

Monmouthshire County Council

Flood and Water Management Act 2010

Section 19 Flood Investigation Report

Llanbadoc, Usk

February 2020

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1. Executive Summary

In accordance with Section 19 of the Flood and Water Management Act 2010 Monmouthshire County Council (MCC) has a duty as Lead Local Flood Authority to investigate flooding within its area, insofar as it considers it necessary or appropriate. This report has been prepared specifically for the purpose of meeting the requirements of Section 19 and provides a factual account of the flood event that occurred on 15th to 16th February 2020 at Llanbadoc, Monmouthshire.

On the 15 and 16th February 2020, a period of heavy rain fell on already saturated ground resulting in significant flooding in the town of Usk and surrounding area. This came from Storm Dennis and also from Storm Ciara, which hit the area just a week before. More than 90% of the monthly average rainfall was recorded in some areas in South Wales during Storm Ciara with 90% also recorded during Storm Dennis. Much of the Brecon Beacons and upper Usk catchment saw 100mm-125mm rainfall in the 48 hour period of Storm Dennis. The upper catchments of the River Usk in the Brecon Beacons responded to the rainfall, resulting in a rapid and significant rise in levels in the river on Friday 15th and Saturday 16th February.

Through the investigation, it has been established that the primary mechanism of flooding was from the River Usk overtopping the banks and flowing across the floodplain towards the properties affected. The area has historically suffered from flooding caused by the ordinary watercourse that flows eastwards along Church Lane and under the highway and discharges into the River Usk adjacent to Llanbadoc Island Car park.

Initial flooding was possibly caused by the brook backing up as the main River Usk levels rose. Once the River Usk level flood locked the brook outfall culvert, the flows would have started to back up through the culverts under the Highway and adjacent properties. As the culvert has not got a flap valve on the outfall it is possible the River Usk also flowed up the brook but there is no evidence either way. In total 9 residential and 2 commercial properties were flooded.

Following the flood event Officers from MCC's Highways and Flood Risk Management Team visited the locations affected by flooding and collated information of the event from residents and landowners to gain an understanding of the nature of the flooding. Further details have been gathered from historic reports from previous flood events at the same location, and information has been shared between MCC and Natural Resources Wales who are the Risk Management Authority for the main River Usk. As the Land Drainage Risk Management Authority, MCC have permissive powers to manage flood risk from the unnamed brook. Further invaluable information has been gathered from residents and business owners through a letter drop.

The report has identified a number of recommendations and actions to avoid or minimise the impact of any future flood events.

2. Introduction

2.1 Purpose of Investigation

On 15th/16th February 2020 Monmouthshire was impacted by a significant weather event which resulted in heavy and prolonged rainfall in the northern parts of the county and upper catchments of many ordinary watercourses and main rivers, including the Rivers Usk, Monnow and Wye.

The heavy rainfall event resulted in significant flooding in many areas across Monmouthshire, notably Skenfrith, Abergavenny and Monmouth as well as the central part of the County, where the Town of Usk was badly affected, particularly to the west and southern side of the town including the community of Llanbadoc. This report will focus on the flooding at Llanbadoc.

The reason behind Monmouthshire County Council's (MCC) investigation is in response to the duties of the local authority in regard to Section 19 of the Flood and Water Management Act 2010, which states:

- (1) On becoming aware of a flood in its area, a Lead Local Flood Authority must, to the extent that it considers it necessary or appropriate, investigate:
 - (a) Which risk management authorities have relevant flood risk management functions, and
 - (b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
- (2) Where an authority carries out an investigation under subsection (1) it must:
 - (a) Publish the results of its investigation, and
 - (b) Notify any relevant risk management authorities.

2.2 Site Location

The community of Llanbadoc lies to the south west of Usk in the west of the County. The village consists of a few properties, church and garden centre & nursery business. The population in the 2011 census was 806.



Figure 1 - Location Plan showing area covered by this report

The area of the investigation runs from the Church in the north to Lanusk Farm in the south. The topography is relatively flat with a shallow gradient to the south following the fall of the River Usk to the east of the flood plain. To the west the ground rises quite steeply to Celfeigan Park and Ty Mawr hill forming 2 natural valleys which drain through Llanbadoc into the river Usk.

The source of River Usk lies in the west of the Brecon Beacons near Llanddeusant on the northern slopes of the Black Mountain and traverses east to Brecon then southeast to Abergavenny before heading south to discharge into the Severn Estuary at Newport.

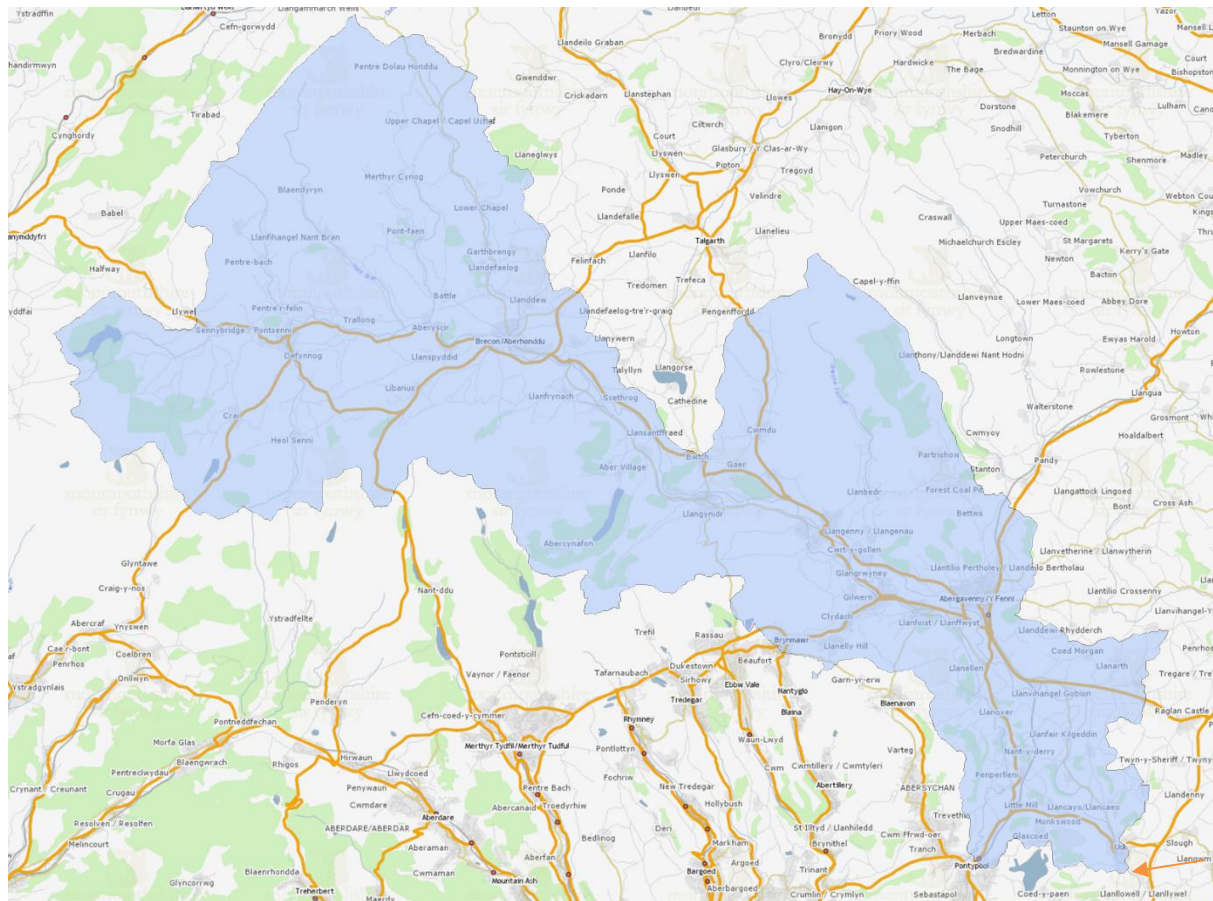


Figure 2 - Catchment of the River Usk at Llanbadoc

The area of Llanbadoc under investigation is made up of a variety of properties ranging from large houses to small terrace houses; there is also the church, garden centre and a couple of farms. The main road (R106) also runs south through Llanbadoc and is the main route between Caerleon and Usk.

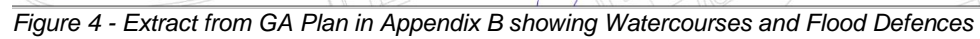
There are two potential sources of surface water flooding to the area of Llanbadoc south of the church, the watercourses that run west to east, one near Church Lane the other near Morris' Garden Centre. There is also a risk of flooding from the main River Usk itself. These sources are all shown on the plan in Appendix B. The River Usk is a designated main river and therefore Natural Resources Wales is the relevant Risk Management Authority. From reports it is understood the watercourse nearer Morris' Garden Centre did not cause any flooding.

Local authorities have permissive powers to manage the flood risk associated with ordinary watercourses; in this case the unnamed streams come under Monmouthshire County Council's jurisdiction.



Figure 3 - NRW Surface Water Flood Risk Mapping

The area of Llanbadoc adjacent to the church is not defended from flooding from the River Usk as there are no raised defences adjacent to the Church or Llanbadoc Island Car Park. The brook that outfalls adjacent to the Island Car Park also has no flap valve on to prevent the River Usk back flowing up the brook. The flood defences adjacent to Lanusk Farm and Llangronwin were perceived to be a private asset, but following dialogue with NRW and further investigation, they have been confirmed as NRW maintained defences. Figure 4 shows the alignment of existing flood defences and watercourses.



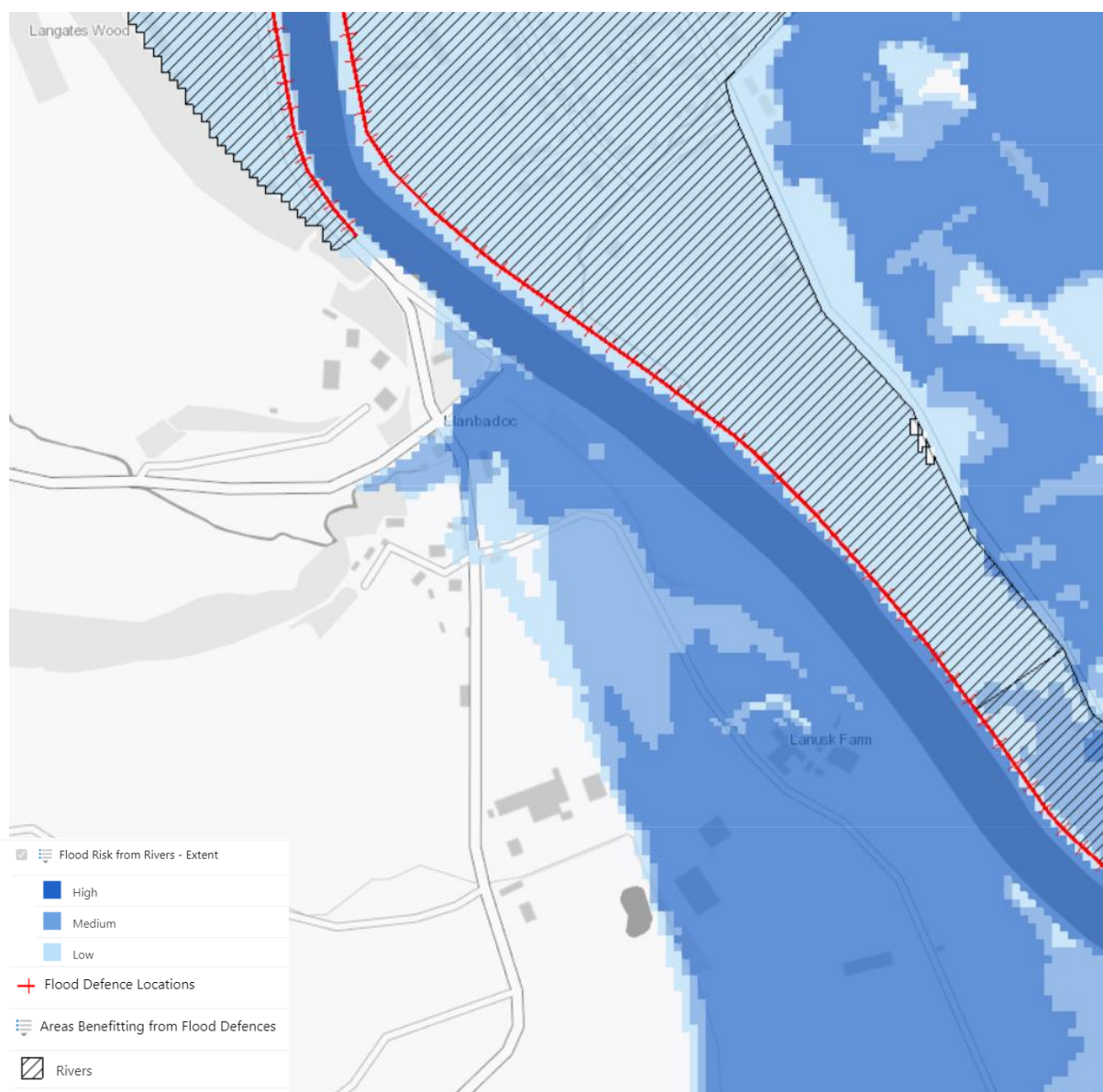


Figure 5 - NRW Main River Flood Risk Mapping showing areas that benefit from current flood defences (hatched)

2.3 Investigation Evidence

To support the investigation a range of qualitative and quantitative evidence has been gathered from numerous sources, the summary of which is listed below:

- Residents – photos, statements, written correspondence
- Surveys – drainage surveys and site inspections
- Met Office Data – Weather warnings and reviews
- Natural Resources Wales – river gauge data
- Natural Resources Wales – rain gauges
- DCWW records and information
- Monmouthshire County Council – rain gauges, asset database & Flood Risk Management Plan
- Monmouthshire County Council – previous land drainage investigations database

3. Flooding History

3.1 Previous Flood Incidents

There is a long history of flooding at Llanbadoc which is outlined below.

