



Flood & Water Management Act 2010

Section 19 Flood Investigation Report FI0106

Location: Pontybodkin, Flintshire
Incident Date: October 2023

Document Control Sheet

Document Author	Elain Jones MEng (Hons) GMICE
Checker	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

Revision History

Date	Version Number	Summary of Changes
27/09/2024	Draft Report 1	NA
10/07/2025	Version 2	Updated to document feedback from Risk Management Authorities.
01/09/2025	Final Version	Final edits made by the LLFA

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Executive Summary

This report has been prepared for the purpose of meeting the requirements of Section 19 of the Flood and Water Management Act 2010. Under Section 19 of the Flood and Water Management Act 2010, the Lead Local Flood Authority (Flintshire County Council) on becoming aware of a flood in its area must, to the extent it considers necessary or appropriate, investigate, prepare and publish a Flood Investigation Report.

As a Lead Local Flood Authority (LLFA), it is the responsibility of Flintshire County Council (FCC) to manage the local flood risk from surface water, groundwater and ordinary watercourses such as streams and ditches (including lakes and ponds).

Section 19 of the Flood and Water Management Act 2010 states:

“On becoming aware of a flood in its area, a lead local flood authority must, to the extent it considers 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 intending to exercise, those functions in response to the flood”*

The flood risk management authorities in Flintshire are:

- Flintshire County Council
- Flintshire’s Environment Department
- Natural Resources Wales
- Dŵr Cymru / Welsh Water

The relevant Flood Risk Management Authority for this event is Flintshire County Council as flooding was mainly attributed to an ‘ordinary watercourse’. Internal flooding to a single residential property warrants that the incident should be investigated, and a report prepared in accordance with the Council’s Local Flood Risk Management Strategy (LFRMS):¹

In October 2023, Storm Babet brought periods of heavy rainfall across large areas of the United Kingdom. The Met Office reported that the 18th to the 21st of October saw “the third-wettest independent 3-day period for England and Wales in a series from 1891”.

Representatives of Waterco Ltd, on behalf of FCC, have carried out community engagement and communicated with relevant stakeholders to gain an understanding of the nature of the October 2023 flood event. This Report provides details of the flooding incident.

Across Pontybodkin, there were 3 reports of internal flooding. The majority of the internal flooding incidents can be attributed to the exceedance of a culvert on Byr Brook near the Scrap Metal Merchants yard.

¹ <https://www.flintshire.gov.uk/en/PDFFiles/Flooding-and-Drainage/Flintshire-Local-Flood-Risk-Management-Strategy.pdf>.

Table 1 sets out the recommended actions required following the flooding of October 2023 and the stakeholder required to undertake each action.

Table 1 – Recommendations to address flooding

Ref	Stakeholder	Action
01	FCC Highways Authority	Inspect the existing culvert inlets along Byr Brook / Black Brook on a frequent basis and remove debris as required.
02	FCC Highways Authority	Undertake a CCTV condition survey of the culvert at the Scrap Metal Merchants yard. Take remedial action as required.
03	FCC Highways Authority	Increase frequency of gully cleansing in affected areas, for example along Corwen Road.
04	FCC LLFA	Communicate with local communities to raise awareness of flood resilience measures that can be implemented to help protect properties.
05	FCC LLFA	Review condition of the ordinary watercourses discussed in this report and inform the riparian landowners if any issues are identified.
06	FCC LLFA	Subject to funding, consider a scheme for flood management measures to aim to manage and reduce flood flows from Black Brook and Byr Brook.
07	DCWW	Review customer complaints and investigate the associated sections of public sewer system to remove any blockage / significant debris following the October 2023 event.
08	Property Owners / Residents	Consider the implementation of property level flood resilience measures. These could include; the installation of non-return valves to prevent ingress of floodwater on private drainage systems and installing flood barriers or flood doors.

