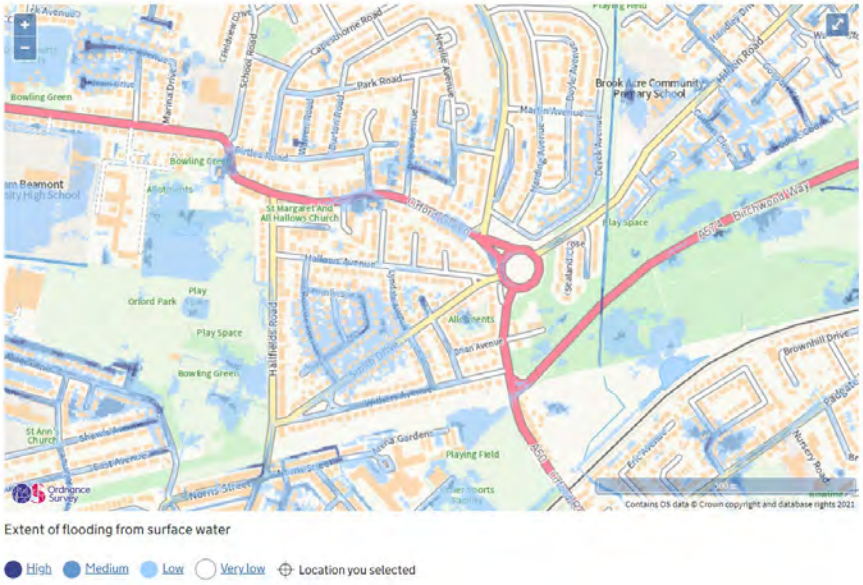
Surface Water Long Term Flood Risk
Whilst the management of surface water falls under the remit of Warrington Borough Council as the LLFA, the Environment Agency has produced the national Updated Flood Map for Surface Water (UFMfSW) in its Strategic Overview role in flood risk management. This

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties in Orford Flood Cluster B are shown at varying levels of risk of surface water flooding. Generally the level of risk is higher to the carriageways than to residential properties.

Figure 191: 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 Orford Flood Cluster B is not within the maximum extent of flooding from reservoirs.

13.2.4 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Orford Flood Cluster B that the primary flood mechanism was most likely sewer flooding.

On this basis, it is the opinion of Warrington Borough Council that United Utilities has relevant flood risk management functions in this respect and are the appropriate risk management authority for managing this flood risk issue going forward.

13.2.5 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with United Utilities at future meetings to determine solutions and timescales where possible.

14 Penketh Flood Cluster

Flooding to 4 properties occurred in this cluster as set out in Table 14.1 below:

Table 14.1: Flooded Properties Summary – Penketh Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
FARNWORTH ROAD	3	
STANSTEAD AVENUE		1
Grand Total	**3**	**1**

Following a review of the flooding information, Penketh Flood Cluster has been split into two separate clusters based on flood mechanism / spatial separation as follows:

- Penketh Flood Cluster A – Farnworth Road
- Penketh Flood Cluster B – Stanstead Avenue

14.1 Penketh Flood Cluster A – Farnworth Road

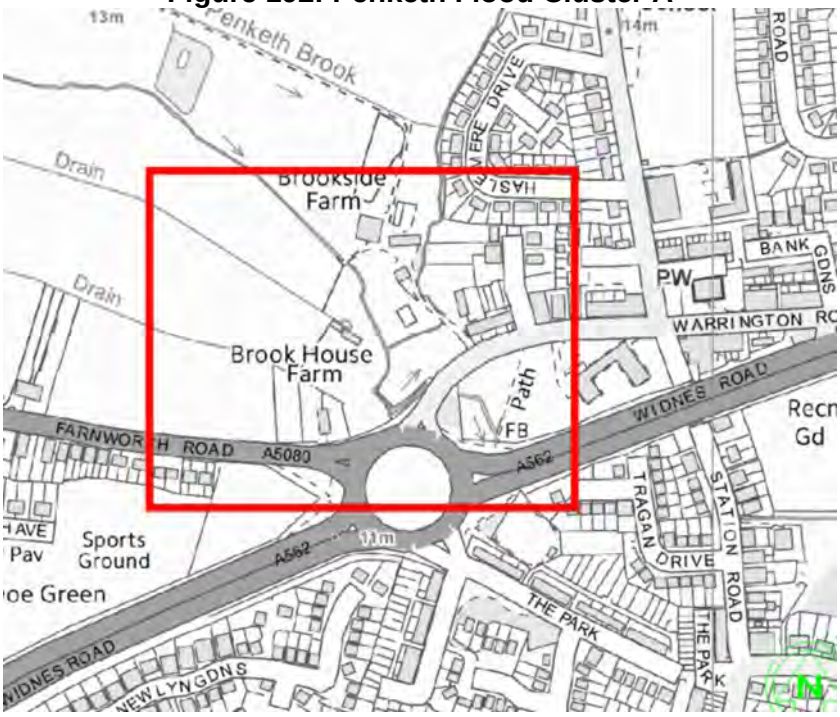
A summary of flooding to Penketh Flood Cluster A is provided in Table 14.2 below.

Table 14.2: Flooded Properties Summary – Penketh Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
FARNWORTH ROAD	3	
Grand Total	**3**	

Penketh Flood Cluster A – Farnworth Road is a predominantly residential area located in Penketh & Cuerdley ward within the administrative area of Warrington Borough Council. It is approximately 3 miles to the west of Warrington town centre.

Figure 192: Penketh Flood Cluster A



14.1.1 Flood History

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

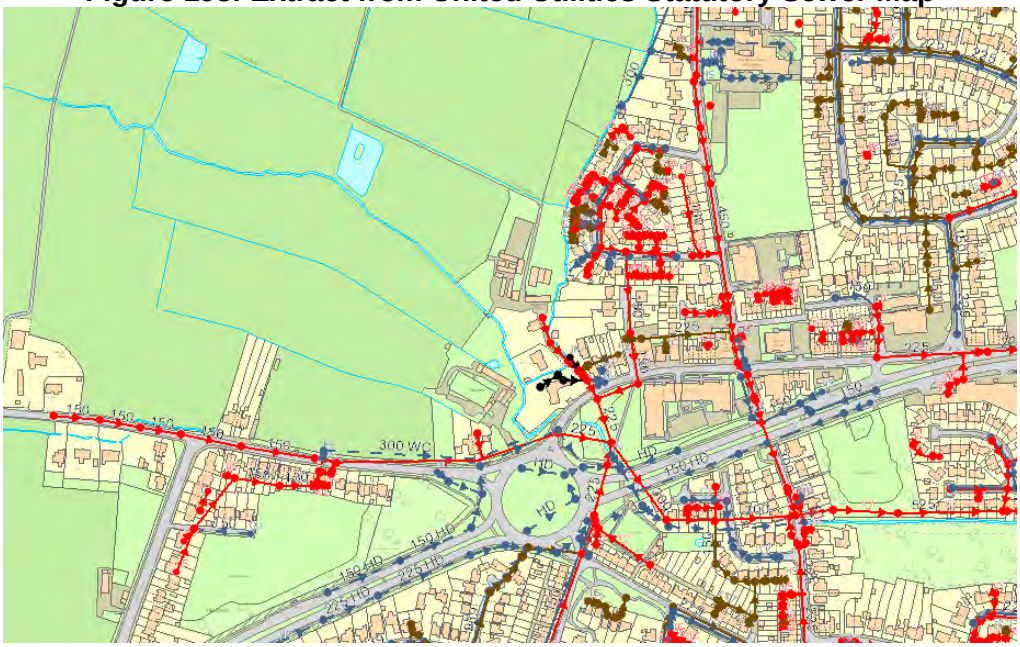
14.1.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Penketh Flood Cluster A area.

The public sewers serving the area are predominantly combined sewers.

The A5080 Farnworth Road and A562 Widnes Road are shown as being served by a series of highway drains which discharge to Penketh Brook. It is likely that the outfalls for the highway drainage system would have experienced hydraulic restriction due to raised watercourse levels following the significant amount of rainfall, therefore affecting the performance of the systems.

Figure 193: Extract from United Utilities Statutory Sewer Map



14.1.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows that Farnworth Road in the vicinity of the roundabout is at high risk of flooding from flooding from rivers or the sea. Other properties further north are shown as being at low risk. The flood risk appears to be associated with Penketh Brook which is classified as ‘main river’ and therefore under the regulatory powers of Environment Agency.