Year	No of properties Flooded
2007	1
2013	1
2017	2
2019	3
2020	9

Table 1 - figures based on anecdotal evidence and reports held by MCC.

From reports both the 2007 and 2013 flood events were driven by the main river and lasted under 12 hours.

In October 2019 several properties were affected by flooding from the ordinary watercourse. The brook was unable to discharge, backed up the rear of the terraced properties, and spilled out flooding several properties.

The most recent event occurred on 16th February 2020 when the River Usk reached its highest ever recorded level of 18.112 metres Ordnance Datum (OD) in Usk, 5.8m reading on the gauge. These flows resulted in out of bank flows across Llanbadoc Island Car Park and created much of the flooding experienced. There was secondary flooding caused by the brook being unable to discharge and breaking bank at the rear of the terraced properties and flowing through the gardens of several properties.

Section 3.2 below provides more details of the event covered by this report.

3.2 Flood Incident

On the morning of 15th February 2020 the Met Office issued a Yellow Warning for heavy rain for most of Wales with an Amber warning covering parts of south Wales and the western edge of Monmouthshire. Heavy and persistent rain fell across much of south Wales during Saturday 15th February and overnight into Sunday as part of Storm Dennis.

Following this persistent period of heavy rain, levels in the River Usk rose rapidly during the 15th February and increased significantly overnight and during the morning of the 16th. The River Usk reached its peak around 2.00pm on the Sunday and then steadily fell back to a more normal level on Monday the 17th.

As the main river levels rose further, the natural river banks were exceeded adjacent to Llanbadoc Island car park and levels rose across the flood plain. There are no formal raised flood defences at Llanbadoc Island car park.

At around 5.30 am Sunday 16th February the residents of one property near the church woke to find water in their property. They evacuated but by the time they evacuated depths were

circa 3ft and the property and opposite properties were surrounded by water. Flood levels began to drop during the evening of the 16th and by 11am on the 17th all flood water had receded.

Formal flood defences adjacent to Llangronwn were also overtopped during this event resulting in damage to properties and to the flood bund in the garden. This overtopping also flooded parts of Morris' Garden Centre's nursery site.

In total nine residential properties, two commercial premise and one church had internal and external flooding and a further two had flooding to gardens or working areas causing damage to properties and disruption to residents and businesses.

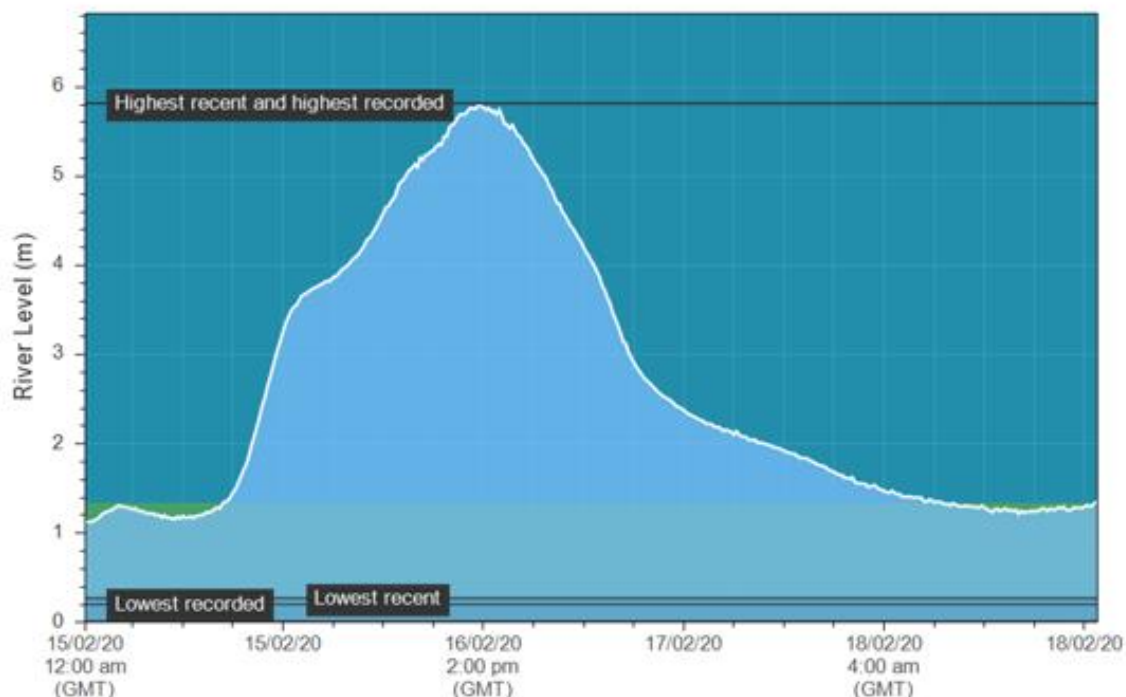


Figure 6 - The Flood Levels in the River Usk at Usk, 15-18 February 2020

From the account of the residents many did not expect the flooding and awoke in the early hours of Sunday 16th to find water in their properties. One resident adjacent to Llanbadoc Church reported waking to water in the ground floor of their property that increased to a maximum depth of 900mm in some properties by the time some were able to evacuate. Others moved what they could off the floor and sheltered upstairs.

Residents at Lanusk Farm described water as starting to spill over the primary flood defence (See plan in Appendix B) adjacent to the river and pooling between that and a lower bund within the garden. This overtopping caused significant damage to the back of the raised defences. Once the water level in the main channel rose significantly above the defences, the 9 properties, businesses and agricultural barns were inundated quickly to a maximum depth of about three feet throughout. When trying to evacuate the resident also explained about water flowing through a hedgerow between the access driveway (see plan in Appendix B) and the higher field to the rear of Llanbadoc Island Car Park confirming that flow was coming over the top of the River Usk banks at Llanbadoc Island Car Park.

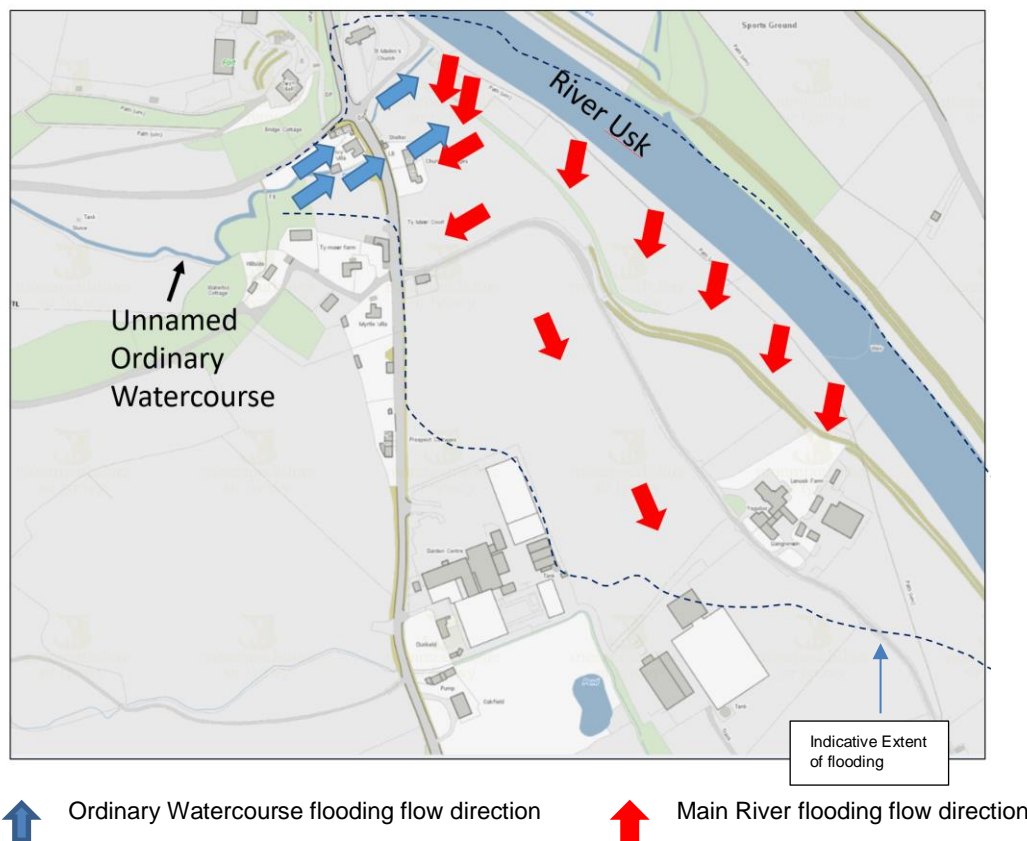


Figure 7 - Flood Flow directions, indicative extents and sources

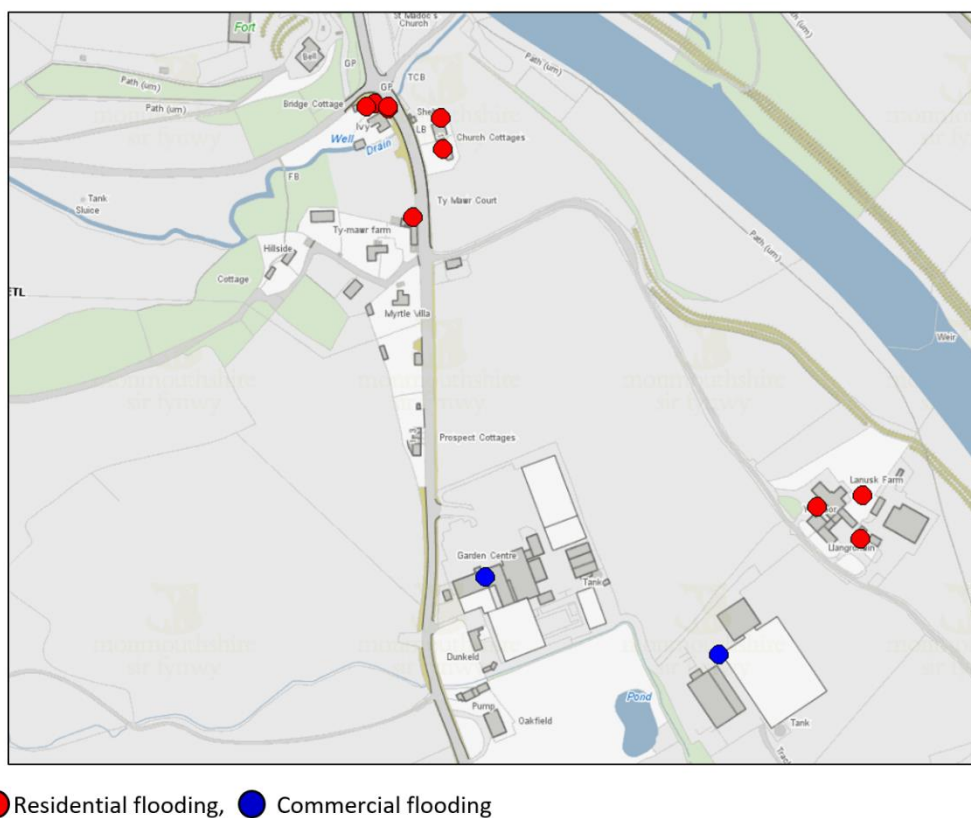


Figure 8 - Flooded properties (indicative locations)



Figure 9 - Rescue crews outside Orchard House standing on the R106 Usk to Caerleon Road - Photo courtesy of Graham Lowe



Figure 10 - Flooding between Church Cottages and Orchard House standing on the R106 Usk to Caerleon Road - Photo courtesy of Graham Lowe



Figure 11 - Flooding between Church Cottages and River Usk beyond tree line



Figure 12 - Damage to rear of Flood Defence Embankment, Llangronwn

Officers from MCC were on site to assist residents and record details of the event on Sunday 16th and again on Monday the 17th.

Flood waters receded steadily on the Monday as the river levels dropped and the unnamed brook could again discharge to the river. Following the flood event there was a large amount of mud and silt in properties and across the highway leading to a significant clean-up operation. Some properties also had to pump out remaining water due to threshold levels.

Morris' Garden Centre also had a major clean-up operation and had to spend a significant amount of money to clean away the mud and silt as well as throwing away stock and damaged products.



Figure 13 - Extent of flooding, view from Llanbadoc Church across R106



Figure 14 - Silt and Debris outside properties, Water level marks also visible on walls

As a result of the severe weather Natural Resources Wales issued a statement over the weekend of the flood as follows:

“The impact of two weekend of storms - Ciara and Dennis - on people and property has been felt across the whole of Wales, and our thoughts are with all those affected. Only a week on from Storm Ciara flooding communities across Wales, we saw exceptional rainfall and river levels during Storm Dennis over the weekend of 15-16 February. Many rivers have reached record levels, properties have been flooded and in some communities, people were evacuated from their homes. The impacts have been significant, on people, property, businesses and livelihoods. These are the biggest floods for years in these areas, and communities will be affected for months to come”.

3.3 Rainfall Analysis

During February 2020, Wales experienced several noteworthy rainfall events on the back of a very wet autumn and winter period. The named storms, Ciara, Dennis and Jorge, affected Wales within a period of just four weeks, with record rainfall and river flows causing some of the most significant flooding impacts in Wales since the 1970's.

