

# Flood and Water Management Act 2010

## Section 19 Flood Investigation Report

### Storm Dennis – Flood Investigation Area RCT10

September 2021

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**DOCUMENT VERIFICATION**

Client	Group Director Prosperity, Development and Frontline Services
Project	Flood and Water Management Act 2010, Section 19 Flood Investigation Report
Document Title	Storm Dennis – Flood Investigation Area RCT10
Document Ref	FRM – S19 - 010
Project No	N/A

Revision Status	Final			
Publication Status	Publication Approved			
Date of Issue	20/09/2021			
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This report should be read in its entirety

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## EXECUTIVE SUMMARY

This report has been produced through the duties placed upon Rhondda Cynon Taf County Borough Council (RCT) under Section 19 of the Flood and Water Management Act 2010. The Act states, “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”.

This Section 19 investigation provides a factual report of the storm event that occurred on 15 and 16<sup>th</sup> of February 2020 within the Rhondda Cynon Taf County Borough Council area, focusing investigation on the flooding at Cilfynydd in the River Taff catchment, to the north-east of Pontypridd (Flood Investigation Area RCT 10, Figure 1). This report was undertaken to identify the mechanism for flooding, establish which Risk Management Authorities have relevant flood risk management functions under the Flood and Water Management Act 2010 and ascertain if those Risk Management Authorities had undertaken or were planning to undertake actions related to those functions to reduce/alleviate the risk of flooding.

The flooding that affected RCT on 15 and 16<sup>th</sup> of February 2020, was a result of an extreme rainfall event, designated by the Met Office as ‘Storm Dennis’. The impact of the event at investigation area RCT10 resulted in internal flooding to 23 residential properties, two commercial properties and flooding to the highway. These impacts were identified through inspections made by RCT’s Flood Risk Management Team during the days following the storm event, as well as information collated by residents, RCT’s Public Health team, Natural Resources Wales and Dŵr Cymru Welsh Water.

It has been established from the evidence gathered within this report that the primary source of flooding at RCT10 on the 15 and 16<sup>th</sup> February 2020 was a result of significant overland runoff being generated from the steep hillsides above Cilfynydd draining to lower ground via a series of ordinary watercourses, many of which became overwhelmed with water and debris and eventually overtopped, impacting several properties on its course of flow.

On review of the hydraulic performance of the three culvert inlets known to have caused flooding to properties, it was confirmed that the Nant Cae Dudwg culvert inlet became hydraulically overloaded while the Heol Mynydd and Ely Brook networks were identified as having standard of protection of up to 1 in 100-year event. This confirms

that both inlets had sufficient capacity to manage the expected flows, but its capacities were significantly reduced due to blockages, resulting in flooding to several properties. The poor structural condition of the Ely Brook network is also considered to have contributed to the flooding at Pontshonnorton Road.

RCTCBC as the Lead Local Flood Authority (LLFA) and Land Drainage Authority (LDA) has been determined as the relevant Risk Management Authority responsible for managing the ordinary watercourse and surface water flooding that occurred in Cilfynydd during Storm Dennis.

In response to the flooding in Cilfynydd during Storm Dennis, the LLFA has undertaken 12 actions and have proposed to undertake a further 8. A summary of which include;

- Undertaken clearance works to the culvert inlet structures identified as sources of flooding prior to and following the storm event (assisted by the Highway Authority);
- Carried out survey, jetting and cleansing works to an estimated 1,229 metres of culverted watercourse network length within the investigation area;
- Led on the development of a central Control Room, to compliment the Council's Contact Centre and CCTV Centre, to provide a comprehensive and informed response to residents during storm events; and
- Initiated an interim Property Flood Resistance project offering expandable flood gates to properties deemed at high risk of ordinary watercourse and surface water flooding.

As the relevant Risk Management Authority for ordinary watercourse flooding, RCTCBC as the Lead Local Flood Authority will also look to better understand the catchment above investigation area RCT10 through the development of a Strategic Outline Business Case to provide recommendations for suitable management mechanisms to mitigate the wider risk of ordinary watercourse and surface water flooding in the community.

The event that occurred on 15 and 16<sup>th</sup> February 2020 was extreme, and it is unlikely flooding from a similar event could be prevented entirely. It is concluded that Risk Management Authorities satisfactorily carried out their flood risk management functions in response to the flood event, however, further functions have been proposed by RMAs to better address preparedness and response to surface water flood events.

## ABBREVIATIONS

**CaRR** – Communities at Risk Register

**DCWW** – Welsh Water

**FRMP** – Flood Risk Management Plan

**FWMA** – Flood and Water Management Act 2010

**LDA** – Land Drainage Authority

**LFRMS** – Local Flood Risk Management Strategy

**LLFA** – Lead Local Flood Authority

**NRW** – Natural Resources Wales

**Q** – Return Period (1 in X chance of an event occurring in any given year)

**RCT** - Rhondda Cynon Taff CBC

**RCT10** – Flood Investigation Area RCT 10

**RMA** – Risk Management Authority

**SAB** – Sustainable Drainage Approval Body

**SuDs** – Sustainable Drainage Systems

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# 1. INTRODUCTION

## 1.1. PURPOSE OF INVESTIGATION

On the 15 and 16<sup>th</sup> February 2020 Rhondda Cynon Taf County Borough Council (RCT) was impacted by an extreme weather event which was designated by the 'Met Office' as 'Storm Dennis'. Due to the extent and impact of the event, the LLFA opted to undertake a formal investigation.

The storm resulted in widespread residential and commercial flooding within the Rhondda Cynon Taf County Borough Council area. This report will focus on Flood Investigation Area RCT 10 which covers the village of Cilfynydd in the River Taff catchment.

The reason behind RCT's 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 the response to the flood."
2. "When an authority carries out an investigation under subsection (1) it must publish the results of its investigation, and notify any relevant risk management authority"<sup>1</sup>

The purpose of the investigation is to determine which Risk Management Authorities have relevant flood risk management functions and which functions have been exercised in response to a flood.

Specific details of Storm Dennis, such as rainfall analysis are covered within a separate overview report that covers the wider RCT area. The report is titled 'Storm Dennis February 2020 – Overview Report' and will be referred to as 'FRM – Storm Dennis – Overview Report'<sup>2</sup>.

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<sup>1</sup> Flood and Water Management Act 2010 – Section 19 - <https://www.legislation.gov.uk/ukpga/2010/29/section/19>

<sup>2</sup> [Flood Investigation Reports | Rhondda Cynon Taf County Borough Council \(rctcbc.gov.uk\)](https://www.rctcbc.gov.uk/flood-investigation-reports)

## 1.2. SITE LOCATION

The area investigated within this report covers the town of Cilfynydd and extends south towards the north of Pontypridd (Figure 1). Cilfynydd is located within the eastern sector of RCT in the River Taff catchment, on the eastern side of the river.

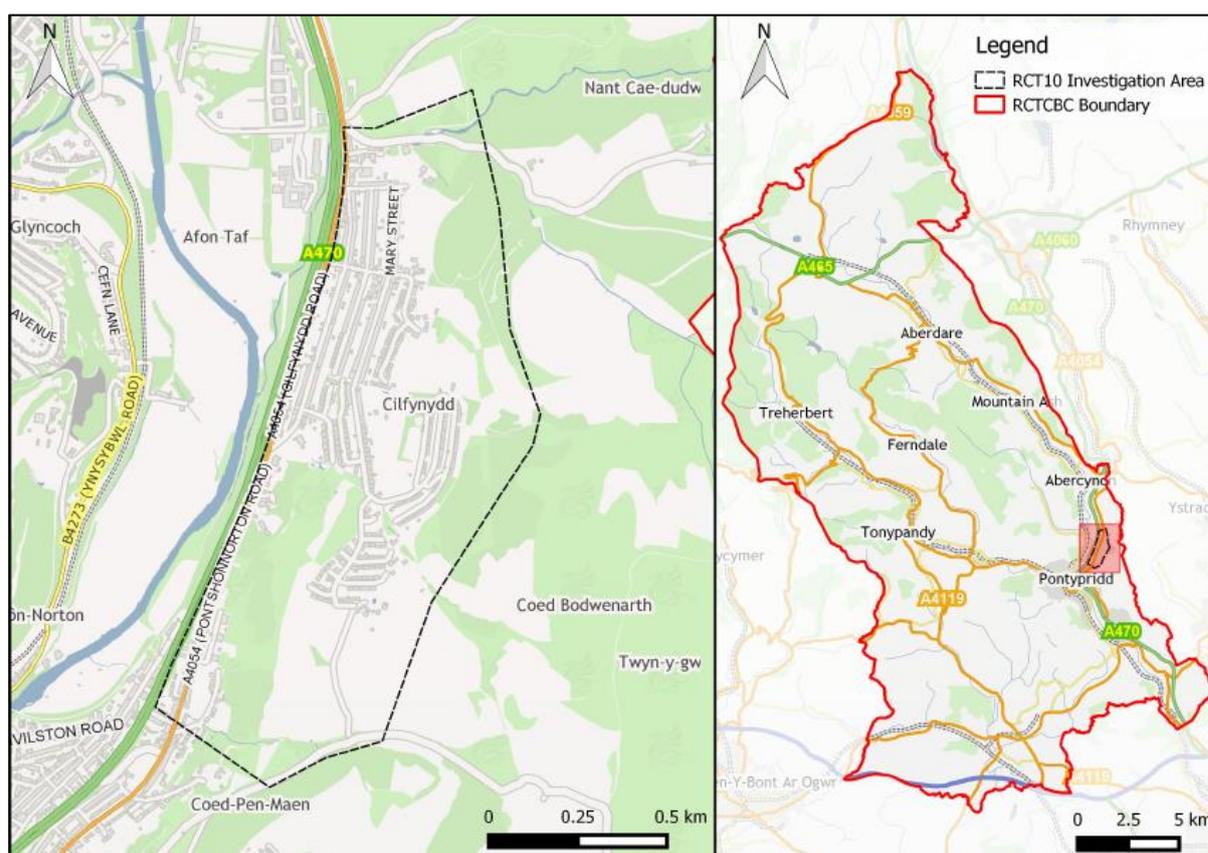
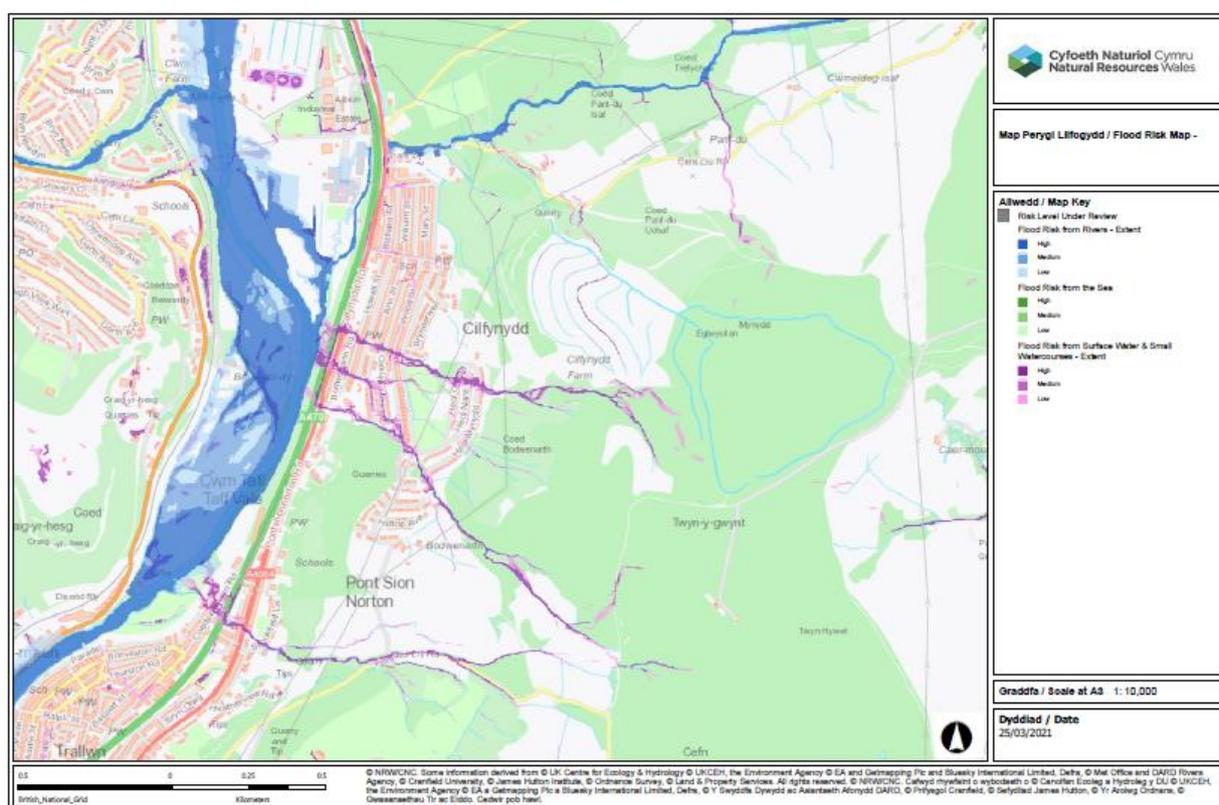