Barrow Green Brook appears to join Penketh Brook directly north of the roundabout. Barrow Green Brook is also classified as ‘main river’. The flood risk appears highest at the confluence of these two watercourses.

The flood risk for Barrow Green Brook doesn’t appear to be mapped.

High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Figure 194: Flood Risk from Rivers or the Sea Mapping

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on directly north of the roundabout at Farnworth Road are generally shown as being either at high risk of surface water flooding.

Significant flow paths are visible which appear to represent Barrow Green Brook and Penketh Brook.

A lesser flow path flowing north to south along the rear of properties on Haslemere Drive is visible which may be associated with a smaller watercourse. This watercourse is classified as 'Ordinary Watercourse' and therefore is under the regulatory powers of Warrington Borough Council as Lead Local Flood Authority.

Figure 195: 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 Penketh Flood Cluster A is not within the maximum extent of flooding from reservoirs.

14.1.4 Watercourse Level Information
Penketh Brook which runs near to the area affected by properties

Warrington Borough Council is not aware of the presence of a river gauging station on Penketh Brook.

Given the amount of rainfall received during Storm Christoph, it is likely that 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.

14.1.5 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is the opinion of Warrington Borough Council in respect of Penketh Flood Cluster A that the primary flood mechanism was water overtopping the banks of Penketh Brook.

On this basis, it is the opinion of Warrington Borough Council that Environment Agency has relevant flood risk management functions in respect to Penketh Flood Cluster A and are the appropriate risk management authority for managing this flood risk issue going forward.

14.1.6 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.

- Provide a copy of this Section 19 Report to Environment Agency as notification that Warrington Borough Council considers Environment Agency to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with Environment Agency at future meetings to determine solutions and timescales where possible.

14.2 Penketh Flood Cluster B – Stanstead Avenue

A summary of flooding to Penketh Flood Cluster B is provided in Table 14.3 below.

Table 14.3: Flooded Properties Summary – Penketh Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
STANSTEAD AVENUE		1
Grand Total		**1**

Penketh Flood Cluster B – Stanstead Avenue is a predominantly residential area located in Penketh & Cuerdley ward within the administrative area of Warrington Borough Council. It is approximately 2 miles to the west of Warrington town centre.

Figure 196: Penketh Flood Cluster B

14.2.1 Flood History

The Engineering and Flood Risk Team is aware of historical flooding issues in the Stanstead Avenue area. A Surface Water Management Plan undertaken in 2009 which covered the Manston Road area which includes Stanstead Avenue. The plan highlighted a high concentration of sewer flooding incidents and it is understood that UU undertook works in this area to alleviate the sewer flooding issues.

14.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the Penketh Flood Cluster B – Stanstead Avenue area.

The public sewers serving the area are a combination of combined and surface water public sewers.

Of note is the presence of a 450mm diameter surface water sewer which runs to the rear of properties on Stanstead Close and Thorn Close. This system discharges to Whittle Brook.

Figure 197: Extract from United Utilities Statutory Sewer Map

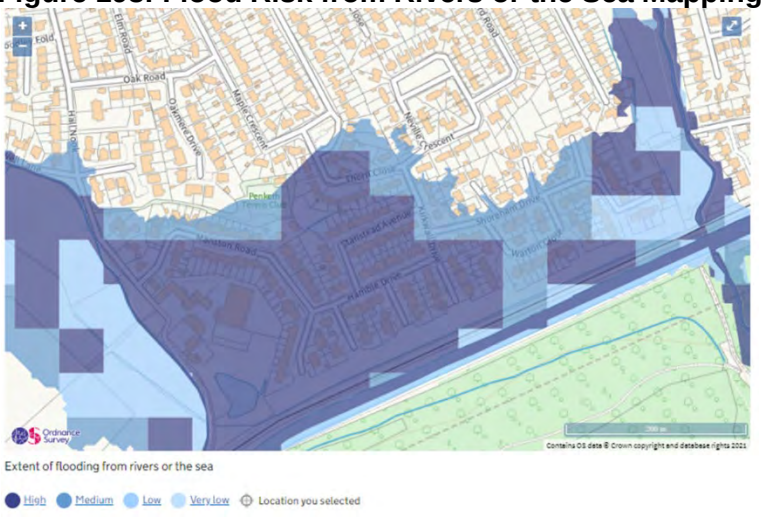
14.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows Stanstead Avenue as being at high risk of flooding from flooding from rivers or the sea. The flood risk appears to be associated with Penketh Brook which is classified as 'main river' and therefore under the regulatory powers of Environment Agency.

High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

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 198: Flood Risk from Rivers 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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

There appears to be varying levels of surface water risk to properties in this area with several pockets of high risk present which may represent localised depressions in topography. The properties are generally shown as being at either medium or low risk of surface water flooding.

Figure 199: 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 Penketh Flood Cluster B is not within the maximum extent of flooding from reservoirs.

14.2.4 Watercourse Level Information
Penketh Brook which runs near to the area affected by properties

Warrington Borough Council is not aware of the presence of a river gauging station on Penketh Brook.

Given the amount of rainfall received during Storm Christoph, it is likely that 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.

14.2.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is not possible to state the most likely cause of flooding to Penketh Flood Cluster B.

14.2.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

15 Poulton with Fearnhead Flood Cluster

Flooding to 5 properties occurred in this cluster as set out in Table 15.1 below:

Table 15.1: Flooded Properties Summary – Poulton with Fearnhead Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
HILDEN ROAD		1
PASTURE LANE		2
WESTDALE ROAD		2
Grand Total		**5**

Following a review of the flooding information, Poulton with Fearnhead Flood Cluster has been split into three separate clusters based on flood mechanism / spatial separation as follows:

- Poulton with Fearnhead Flood Cluster A – Westdale Road
- Poulton with Fearnhead Flood Cluster B – Pasture Lane
- Poulton with Fearnhead Flood Cluster C – Hilden Road

15.1 Poulton with Fearnhead Flood Cluster A – Westdale Road

A summary of flooding to Poulton with Fearnhead Flood Cluster A – Westdale Road is provided in Table 15.2 below.

Table 15.2: Flooded Properties Summary – Poulton with Fearnhead Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
WESTDALE ROAD		2
Grand Total		**2**

Poulton with Fearnhead Flood Cluster A – Westdale Road is a predominantly residential area located in Poulton South ward within the administrative area of Warrington Borough Council. It is approximately 2 miles north east of Warrington town centre.

Figure 200: Poulton with Fearnhead Flood Cluster A

15.1.1 Flood History

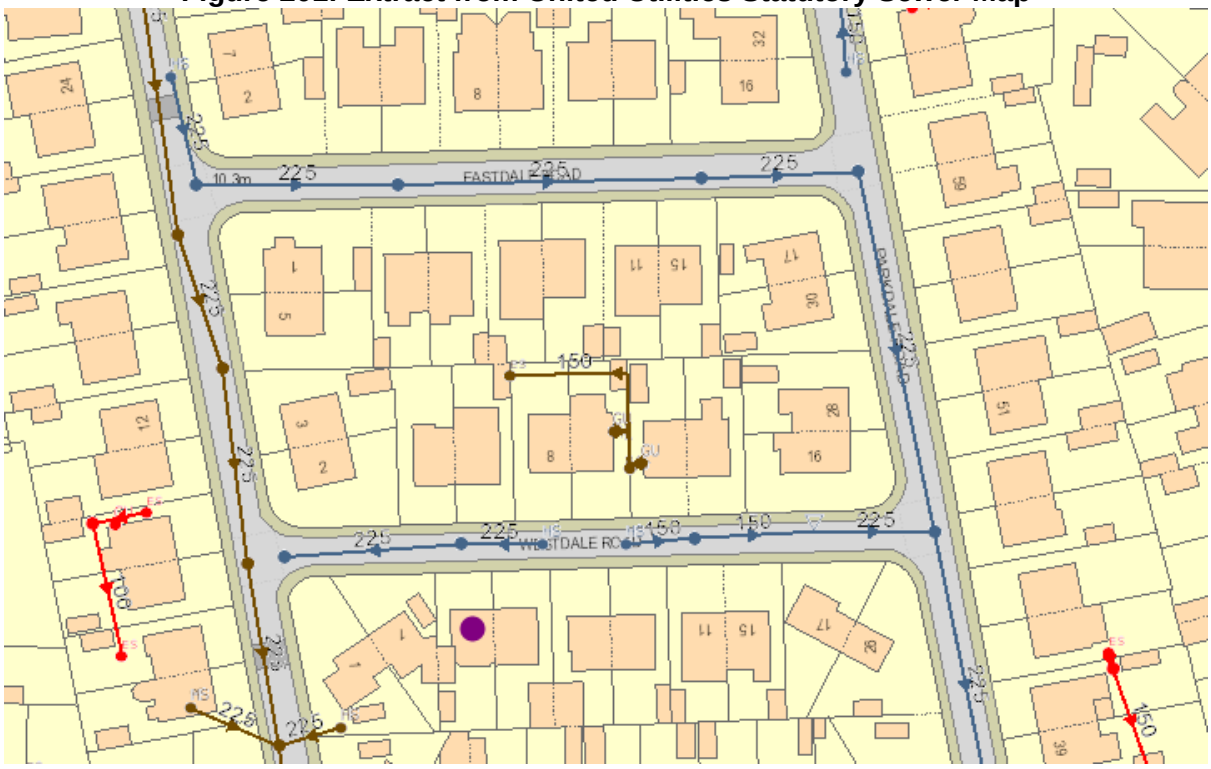
The Engineering and Flood Risk Team has no records of any historic flooding at Westdale Road but that is not to say flooding has not occurred.