February 2020 was the wettest February on record in Wales and the UK as well as the fifth wettest month ever recorded.

Rainfall on the catchment areas of Wales during these events was of such intensity that many rivers reacted extremely quickly, reaching record levels and flows. Notably, and of consequence, catchments were already fully saturated from the previous months of near continuous rain.

Storm Ciara and the week preceding Storm Dennis

Storm Ciara (8th and 9th February) impacted the catchments of North Wales most severely. However, significant rainfall was still recorded in South Wales, particularly on the uplands of the Brecon Beacons and Black Mountains, both of which are within the catchment of the Usk. The Tal y Maes rainfall gauge in the Black Mountains recorded 38 mm of rainfall between 20:00 on 8th February and 16:15 on 9th February. Further smaller rainfall events continued in the week preceding Storm Dennis, including a rainfall of 31 mm on 13th February. In the seven days prior to Storm Dennis the gauge at Tal y Maes recorded 93 mm of rain. A similar rainfall pattern was observed elsewhere in the upper catchment of the Usk but with even higher amounts of rainfall. The rainfall gauge at Crai Reservoir recorded 174 mm over the seven days prior to Storm Dennis.

Storm Dennis

Storm Dennis (15th and 16th February) saw even heavier rainfall fall on the already saturated catchment of the Usk. The Tal y Maes rainfall gauge recorded 84 mm over the two days with even higher rainfall recorded higher in the catchment of the Usk. The rainfall gauge at Crai Reservoir recorded 152 mm over the two days.

Date	Rainfall at Tal y Maes (mm)
8 th February (Storm Ciara)	6
9 th February (Storm Ciara)	33
10 th February	13
11 th February	1
12 th February	8
13 th February	31
14 th February	2
15 th February (Storm Dennis)	55
16 th February (Storm Dennis)	29
Total (8 th to 16 th February)	177

Table 2 Daily rainfall totals for the nine days up to and including 16th February 2020.

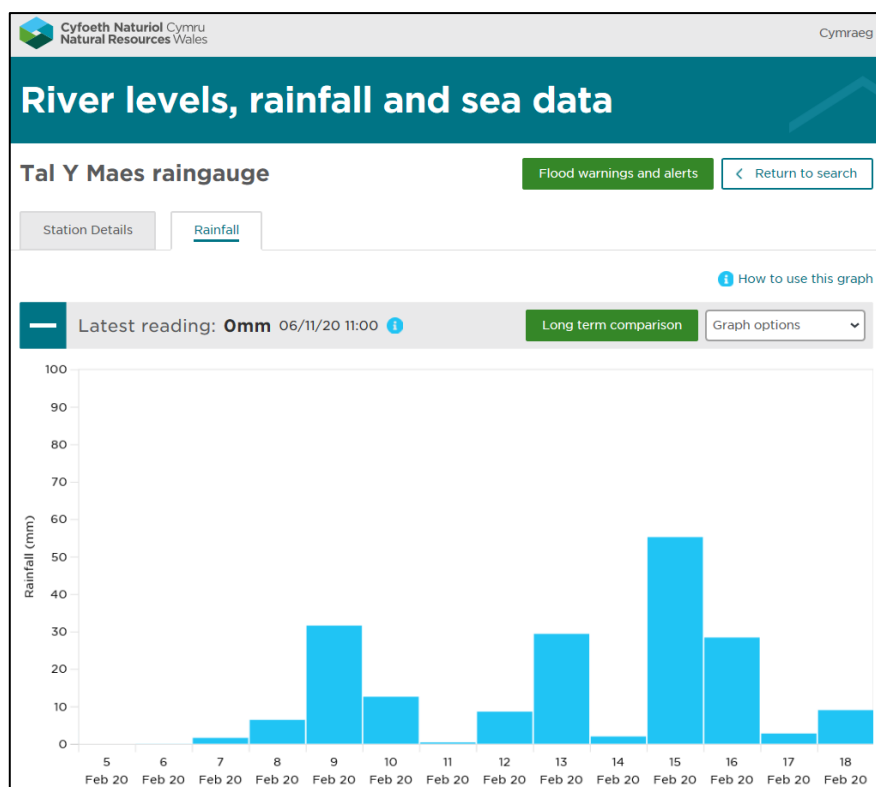


Figure 15 - Rainfall gauge data from the Tal y Maes rain-gauge. 5th to 18th February 2020. Produced by NRW.

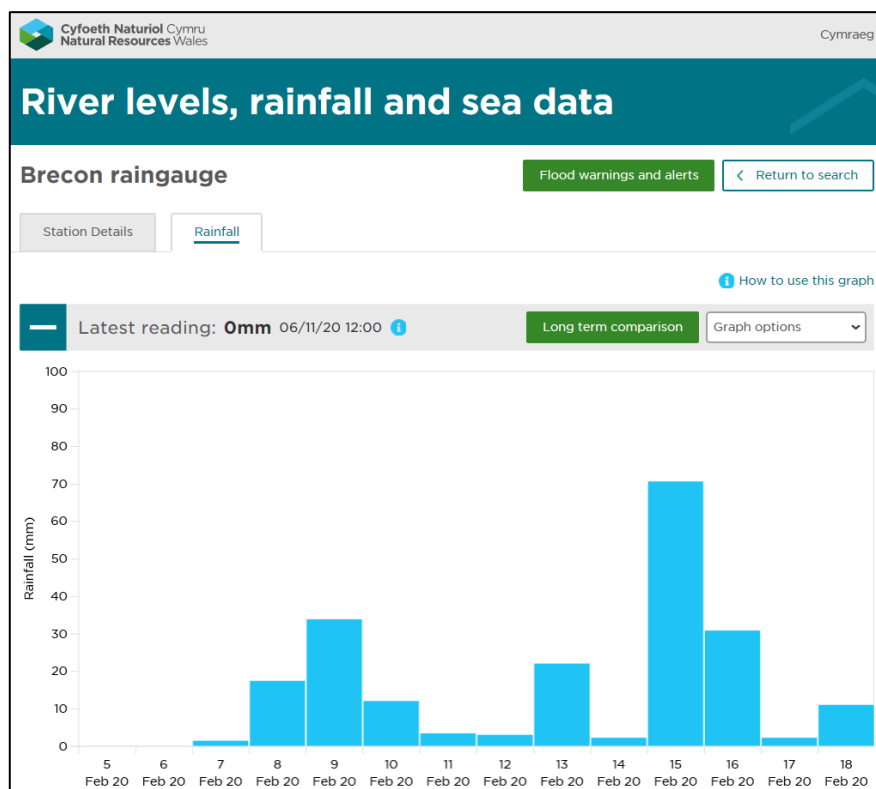


Figure 16 - Rainfall gauge data from the Brecon rain-gauge. 5th to 18th February 2020. Produced by NRW

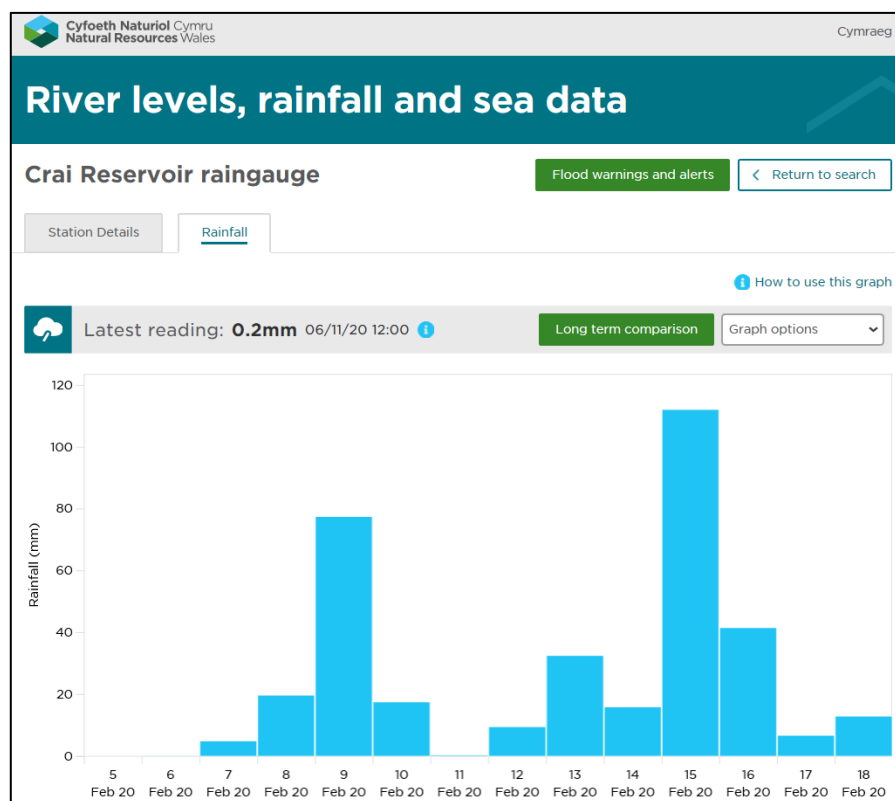
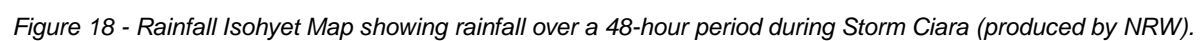


Figure 17 - Rainfall gauge data from the Crai Reservoir rain-gauge. 5th to 18th February 2020. Produced by NRW.



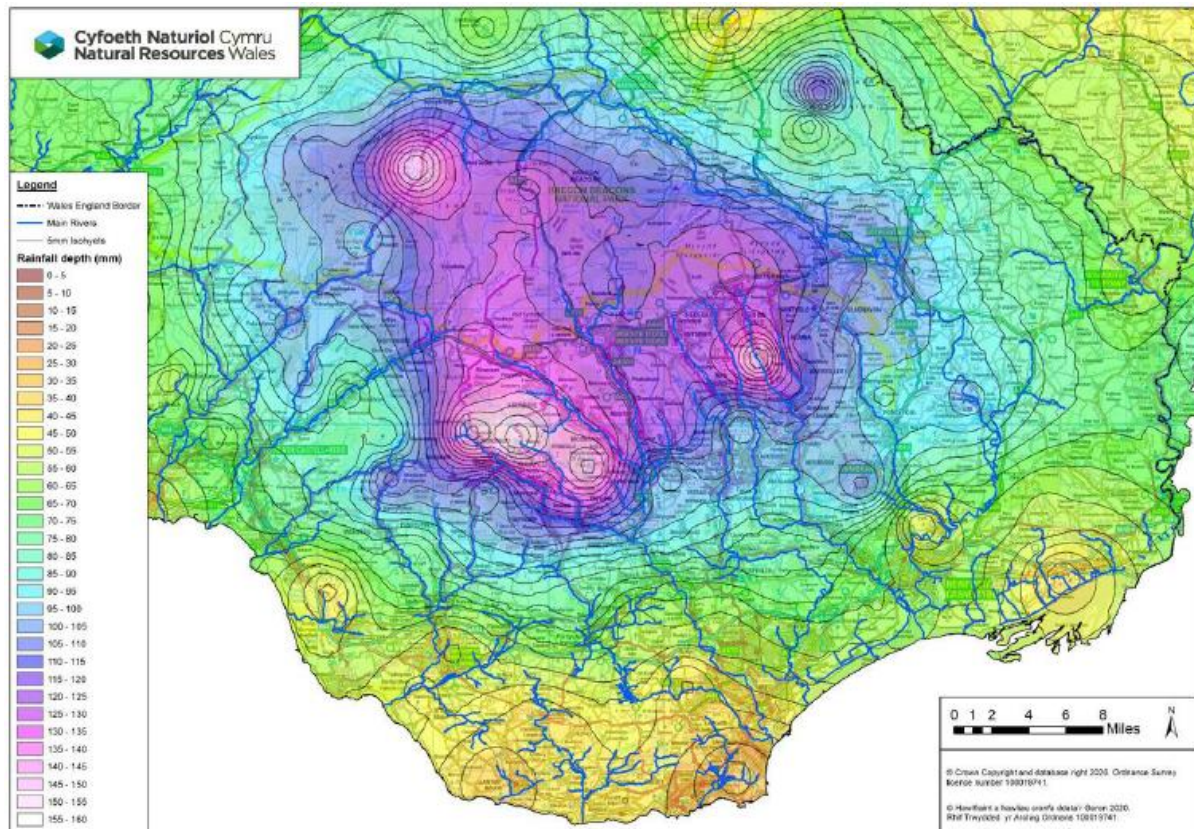


Figure 19 - Rainfall Isohyet Map showing rainfall over a 48-hour period during Storm Dennis in South Wales (produced by NRW).