Figure 1: Flood Investigation Area RCT10 Location Plan

The catchment is predominantly a rural environment owing to the steep topography of the higher elevations in the east, consisting of exposed moorland and areas of forested land. Residential development is situated in the central western portion of the investigation area and is built back from the A470.

The most significant watercourse within Cilfynydd is the Nant Cae Dudwg which drains the north-east of the site and discharges into the River Taff. To the south of Cilfynydd, a small watercourse named Ely Brook flows east to west and is culverted beneath the A4054 and A470. Several other minor unnamed watercourses drain the steep slopes in the east of investigation area RCT10 and discharge into the River Taff. Large sections of these watercourses are culverted beneath residential development in the urban area.

The highest risk posed to people and properties according to RCT's Flood Risk Management Plan (FRMP)<sup>3</sup> is broadly associated with the culvert inlet of the Nant Cae Dudwg where it crosses under Cilfynydd Road. The FRMP also notes a low to high risk of flooding sourced from the unnamed watercourses culverted beneath Cilfynydd. The risk of flooding from these watercourses is illustrated within Natural Resources Wales' Flood Risk Assessment Wales (FRAW) map presented in Figure 2. Flooding from the Main River is noted within the floodplains adjacent to the River Taff, however these areas fall outside of investigation area RCT10.



**Figure 2:** Natural Resources Wales' Flood Risk Assessment Wales (FRAW) map for rivers and ordinary watercourse and surface water flood risk at investigation area RCT10. Contains Natural Resources Wales information © Natural Resources Wales and database right. All rights reserved.

### 1.3. DRAINAGE SYSTEM

The surface water drainage system that serves investigation area RCT10 is that of the highway drainage network designed to manage the surface water within the highway and public surface water sewer and combined sewer networks operated by Dŵr Cymru Welsh Water.

<sup>3</sup> [RCT's Flood Risk Management Plan \(rctcbc.gov.uk\)](http://rctcbc.gov.uk)

## 1.4. 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 within Table 1.

**Table 1:** Investigative evidence gathered in preparation of the Storm Dennis Section 19 report

Source	Data
<b>Residents</b>	Photos, videos, statements, email correspondence, public engagement survey responses
<b>Responders' statements</b>	Local responders' statements
<b>CCTV Surveys</b>	Internal surveys of the local drainage networks
<b>Met Office Data</b>	Weather Warning information (see FRM – Storm Dennis – Overview Report)
<b>Rain Gauges</b>	RCT and NRW operated gauge information (see FRM – Storm Dennis – Overview Report)
<b>Natural Resources Wales</b>	River Level and Flood Warning data
<b>RCT Flood Risk Management Plan</b>	Site specific information and data for each electoral ward in RCTCBC
<b>Communities at Risk Register</b>	Flood risk ranking and scores for all flood types based on community data in Wales
<b>Flood Investigation Report (Redstart's FIR)</b>	A summary of the source-pathway-receptors, culvert capacity assessment and hydraulic modelling work undertaken by Redstart. The Flood Investigation Report was commissioned by RCTCBC prior to writing the Section 19 report.

Evidence sourced from the 'Flood Investigation Report', commissioned by RCTCBC, will be further referred to as 'Redstart's FIR' throughout this report.

## 1.5. PUBLIC ENGAGEMENT

Following the initial flooding event that occurred on the 15<sup>th</sup> and 16<sup>th</sup> February during Storm Dennis, flood risk officers from RCT's Flood Risk Management department were deployed to areas across the borough to investigate reports of internal flooding by residents. Residents were engaged by the Flood Risk Management team to help determine the initial impacts caused by the flooding event and to investigate the potential source(s) and pathway(s) of flood water during the event. Due to the volume

of calls received by RCT's Out of Hour department, visits were prioritised to those areas experiencing significant internal flooding to residential properties.

To support the flood investigations, a public engagement exercise was undertaken between 4<sup>th</sup> and 25<sup>th</sup> January 2021 by Redstart on behalf of RCTCBC. The aim of this was to engage with the local residents who were affected by the flood event to capture details on how they were impacted, the source and movement of flood water within the area, how receptors were impacted as well as drawing on local knowledge to query how local conditions could have exacerbated the event. This data is useful to help the LLFA better understand and validate our assessment of the flood event to support the investigation under Section 19 of the FWMA.

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## 2. FLOODING HISTORY

### 2.1. PREVIOUS FLOOD INCIDENTS

Local knowledge of the investigation area notes that the Nant Cae Dudwg ordinary watercourse and culvert inlet has a history of flooding in times of extreme rainfall. This is corroborated by residents' accounts captured as part of the public engagement exercise, which identify that properties affected at Cilfynydd Road have experienced internal flooding prior to Storm Dennis, originating from the Nant Cae Dudwg watercourse and culvert inlet.

Since the development and construction of a Flood Alleviation Scheme (FAS) on the Nant Cae Dudwg in 2014, led by RCT as the Lead Local Flood Authority, flood risk sourced from the watercourse and culvert inlet has reduced significantly. The watercourse is not known to have overtopped or surcharged at the inlet since the FAS, and no instances of internal flooding to those properties at Cilfynydd Road has occurred, up until Storm Dennis.

Previous incidences of flooding to properties within the wider investigation area have occurred over the past twenty years however, nothing as extreme as the flooding that occurred during Storm Dennis. Information relating to historical flood incidences is limited, however a list of dates where flooding has occurred within RCT10 has been provided below;

- January 1998
- September 1998
- September 2000
- July 2001
- September 2004
- December 2007
- September 2008
- September 2009

These instances relate to the network of ordinary watercourses and culverted infrastructure which convey a substantial volume of water through the village of Cilfynydd. The most notable flood event occurred during September 2008 where residents at Oakland Terrace, Bedw Road and surrounding streets were impacted by flooding associated with culvert inlet blockages.

## 2.2. FLOOD INCIDENT

The flooding that occurred on the 15<sup>th</sup> and 16<sup>th</sup> February 2020 was a result of an extreme rainfall event, designated by the Met Office as ‘Storm Dennis’. The rainfall event affected the majority of RCT and caused widespread flooding to communities.

Specific details of Storm Dennis, such as rainfall and river level analysis are covered within a separate overview report that covers the wider RCT area, referenced ‘FRM – Storm Dennis – Overview Report’<sup>2</sup>.

The post event inspections undertaken on the days following the storm event by RCT’s Flood Risk Management Team and RCT’s Public Health, Protection and Community team identified 23 residential properties and two commercial properties as internally flooded.

A summary of the source(s) and pathway(s) for flooding within the Cilfynydd investigation area during Storm Dennis have been outlined in Table 2 and further described throughout this section.

**Table 2:** Summary of the source(s), pathway(s) and receptor(s) affected during Storm Dennis within investigation area RCT 10

Source	Pathway	Receptor
Intense rainfall running off the steep hillsides to the east of Cilfynydd draining to lower ground via the Nant Cae Dudwg.	<p>The initial flow path for this incident was the routing of runoff from the steep hillside to the northeast of Cilfynydd. These flows are conveyed via the Nant Cae Dudwg Ordinary watercourse.</p> <p>The Nant Cae Dudwg ordinary watercourse overtopped its channel side/flood wall adjacent to Cilfynydd Road.</p> <p>Water flowed into the lane behind properties along Cilfynydd Road and then overtopped the rear garden walls and into the properties.</p>	Internal flooding to the basement level of 8 residential properties on Cilfynydd Road, situated adjacent the Nant Cae Dudwg ordinary watercourse and culvert inlet.