1.0 Introduction

- 1.1 Since the introduction of the Flood and Water Management Act 2010 (FWMA) Flintshire County Council (FCC) is the designated Lead Local Flood Authority (LLFA).
- 1.2 Under Section 19 of the FWMA, Flintshire County Council as the LLFA on becoming aware of a flood in its area must, to the extent that it considers necessary or appropriate, investigate and prepare a report.
- 1.3 Where a LLFA carries out an investigation then the report must be published, and any relevant risk management authorities notified.
- 1.4 Waterco have been commissioned by FCC to carry out a Flood Investigation Report in relation to flooding in Pontybodkin during Storm Babet which occurred in October 2023. Storm Babet caused internal and external flooding to residential properties in Pontybodkin.
- 1.5 The purpose of this Section 19 (S19) Flood Investigation Report is to identify the cause of internal flooding to properties in Pontybodkin during the October 2023 flood event. This report will provide an overview of flooding mechanisms, identify relevant Risk Management Authorities and stakeholders, and provide a list of recommendations.
- 1.6 The opinions expressed in this report and the comments and recommendations given are based on an assessment of available information.
- 1.7 The information, views and conclusions drawn are based, in part, on information supplied to Waterco by other parties. Waterco has proceeded in good faith on the assumption that this information is accurate. Waterco accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to Waterco from others.

2.0 Summary of Storm Babet and Impact

National Context

- 2.1 Storm Babet brought heavy and persistent rainfall across much of the UK and ‘was the third-wettest independent 3-day period for England and Wales in a series from 1891’ according to the Met Office². As shown in Figure 1, many parts of the UK received over 50mm of rain, with 75-100mm of rain recorded across areas of North Wales. Several areas across the UK received over 100% of the average rainfall amount for October.