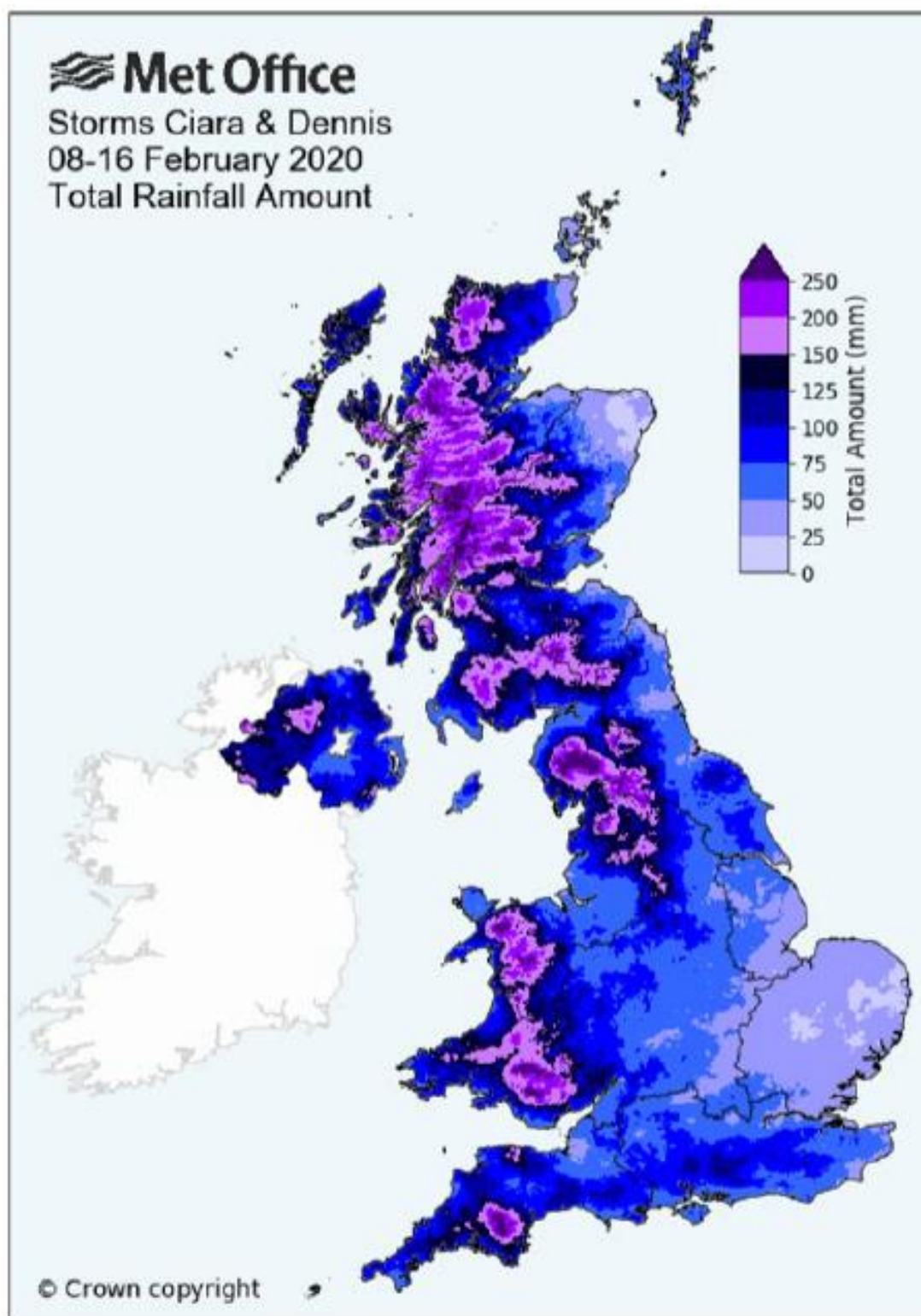


Figure 20 - Total Rainfall amounts experienced during Storm Ciara and Dennis in the UK (produced by Met Office).

4 Mechanisms of Flooding

4.1 Fluvial Flooding

The flooding mechanisms at Llanbadoc are well known with the main river being the key source of flooding. There is no raised flood defence at Llanbadoc Island therefore the level of flood risk is higher than that of Usk Town just upstream, which benefits from flood defences.

The unnamed brook that crosses through Llanbadoc along Church Lane draws its flows from the hills to the west, then flows across the area, crosses under the highway in a culvert, then into a short section of open channel and then is culverted through the River Usk banks into the main channel via a circa 1000mm diameter corrugated metal pipe. Generally, the River Usk levels rise from rainfall in its main catchment in the Brecon Beacons and by the time the peak flow reaches Usk town the local rainfall will have cleared. On this occasion the River Usk and flows in the watercourse coincided and created an even more significant event.

Once flood locking takes effect, the highway and adjacent properties begin to flood, floodwater backs up from the culvert and starts to extend on to the surrounding area of the flood plain. As the levels in the River Usk rise further this spills out onto the flood plain and flood extents become more widespread.

4.2 Land Drainage

There is a very limited system of identified land drainage outside of the watercourse that joins the River Usk adjacent to the Church. This watercourse splits upstream of Ivy Villa with the main flow route currently running through the culvert underneath Bridge Cottages. There is also an overflow channel that flows to the west of Ivy Villa and through a second culvert discharging adjacent to the bus stop. Drawings from the Usk Town flood scheme in 1980 appear to show the intended main channel as being that to the south, between Ivy Villa and The Orchards and not beneath Bridge Cottages. It would appear that this channel has slowly silted up over time and reduced in capacity resulting in normal base flows being directed through the culvert beneath Bridge Cottages.

Historically this watercourse had a different alignment downstream of the R106 and once flowed parallel to the River Usk, discharging further downstream to its current location which is at 90 degrees to the main river. It is unclear as to the intended purpose or benefit of this realignment which was undertaken by NRW's predecessor in 1982.

The features and alignments described above are shown in Figure 21.

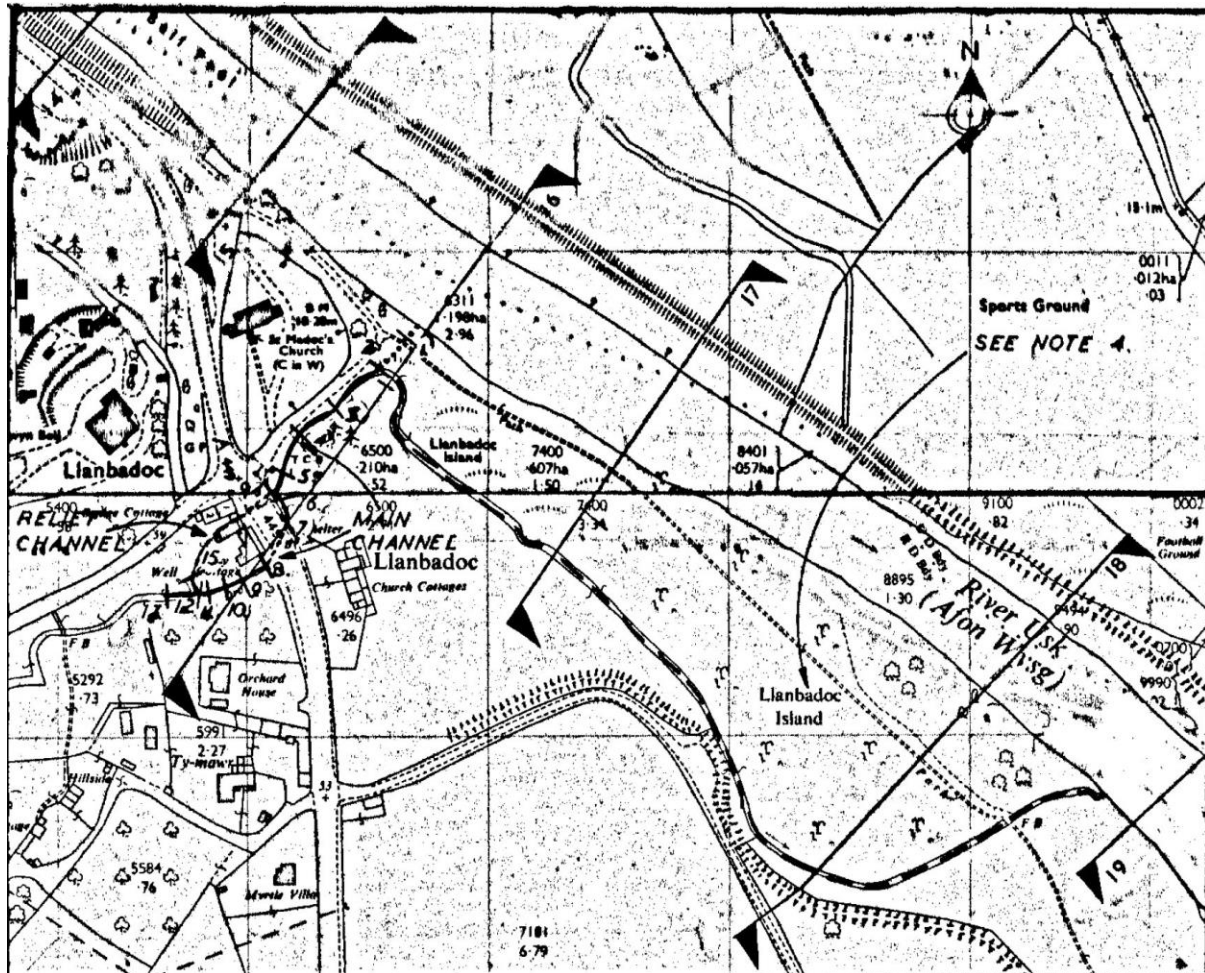


Figure 21 - Extract from Scheme Drawing showing historic alignment of Brook & Main Channel – Works undertaken during Usk Town Scheme – Drawing Source: Llanbadoc Brook Improvements - Welsh Water Authority, Usk Division 1981

4.3 Surface Water Drainage

Within the flooded area of Llanbadoc there is a system of highway drainage where individual or groups of highway gullies collect highway run off and discharge via outfalls to the unnamed watercourse where it flows under the highway at Ivy Villa. Responsibility for the highway gullies rests with MCC as the Highways Authority.

Following previous flood events, the details of the land drainage and surface water systems were collected through site investigations. This detail has been recorded on MCC's flood and drainage asset database in accordance with the duties of MCC as the Lead Local Flood Authority. Additional surveys will be required, as some information was not collected at the time of the initial investigations. Known locations of surface water drainage features are included in the plan in Appendix D.

4.4 Foul Water Drainage

Whilst there is no DCWW infrastructure mapped at Llanbadoc many properties have their own sewage systems with septic tanks, cesspits or other forms of private sewage treatment systems. Several private systems were overwhelmed during the event.

5 Rights and Responsibilities of Risk Management Authorities

5.1 Lead Local Flood Authority

Under the Flood and Water Management Act 2010, Monmouthshire County Council (MCC) has been established as the Lead Local Flood Risk Authority (LLFA) for its administrative area.

As defined in the Flood and Water Management Act 2010, MCC is responsible for 'Managing' what is termed, its 'local flood risk'. This includes the risk of flooding from ordinary watercourses, surface runoff and groundwater.

Local Authorities have always had certain responsibilities in relation to ordinary watercourses, and in practice most Local Authorities took the lead in dealing with surface water flooding incidents prior to the changes contained within the Flood and Water Management Act 2010.

The Flood and Water Management Act 2010 places a number of statutory duties on Local Authorities in their new role as LLFAs including:

- The preparation of local flood risk management strategies;
- A duty to comply with the National Strategy;
- To co-operate with other authorities, including sharing data;
- A duty to investigate all flooding within its area, insofar as a LLFA consider it necessary or appropriate;
- A duty to maintain a register of structures and features likely to affect flood risk;
- A duty to contribute to sustainable development; and
- Consenting powers on ordinary watercourses.

In addition to these each LLFA has a number of permissive powers. These are powers that allow them to undertake certain activities to manage flood risk, they are discretionary and include:

- Powers to request information;
- Powers to designate certain structures or features that affect flood or coastal erosion risk;
- The expansion of powers to undertake works to include broader risk management actions; and
- The ability to cause flooding or coastal erosion under certain conditions.

LLFA's in Wales have also taken on the role of the SuDS Adopting and Approving Body in relation to sustainable drainage systems as of the 7th January 2019. In this role they are responsible for both approving the original design of the SuDS and adopting and maintaining the finished system in accordance with Welsh Government's National Standards for Sustainable Drainage.

The function of the LLFA during and after the flooding at Llanbadoc included a range of Response and Recovery functions:

- Officers investigated the initial flooding and have produced this report in line with Section 19 FWMA 2010.
- Officers contacted residents affected by flooding to offer support and advice to assist in the recovery following the event.

- Officers coordinated the response to the flooding with Emergency Services
- Asset information collected during the flood event has been incorporated into the LLFA Asset Register.

5.2 Natural Resources Wales

Under the Flood and Water Management Act 2010 and The Water Resources Act 1991, NRW have discretionary powers to manage the risk of flooding from main rivers, reservoirs and the sea. They are also recognised as a coastal erosion risk management authority under the Coastal Protection Act 1949.

Their strategic oversight role is about having a Wales-wide understanding of all sources of flooding, coastal erosion and the risks associated with them, on a consistent basis across Wales to help inform the RMAs and the public.

NRW is the internal drainage board or carries out the functions of the internal drainage board, for the Internal Drainage Districts (IDDs) in Wales. It is granted powers under the Land Drainage Act 1991 to carry out works to manage the risk of flooding from ordinary watercourses and to regulate obstructions to ordinary watercourses within the IDD. Their main role is the management of water levels in ordinary watercourses in areas where there is a special need for drainage, including flooding.

NRW as the Risk Management Authority can use its permissive powers to carry out work in several ways:

- By building new flood defences and other structures such as sluices and pumping stations
- By maintaining defences and structures once built, keeping them in good condition subsequently, and repairing or improving them if and when required
- By maintaining main river watercourses, removing obstructions, vegetation and silt or gravel, to keep water flowing and remove significant flooding risks

5.3 Water / Sewerage Company

Sewerage Undertakers are responsible for maintaining the public sewerage systems, including adopted sewers carrying surface water run-off.