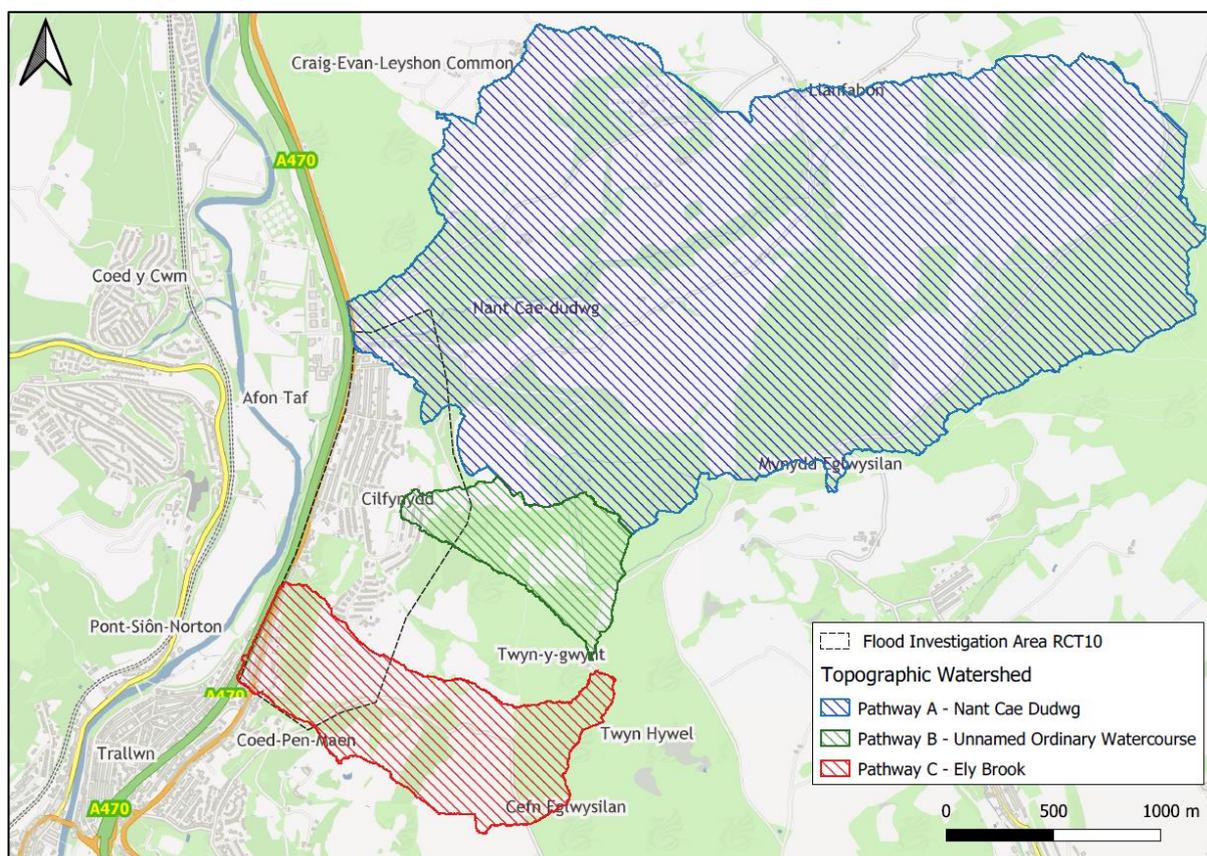
<p>Surface water accumulation on the A4054 Cilfynydd Road</p>	<p>Surface water ponding occurred along the Cilfynydd Road highway adjacent the junction of Park Place</p>	<p>Internal flooding to one commercial property situated at the junction of Park Place.</p>
<p>Intense rainfall running off the steep hillsides to the east of Cilfynydd draining to lower ground via an unnamed watercourse to the east of Heol Mynydd.</p> <p>The debris screen of the culvert inlet to the rear of Heol Mynydd became blocked during the event.</p>	<p>Surcharging flows from the culvert inlet overtopped the rear garden fences of two properties at Heol Mynydd and onto the road before continuing to flow towards Heol Nant and Heol Cronfa.</p> <p>Water travelled overland towards Brynderwen via a lane from Heol Nant.</p> <p>Water re-entered the watercourse network from Heol Cronfa towards Oakland Terrace.</p>	<p>Internal flooding to two residential properties at Heol Mynydd and a further two properties at Heol Nant.</p> <p>Several properties were affected at Brynderwen, including internal flooding to three properties and external flooding to at least a further three properties.</p> <p>Highway flooding also occurred along multiple streets due to surface water and ordinary watercourse flooding.</p>
<p>Intense rainfall running off the steep hillsides to the east of Cilfynydd draining to lower ground via a land drain to the east of Brynderwen.</p>	<p>Exceedance surface water flows overtopped the land drain and continued its pathway towards the lane located at the rear of Brynderwen.</p> <p>This flow path was observed to have occurred prior to the blockage at Heol Mynydd culvert inlet which also contributed flows down the lane towards Brynderwen.</p>	<p>Contributed to the external flooding of properties at Brynderwen and exacerbated the internal flooding of 3 properties</p>
<p>Intense rainfall running off the steep hillsides to the rear of the A4054 in the south of Cilfynydd draining to lower ground via the Ely Brook ordinary watercourse.</p> <p>The Ely Brook ordinary watercourse surcharged at</p>	<p>Water overflowed from the Ely Brook culvert inlet and travelled onto the A4054 Pontshonnorton Road.</p> <p>Water conveyed north down Pontshonnorton Road towards Norton Court and Evans Square which is</p>	<p>A commercial property directly opposite the Ely Brook culvert inlet was internally flooded.</p> <p>Internal flooding to 8 residential properties at Belgrave Terrace, Evans Square and Norton Court.</p>

the inlet due to debris blockages.	situated at a slightly lower elevation than the A4054.	
A section of the Ely Brook culvert network failed during the storm event, contributing to the flooding.	Water escaped from a culvert barrel, and conveyed north down Pontshonnorton Road, contributing to the flooding sourced by the surcharging Ely Brook culvert inlet.	Contributed to the flooding of properties at Pontshonnorton Road, Belgrave Terrace, Evans Square and Norton Court.

On review of Table 2, the principal source of flooding has been attributed to intense rainfall generating significant surface water runoff from the steep hillsides to the north and east of Cilfynydd draining to lower ground via several natural ditches and ordinary watercourses.

The principal sources of flooding, as depicted within Table 2, have been spatially represented within Figure 3, which depicts the topographic watershed of the three primary watercourses that drain towards the Cilfynydd urban area. The area of land that would expect to drain towards the three watercourses under investigation is shown in the hatched areas within Figure 3.

Residents of the affected properties in Cilfynydd reported the overtopping of the three watercourses flowing through the village, which resulted in flood water flowing overland towards the lower reaches of Cilfynydd and affecting several properties on its course. The primary flow paths that occurred during Storm Dennis have been identified as 'A' to the northeast (blue hatched area), 'B' on the eastern edge (green hatched area), and 'C' to the south (red hatched area) of investigation area RCT10 (Figure 3). These flow paths have been further described within their individual sections below.

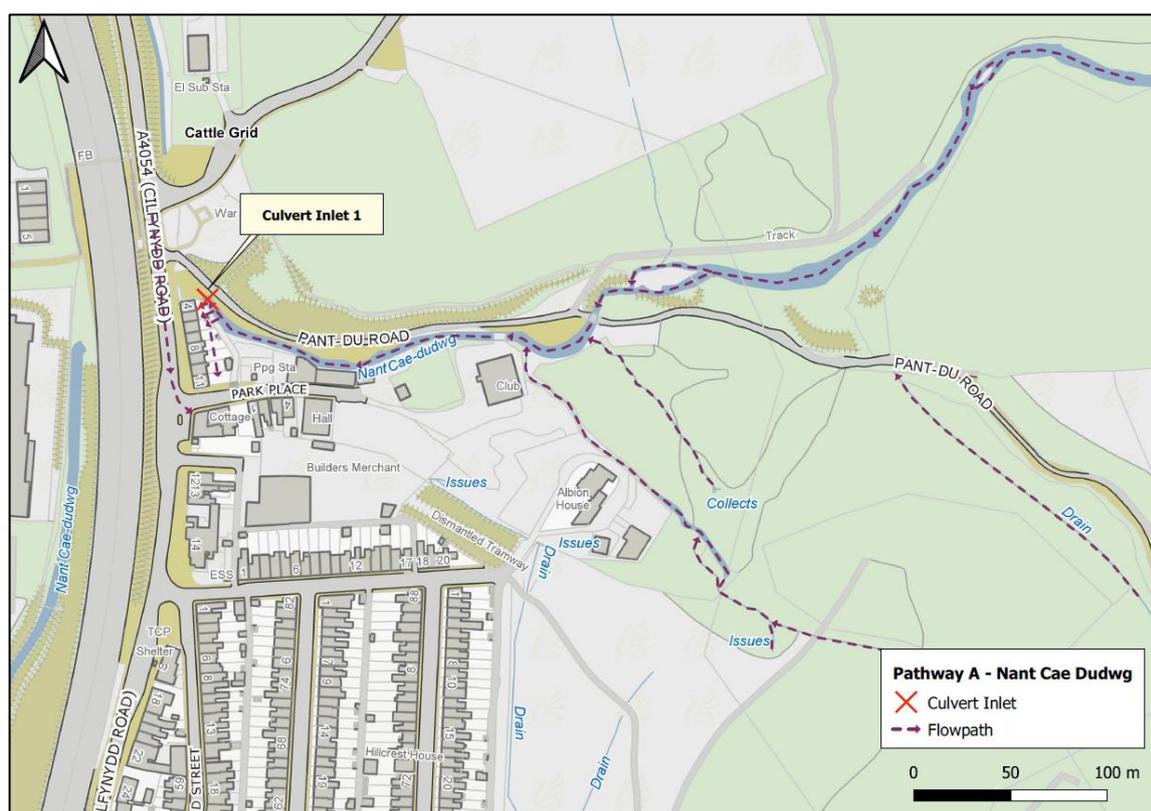


**Figure 3:** Rainfall Topographic Watersheds of the three primary watercourses flowing through investigation area RCT10

### 2.2.1. PATHWAY A

Pathway A shows where water enters the northeast of Cilfynydd via the Nant Cae Dudwg ordinary watercourse, which is the primary watercourse that runs through the town of Cilfynydd. The watercourse is culverted beneath Cilfynydd Road before discharging into the River Taff to the west of Cilfynydd.

Several calls were received from residents at Cilfynydd Road on the 16<sup>th</sup> February 2020, to report that water from the Nant Cae Dudwg watercourse had overtopped the flood wall at the inlet (labelled 'Culvert Inlet 1' in Figure 4) and was threatening to enter the rear gardens of properties situated directly downstream of the culvert inlet. The inlet location is provided in Figure 4.



**Figure 4:** Map illustrating flow path A and the Nant Cae Dudwg culvert inlet, 'Culvert Inlet 1'

During the early hours of Sunday 16<sup>th</sup> February, the Nant Cae Dudwg ordinary watercourse overtopped the flood wall at the inlet, causing water to accumulate within the lane behind properties at Cilfynydd Road. The result of which saw riverine debris including silt and mud being deposited in the lane area. This resulted in blockages to the surface water drainage gullies in the lane, reducing the capacity of the drainage network to manage the excess water (Figure 5).

Following the initial overtopping of the lane, the Nant Cae Dudwg overtopped the properties rear retaining walls, flooding the gardens before entering the basement level of eight properties at Cilfynydd Road. Water levels were reported to have reached up to 1.5m - 1.8m within the basements of the properties (illustrated by the water depth marks in Figure 7).

Post event inspections found evidence of collapsed concrete boundary walls, exemplifying the force of the water emanating from the watercourse and flowing through the gardens during the event. The images below reveal the severe and long-lasting damages caused by the flood event to properties at Cilfynydd Road (Figure 6).



**Figure 5:** View of the lane between the Nant Cae Dudwg inlet and the rear gardens of properties on Cilfynydd Road captured by FRM officers on 17<sup>th</sup> February 2020.