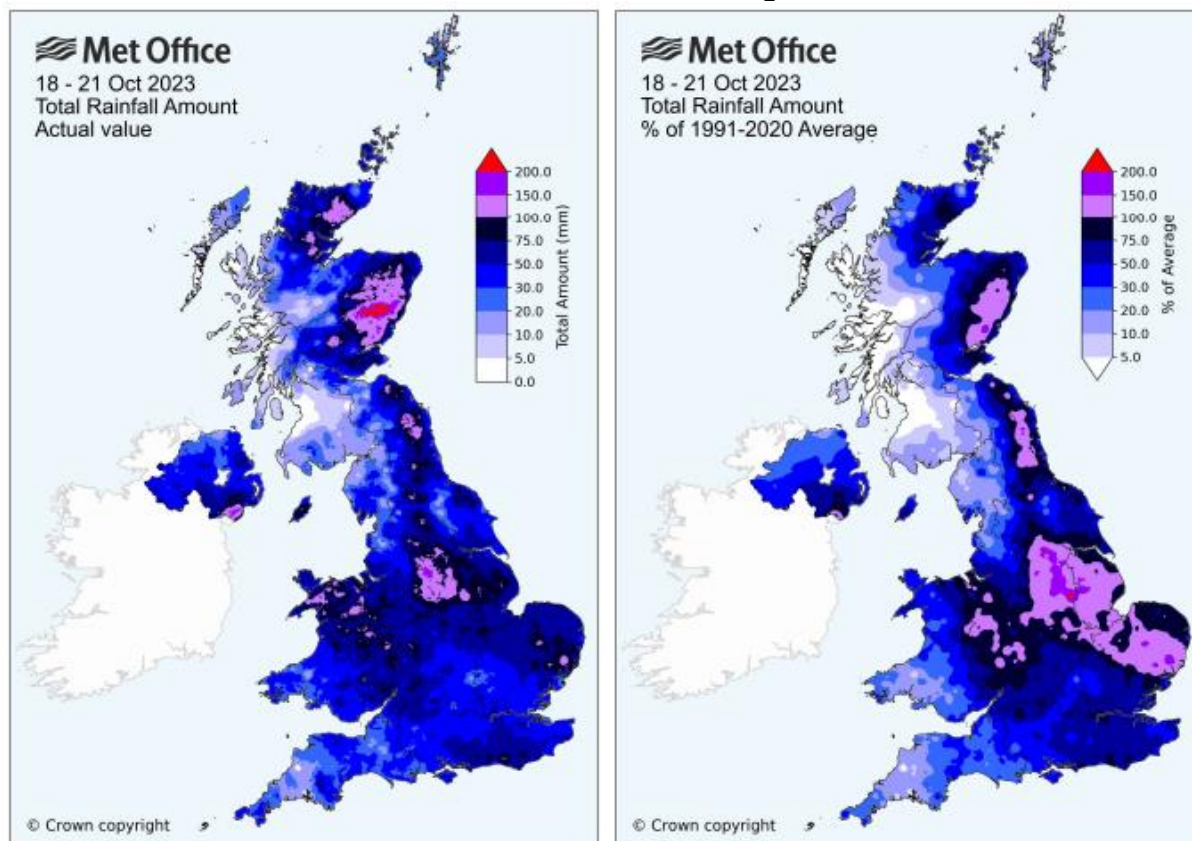


Figure 1 - Met Office Accumulated Daily Rainfall 18th-21st of October 2023

- 2.2 Storm Babet was part of a wider period of heavy rainfall across the country. According to NRW, the 9 month period ending in March 2024 was the second wettest of any 9 month period recorded in North Wales, and the wettest 9-month period ending in the month of March. Storms over this period (such as Storm Babet) were characterised more by their prolonged rainfall rather than their intensity. Between September 2023 and March 2024 NRW issued 194 Flood Warnings and 3 Severe Flood Warnings.

Regional Context

- 2.3 Unlike most storms, Storm Babet did not pass over rapidly. This allowed multiple fronts to add more rainfall over a prolonged period of time. The evapotranspiration rate in October was low and rainfalls were frequent throughout the month, with high levels of antecedent rainfall on October 13th / 14th (27mm in Mold) leading to soils being close to saturation.
- 2.4 Rainfall records have been obtained from NRW's Mold rain gauge³.

² Storm Babet Report https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/interesting/2023/2023_08_storm_babet.pdf

³ <https://rivers-and-seas.naturalresources.wales/Station/1011?parameterType=2>

- 2.5 Figure 2 shows the rainfall in the days leading up to the flooding on the 20th October. Flintshire experienced rainfall two days prior to the 20th October, with 15.2mm of rainfall on the 18th and 11.8mm on the 19th. On 20th October, Mold rain gauge recorded 61.8mm of rainfall.