In flood conditions, the sewer systems can often become overloaded with a mixture of floodwater and sewage leading to overflow and flooding. Where applicable, Sewerage Undertakers are responsible for the removal of surface water from impermeable surfaces through their sewerage system. Where there is frequent and severe sewer flooding, Sewerage Undertakers are required to address this through their capital investment plans which are regulated by Ofwat. To prevent further flooding, water and sewer companies have a responsibility to: monitor the levels; prevent overloading sewer systems; maintain and repair drainage pipes as necessary. This investigation has not identified any assets or infrastructure belonging to a water or sewage company that may have contributed to the flood event

5.4 Network Rail

Network Rail has an operational responsibility as a riparian owner and is required to undertake regular maintenance of all assets that pose a risk to flooding. This investigation has not identified any assets or infrastructure belonging to Network Rail that may have contributed to the flood event.

5.5 Highway Authority

The Highway Authority is responsible for ensuring the highway is clear of obstructions and has a drainage system that controls the surface water that falls onto the highway.

Monmouthshire County Council is the Highways Authority for all highways in Monmouthshire apart from Trunk Roads which are managed by the Welsh Government. Highways Authorities are also Risk Management Authorities in their own right according to the Flood and Water Management Act 2010 and must adhere to all the responsibilities of Risk Management Authorities.

Under the Highways Act 1980, the Highways Authority has a duty to maintain the highway. This includes ensuring that highway surface water drainage systems are clear and free from blockages.

5.6 Riparian Landowners

A riparian owner possesses rights over and responsibilities for the stretch of a watercourse that forms the boundary of their property. A riparian owner is anyone who owns a property where there is a watercourse within or adjacent to the boundaries of their property. A watercourse includes a river, stream or ditch. Riparian owners, (householders and businesses) are responsible for maintaining their rivers, streams, ditches, pipes culverts and bridges

Riparian Landowners are legally responsible under common law for the maintenance of the land generally up to the centreline of any watercourse adjacent to their property. This includes the maintenance of the bed, banks and any boundary features e.g. vegetated strips such as hedging, with routine clearance of debris and/or blockages.

This does not mean that the owner must remove all debris from the watercourse, but it does require the owner to maintain as far as it does not pose a risk or 'nuisance' to a neighbour. Any works to modify the watercourse by the landowner will first require the necessary consents or permits from the relevant Risk Management Authority, Lead Local Flood Authority (LLFA) or Natural Resources Wales (NRW).

Landowners are responsible for ditches and land drainage assets upon their land at Llanbadoc. NRW has permissive powers to maintain watercourses which are designated as Main Rivers and MCC has permissive powers to maintain the ordinary watercourses respectively.

5.7 Residents and Property Owners

Residents and property owners are responsible for the maintenance and operation of drainage assets and connecting pipework falling within their ownership. They are also responsible for the protection of their own properties against flooding. Where safe to do so, they should take measures to protect themselves and their property from flooding. Residents and property owners have the right to defend their property as long as they do not subsequently increase the risk of flooding to other properties.

6 Permissive Powers of Risk Management Authorities

As Risk Management Authority for the main River Usk, Natural Resources Wales have permissive powers under the Flood and Water Management Act 2010 and Water Resources Act 1991. These discretionary powers include the ability to undertake works to clear watercourses as well as developing and implementing flood alleviation schemes when justifiable.

MCC also have permissive powers under the Land Drainage Act 1991 on ordinary watercourses and drainage features that fall outside of the Internal Drainage District. As Highway Authority, MCC arranged clearance of the highway drainage systems following the flood event and will be undertaking a full drainage survey and recording the detail on their drainage asset database in accordance with their duties as Lead Local Flood Authority.

7 Flood Alleviation Scheme / Drainage Improvements

In the 1980s following a severe flood event the Usk Town defences were raised by Usk River Board in 1982 to protect the town of Usk. As part of this scheme works were undertaken to realign the brook and create the new outfall adjacent to the now Llanbadoc Island Car Park. The previous alignment can be seen in the plan in Appendix B.

Following the multiple flooding events in this part of Llanbadoc, MCC have undertaken several investigations. The outcome of these has been to contact riparian owners to clear debris and undertake maintenance on the watercourse and undertake clearance works of the highway drainage system.

Further consideration will need to be given to the viability of any formal defences or Property Flood Resilience measures. Such work will form part of the Recommendations of this report.

8 Conclusion

The investigation has identified that the flooding that affected Llanbadoc between the 15th and 17th February 2020 was the result of a prolonged and significant rainfall event. This event, which created the largest accumulations of rain falling on already wet ground, occurred predominately during 15th and 16th February 2020, as part of Storm Dennis. More than 90% of the monthly average rainfall was recorded in some areas in South Wales during Storm Dennis alone. Much of the Brecon Beacons and upper Usk catchment saw 100mm-125mm rainfall in the 48-hour period of Storm Dennis.

The upper catchments of the River Usk in the Brecon Beacons responded to the rainfall, resulting in a rapid and significant rise in levels in the river at Llanbadoc on Friday 15th and Saturday 16th February. The River Usk broke banks and resulted in flooding of the properties. This peak in the level of the River Usk coincided with a peak from the local rainfall that was experienced on the 16th that resulted in increased water levels through the watercourse to the west further exacerbating flood impacts.

As the described flows built up on the highway, flooding of local properties occurred, and flood water continued to flow south and east into lower lying areas and then continued further south to flood the garden centre and farms. In total 9 residential and 2 commercial premises had internal and external flooding of gardens and working areas, causing damage to properties and disruption to residents and businesses. However, this is based on reported data and it is possible that more properties and businesses were affected considering the extent and depth of the flooding.

In addition, water was noted to be flowing over the defences (previously perceived to be private defences) adjacent to Lanusk Farm causing damage to them. Any further erosion or damage to these defences could have created a serious risk to life.

Concerns were raised with the level of risk residents face from future flood events and actions to address these concerns were put forward by residents and property owners. These actions have been considered further and a number of recommendations have been made in Section 9 of this report.

9 Recommendations

In accordance with Section 19 of the Flood and Water Management Act 2010, as Lead Local Flood Authority Monmouthshire County Council has investigated this flood event and identified which Risk Management Authorities have relevant flood risk management functions. As a result of the findings of this investigation and discussions with residents and other Authorities, the following recommendations have been made.

Reference	Recommendation	Responsible Risk Management Authority(s)
LB1	Notify landowners adjacent to the unnamed brooks to clear and remove debris and silt as riparian owners as required.	MCC
LB2	MCC Highways to ensure all gullies, pipework and culverts together with their connections and outfalls are cleared of silt and debris and ensure such features are maintained to the required standards.	MCC
LB3	MCC Flood Team to consider preparing a bid to Welsh Government to undertake a Strategic Outline Business Case / Business Justification Case to consider possible mitigation options to reduce flood risk from the Ordinary Watercourse.	MCC
LB4	NRW to consider undertaking an Initial Assessment of options to reduce flood risk from the main River Usk and tributary flood-lock events using current Welsh Government FCERM Business Case Guidance.	NRW
LB5	Record detail, ownership and maintenance responsibility of all surface water and land drainage features and structures and ensure such features/structures are maintained to the required standards	MCC /NRW
LB6	NRW to consider future maintenance requirements of existing defences and/or provide specialist advice to riparian owners covering repair and maintenance of the existing flood defence assets	NRW

10 Useful Links and Contacts

- Monmouthshire County Council Flood Pages:
www.monmouthshire.gov.uk/flood-risk-management
- Natural Resources Wales:
www.naturalresources.wales/flooding
- Welsh Government:
www.gov.wales/flooding-coastal-erosion
- Blue Pages
www.bluepages.org.uk
- Flood Re (Insurance):
www.floodre.co.uk

Appendix A – Met Office Report

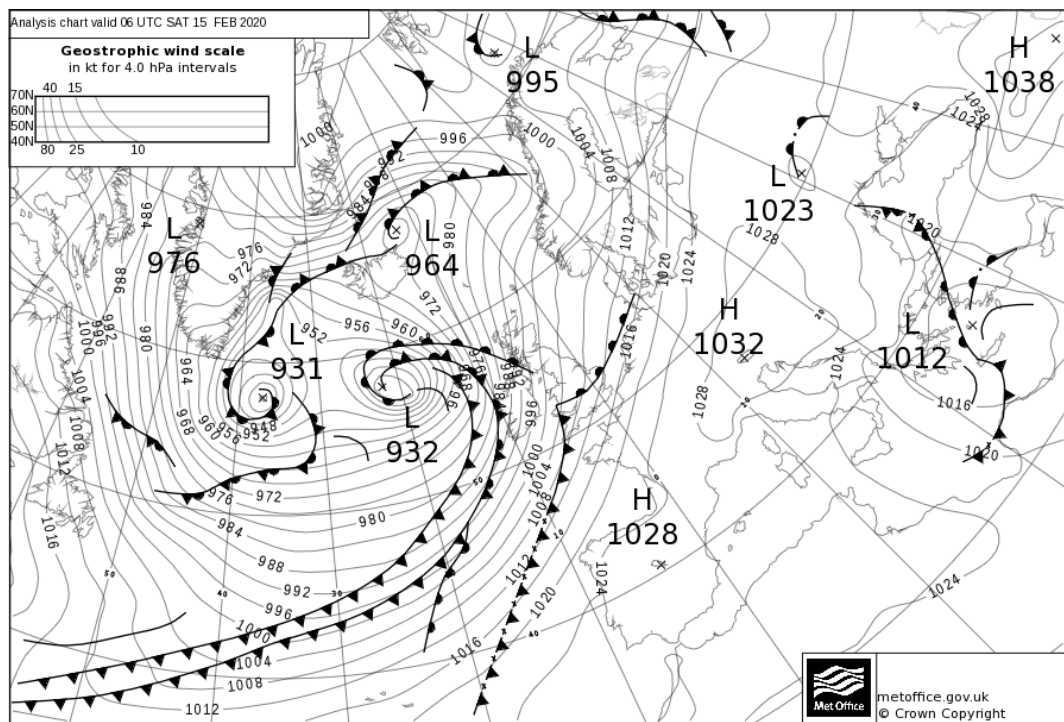
Storm Dennis was the fourth named storm of the 2019/2020 season. Arriving one week after storm Ciara, Dennis brought heavy and persistent rain across much of the UK – especially Wales and western England. Western upland parts of the UK received 50 to 100mm or more of rain falling on saturated ground. The Met Office issued a Red Warning for rain across parts of south Wales and there was major and widespread flooding. Storm Dennis also brought very strong winds, but the worst of the impacts were from the rain.

Impacts

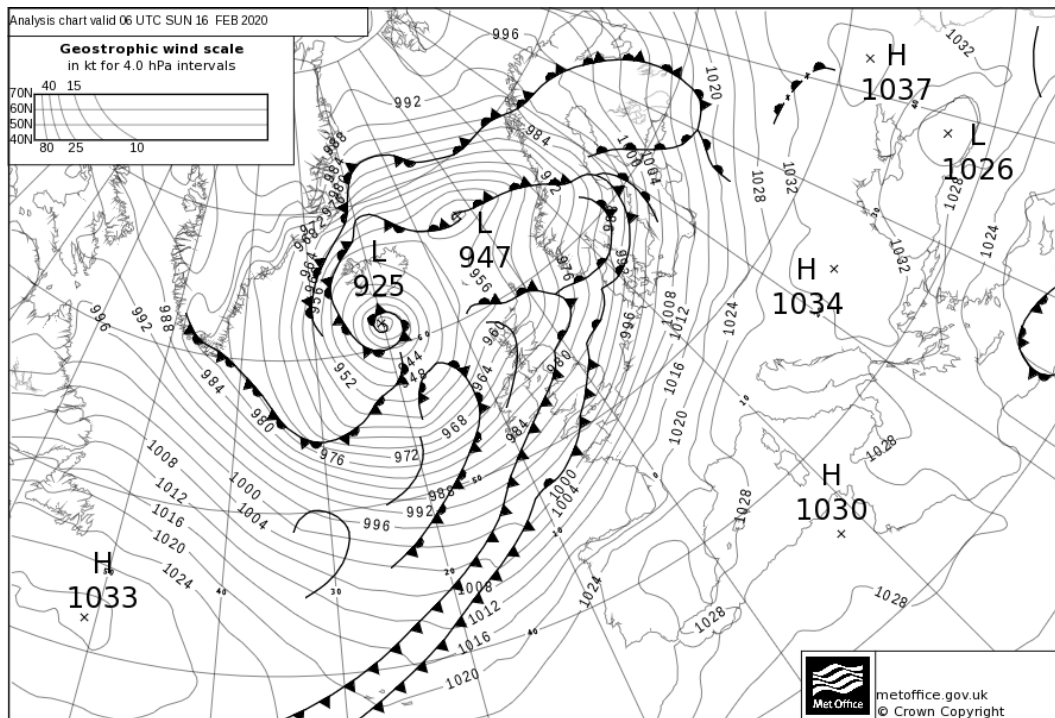
South Wales, Herefordshire, Worcestershire and Shropshire were worst affected by flooding and major incidents declared. The River Wye and River Severn which were reported to have reached their highest-ever levels. Areas of several towns including Hereford and Pontyprydd were inundated. The Environment Agency issued over 600 flood warnings and alerts including several severe flood warnings. A woman was swept away by floodwater in Worcestershire and over 1400 homes and businesses were flooded across several counties. The flooding also caused major travel disruption with roads blocked, damaged railway lines and hundreds of flights cancelled. Large areas of farmland were also underwater. Strong winds and large waves battered exposed coastlines, and in County Cork an abandoned 'ghost' cargo ship was washed ashore.