**Figure 6:** Damages left after the event to the rear of a property at Cilfynydd Road captured by FRM officers on 17<sup>th</sup> February 2020



**Figure 7:** Water depth marks in a property at Cilfynydd Road following Storm Dennis (image provided by resident)

Further spells of heavy rain continued to impact Rhondda Cynon Taf when Storm Jorje, the fifth named storm of the 2019/20 season, brought strong winds and heavy rain across Wales and the UK from 28<sup>th</sup> February to 1<sup>st</sup> March 2020. Although the weather impacts from Storm Jorje were less severe than Storm Dennis, localised flooding problems continued in the aftermath of the earlier storms and as a result of further rainfall on already saturated ground<sup>4</sup>. During Storm Jorje, some residents at Cilfynydd Road reported that the Nant Cae Dudwg watercourse was beginning to overtop the flood wall at the inlet and into the rear lane once again, however, water did not enter the properties during this event.

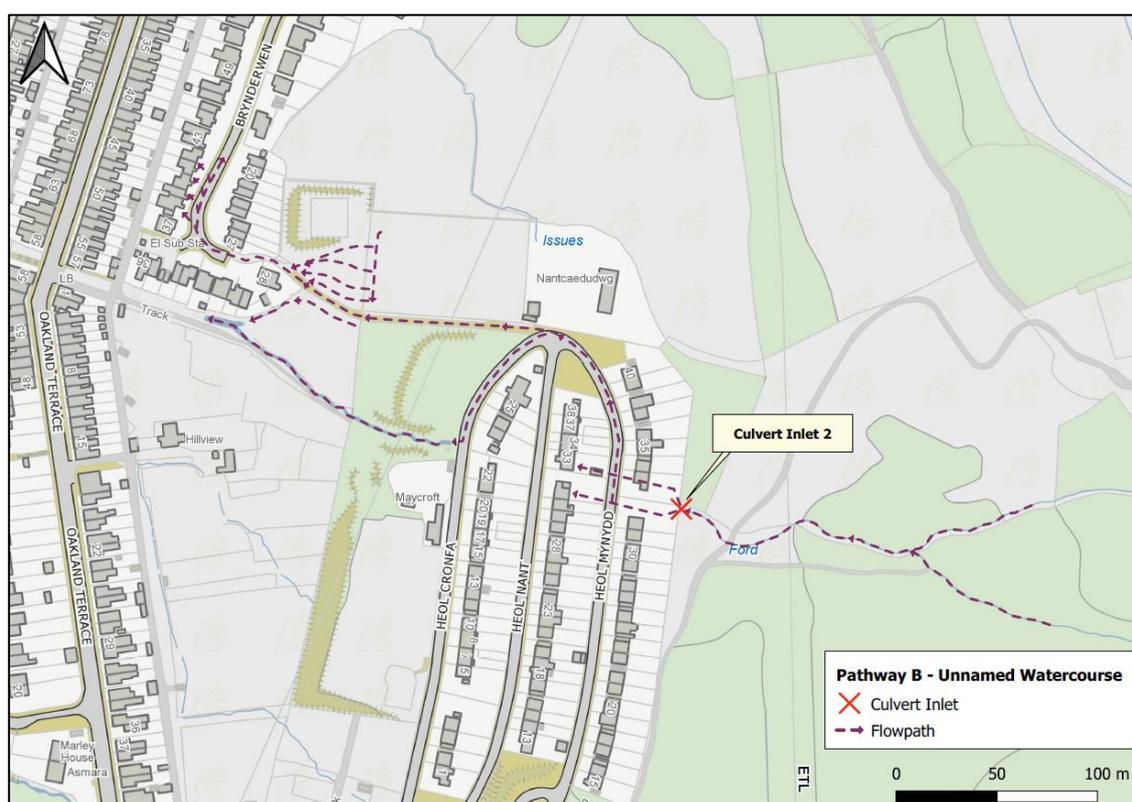
Surface water was also observed to flow down the A4054 Cilfynydd Road and down Pant Ddu Road and Park Place during Storm Dennis, according to residents. Runoff travelled down the steep rural tracks leading from the hillsides in the east and onto the highway, resulting in minor internal flooding to one commercial property situated at the junction to Park Place. The affected property is situated slightly lower than the main road which resulted in the accumulation of overland flows within the low spot. Whilst the property benefits from a highway gully, this structure become overwhelmed as a result of overland flow, resulting in surface water entering through the front of the

<sup>4</sup> [2020\\_04\\_storm\\_jorge.pdf \(metoffice.gov.uk\)](#)

property. Significant cleansing from the Council Highway and Streetcare Depot was carried out to clear the surface water networks following the storm event.

## 2.2.2. PATHWAY B

Pathway B, shown in Figure 3, shows where surface water flows from the east of Cilfynydd enter the town through an unnamed ordinary watercourse. The watercourse crosses the town via several culverts before discharging into the River Taff. Calls were received from residents at Heol Mynydd and Heol Nant to report that water from the unnamed watercourse to the rear of Heol Mynydd was overtopping near the inlet and beginning to flood properties. The inlet's location, labelled 'Culvert Inlet 2', is provided in Figure 8.



**Figure 8:** Map illustrating flow path B the culvert inlet of the unnamed watercourse, 'Culvert Inlet 2'

Post event inspections identified the inlet's debris screen as blocked with woody debris mobilised during the event, reducing the inlet's capacity to manage the flow and causing the inlet to surcharge and flood. According to residents, water was observed to have overtopped the garden walls to the rear of Heol Mynydd, flowing through the properties and out onto the street (Figure 9). Water then continued to flow downhill, flooding two properties on Heol Nant from the rear. As the water cascaded over the

roads and gardens of Heol Nant and Heol Cronfa, much of the water made its way back into the watercourse towards Oakland Terrace. Mud and silt deposited along the highway were identified by the inspection teams (Figure 10) indicating the flow path of the water during the storm event.

Four properties were identified as internally flooded due to the floodwater's initial pathway. Emergency clearance works were undertaken by the Council's Highway and Streetcare Depot to remove the debris from the inlet and cleanse the highway drainage infrastructure.



**Figure 9:** Damages to rear garden of a property at Heol Mynydd following the storm event (captured by FRM officers on 17<sup>th</sup> February 2020)



**Figure 10:** Road damages and debris deposited along Heol Cronfa following the storm event (captured by FRM officers on 17<sup>th</sup> February 2020)

Residents at Brynderwen, situated further downstream, reported significant surface water runoff travelling down the lane from Heol Nant towards the southern end of Brynderwen during Storm Dennis. The overtopping of the watercourse behind Heol Mynydd was likely the primary contributing source of flood water, however, discussions with the local community report that overland flows originating from the field behind Brynderwen contributed to the initial flooding. The area of land has been identified as falling under private ownership.

Water was observed coming out from the field before conveying onto the path towards Brynderwen. The path was badly damaged, assumed to be caused by the force of water flowing towards Brynderwen (Figure 11). Damages to the path were identified higher up than the gate, indicating that significant flows were also travelling from the overtopped watercourse at Heol Mynydd (Figure 12). The water entered the road, carrying debris in its flow which caused highway and private drainage infrastructure to block and surface water to pool. Properties on the western side of Brynderwen are situated slightly lower than the road, which resulted in internal flooding to three residential properties and external flooding to the front of several others.



**Figure 11:** Evidence of damages to the top of the path looking up towards Heol Nant (captured by FRM officers on 17<sup>th</sup> February 2020)

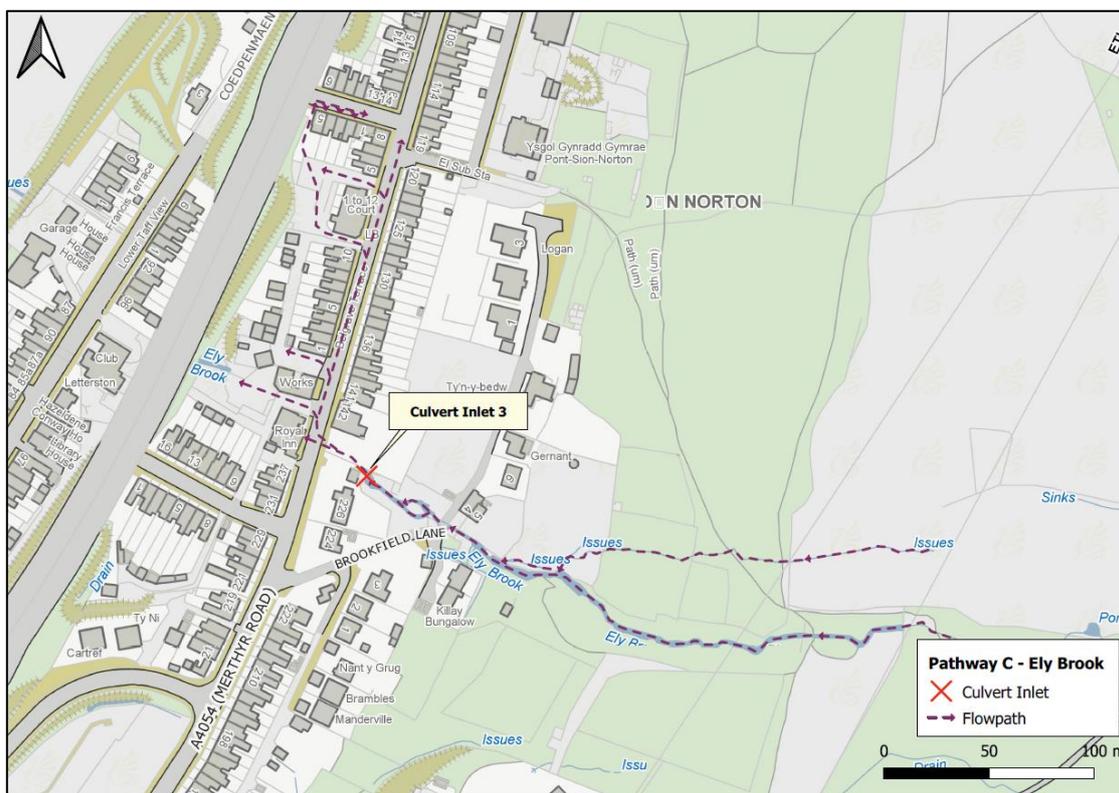


**Figure 12:** Evidence of deposited debris and damages to the bottom of the path looking down towards Brynderwen. Overland flows were observed flowing through land to the right behind the fencing (captured by FRM officers on 17<sup>th</sup> February 2020).

### 2.2.3. PATHWAY C

Pathway C, shown in Figure 3, shows where surface water flows enter the investigation area from the southeast corner of the catchment. The surface water flows through the Ely Brook ordinary watercourse, passes through the southern catchment via several culverts, and ultimately discharges into the River Taff. On its course of flow, the Ely Brook culvert ('Culvert Inlet 3', Figure 13) surcharged at the inlet opposite the Royal Oak Inn and resulted in flooding to properties and the highway during the storm event. The inlet location is shown in Figure 13.

The evidence suggests the inlet became blocked with debris during the storm event which caused water to overflow from the culvert inlet and flow down the driveway of a residential property opposite the Royal Oak Inn, and onto Pontshonnorton Road. Post event inspections also identified a section of the tarmac driveway to have suffered from subterranean hydraulic pressure, i.e., the driveway appears to indicate that water from the culvert network erupted, through the tarmac and contributed to the flooding along Pontshonnorton Road (Figure 14).