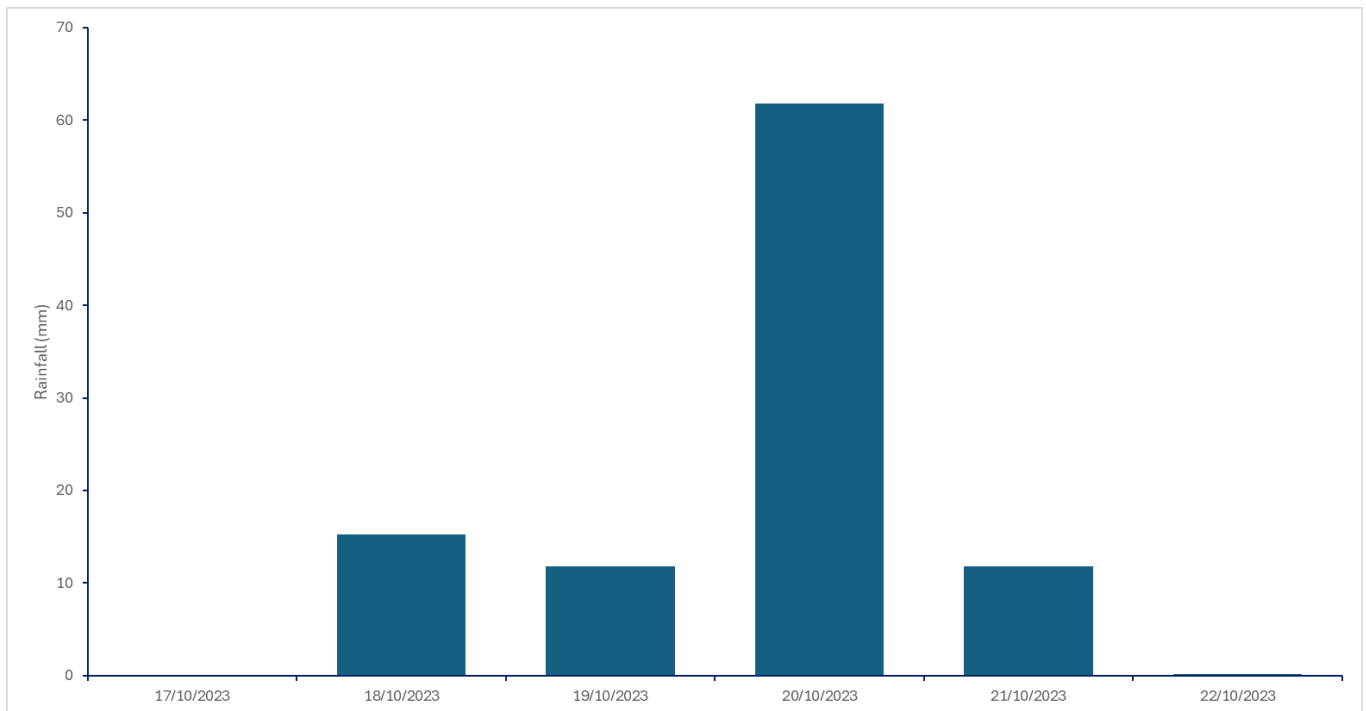


Figure 2 - NRW Mold Rain Gauge - Daily Rainfall From 18th-21st October

- 2.6 Figure 3 shows that there was a period of intense rainfall on Wednesday the 18th October which began at 19:00pm and peaked between 21:00-22:00 with 5mm of rainfall per hour. There was some additional rainfall on Thursday the 19th October peaking at approximately 1mm per hour. During 20th October, rainfall was prolonged with peak rainfall intensities at approximately 4.2mm per hour.