Weather data

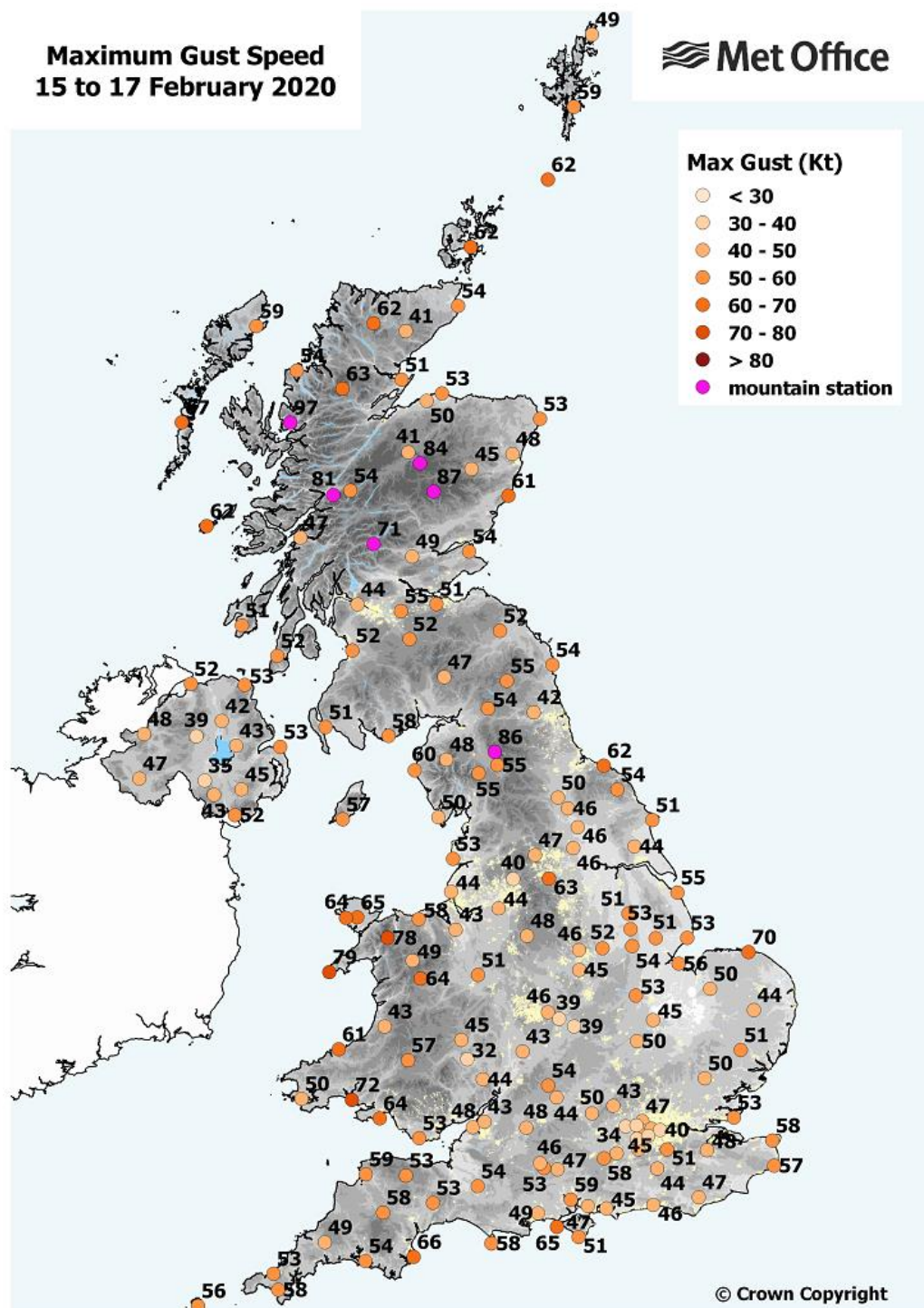
The analysis chart at 06 UTC 15 February 2020 shows storm Dennis as the deepening area of low pressure to the north-west of the UK, driven by a powerful Atlantic jet stream.



The analysis chart at 06 UTC 16 February 2020 (24 hours later) shows storm Dennis as the large area of low pressure still dominating the north Atlantic with rain-bearing fronts and strong winds sweeping across the UK.

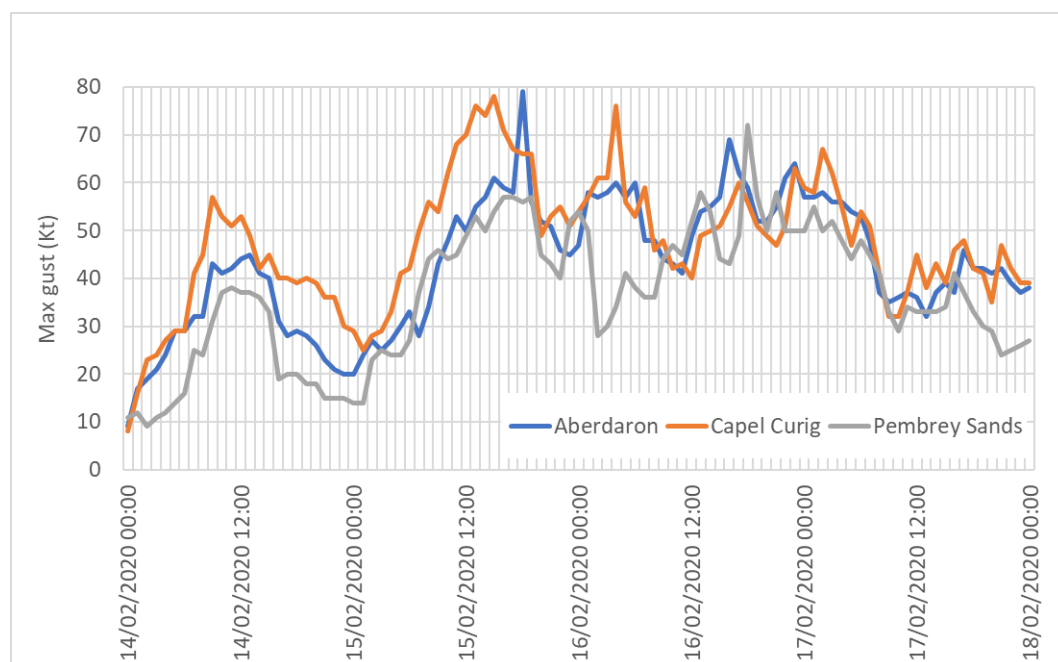


The map below shows maximum gust speeds from storm Dennis. Winds were comparable to storm Ciara, gusting at over 50 Kt (58 mph) across the UK and over 60 Kt (69 mph) around exposed coastlines. In total over 20 stations recorded gusts exceeding 60 Kt. The highest gusts were 79 Kt (91 mph) at Aberdaron, Llyn Peninsula, 78 Kt (90 mph) at Capel Curig, Conwy, 72 Kt (83 mph) at Pembrey Sands, Dyfed and 70 Kt (81 mph) at Weybourne, Norfolk. Wind speeds reached around 100 mph across the tops of the Pennines and Scottish mountains.

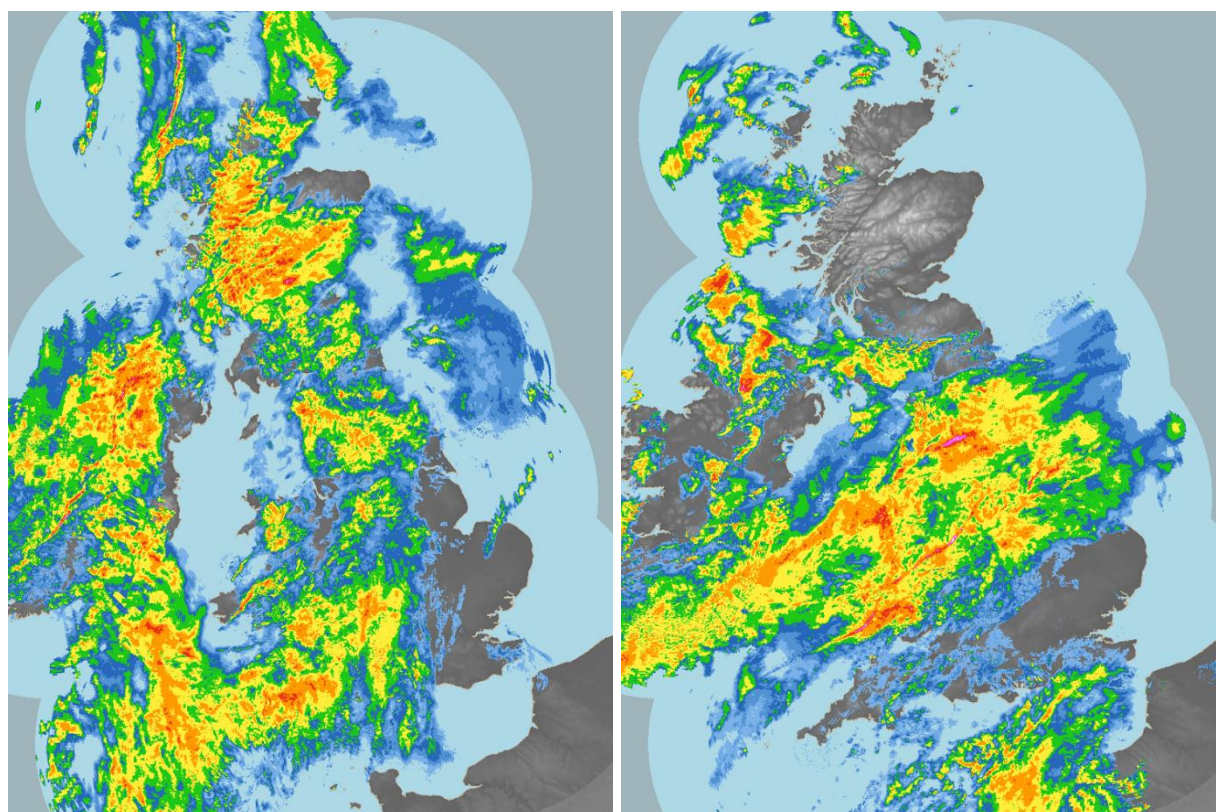


In terms of wind speeds, this was a notable although not exceptional storm for the time of year. However, one feature of storm Dennis was the persistence of the strong winds across the UK for several days, with the low pressure centre to the north-west slow to clear. The strongest winds on 15th to 16th were across England and Wales, transferring to Scotland on the 17th as the low's centre finally pulled away east toward Norway. The chart below shows hourly maximum gust speeds for three stations in Wales – Aberdaron, Capel Curig and Pembrey Sands – all three being

exposed locations. Hourly maximum gust speeds reached 50 Kt during the morning of the 15th and remained mostly above 50 Kt until the morning of the 17th – being sustained at this level for around two days.



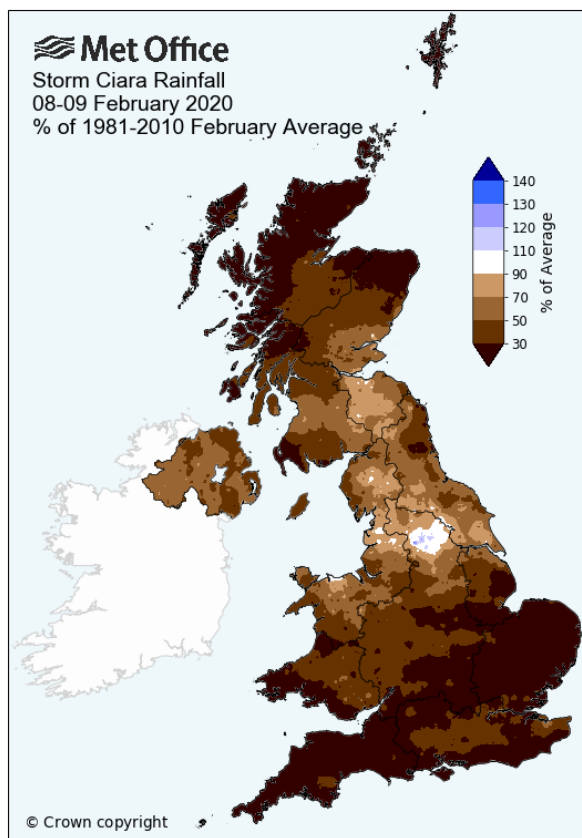
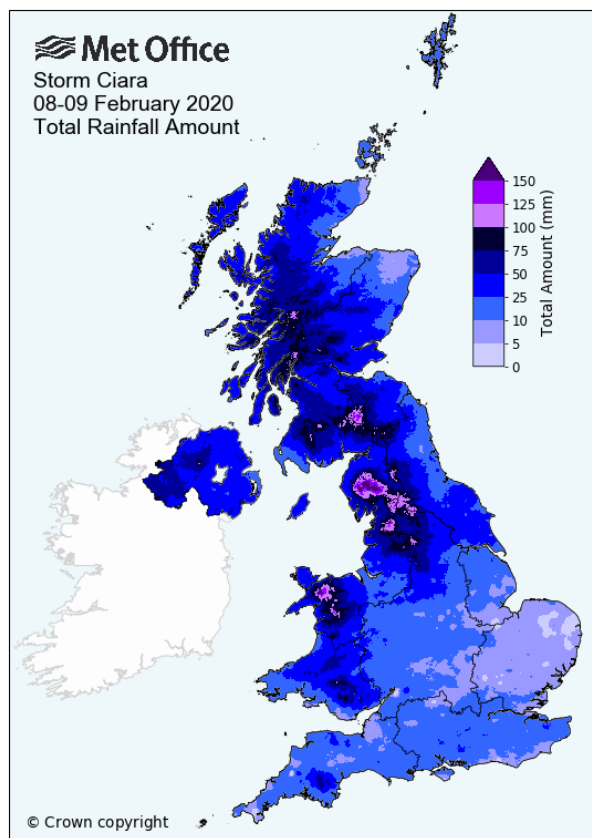
The rain-radar images at 12 UTC 15th and 00 UTC 16th February 2020 show the heavy and persistent rainfall from storm Dennis with the fronts sweeping across the UK.