**Figure 13:** Map illustrating flow path C and the Ely Brook culvert inlet, 'Culvert Inlet 3'



**Figure 14:** Damages to the driveway situated below the Ely Brook culvert inlet showing evidence of subterranean hydraulic pressure (captured by FRM officers on 17<sup>th</sup> February 2020)

Water conveyed north along Pontshonnorton Road, affecting one commercial premise and a residential property at Belgrave Terrace. According to residents' accounts of the

storm event, the highway gullies along Pontshonnorton Road could not cope with the volume of water discharging from the Ely Brook watercourse and consequently flood water began to pond outside the front of properties, contributing to the internal flooding. Debris deposited from the Ely Brook was also evident along the western verge of Pontshonnorton Road which likely contributed to the ponding of flood water.

Water entered the two junctions of Norton Court which are situated slightly lower than the main road and initially flooded the ground floor flats at Norton Court. Water then cascaded through the rear garden of a property at Evans Square and onto the highway. Flood water entered properties on Evans Square from the front, resulting in internal flooding to five properties. Due to the slope of the road only properties on the southern side of the street were affected.

### **2.3. RAINFALL ANALYSIS**

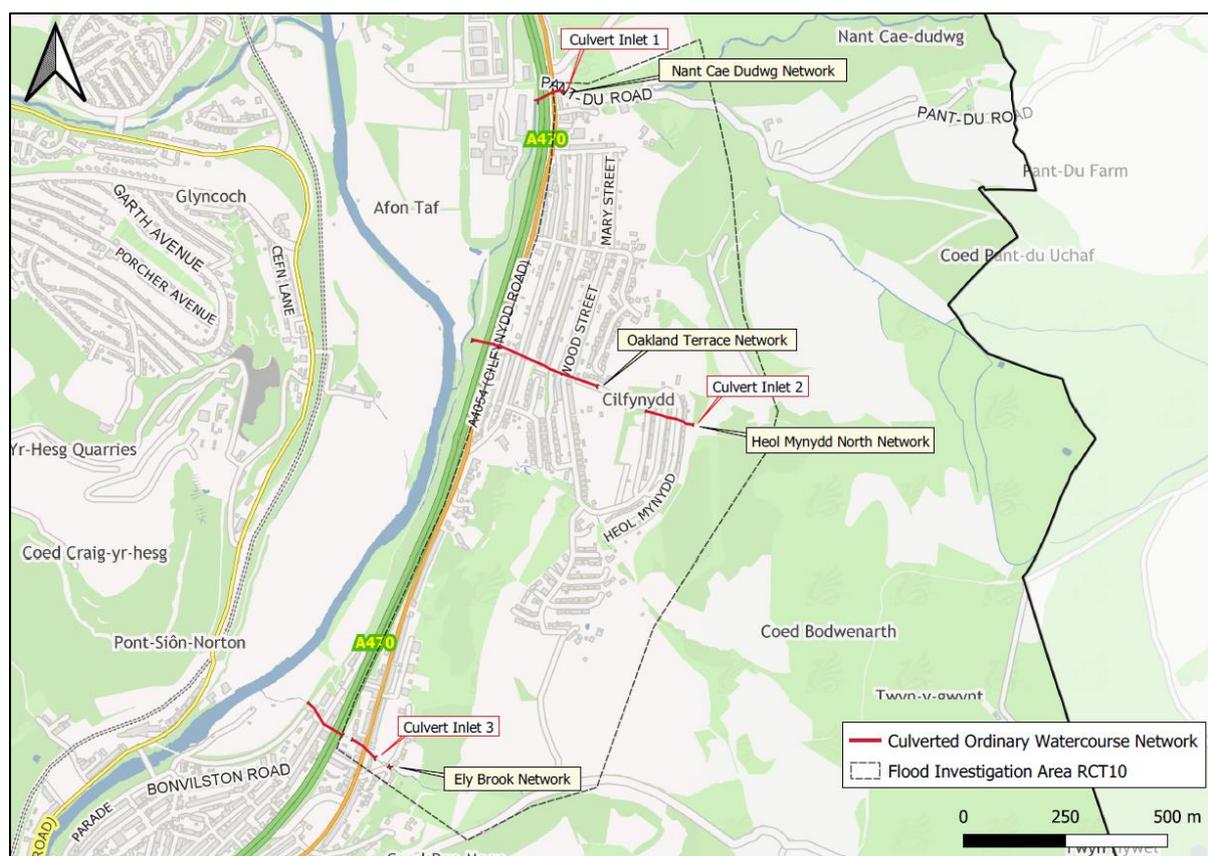
See RCT's 'Overview Report' of Storm Dennis, reference 'FRM – Storm Dennis – Overview Report'<sup>2</sup>, for a detailed analysis of the rainfall and ordinary watercourse response.

## 3. POSSIBLE CAUSES

### 3.1. CULVERT CONDITIONS

Several unnamed watercourses flow through investigation area RCT10, many of which are culverted beneath Cilfynydd's urban settlements (previously described in Section 1.2).

Several culvert inlets were inspected by RCT's Flood Risk Management team after the flood event to assess their condition and to determine whether they served as a contributing factor to the flooding in Cilfynydd. CCTV survey inspections of the culvert networks were also undertaken to ascertain both the operational condition of the network, and its structural integrity along sections of the network. Figure 15 outlines the four networks surveyed and highlights the culvert inlets known to have surcharged.



**Figure 15:** Surveyed culverted watercourse networks within flood investigation area RCT10

It should be noted that all surveys reported in this section were undertaken post flood event. It's not possible to say what debris identified in the survey was mobilised and deposited as a result of the storm event and what had been deposited by previous

events. As such, the following should be considered to be reflective of the asset condition at the end of the storm event and may not necessarily be reflective of the condition of the assets prior to the onset of the storm event.

### 3.1.1. CULVERT INLET 1

The culvert inlet was inspected by RCT's Highway Authority prior to the storm event on the 13<sup>th</sup> February 2020 and was found to be in good condition with no significant blockages or debris present (Figure 16).



**Figure 16:** Photo of 'Culvert Inlet 1' (Nant Cae Dudwg culvert inlet) captured by RCT's Flood Risk Management team prior to Storm Dennis on 13<sup>th</sup> February 2020

Following reports that 'Culvert Inlet 1' which conveys the Nant Cae Dudwg ordinary watercourse beneath Cilfynydd Road was the source of flooding to eight residential properties at Cilfynydd Road, post event inspections were carried out. According to emergency responders, the culvert inlet debris screen was partially blocked with woody debris, suggesting some debris was likely deposited during Storm Dennis however, there was little evidence to suggest that the inlet surcharged due to blockage during the event.

The culvert inlet was cleared of debris on 17<sup>th</sup> February 2020 by the Council's Depot once the watercourse level had subsided and safe working conditions were available. Notably, the debris screen shows no evidence of damage caused by the flood event (Figure 17). Trash screens further upstream of the inlet had significant stonewash and debris trapped behind which would suggest that the largest debris did not reach the

inlet and cause significant blockage. The condition of the Nant Cae Dudwg watercourse upstream of the inlet is described in Section 3.2.



**Figure 17:** Nant Cae Dudwg culvert inlet (captured by FRM officers on 17<sup>th</sup> February 2020)

Although some settled coarse deposits was identified downstream of the inlet, the condition of both the inlet and culvert network is not considered to be the primary cause of flooding to properties at Cilfynydd Road. The water level within the Nant Cae Dudwg was high enough that debris likely travelled over the debris screen, avoiding any significant blockages, therefore the cause of flooding to Cilfynydd Road is considered to be related to the watercourse becoming overwhelmed during the storm event.

### **3.1.2. CULVERT INLET 2**

The Heol Mynydd North culvert inlet (Culvert Inlet 2) was identified as the source of flooding to properties at Heol Mynydd and Heol Nant, and also contributed to the flooding at Brynderwen. The surcharging occurred at the inlet structure due to natural hillside debris, mobilised during the storm event, blocking the debris screen and reducing the inlet's hydraulic capacity to manage the flow of water. The inlet is identified as a privately owned asset, however the Council's Highway Authority maintain an inspection schedule of the asset pre storm events due to the inherent risk associated to the inlet. The inlet was inspected and cleared of debris on the 8<sup>th</sup> and 15<sup>th</sup> February 2020, respectively.

Figure 18 depicts the culvert inlet cleared from debris by the Council Highway and Streetcare Depot following the storm event.



**Figure 18:** Culvert inlet to the rear of Heol Mynydd which surcharged during Storm Dennis due to blockages at the inlet (captured by FRM officers on 17<sup>th</sup> February 2020 following clearance works)

The culvert network was found to be in acceptable operational and structural condition following internal CCTV surveys. It is considered that blockages to the debris screen itself was the primary cause of flooding to Heol Mynydd and not the condition of the culvert network.

Downstream of Heol Mynydd the unnamed watercourse flows towards Oakland Terrace before entering a further culverted section. The Oakland Terrace culvert network has multiple structural and operational defects throughout, including fractures, collapsed brickwork and holes in the pipework. Despite its poor condition there was no evidence to suggest that the network did in fact surcharge or cause any flooding to properties at Oakland Terrace.

### 3.1.3. CULVERT INLET 3

The source of the flooding at Pontshonnorton Road was initially identified as originating from a blocked culvert inlet located opposite the Royal Oak Inn. The inlet structure was identified by first responders as being blocked with debris and was subsequently cleansed. Figure 19 captured post event by FRM officers depicts the

inlet following clearance works. The inlet is identified as a privately owned inlet but similarly to the Heol Mynydd culvert, the Council's Highway Authority maintain an inspection schedule of the asset pre storm events. The inlet was also inspected and cleared of debris on the 8<sup>th</sup> and 15<sup>th</sup> February 2020, respectively.



**Figure 19:** Ely Brook culvert inlet to the rear of Pontshonnorton Road which surcharged during Storm Dennis due to blockages at the inlet (captured by FRM officers on 17<sup>th</sup> February 2020 following clearance works)

Internal surveys of the Ely Brook network have highlighted several sections of the culvert drainage system that are in poor condition following the flood event. The culvert section immediately downstream of the inlet known to surcharge is in the poorest condition, both structurally and operationally according to CCTV survey data.

A Grade 5 structural defect was identified approximately 23 meters downstream of the inlet (Figure 20), located on the driveway below the Ely Brook culvert inlet, and has been determined as a secondary source of flooding to properties along Pontshonnorton Road, Norton Court and Evans Square, whereby water breached the culvert system below the tarmac driveway due to hydraulic pressure, contributing to the flooding at Pontshonnorton Road.