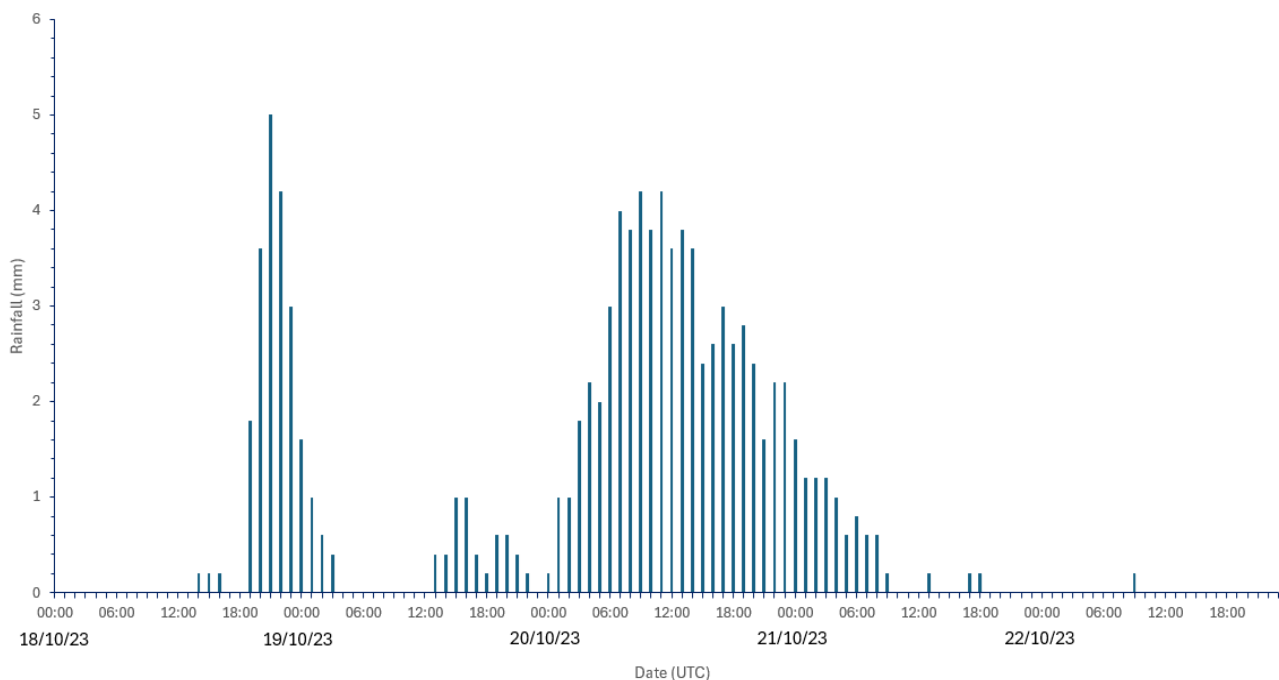


Figure 3 - Hourly rainfall between the 18th and 22nd of October

- 2.7 Flood Estimation Handbook (FEH) analysis estimates that a total of 61.8mm of rainfall over 24 hours (on the 20th October), as recorded at the NRW Mold rain gauge, equates to a return period of 1 in 20 years.
- 2.8 The 73.6mm of rainfall over a 48-hour period between the 19th and 20th of October (recorded at the NRW Mold rain gauge) equates to a return period of approximately 1 in 23 years. The 88.8mm of rainfall over a 72-hour period between the 18th and 20th of October equates to an approximate return period of 1 in 38 years.
- 2.9 Due to high amounts of rainfall throughout October, there would have been a lack of soil water storage and in consequence, higher and quicker runoff resulting in flooding.

Local Context

- 2.10 Community Engagement was undertaken by Waterco in Pontybodkin on the 20th of August 2024. The purpose of the community engagement exercise was to gather information on the number of properties affected and the flooding mechanisms / source(s). In addition to speaking with householders, a questionnaire was posted to seek additional feedback. Table 2 shows a summary of the number of responses received. A Photographic record from the community engagement exercise can be found in Appendix A.

Table 2 - Summary of Community Engagement Undertaken in Pontybodkin

Location	Verbal responses received (properties)	Number of questionnaire responses
Ffordd y Bont	1	0
Corwen Road	5	3

- 2.11 In addition to the community engagement exercise, a number of stakeholders were consulted regarding any information on flooding in Pontybodkin:
- **Natural Resources Wales** – provided information on calls received during Storm Babet; a record of properties known to have flooded; and correspondence with North Wales Fire & Rescue Service.
 - **FCC Highways Authority** – provided a call log showing where members of public had reporting flooding.
 - **Dŵr Cymru Welsh Water** – held a post-Storm Babet meeting with FCC and Waterco to share details of asset performance and flooding records during Storm Babet.

2.12 Table 3 provides a summary of the locations and reported effects of flooding following the community engagement exercise and stakeholder engagement. A location plan of the affected areas can be found in Appendix B.

Table 3 - Summary of Flooding in Pontybodkin During Storm Babet

Location	Internal Flooding	Impact
Ffordd y Bont	1	Internal flooding to 1 property.
Corwen Road	2	Internal flooding confirmed at 2 properties. External driveway / garden flooding confirmed to at least 3 others.
Total Internal Flooding Reports	3	Number of internal flooding incidents based on community engagement exercises and stakeholder engagement. Flooding to additional properties may have occurred but not reported to FCC.

3.0 Study Area Overview

Location

- 3.1 Flooding in Pontybodkin was generally reported on or adjacent to Corwen Road. Figure 4 shows the approximate locations of internal property flooding in Pontybodkin. Figure 4 is also reproduced as Appendix C.



Figure 4 - Plan of Reported Flooding Areas
Contains OS Data © Crown Copyright (2024)

Geology

- 3.2 The British Geological Survey (BGS)⁴ online mapping (1:50,000 scale) indicates that Pontybodkin is predominantly underlain by superficial deposits of Till, generally comprising Diamicton. The underlying bedrock geology is identified as being a mixture of Mudstone, Siltstone and Sandstone. BGS Mapping can be found in Appendix G.

⁴ British Geological Survey - <https://mapapps2.bgs.ac.uk/geoindex/home.html>

Hydrological Setting

- 3.3 'Byr Brook' flows north through Pontybodkin and is culverted in multiple locations including beneath Ffordd y Bont at National Grid Reference (NGR): 327068, 359288. Byr Brook joins 'Black Brook' watercourse at National Grid Reference (NGR): 327173, 359355. Black Brook flows east through Pontybodkin. After joining Byr Brook, the watercourse is culverted beneath Corwen Road where it becomes Main River. Once this becomes Main River it is called the Nant Brook. The watercourses and culverts are shown in Figure 5.