15.1.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Poulton with Fearnhead Flood Cluster A – Westdale Road area.

The area appears to be served by a combination of foul and surface water public sewers. United Utilities records for the area appear incomplete.

Figure 201: Extract from United Utilities Statutory Sewer Map



15.1.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows that Westdale Road is not at risk 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.

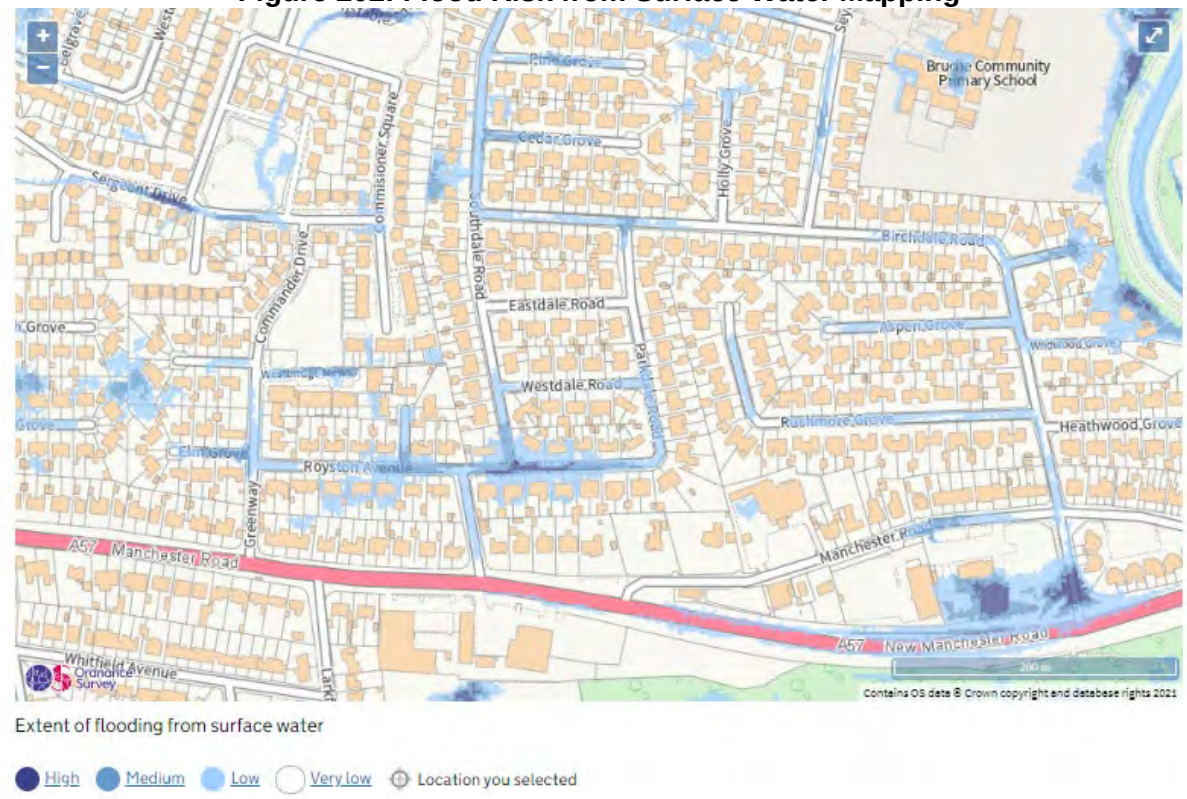
Surface Water Long Term Flood Risk

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

Properties on Westdale Road appear to be at very low risk of flooding from surface water. The carriageway at either end of Westdale Road appears to be at low risk of flooding.

Figure 202: 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 Poulton and Fearnhead Flood Cluster A is not within the maximum extent of flooding from reservoirs.

15.1.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to Poulton and Fearnhead Flood Cluster A.

15.1.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

15.2 Poulton with Fearnhead Flood Cluster B – Pasture Lane
A summary of flooding to Poulton with Fearnhead Flood Cluster B – Pasture Lane is provided in Table 15.3 below.

Table 15.3: Flooded Properties Summary – Poulton with Fearnhead Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
PASTURE LANE		2
Grand Total		**2**

Poulton with Fearnhead Flood Cluster B – Pasture Lane is a predominantly residential area located in Poulton North ward within the administrative area of Warrington Borough Council. It is approximately 2.5 miles north east of Warrington town centre.

Figure 203: Poulton with Fearnhead Flood Cluster B

15.2.1 Flood History

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

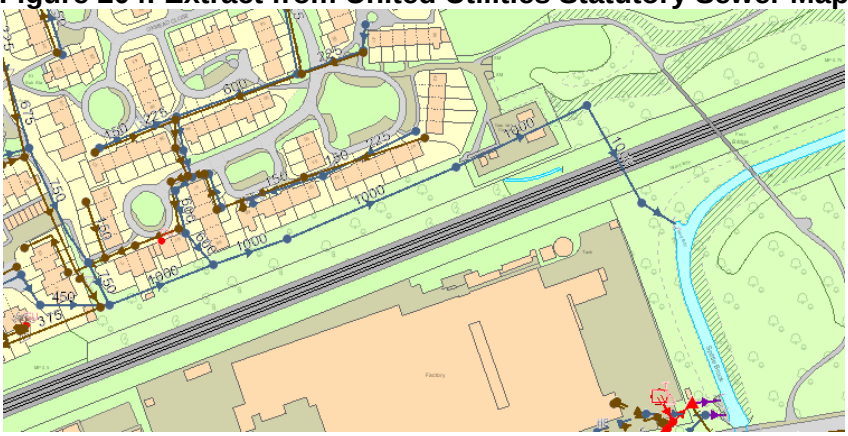
15.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing Poulton with Fearnhead Flood Cluster B – Pasture Lane area.

The area appears to be served by a combination of foul and surface water public sewers.

A significant large diameter surface water sewer (1m diameter) is shown running to the rear of properties on Pasture Lane which appears to pass under the railway line before discharging to Spittle Brook. A 600mm diameter surface water sewer appears to pass between 67 and 65 Pasture Lane which connects to the large diameter surface water sewer which runs to the rear of the properties.

Figure 204: Extract from United Utilities Statutory Sewer Map



15.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows that Pasture Lane is not at risk of flooding from rivers or the Sea.