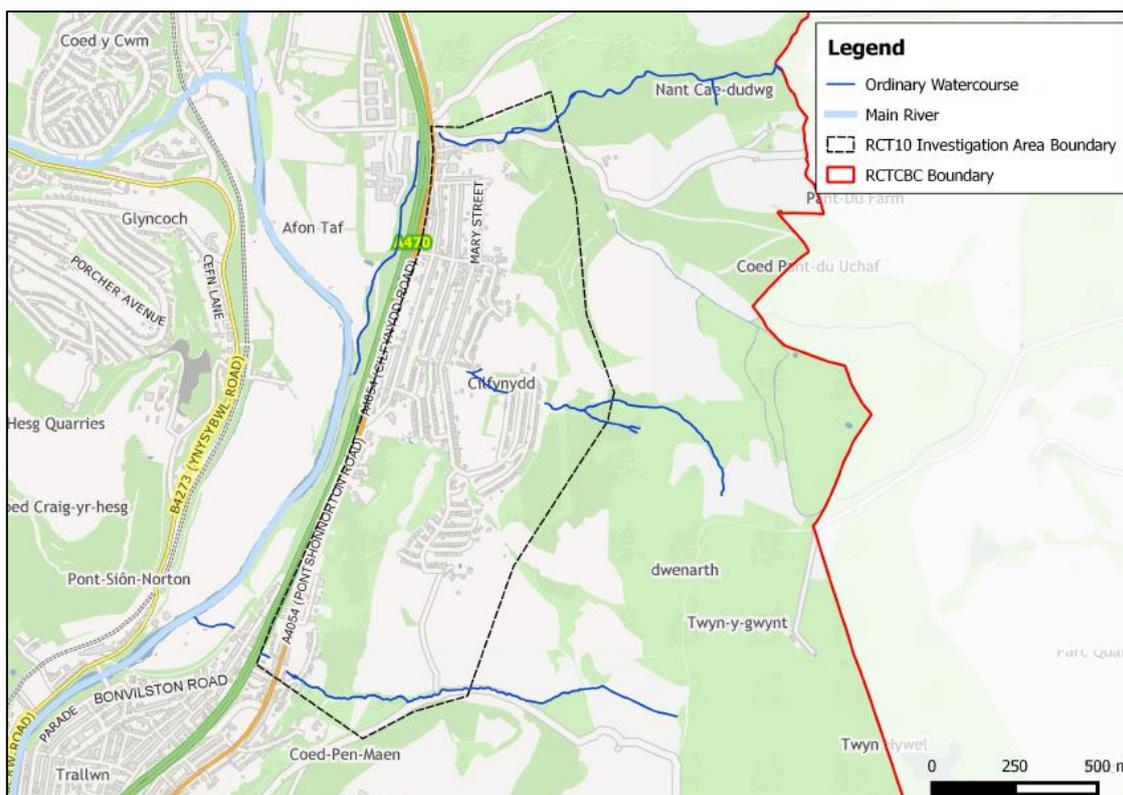
The poor condition of the culvert network is considered to have contributed to the flooding, however, the blockage to the inlet structure has been determined as the most significant contributor to flood flow path C (Figure 3) during Storm Dennis.



**Figure 20:** Hole in culvert 22.9 meters downstream of the Ely Brook inlet opposite Royal Oak Inn

## 3.2. ORDINARY WATERCOURSE CONDITIONS

Several unnamed open watercourses and ditches which drain the steep catchment to the east and northeast of Cilfynydd are identified to flow through investigation area RCT10. The ordinary watercourses associated to the flooding at Cilfynydd are illustrated in Figure 21.



**Figure 21:** Map of Ordinary Watercourses which feed into investigation area RCT10

### 3.2.1. NANT CAE DUDWIG ORDINARY WATERCOURSE

A general assessment of the Nant Cae Dudwg watercourse revealed significant deposition of large stones and boulders within the channel. Figures 22 and 23 were captured on the 17<sup>th</sup> February 2020 and show significant accumulation of natural material across the full width of the upper catchment debris screens. A Council appointed contractor carried out the removal of all large debris from the watercourse following Storm Dennis which totaled approximately 350 tons.

Figures 24 and 25 have been provided to illustrate the condition of the upper catchment debris screens operating debris free prior to Storm Dennis.



**Figure 22:** Initial upstream debris screen in the Nant Cae Dudwg watercourse (captured by RCT's Flood Risk Management team on 17<sup>th</sup> February 2020)



**Figure 23:** Second upstream debris screen in the Nant Cae Dudwg watercourse (captured by RCT's Flood Risk Management team on 17<sup>th</sup> February 2020)



**Figure 24:** Initial upstream debris screen in the Nant Cae Dudwg watercourse captured prior to Storm Dennis



**Figure 25:** Second upstream debris screen in the Nant Cae Dudwg watercourse captured prior to Storm Dennis

Evidence of embankment scour and localised landslips were identified along sections of the Nant Cae Dudwg watercourse (Figures 26 and 27). It is considered that this scoured material contributed to the volume of debris deposited along the watercourses' upper debris screens.



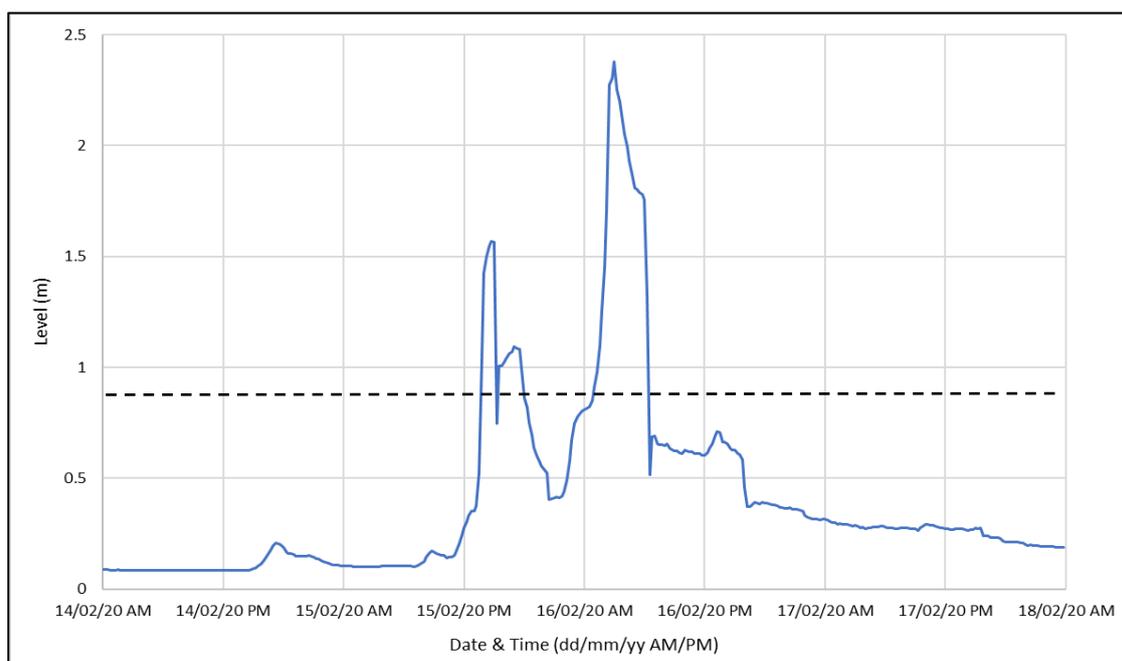
**Figure 26:** Photo of localised landslip on the embankment of the Nant Cae Dudwg watercourse (image captured by RCT's Flood Risk Management team on 02/03/2020)



**Figure 27:** Photo of embankment scour to the Nant Cae Dudwg watercourse (image captured by RCT's Flood Risk Management team on 02/03/2020)

The images captured pre and post event highlight the extreme flows within the Nant Cae Dudwg during the storm event. These strong flows were able to convey a significant volume of debris downstream, however, the upstream debris screens and modified channel walls succeeded in minimising the volume of debris travelling downstream and onto the inlet grill near Cilfynydd Road.

Based on data captured by RCT's Nant Cae Dudwg monitoring station, the storm resulted in two significant peaks in the level of flow within the Nant Cae Dudwg watercourse. Both peaks are illustrated in Figure 28. The initial peak triggered the alarm system at 13:45 on 15<sup>th</sup> February 2020 which resulted in a peak watercourse level of 1.567 meters at 14:45. During this hour the Nant Cae Dudwg rose suddenly by 528mm. The second and most prominent peak activated the alarm system at 01:00 on 16<sup>th</sup> February 2020 and caused a peak level of 2.37m at 03:00.



**Figure 28:** Water level in the Nant Cae Dudwg ordinary watercourse during the 14 – 18th February 2020 captured by RCT's monitoring station. Dashed line represents the alarm trigger threshold (0.9m)

Based on data captured by the monitoring station, and accounts provided by residents, it is considered that the volume of water in the Nant Cae Dudwg watercourse exceeded the capacity of the inlet and headwall structures during the early hours of Sunday 16<sup>th</sup> February 2020. This resulted in the watercourse backing up the channel where the flood water overtopped the flood wall before ultimately entering the affected properties from the rear.

### 3.2.2. HEOL MYNYDD UNNAMED ORDINARY WATERCOURSE

Upon a walkover assessment of the open watercourse to the rear of Heol Mynydd, undertaken by FRM officers following the storm event, it was noted that although the catchment is relatively flat, the ground is unconsolidated, with evidence of scour at the banks and old trees collapsed into the watercourses. Eroded woody material, silt and

stone from land to the rear of Heol Mynydd is considered to have been mobilised by heavy rainfall and washed down into the unnamed watercourses before accumulating and causing a blockage at the inlet. The reduction in the inlet's hydraulic capacity to manage the flow of water into the culverted system resulted in surcharging at the inlet and internal flooding to properties below.

Post event inspections undertaken by RCT's FRM officers also identified a collapsed tree within the watercourse (Figure 29), just upstream of the culvert inlet. It is not believed that the collapsed tree contributed to the flooding at Cilfynydd, however it does provide evidence of the powerful flows within the watercourse during the storm event which caused embankment scouring as well as mobilisation of debris, contributing to the inlet blockage downstream. Emergency clearance works were undertaken by the Council's Depot to remove the tree from the watercourse.



**Figure 29:** Tree collapse in the unnamed ordinary watercourse to the rear of Heol Mynydd (captured by FRM officers on 17<sup>th</sup> February 2020)

### **3.2.3. ELY BROOK ORDINARY WATERCOURSE**

The Ely Brook watercourse was observed as having significant deposition of erosive debris along its length. The evidence suggests that the debris identified at the surcharged inlet originated from the upstream sections of watercourse where natural hillside material is likely to have been washed down onto the structure following intense rainfall.

Post event inspections of the Ely Brook watercourse identified large stonewash within the channel, as well as the undercutting of large trees caused by bank erosion in the upper catchment (depicted in Figures 30). The inspection also noted that the watercourse is very steep in its upper reaches, indicating that fast flowing water generating large debris mobilisation and sedimentation is likely in this part of the catchment during storm events.



**Figure 30:** Photo of stone deposition, bank erosion and undercutting of trees within the Ely Brook ordinary watercourse in the upper catchment (captured by RCT's Flood Risk Management team post Storm Dennis)

### 3.3. MAIN RIVER

The designated main river, the River Taff, flows in a southerly direction to the west of Cilfynydd (Figure 21). The River Taff falls outside of investigation area RCT10.

There is no evidence from this investigation to suggest that the River Taff significantly contributed to the recorded flooding of properties in Cilfynydd during Storm Dennis.