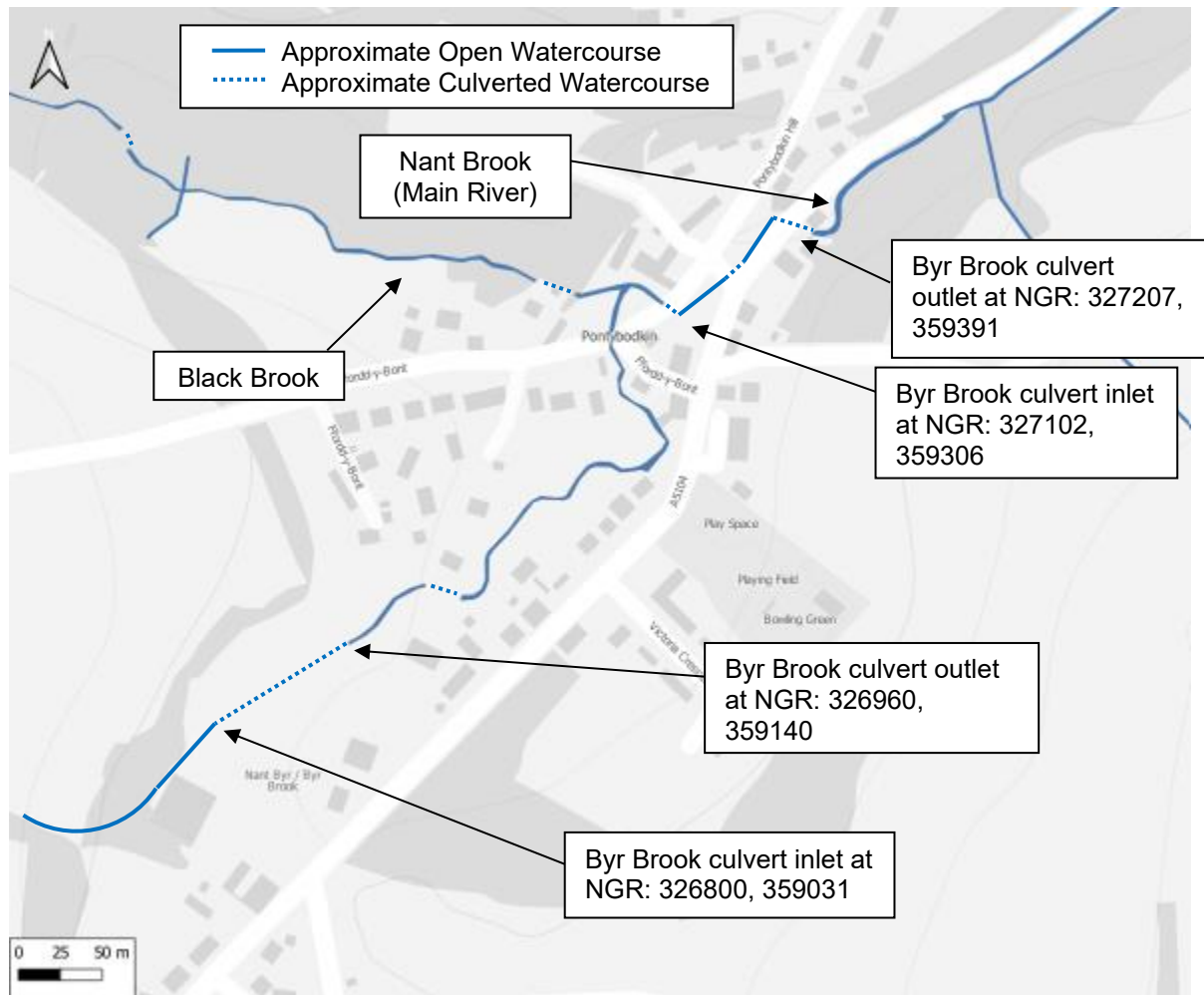


Figure 5 – Watercourse Map
Contains OS Data © Crown Copyright (2024)

- 3.4 The catchment area of Black Brook covers approximately 1.6km². Figure 6 shows the approximate catchment area generated using Scalgo software⁵.