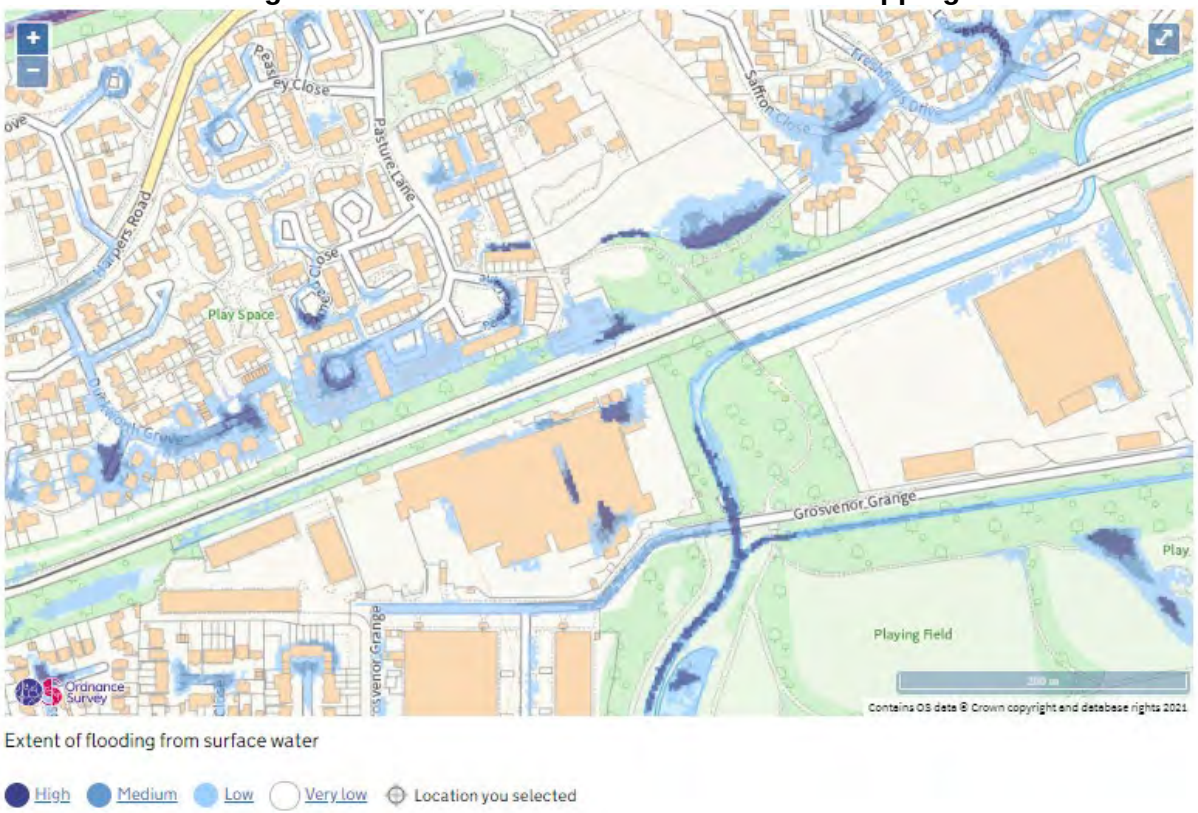
Note: The Environment Agency Flood Map for Planning does not show the risk of flooding from watercourses with a catchment area of less than 3km^2 and does not provide information on flood depth, speed or volume of flow.

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

There are pockets of surface water flood risk at the southern end of pasture with the carriageway shown as being at high risk of flooding but the properties generally shown as low risk.

Figure 205: 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 Poulton and Fearnhead Flood Cluster B is not within the maximum extent of flooding from reservoirs.

15.2.4 Watercourse Level Information
The nearest significant watercourses to Pasture Lane is Spittle Brook.

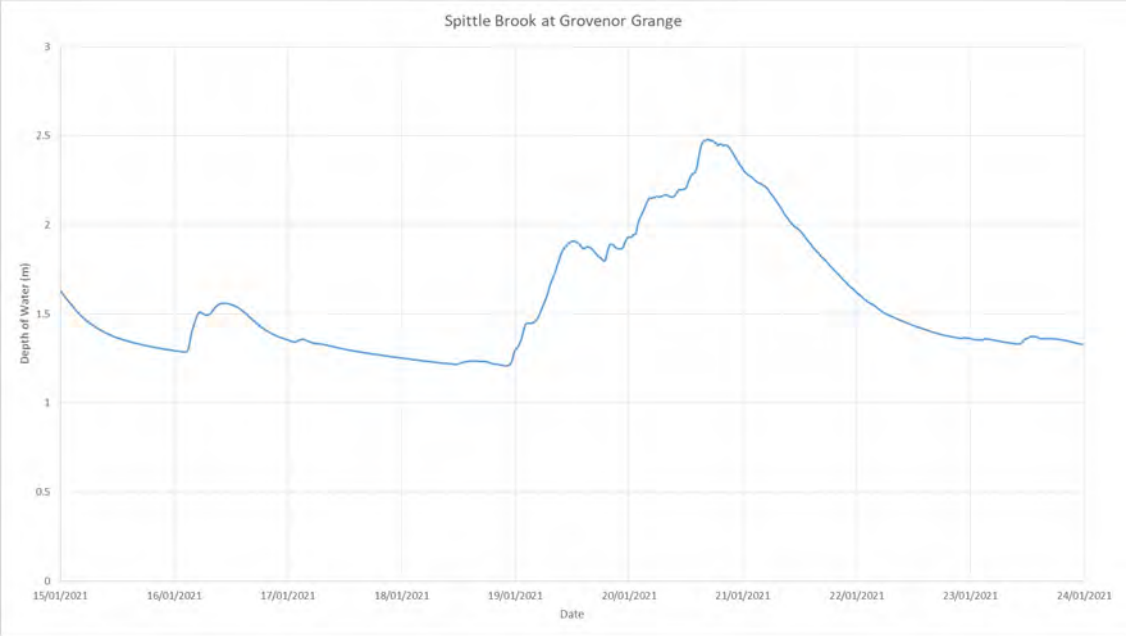
Spittle Brook is classified as 'Main River' meaning that it is under the regulatory control of the Environment Agency.

The nearest river gauging station is at Grovenor Grange on Spittle Brook. Watercourse level data was obtained from Environment Agency.

During Storm Christoph, water levels rose by approx 1.3m before peaking at 2.48m at 16:30 on 20 January 2021.

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.

Figure 206: Graph showing Water Levels in Spittle Brook at Grovenor Grange during Storm Christoph



15.2.5 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is the opinion of Warrington Borough Council in respect of Poulton and Fearnhead Flood Cluster B that the primary flood mechanism was most likely flooding from the public surface water system due to hydraulic restriction as a result of outfalls being submerged.

On this basis, it is the opinion of Warrington Borough Council that United Utilities has relevant flood risk management functions in respect to Poulton and Fearnhead Flood Cluster B and are the appropriate risk management authority for managing this flood risk issue going forward.

15.2.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with United Utilities at future meetings to determine solutions and timescales where possible.

15.3 Poulton with Fearnhead Flood Cluster C – Hilden Road

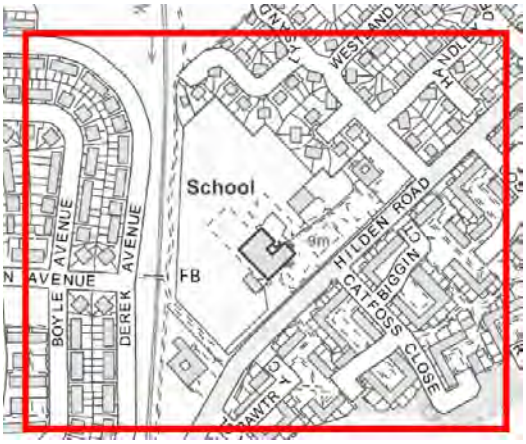
A summary of flooding to Poulton with Fearnhead Flood Cluster C – Hilden Road is provided in Table 15.4 below.

Table 15.4: Flooded Properties Summary – Poulton with Fearnhead Flood Cluster C

Location	Count of Internally Flooded	Count of Externally Flooded
HILDEN ROAD		1
Grand Total		**1**

Poulton with Fearnhead Flood Cluster C – Hilden Road is a predominantly residential area located in Poplars & Hulme ward within the administrative area of Warrington Borough Council. It is approximately 1.8 miles north east of Warrington town centre.

Figure 207: Poulton with Fearnhead Flood Cluster C



15.3.1 Flood History

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

15.3.2 United Utilities Statutory Sewer Map

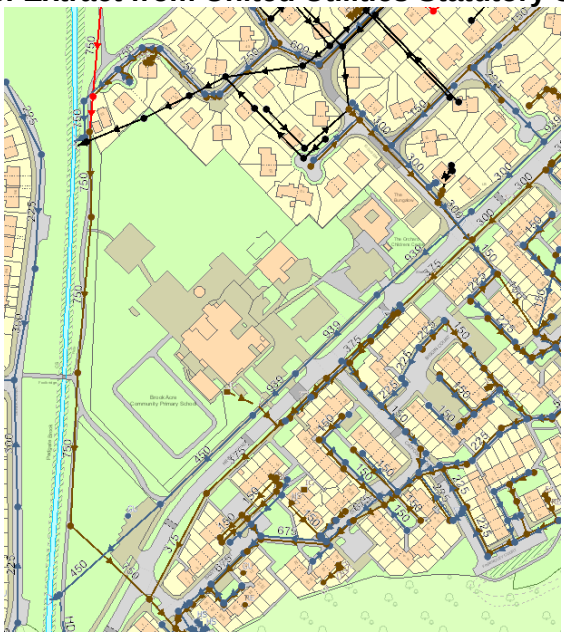
The Statutory Sewer Map was obtained from United Utilities showing Poulton with Fearnhead Flood Cluster C – Hilden Road area.