### 3.4. HIGHWAY DRAINAGE CONDITIONS

Anecdotal reports note surface water was observed to flow directly down several streets within the investigation area during Storm Dennis. Notably, much of the observed surface water originated from ordinary watercourse flooding.

Overland flows from private land and runoff originating from the surcharged inlet to the rear of Heol Mynydd caused water to travel towards Heol Nant and Heol Cronfa, and onwards toward Brynderwen via a small pathway. Deposited mud, silt and debris was evident across these streets, along with several reports of blocked highway drainage gullies, illustrating the flow path of water during the event. Likewise, water sourced by the Ely Brook watercourse travelled north along Pontshonnorton Road, depositing debris on its course, causing blockages to the highway drainage infrastructure (Figure 31).



**Figure 31:** Debris left after the storm event at Pontshonnorton Road (captured by FRM officers on 17th February 2020)

Reports of surface water flooding were also received at Park Place, near Cilfynydd Road, whereby runoff was observed to travel from the steep hillsides in the east via rural tracks and onto the highway, causing fine silt to block several gullies and reduce the capacity of the highway network to manage exceedance flows. Minor internal flooding to one commercial property located at a low point in the road was confirmed.

The condition of highway drainage infrastructure within investigation area RCT10 is considered to have been impacted by debris carried by ordinary watercourse and

surface water flows during Storm Dennis. In these instances, it is likely that highway drainage assets will have had a limited capacity to intercept the flows along Heol Mynydd, Heol Nant, Heol Cronfa, Brynderwen, Park Place and Pontshonnorton Road.

In addition, highway drainage is not designed to manage overland flows from private areas, parks or open space. In this instance, the capacity of the highway drainage was exceeded by the substantial surface water flows entering the drainage network across RCT10. Given the severity of the storm, the maintenance condition of the highway surface water drainage system is not considered to have significantly impacted on the flooding experienced within Cilfynydd.

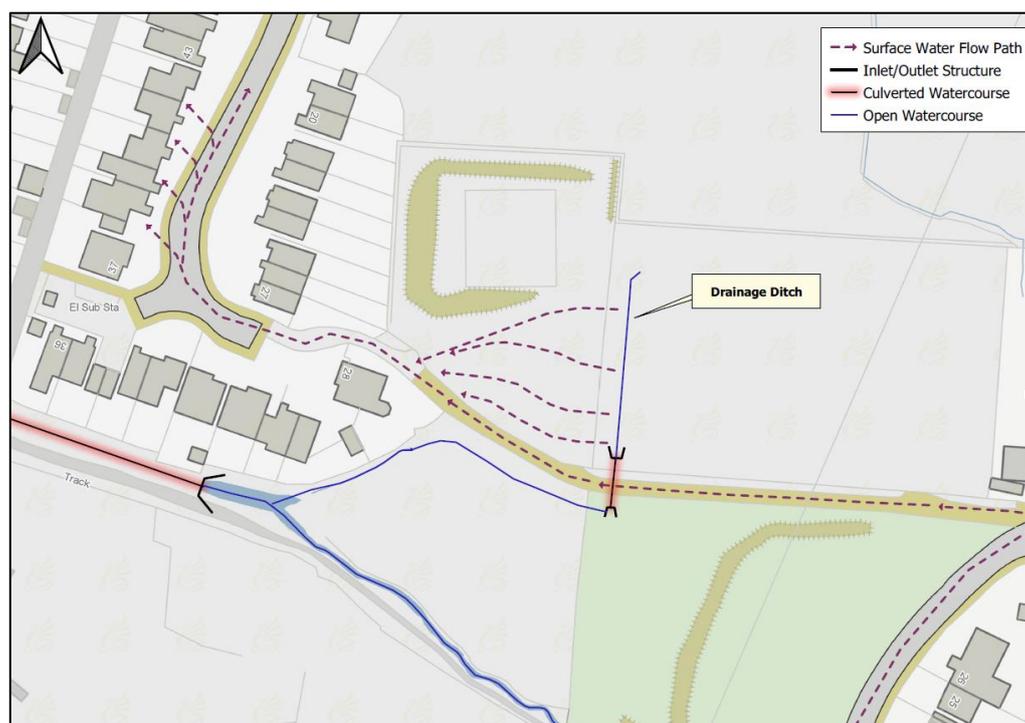
### 3.5. SURFACE WATER

Surface water flooding from an area of land behind Brynderwen was observed by residents as a secondary source of flooding to properties at Brynderwen during Storm Dennis. Upon an inspection of the land by RCT's Flood Risk Management team a small land drainage channel was identified, within privately owned land.

The inspection noted that the land drainage channel is culverted beneath the lane before outfalling into the adjacent stream that flows towards Oakland Terrace culvert network. Residents report that the inlet became blocked during the event, resulting in water overtopping the channel (Figure 32) and flowing towards the downstream field and onwards to impact properties at Brynderwen. The land drainage channel and observed flow paths have been illustrated in Figure 33.



**Figure 32:** Photo of the drainage ditch overtopping (image captured by resident on 16/02/2020)



**Figure 33:** Location of the identified land drainage ditch and observed surface water flow paths during Storm Dennis

Despite the land drainage channel being identified as a secondary source of flooding, the primary source of flooding to properties in this area originated from the surcharged culvert inlet to the rear of Heol Mynydd.

### 3.6. ACCESS STRUCTURES

No access structures were identified during the asset investigations within the area, as such 'access structures' have not been considered within this report.

### 3.7. SYSTEM AT CAPACITY

Culvert networks within the flood investigation area (Figure 15) were surveyed post event to ascertain the internal condition of the network, the results of which fed into a review of the hydraulic performance of the network to ascertain its current standard of protection using Causeway Flow modelling. The results of the culvert inlet capacity assessments are summarised in the Table below, along with a determination of whether flooding was observed during Storm Dennis.



of 'Culvert Inlet 3' (noted in Figure 13), alongside evidence of culvert failure (Figure 14), it is likely that the networks' hydraulic capacity was further reduced.

### 3.8. SUMMARY OF POSSIBLE CAUSES

The above sections have identified and described the possible causes of flooding within investigation area RCT10 during Storm Dennis (15-16<sup>th</sup> February 2020). A summary of the identified sources and possible causes of flooding (issue) have been outlined below in Table 4.

**Table 4:** Summary of the source(s) and possible cause(s) of flooding in investigation area RCT10 during Storm Dennis

Ref No	Asset (Source)	Issue	Asset Owner	Type of Flooding
1	Nant Cae Dudwrg culvert inlet and flood wall	Water overtopped the flood defence wall adjacent to the culvert inlet after becoming hydraulically overwhelmed during the storm event. This resulted in internal flooding to several residential properties at Cilfynydd Road	Rhondda Cynon Taf CBC	Ordinary Watercourse
2	Heol Mynydd North culvert inlet	The culvert inlet to the rear of Heol Mynydd became blocked with debris during the storm event which caused water to overtop at the inlet resulting in internal flooding to properties at Heol Mynydd and Heol Nant before continuing on its path downstream to impact properties at Brynderwen.	Private Landowner	Ordinary Watercourse
3	Land Drainage Channel located to the rear of Brynderwen	A Land drainage channel located on land to the rear of Brynderwen was identified as overflowing during the storm event, resulting in additional surface water runoff conveying towards Brynderwen.  A blockage was identified at the inlet.	Private Landowner	Surface Water
4	Ely Brook culvert inlet located opposite the Royal Oak Inn	The Ely Brook culvert inlet became blocked with debris during the storm event which led to surcharging at the inlet causing water to overtop and flow towards Pontshonnorton Road.	Private Landowner	Ordinary Watercourse
5	Section of the Ely Brook culvert network downstream of	The structural condition of the culvert barrel has been attributed to flooding in this location where a grade 5 structural defect enabled the ordinary watercourse to surcharge through a tarmac driveway which contributed to flooding along Pontshonnorton Road.	Private Landowner	Ordinary Watercourse

	the surcharged inlet			
6	Surface water drainage network across RCT10	<p>Ponding surface water across the highway was reported by several residents at Brynderwen, Heol Mynydd, Heol Nant, Heol Cronfa, Park Place and Pontshonnorton Road.</p> <p>The highway drainage network within RCT10 was over capacitated and was unable to convey the substantial surface water exceedance flows during Storm Dennis. Overland flow transporting silt and debris also contributed to the blockage of highway drainage infrastructure, limiting the capacity of the network further.</p>	Rhondda Cynon Taf CBC Highway Authority	Surface Water

## 4. RISK MANAGEMENT AUTHORITY ACTIONS

A Welsh Risk Management Authority is defined in Section 6 of the Flood and Water Management Act 2010 as NRW; a Lead Local Flood Authority, a district council for an area where there is no unitary authority, or a highway authority wholly in Wales; an internal drainage board for an internal drainage district that is wholly or mainly in Wales; a water company that exercises functions in relation to an area in Wales. As the LLFA, RCTCBC has the responsibility to coordinate the management of flood risk and the interaction of Risk Management Authorities across Rhondda Cynon Taf.

An overview of the responsible Risk Management Authority in relation to flood type is provided in Table 5. For further details of the roles and responsibilities of individual Risk Management Authorities in managing flooding, refer to 'FRM – Storm Dennis - Overview Report'.

**Table 5:** Risk Management Authority responsible for different flood types

Type of Flooding	Responsible Risk Management Authority
<b>Flooding from Main River, reservoirs and the sea (including coastal erosion).</b>	Natural Resources Wales
<b>Flooding from ordinary watercourses, surface water and groundwater</b>	Lead Local Flood Authority
<b>Flooding from water and sewage systems</b>	Water Companies (Dŵr Cymru Welsh Water)
<b>Flooding from the highway</b>	Highway Authority
<b>Flooding from the highway (motorways and major trunk roads)</b>	Welsh Government Trunk Road Agency

Risk Management Authorities have direct flood risk management functions under the Flood and Water Management Act 2010, as well as the Land Drainage Act 1991 and the Highways Act 1980. Through analysis of the flooding that impacted investigation area RCT10, the flood risk management functions exercised or proposed to be exercised by relevant RMAs was recorded in pursuant to Section 19 of the Flood and Water Management Act 2010, which states;

“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 the response to the flood.”

Through the investigation process, the source(s) and possible causes of flooding in Cifynydd as a result of Storm Dennis have been previously identified and summarised within Table 6. The Risk Management Authority(ies) responsible for managing that flooding have been determined in Table 6, along with a series of recommendations presented by the LLFA.