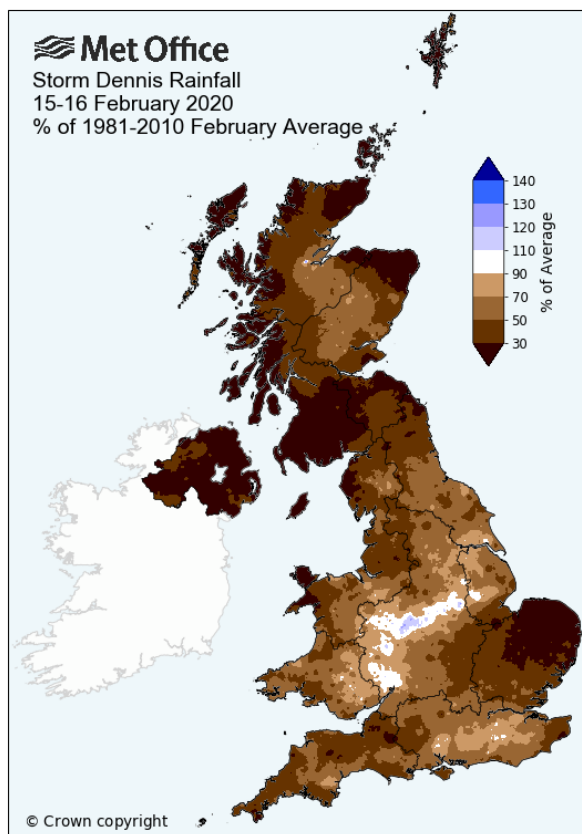
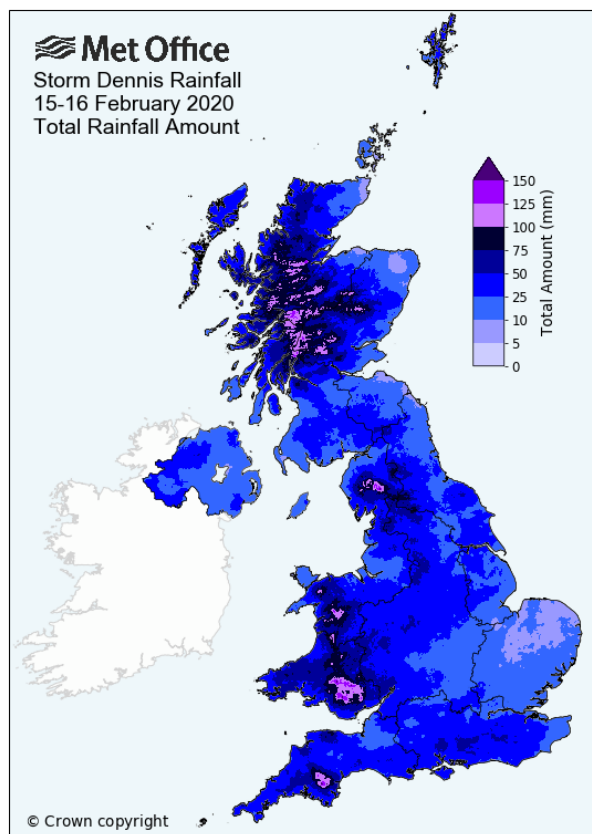
The map below shows rainfall totals for a) storm Ciara and b) storm Dennis, as actuals and % of 1981-2010 February long-term average. Storm Dennis brought 50 to 100mm or more of rain across the high ground of Dartmoor, parts of Wales, the Lake District and Highlands. 100 to 150mm of rain fell across parts of the Brecon Beacons and south Wales valleys. More than the February whole-month average rain fell for the rain-days 15-16 February (09 UTC 15th to 09 UTC 17th) across parts of the west and north Midlands.

Storm Ciara one week earlier brought 100mm+ of rain across the high ground of Snowdonia, the Lake District and parts of the Pennines. More than the February whole-month average rain fell for the rain-days 8 to 9 February (09 UTC 8th to 09 UTC 10th) across parts of the south Pennines

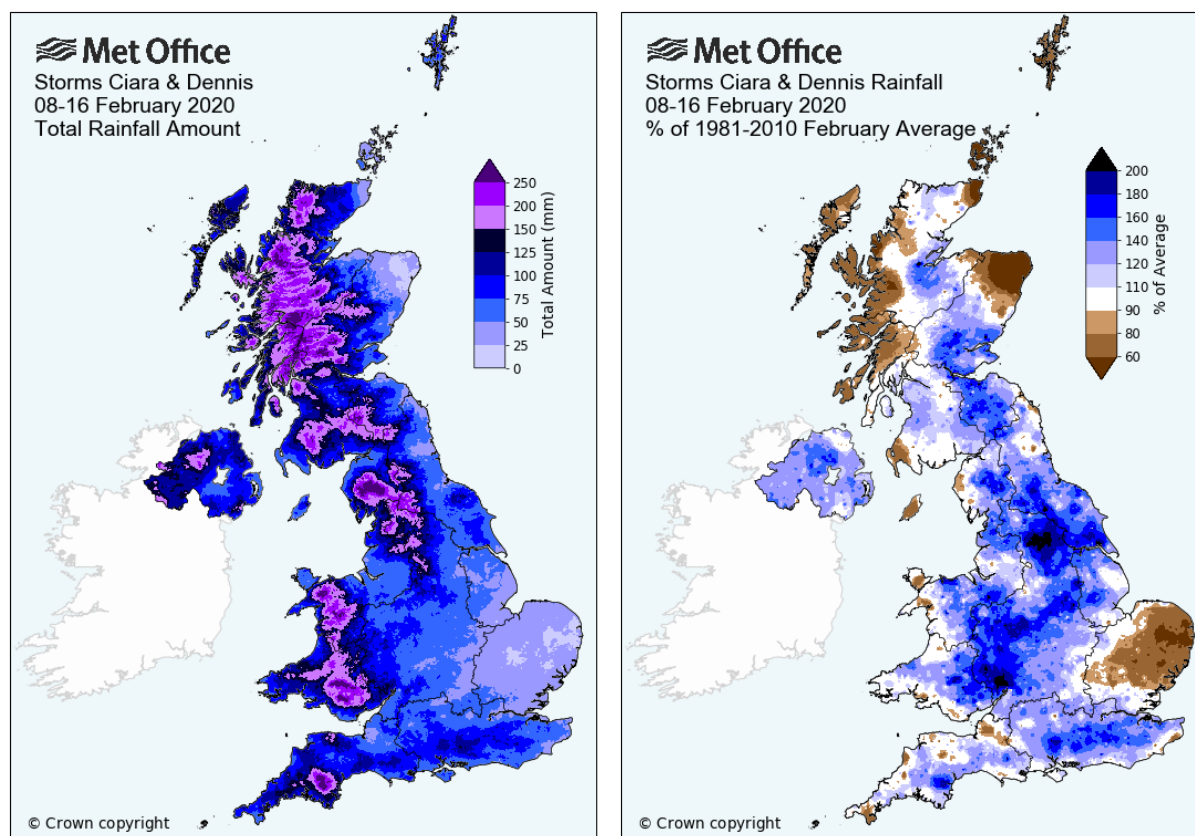
a) – storm Ciara rainfall



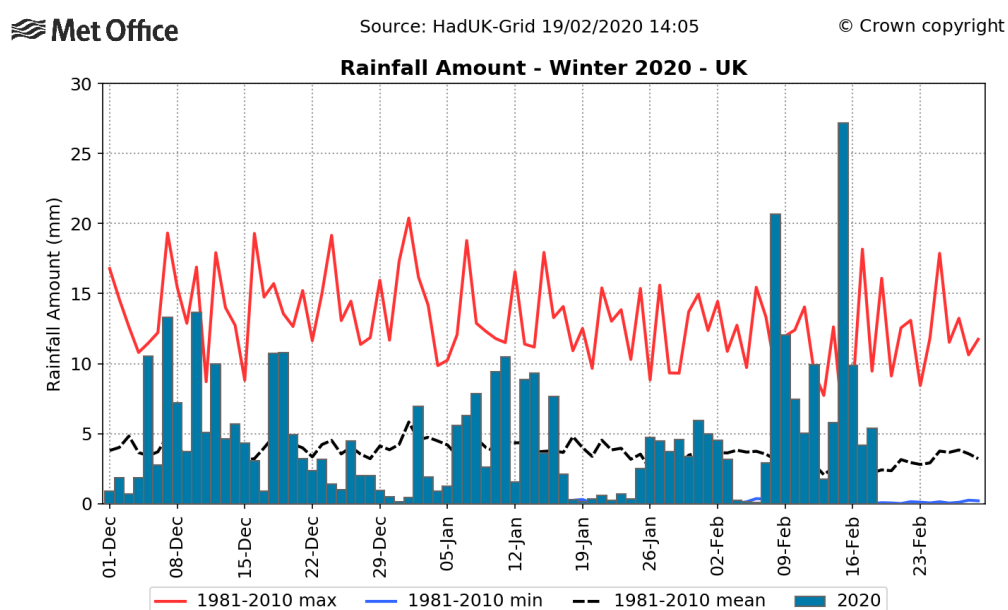
b) – storm Dennis rainfall



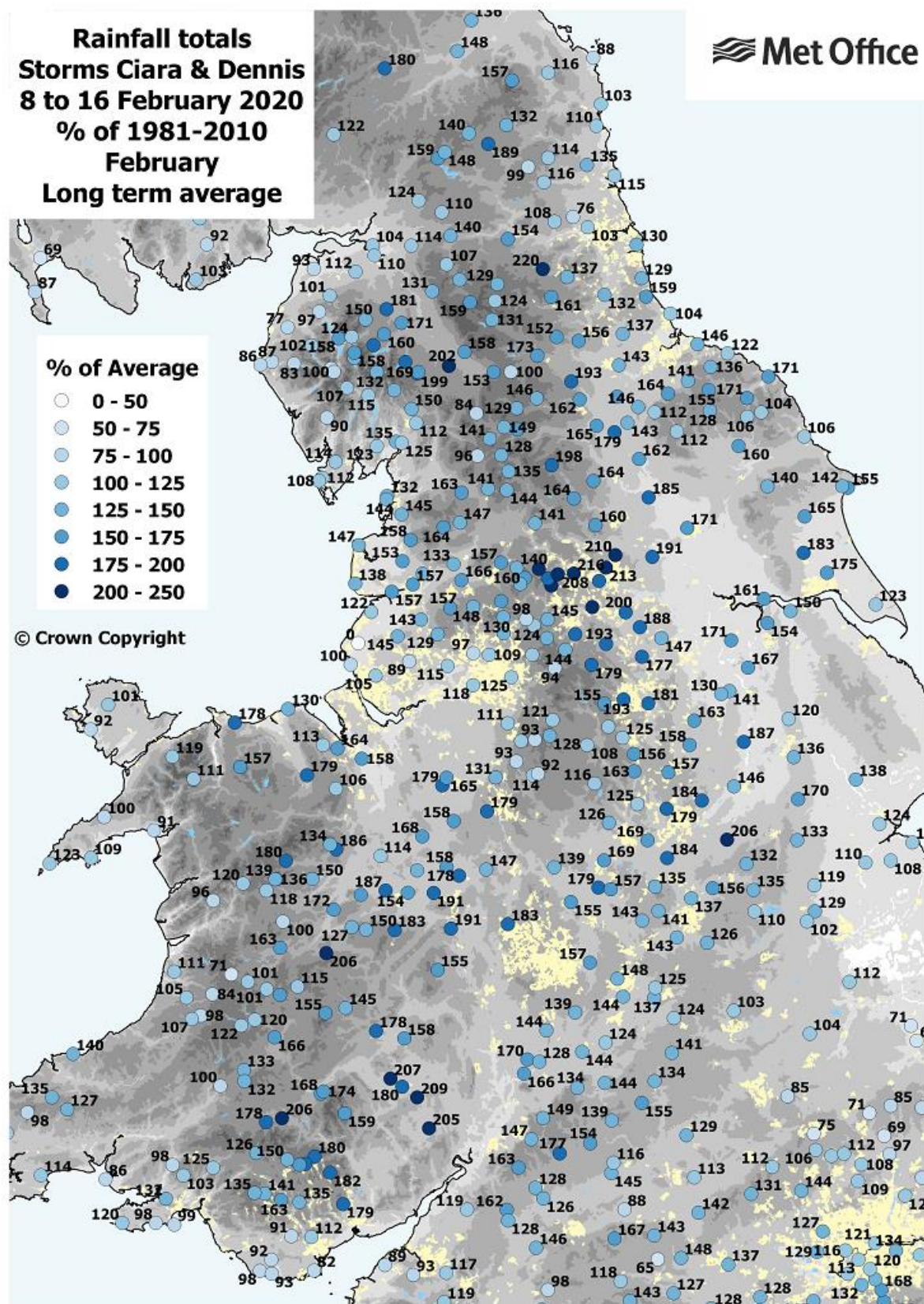
The maps below show how much rain fell across the UK overall for the 9-day period from 8th to 16th February, including both storms Ciara and Dennis. Over 100mm of rain fell across many western parts of the UK through this period with 150 to 250mm or more across the high ground of Dartmoor, Wales, northern England, Southern Uplands, West Highlands and parts of Northern Ireland. Most of the UK received the February whole-month average rainfall over this 9-day period, with around 150% fairly widely across east Wales, the West Midlands and a swathe of the Pennines through to Edinburgh and over 200% locally in the Pennines and parts of Gloucestershire and Herefordshire.