The area appears to be served by a combination of foul and surface water public sewers.

A 750mm diameter foul sewer flowing north to south parallel with Padgate Brook.

A 939mm surface water sewer flowing north east to south west parallel with Hilden Road appears to reduce to 450mm diameter outside Brook Acre Community School. The 450mm diameter system discharges to Padgate Brook.

Figure 208: Extract from United Utilities Statutory Sewer Map



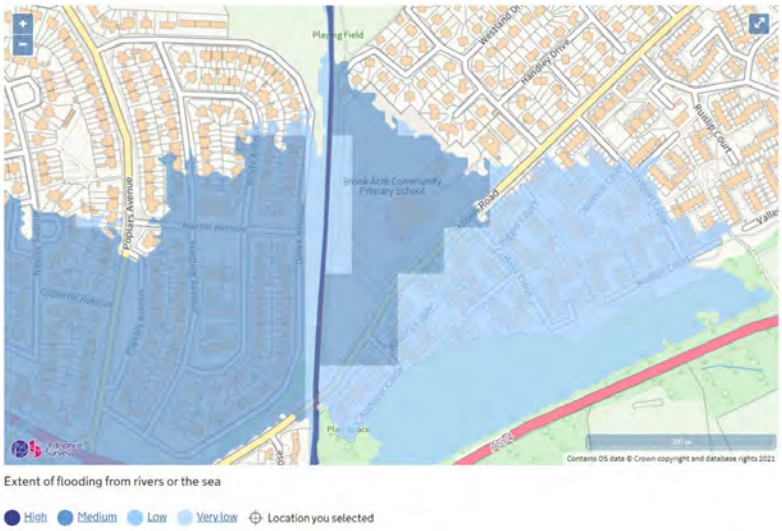
15.3.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows that the north of Hilden Road adjacent to Padgate Brook is predominantly at medium risk of flooding from rivers or the Sea. South east of Hilden Road is predominantly at low risk 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.

Figure 209: Flood Risk from Surface Water Mapping



Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

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 or reflect local detailed sewer drainage networks and is not designed to represent the risk of fluvial flooding from watercourses.

There are pockets of varying surface water flood risk in the general area of Hilden Road.

Figure 210: 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 Poulton and Fearnhead Flood Cluster C is not within the maximum extent of flooding from reservoirs.

15.3.4 Watercourse Level Information
The nearest significant watercourses to Hilden Road is Padgate Brook.

Padgate Brook is classified as ‘Main River’ meaning that it is under the regulatory control of the Environment Agency.

The nearest river gauging station is at Hilden Road on Padgate Brook. Watercourse level data was obtained from Environment Agency.

During Storm Christoph, water levels rose by approx 0.75m before peaking at 1.43m at 16:00 on 20 January 2021.

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.

Figure 211: Graph showing Water Levels in Padgate Brook at Hilden Road during Storm Christoph

15.3.5 Flooding Mechanism Conclusion & Risk Management Authority

United Utilities confirmed that they attended site and found that although the public sewer was running clear, the outfall to Padgate Brook was approximately 80% blocked due to silt within the brook and that the brook requires dredging. Padgate Brook is classed as main river and in this respect, Environment Agency are the appropriate risk management authority.

In the absence of further information, it is the opinion of Warrington Borough Council in respect of Poulton and Fearnhead Flood Cluster C that the primary flood mechanism was most likely flooding from the public surface water system due to hydraulic restriction as a result of the outfall being blocked by silt / debris.

On this basis, it is the opinion of Warrington Borough Council that both United Utilities and Environment Agency have relevant flood risk management functions in respect to Poulton and Fearnhead Flood Cluster C and are the appropriate risk management authorities for managing this flood risk issue going forward.

15.3.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities and Environment Agency as notification that Warrington Borough Council considers United Utilities and Environment Agency to be the appropriate risk management authorities in respect of this flooding incident.
- Continue to raise this issue with United Utilities / Environment Agency at future meetings to determine solutions and timescales where possible.

16 Stockton Heath Flood Cluster

Flooding to 2 properties occurred in this cluster as set out in Table 16.1 below:

Table 16.1: Flooded Properties Summary – Stockton Heath Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
BARTON AVENUE		1
FAIRFIELD ROAD		1
Grand Total		**2**

Following a review of the flooding information, Stockton Heath Flood Cluster has been split into two separate clusters based on flood mechanism / spatial separation as follows:

- Stockton Heath Flood Cluster A – Fairfield Road
- Stockton Heath Flood Cluster B – Barton Avenue

16.1 Stockton Heath Flood Cluster A – Fairfield Road

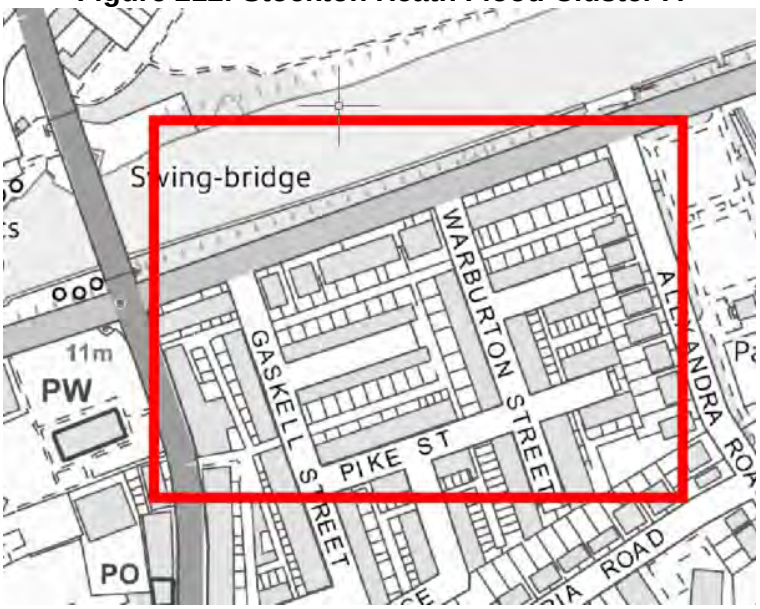
A summary of flooding to Stockton Heath Flood Cluster A – Fairfield Road is provided in Table 16.2 below.

Table 16.2: Flooded Properties Summary –Stockton Heath Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
FAIRFIELD ROAD		1
Grand Total		**1**

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.

Figure 212: Stockton Heath Flood Cluster A



16.1.1 Flood History

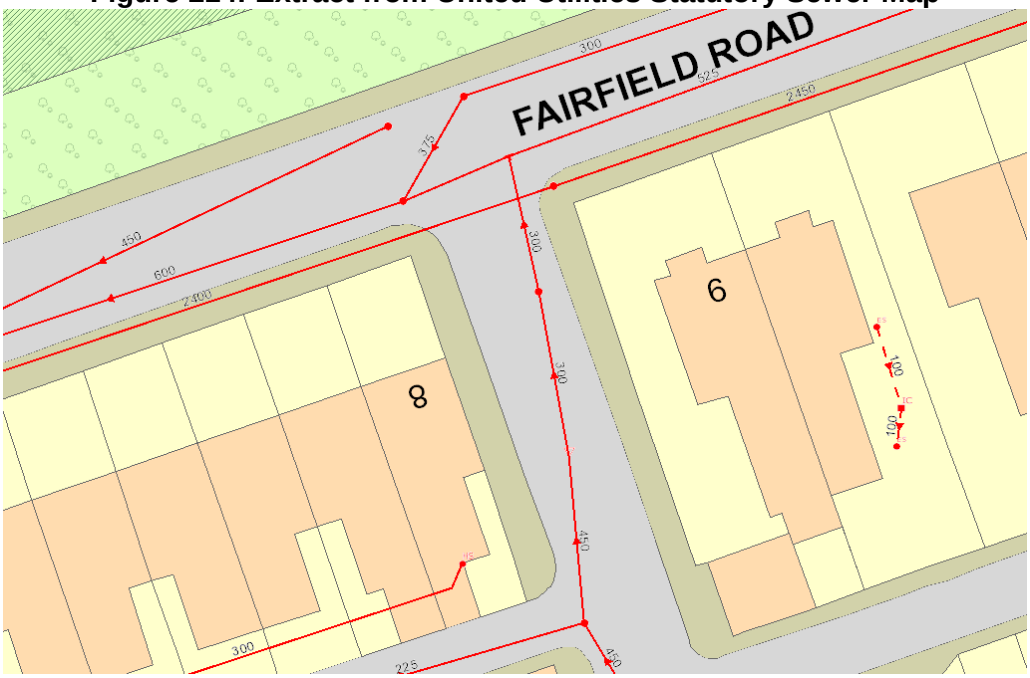
It is understood that external flooding occurred to numerous property and flooding occurred to public highway at the junction of Fairfield Road and Gaskell Street as evidenced by the extract from the Warrington Guardian website in September 2019.