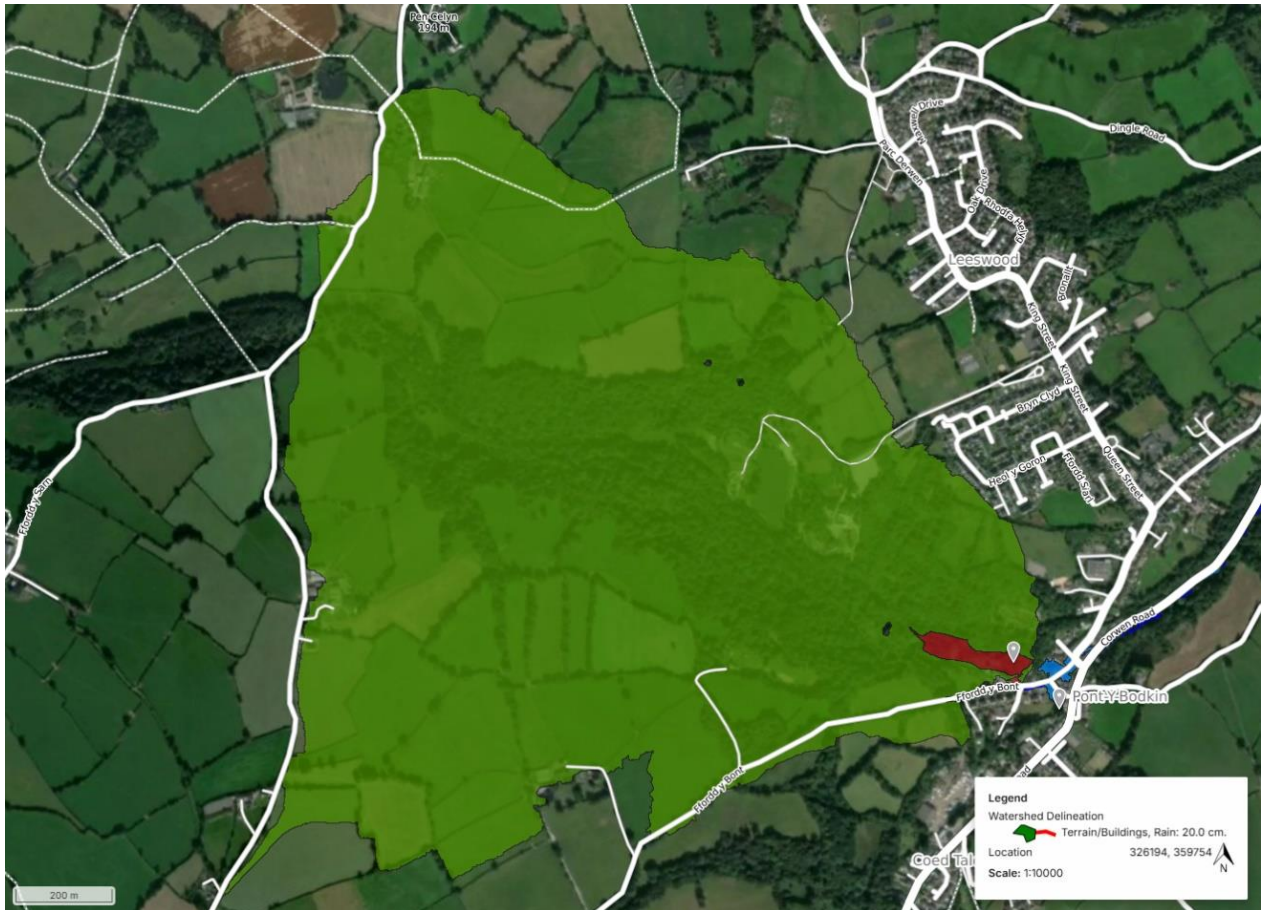
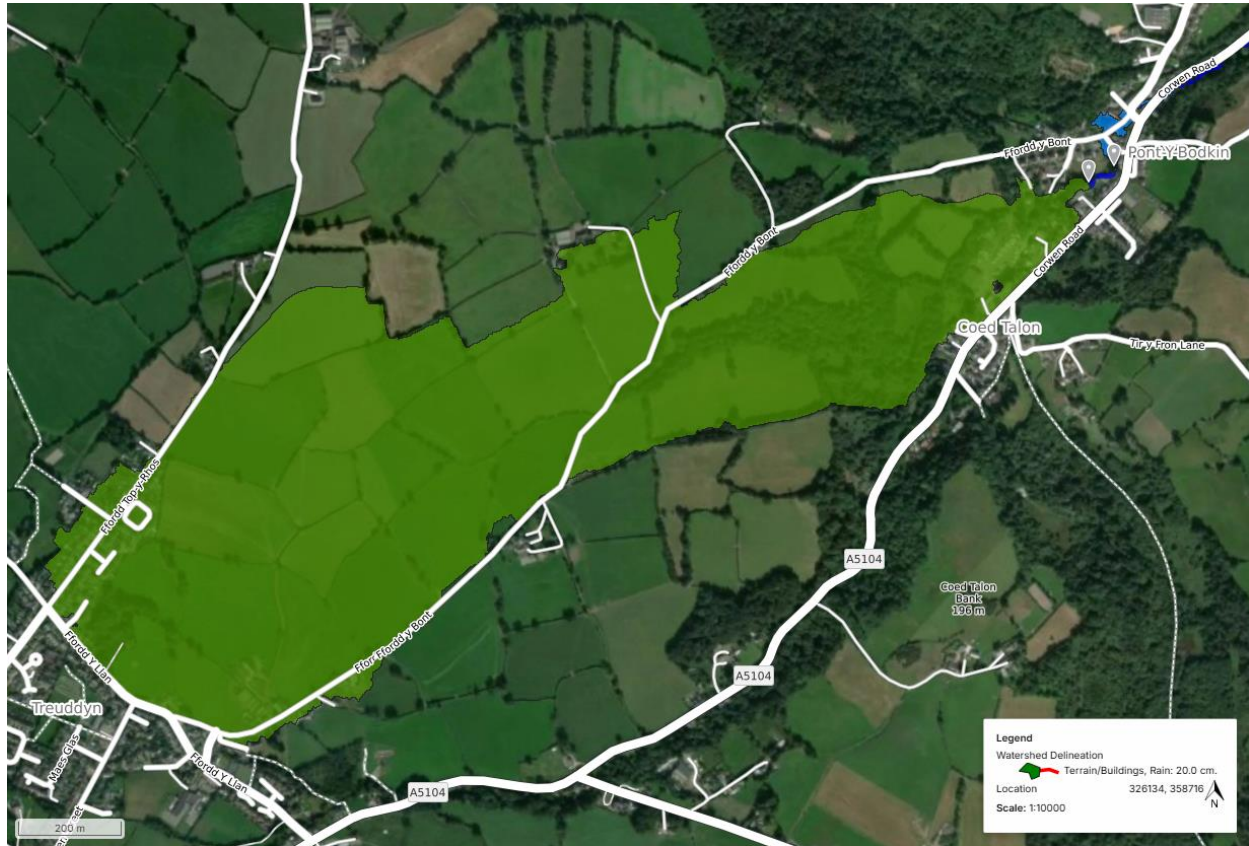