**Table 6:** Recommendations provided by the LLFA to be considered by the relevant Risk Management Authority identified in response to the source(s) of flooding in Investigation Area RCT10 (as per Table 4)

Ref No	Asset (Source)	Asset Owner	Type of Flooding	RMA Responsible for Managing Risk	Recommendations	
1	Nant Cae Dudwg culvert inlet and flood defence wall	Rhondda Cynon Taf CBC	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R1A	The LLFA and LDA to investigate the standard of protection and the condition of the culvert structure and network as a whole.
					R1B	Jet and cleanse the ordinary watercourse network.
					R1C	The LLFA to review the current FAS infrastructure.
					R1D	The LLFA and LDA to review the risk of scour potential within the ordinary watercourse channel.
					R1E	The LLFA and LDA to work with riparian

						landowners to identify suitable management methods to reduce the risk of scour within the ordinary watercourse.
2	Heol Mynydd North culvert inlet	Private Landowner	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R2A	The LLFA and LDA to identify drainage asset ownership and responsibility.
					R2B	The LLFA and LDA to investigate the standard of protection and the condition of the culvert structure and network as a whole.
					R2C	Jet and cleanse the ordinary watercourse network.
					R2D	The LLFA and LDA to review the risk of scour potential within the ordinary watercourse channel.
					R2E	The LLFA and LDA to work with riparian landowners to identify suitable management methods to reduce the risk of scour within the ordinary watercourse.
3	Land Drainage Channel located on land to the rear of Brynderwen	Private Landowner	Surface Water and Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R3A	The LLFA and LDA to identify drainage asset ownership and responsibility.
					R3B	The LLFA and LDA to exercise their permissive powers under Section 64 of the Land Drainage Act to investigate the surface water drainage

						arrangements on the area of land where the ditch is situated.
					R3C	The LLFA and LDA to regulate the land drainage channel to ensure the riparian owner maintains an unobstructed flow.
4	Ely Brook culvert inlet located opposite the Royal Oak Inn	Private Landowner	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R4A	The LLFA and LDA to identify drainage asset ownership and responsibility.
					R4B	The LLFA and LDA to investigate the standard of protection and the condition of the culvert structure and network as a whole.
					R4C	Jet and cleanse the ordinary watercourse network.
					R4D	The LLFA and LDA to review the risk of scour potential within the ordinary watercourse channel.
					R4E	The LLFA and LDA to work with riparian landowners to identify suitable management methods to reduce the risk of scour within the ordinary watercourse.
5	Section of the Ely Brook culvert network downstream of the	Private Landowner	Ordinary Watercourse	Lead Local Flood Authority and Land Drainage Authority	R5A	The LLFA and LDA to identify drainage asset ownership and responsibility.
					R5B	The LLFA and LDA to investigate the standard of protection and the

	surcharged inlet					condition of the culvert section.
					R5C	The LLFA and LDA to regulate the ordinary watercourse culvert to ensure the riparian owner maintains an unobstructed flow.
6	Surface water drainage network across RCT10	Rhondda Cynon Taf CBC Highway Authority	Surface Water	Highway Authority and Lead Local Flood Authority	R6A	The Highways Authority to jet and cleanse the highway drainage network and action repairs accordingly.

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#### 4.1. LEAD LOCAL FLOOD AUTHORITY

In review of Ref 1-6 Table 6, the LLFA and LDA have been determined as the responsible Risk Management Authorities in relation to the flooding which occurred at investigation area RCT10 during Storm Dennis.

The LLFA exercised the following functions in response to the flooding at investigation area RCT10;

- Officers investigated the initial flooding and have produced this report in line with Section 19 of the Flood and Water Management Act 2010.
- Officers contacted residents affected by flooding to offer support and advice to assist in the recovery following the event.
- A public engagement exercise carried out by Redstart, on behalf of RCTCBC as the LLFA, was undertaken in order to gain further local insight and anecdotal evidence to support the flood investigation
- The LLFA and LDA have exercised their permissive powers under Section 64 of the Land Drainage Act 1991 to investigate the culvert structures and network conditions and its impact on the flooding within the investigation area. **(R1A, R2B, R3B, R4B, R5B)**
- An estimated 1,229 meters of ordinary watercourse culvert network length within investigation area RCT10 has been surveyed following the event to ascertain both the operational condition of the network, and its structural integrity along sections of the network. **(R1A, R2B, R3B, R5B)**
- An estimated three tonnes of material and debris was removed from the culvert network within investigation area RCT10 during jetting and cleansing operations. **(R1B, R2C, R4C)**
- The LLFA and LDA have undertaken clearance works to the culvert inlet structures which fall under the responsibility of the Authority. In addition to this, the LLFA and LDA have carried out clearance works to the culvert inlet structures which fall under private land ownership utilising powers under Section 14A of the Land Drainage Act. **(R1B, R2B, R4C)**
- The LLFA commissioned Redstart to investigate the standard of protection of the existing culvert networks in Cilfynydd to determine their hydraulic capacity following the identification of several structural and operational defects within sections of the network. **(R1A, R2B, R3B, R5B)**

- The LLFA has set up a central Control Room, to compliment the Council's Contact Centre and CCTV centre which is based at the Council's offices, to provide a comprehensive and informed response to the residents of RCT as appropriate during storm events.
- The LLFA have initiated an interim Property Flood Resistance project offering expandable flood gates to those properties deemed at high risk of flooding from local sources.
- The LLFA and LDA have initiated engagement with riparian landowners to ensure the ordinary watercourse and land drainage infrastructure is free flowing and unobstructed **(R2A, R3A, R3C, R4A, R5A, R5C)**.
- In review of Ref 1 and following a review of the Nant Cae Dudwg ordinary watercourse conditions post Storm Dennis, the LLFA has secured funding from the Welsh Government to facilitate the rehabilitation of the scoured sections of ordinary watercourse channel. **(R1D)**

The LLFA propose to exercise the following functions in response to the flooding at investigation area RCT10;

- Following the surveying of culvert networks in investigation area RCT10, the LLFA propose to input and update all relevant asset data. **(R1A, R2A, R2B, R3A, R3B, R4A, R4B, R5A, R5B)**
- The LLFA will develop a Strategic Outline Business Case to better understand the risk of flooding using a whole catchment approach to provide recommendations for suitable management mechanisms to reduce the wider risk of flooding to people and properties from local sources (Ordinary Watercourse, Surface Water and Groundwater).
- The LLFA and LDA intend to clarify drainage asset owners and management responsibilities to make them aware of riparian responsibility. To ensure landowners manage the risk in compliance with the relevant legislation, a team of Flood Enforcement Officers including legal support is to be appointed. **(R2A, R3A, R3C, R4A, R5A)**
- The LLFA propose to install remote telemetry monitoring devices at key culvert structures to enable operators to ensure the drainage systems in Cilfynydd are operating effectively.
- As part of RCTCBC's comprehensive review of the County Borough's most at risk communities, the LLFA are proposing to undertake a formal Strategic Flood Risk Assessment (SFRA) of the Lower Cynon catchment area (which includes the community of Cilfynydd) to better understand the overall risk from ordinary

watercourse and surface water flooding in order to target investment to areas of highest risk. The SFRA also aim to encourage whole catchment measures, including working with natural processes, to alleviate flood risk in those areas of highest risk.

- The LLFA and LDA propose to undertake Geomorphological assessments of the upper catchments in Cilfynydd to determine the risk of culvert blockages as a result of scour and debris potential. In addition to this the LLFA and LDA will engage with Riparian landowners to identify suitable management methods to reduce the risk of scour within the ordinary watercourses. **(R1D, R1E, R2D, R2E, R4D, R4E)**
- The LLFA and LDA will continue to engage with riparian landowners and regulate the ordinary watercourse infrastructure to ensure the infrastructure is free flowing and unobstructed. **(R2A, R3A, R3C, R4A, R5A, R5C)**
- The LLFA are developing a scheme to facilitate the rehabilitation of the scoured section of the Nant Cae Dudwg ordinary watercourse channel which suffered significant scour and minor landslips during Storm Dennis. The scheme is programmed for completion by the end of the 2021-22 financial year. **(R1D)**

#### **4.2. NATURAL RESOURCES WALES**

Natural Resources Wales were not identified as a responsible authority in relation to the flooding at investigation area RCT10 on the 15<sup>th</sup> and 16<sup>th</sup> February 2020. Furthermore, the authority does not propose to undertake any functions in relation to the event.

#### **4.3. WATER COMPANY**

Welsh Water were not identified as a responsible authority in relation to the flooding at investigation area RCT10 on the 15<sup>th</sup> and 16<sup>th</sup> February 2020. Furthermore, the authority does not propose to undertake any functions in relation to the event.

#### **4.4. HIGHWAY AUTHORITY**

During the investigation into the flooding at investigation area RCT10 during Storm Dennis, the Highway was identified as flooding as a result of the ordinary watercourse flooding and surface water runoff flowing down the steep hillsides of Cilfynydd and

onto the highway at several locations, including the A4054 Cilfynydd Road, Pontshonnorton Road, Brynderwen, Heol Cronfa and Heol Nant. Mud and debris mobilised and deposited by overland flows caused partial blockages to highway gullies along the aforementioned roads, which limited the capacity of the highway drainage network to convey surface water and exceedance flows.

RCTCBC as the Highway Authority have exercised the following functions in response to the flooding at investigation area RCT10;

- The Highway Authority assisted with the emergency response during the event by supplying equipment and sandbags, some to individual properties and using sandbags to redirect flood water away from properties.
- The Highway Authority exercised their functions under Section 100 of the Highways Act 1980, to arrange for all gullies and open drains in the highway to be inspected and cleansed following the influx of flood water to ensure the safety of the highway post event. **(R6A)**
- The Highway Authority also carried out maintenance works to clear any vegetation from the surrounding area of their drainage infrastructure to reduce the risk of further blockages.
- The Highway Authority has undertaken four separate phases of debris removal from the Nant Cae Dudwg watercourse and associated debris screens following Storm Dennis. This has resulted in the removal of approximately 350 tons of material from the watercourse. **(R1B)**
- The Highway Authority has undertaken emergency clearance works to the culvert inlets identified as sources of flooding. **(R1B, R2C, R4C)**

RCTCBC as the Highway Authority propose to undertake the following function in relation to the event at investigation area RCT10;

- The Highway Authority intend to increase their resource capacity by establishing a dedicated 'Pluvial Drainage Team' to focus entirely on the refurbishment and maintenance of RCT's existing and enhanced highway drainage infrastructure.

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## USEFUL LINKS/CONTACTS

**Blue Pages** – property Resilience - <http://bluepages.org.uk/>

**Flood Re** – Flooded Property Insurance Scheme - <https://www.floodre.co.uk/>

**Natural Resources Wales** – Check Flood Warnings - <https://naturalresources.wales/flooding/check-flood-warnings/?lang=en>

**Natural Resources Wales** - Long Term Flood Risk - <https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en>

**Rhondda Cynon Taf CBC** - Local Flood Risk Management Plan - <https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/FloodAlleviation/Floodriskregulations2009.aspx>

**Rhondda Cynon Taf CBC** - Local Flood Risk Management Strategy - <https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/FloodAlleviation/LocalFloodRiskManagementStrategy.aspx>

**Rhondda Cynon Taf CBC** – Sustainable Drainage – <https://www.rctcbc.gov.uk/EN/Resident/ParkingRoadsandTravel/Roadspavementsandpaths/SustainableDrainage/SustainableDrainage.aspx>

**Welsh Government** - National Strategy for Flood and Coastal Erosion Risk Management - <https://gov.wales/sites/default/files/publications/2019-03/national-strategy-for-flood-and-coastal-erosion-risk-management-in-wales.pdf>

**Welsh Water** – How to Contact Us – <https://www.welshwater.com/en/Contact-Us.aspx>