Figure 213: Extract from Warrington Guardian Website

16.1.2 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 214: Extract from United Utilities Statutory Sewer Map



16.1.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows that Fairfield Road is not at risk 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 or 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 215: 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 215 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 Fairfield Road is not within the maximum extent of flooding from reservoirs.

16.1.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to Fairfield Road.

16.1.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

16.2 Stockton Heath Flood Cluster B – Barton Avenue
A summary of flooding to Stockton Heath Flood Cluster B – Barton Avenue is provided in Table 16.3 below.

Table 16.3: Flooded Properties Summary –Stockton Heath Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
BARTON AVENUE		1
Grand Total		**1**

Barton Avenue is a predominantly residential area located in Grappenhall ward within the administrative area of Warrington Borough Council. It is approximately 1 mile to the south of Warrington town centre.

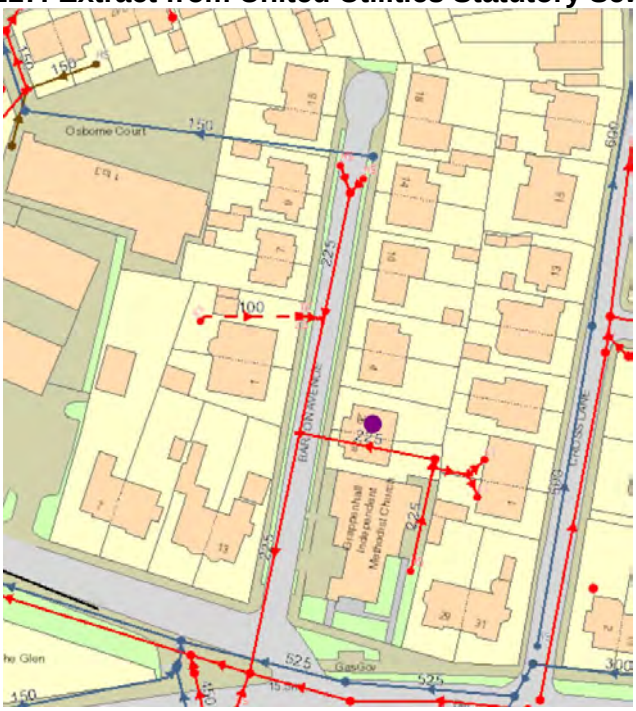
Figure 216: Stockton Heath Flood Cluster B

16.2.1 Flood History
The Engineering and Flood Risk Team has no records of any historic flooding at Barton Avenue but that is not to say flooding has not occurred.

16.2.2 United Utilities Statutory Sewer Map
The Statutory Sewer Map was obtained from United Utilities showing the section of Barton Avenue which was affected.

The mapping shows several combined United Utilities systems in the area generally 225mm diameter and a public surface water sewer running in an east to west direction across the head of the cul de sac. This appears to be the head of the surface water system and the information may be incomplete.

Figure 217: Extract from United Utilities Statutory Sewer Map



16.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows that Barton Avenue is not at risk 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 or 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, there appears to be a flow path along the carriageway of Barton Avenue but the properties appears to be at very low risk.

Figure 218: 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 Barton Avenue is not within the maximum extent of flooding from reservoirs.

16.2.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is not possible to state the most likely cause of flooding to Barton Avenue.

16.2.5 Actions
Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

17 Winwick Cluster

Flooding to 19 properties occurred in this cluster as set out in Table 17.1 below:

Table 17.1: Flooded Properties Summary – Winwick Flood Cluster

Location	Count of Internally Flooded	Count of Externally Flooded
CAMERON COURT		1
HOLLINS LANE		18
Grand Total		**19**

Following a review of the flooding information, Winwick Flood Cluster has been split into two separate clusters based on flood mechanism / spatial separation as follows:

- Winwick Flood Cluster A – Cameron Court
- Winwick Flood Cluster B – Hollins Lane

17.1 Winwick Flood Cluster A – Cameron Court

A summary of flooding to Winwick Flood Cluster A – Cameron Court is provided in Table 17.2 below.

Table 17.2: Flooded Properties Summary – Winwick Flood Cluster A

Location	Count of Internally Flooded	Count of Externally Flooded
CAMERON COURT		1
Grand Total		**1**

Cameron Court is a predominantly industrial area located in Bewsey & Whitecross ward within the administrative area of Warrington Borough Council. It is approximately 2 mile to the north of Warrington town centre.

Figure 219: Stockton Heath Flood Cluster A

17.1.1 Flood History

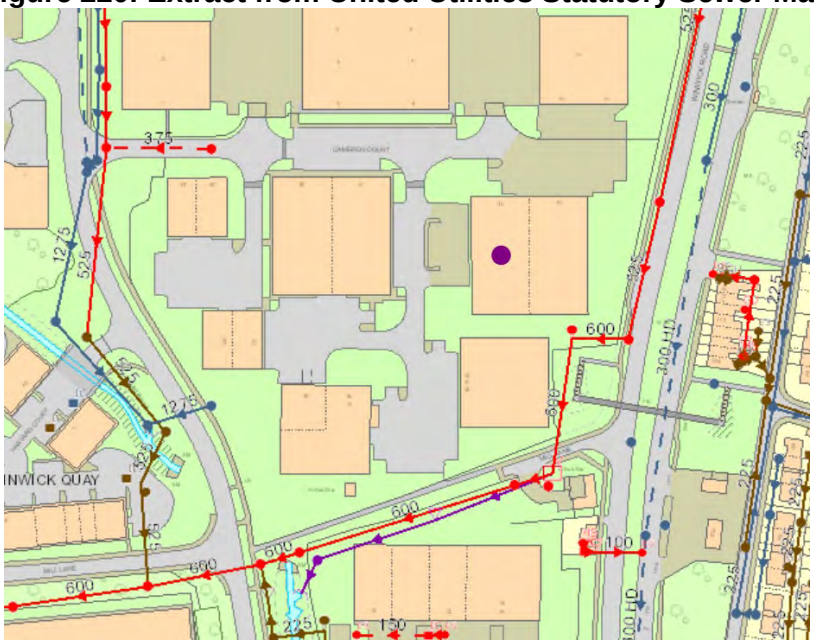
The Engineering and Flood Risk Team has no records of any historic flooding at Camerson Court but that is not to say flooding has not occurred.

17.1.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing a foul 375mm diameter connection and a 1275mm diameter surface water connection. It is assumed that the drainage serving Cameron Court is private and hence not shown.

The 1275mm diameter surface water appears to discharge to Mill Brook on the west side of Calver Road.

Figure 220: Extract from United Utilities Statutory Sewer Map



17.1.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk

The Environment Agency Flood Risk from Rivers or the Sea Map shows that Cameron Court is not at risk 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.