The chart below shows UK areal-average rainfall totals for each day of winter 2020 so far (1 December 2019 to 18 February 2020), with the exceptionally wet days of 8 and 15 February associated with storms Ciara and Dennis.



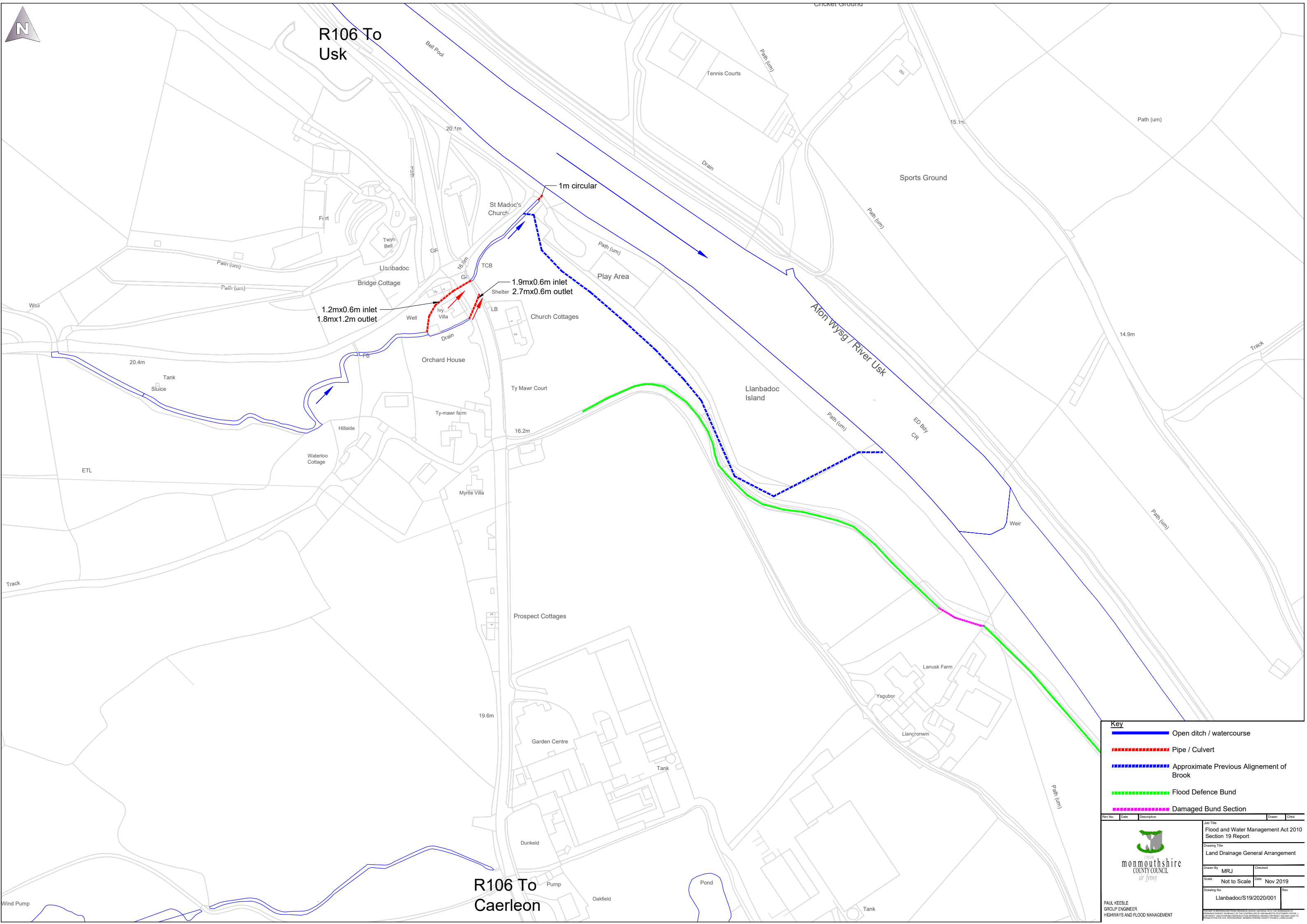
The map below shows rainfall totals at individual stations for storms Ciara and Dennis combined as % of 1981-2010 February long term average.



Author: Mike Kendon, Met Office National Climate Information Centre

Last updated 20/02/2020


Appendix B – Land Drainage General Arrangement



Key

- Open ditch / watercourse
- Pipe / Culvert
- Approximate Previous Alignment of Brook
- Flood Defence Bund
- Damaged Bund Section

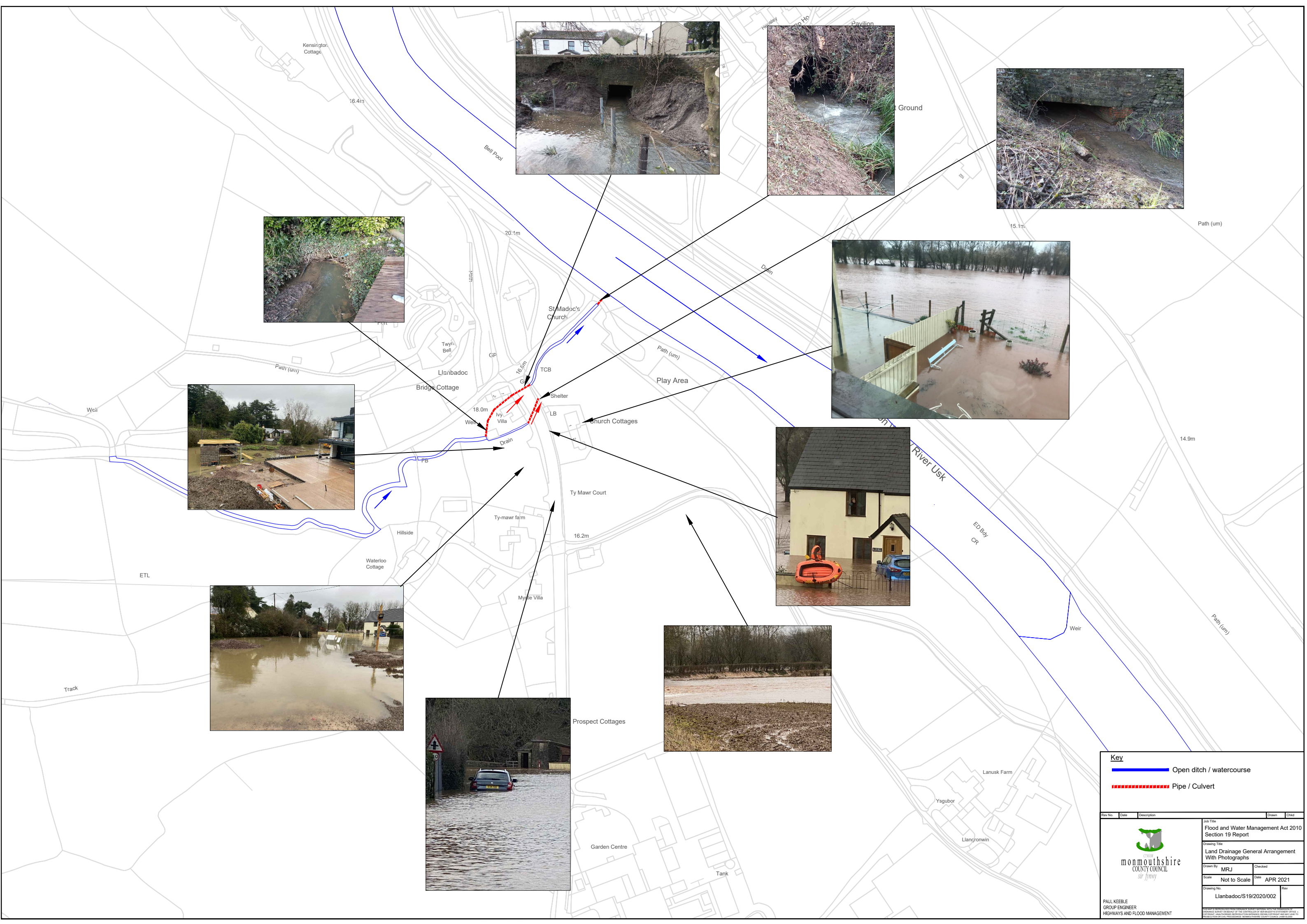
Rev No.	Date	Description	Drawn	Chkd
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 monmouthshire COUNTY COUNCIL sir fynydd	Job Title	
	Flood and Water Management Act 2010 Section 19 Report	
	Drawing Title	
	Land Drainage General Arrangement	
Drawn By		Checked
MRJ		
Scale		Date
Not to Scale		Nov 2019
Drawing No.		Rev
Llanbadoc/S19/2020/001		

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Appendix C – Land Drainage GA Plan with Photographs




Key

Open ditch / watercourse

Pipe / Culvert

Rev No.	Date	Description	Drawn	Chkd



monmouthshire
COUNTY COUNCIL
sr jenny

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HIGHWAYS AND FLOOD MANAGEMENT

Job Title

Flood and Water Management Act 2010
Section 19 Report

Drawing Title

Land Drainage General Arrangement
With Photographs

Drawn By

MRJ

Checked

Scale

Not to Scale

Date

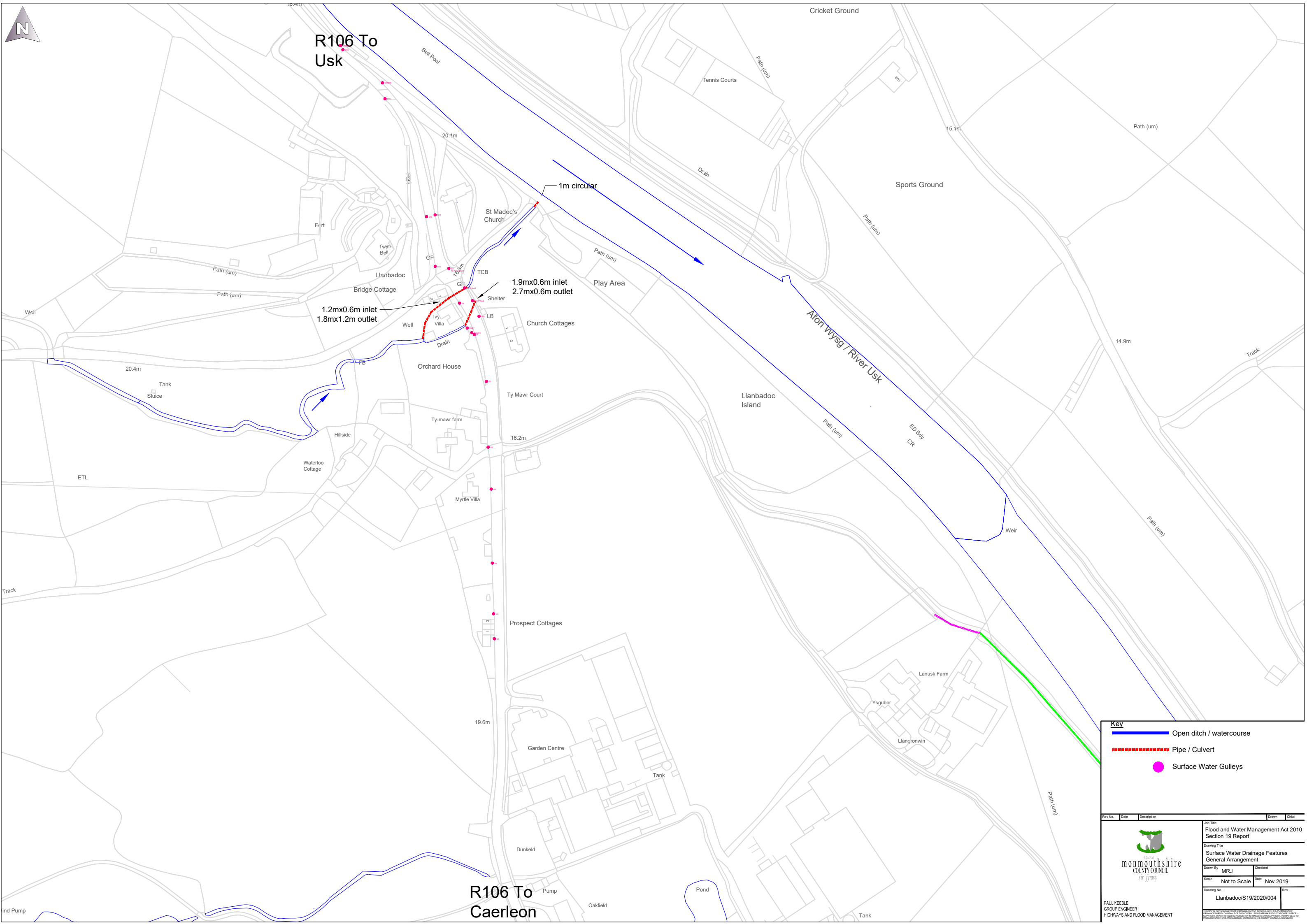
APR 2021

Drawing No.

Llanbadoc/S19/2020/002

Rev

Appendix D – Surface Water Drainage Features Plan



Key

- Open ditch / watercourse
- Pipe / Culvert
- Surface Water Gulleys

Rev No.	Date	Description	Drawn	Chkd

Job Title	
Flood and Water Management Act 2010 Section 19 Report	
Drawing Title	
Surface Water Drainage Features General Arrangement	
Drawn By	Checked
MRJ	
Scale	Date
Not to Scale	Nov 2019
Drawing No.	Rev
Llanbadoc/S19/2020/004	



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