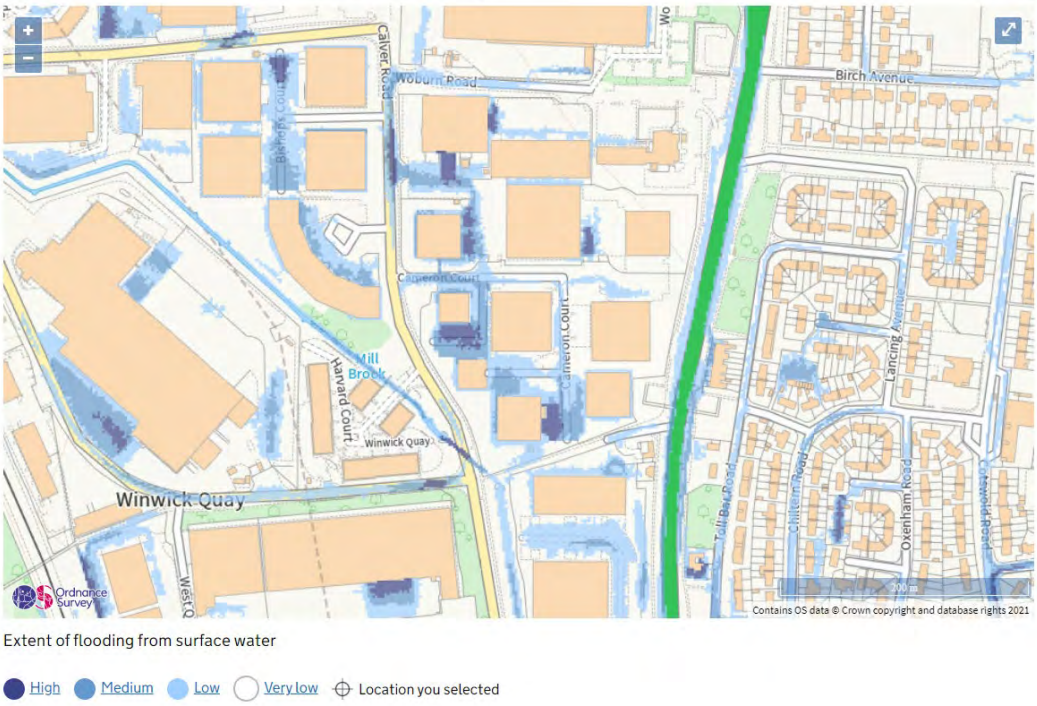
Surface Water Long Term Flood Risk

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 or 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, some of the industrial units at Camerson Court maybe 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 221: 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 or the private drainage systems within the area.

Reservoir Long Term Flood Risk
The Environment Agency Flood Risk from Reservoirs map indicates Cameron Court is not within the maximum extent of flooding from reservoirs.

17.1.4 Watercourse Level Information

Mill Brook is located in close vicinity to Cameron Court, Mill Brook is a tributary to Dallam Brook which is a tributary to Sankey Brook.

All three of the above watercourses are classified as 'Main River' meaning that they are under the regulatory control of the Environment Agency.

The nearest watercourse telemetry station is approximately 1400m south west of the affected area and is located on Sankey Brook at Higham Avenue.

Watercourse level data was obtained from Environment Agency. The maximum water level reached during the Storm Christoph event for Sankey Brook at Higham Avenue was 3.82m on 21 January 2021.

The highest level previously recorded for this gauge station since it became operation was 3.32m which occurred on 26 September 2012.

According to Environment Agency, when the water level reaches 2.80m at this gauge, minor flooding is possible in this area.

According to the Environment Agency, the typical range for Sankey Brook at this location is between 0.24m and 2.80m.

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.

Tributary watercourses including Dallam Brook and Mill Brook will have experienced hydraulic restriction and may have experienced back flow from Sankey brook due to the high levels recorded.

17.1.5 Flooding Mechanism Conclusion & Risk Management Authority

In the absence of further information, it is not possible to state the most likely cause of flooding to Cameron Court.

17.1.6 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Follow up with UU and EA to determine if they are aware of any issues in respect of flood risk in this area going forward.

17.2 Winwick Flood Cluster B – Hollins Lane

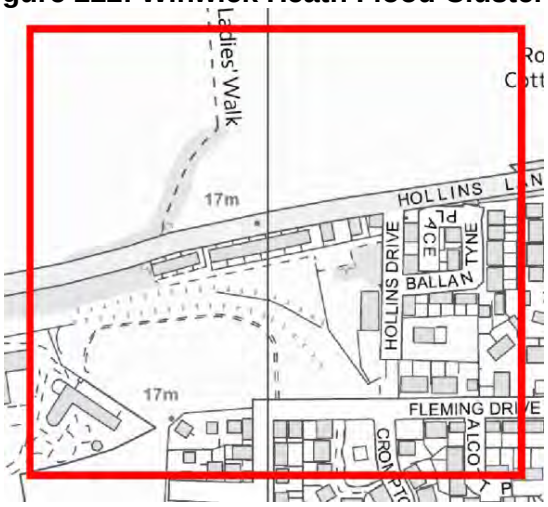
A summary of flooding to Winwick Heath Flood Cluster B – Hollins Lane is provided in Table 17.3 below.

Table 17.3: Flooded Properties Summary – Winwick Flood Cluster B

Location	Count of Internally Flooded	Count of Externally Flooded
HOLLINS LANE		18
Grand Total		**18**

Hollins Lane is a predominantly rural residential area located in Burtonwood and Winwick ward within the administrative area of Warrington Borough Council. It is approximately 2.9 miles to the north of Warrington town centre.

Figure 222: Winwick Heath Flood Cluster B



17.2.1 Flood History

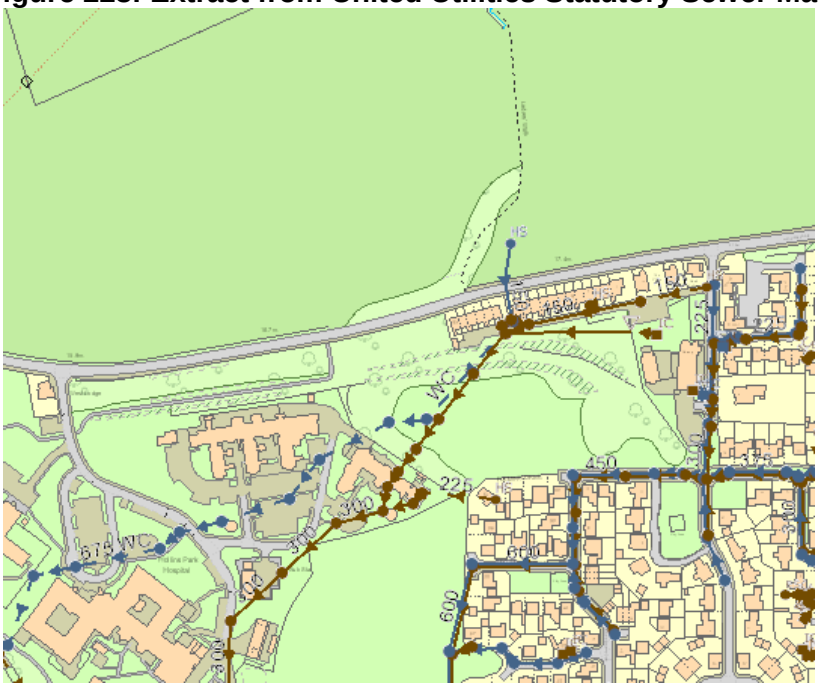
The Engineering and Flood Risk Team has no records of any historic flooding at Hollins Lane but that is not to say flooding has not occurred.

17.2.2 United Utilities Statutory Sewer Map

The Statutory Sewer Map was obtained from United Utilities showing the section of Hollins Lane which was affected.

The mapping shows the area is served by separate foul and surface water sewers. In respect of the public surface water sewer, the UU information appears to show the public sewer becomes a watercourse to the rear of 12/13 Hollins Green.

Figure 223: Extract from United Utilities Statutory Sewer Map



Warrington Borough Council cannot find any evidence of a historic watercourse which follows the alignment of the watercourse shown on the UU mapping.

Figure 224: Extract from WBC Historic Mapping (mid 1800's)

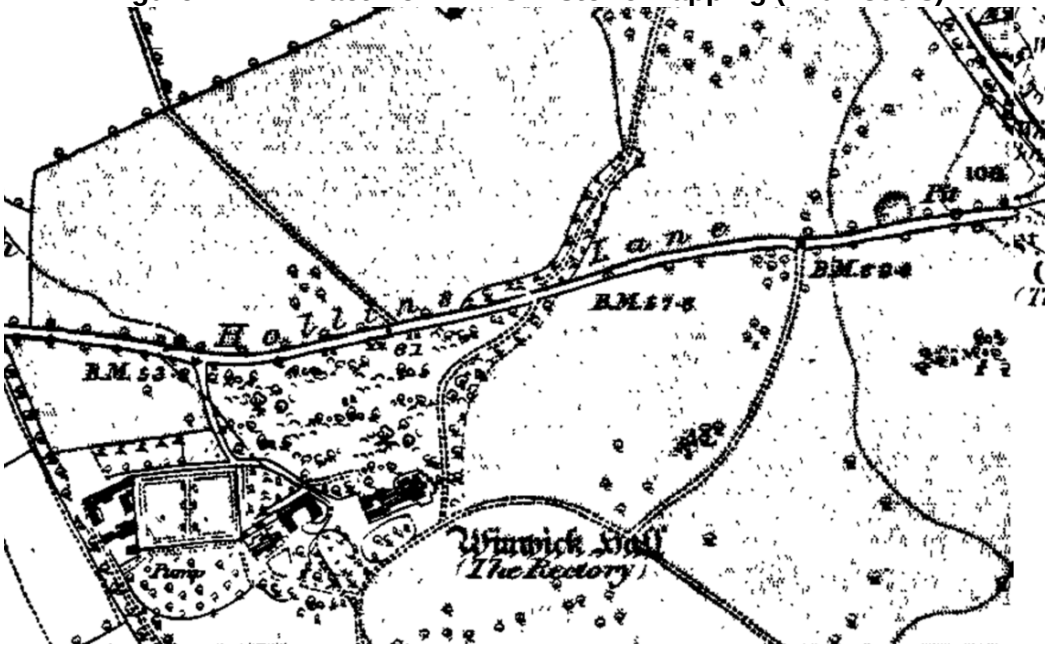


Figure 225: Extract from National Library of Scotland Historic Mapping (Published 1908)

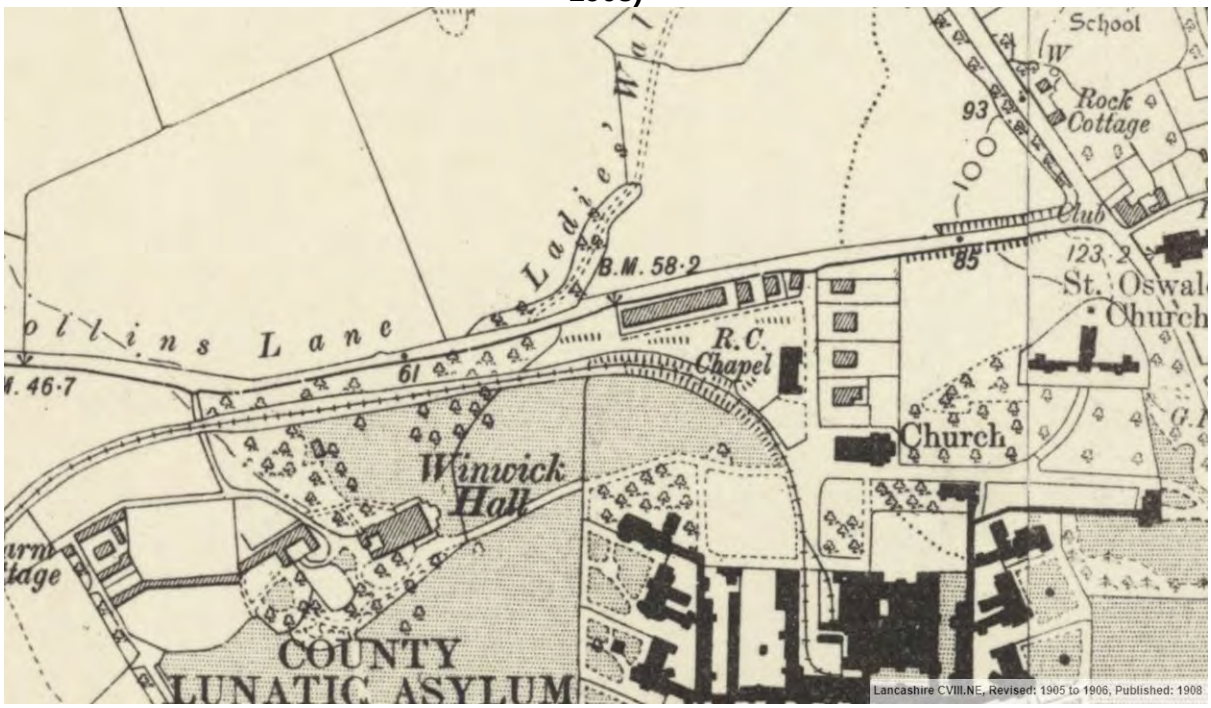
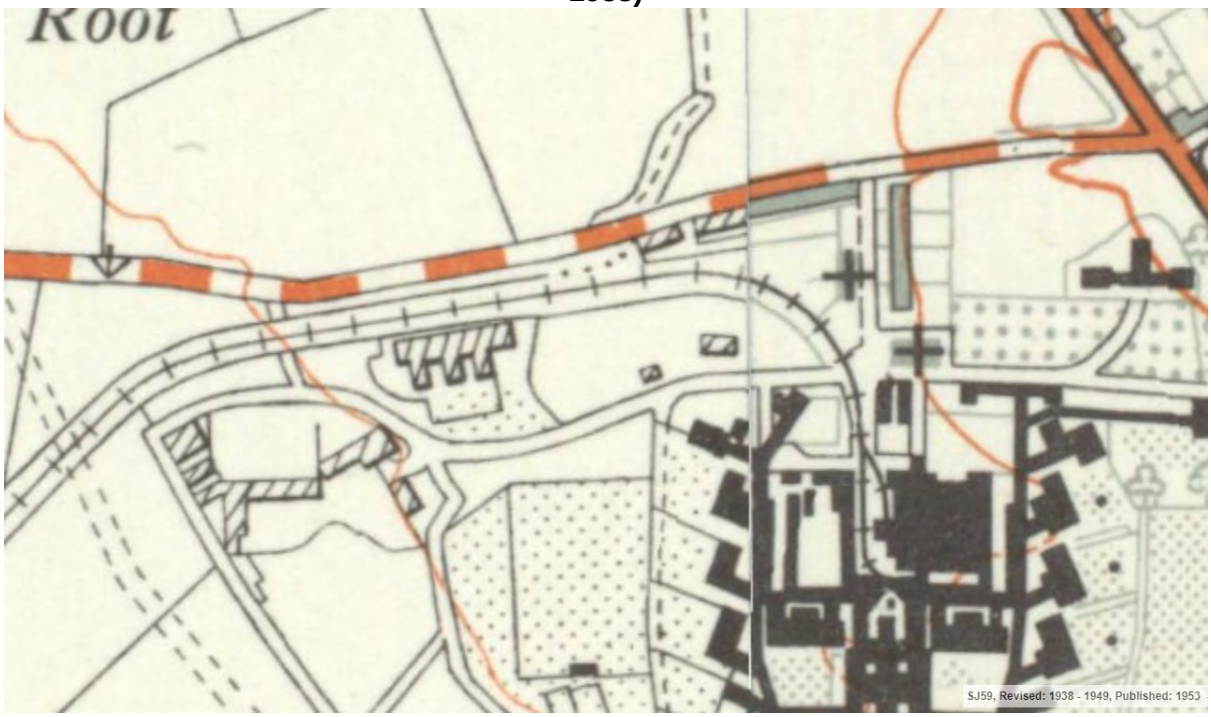


Figure 226: Extract from National Library of Scotland Historic Mapping (Published 1953)



17.2.3 Long Term Flood Risk

Fluvial / Tidal Long Term Flood Risk
The Environment Agency Flood Risk from Rivers or the Sea Map shows that Hollins Lane is not at risk 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 or 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, there appears to be a significant flow path from the fields to the north of Hollins Lane towards the affected area.

Figure 227: 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 Hollins Lane is not within the maximum extent of flooding from reservoirs.

17.2.4 Flooding Mechanism Conclusion & Risk Management Authority
In the absence of further information, it is the opinion of Warrington Borough Council in respect of Winwick Heath Flood Cluster B – Hollins Lane that the flood mechanism was a combination of flooding from overland flow and public sewers.

On this basis, it is the opinion of Warrington Borough Council that both Warrington Borough Council and United Utilities have relevant flood risk management functions in respect to Winwick Flood Cluster B and are the appropriate risk management authority for managing this flood risk issue going forward.

17.2.5 Actions

Warrington Borough Council will:

- Continue to monitor this area for flooding.
- Provide a copy of this Section 19 Report to United Utilities as notification that Warrington Borough Council considers United Utilities to be the appropriate risk management authority in respect of this flooding incident.
- Continue to raise this issue with United Utilities at future meetings to determine solutions and timescales where possible.

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.