Figure 6 – Contributing Watercourse Catchment
(source: SCALGO)

- 3.5 The catchment area of Byr Brook covers approximately 0.9km². Figure 7 shows the approximate catchment area generated using Scalgo software.

⁵ Scalgo - <https://scalgo.com/>



(source: SCALGO)

Figure 7 - Contributing Watercourse Catchment

Drainage Assets

- 3.6 Public sewer records have been obtained from Dŵr Cymru Welsh Water (DCWW). The sewer records show that large areas of Pontybodkin, including Ffordd y Bont and Corwen Road are served by a combined drainage system. The combined drainage system enters a sewage pumping station which appears to accommodate flows from all gravity foul and combined sewers in Pontybodkin. DCWW sewer plans are included in Appendix E.

NRW Flood Maps

- 3.7 The NRW 'Flood Map for Planning – Rivers and Sea' map identifies the flood risk associated with main river and sea, shown in Figure 8 and Appendix F. The NRW map shows that a number of the properties / streets in Pontybodkin are located in Flood Zones 2 and 3. Flood Zone 2 is defined as an area with between a 0.1% and 1% chance of flooding from rivers and / or sea in any given year, including the effects of climate change. Flood Zone 3 is defined as an area with a greater than 1% chance of flooding from rivers and / or sea in any given year, including the effects of climate change.
- 3.8 The flood risk shown on the NRW 'Flood Map for Planning –Surface Water and Small Watercourses' map identifies the flood risk associated with small watercourses such as Byr Brook and Black Brook and is based on a combination of rainfall and LiDAR data. The mapping identifies areas where surface water may flow or pool during heavy rainfall. LiDAR Mapping for context of elevations surrounding Pontybodkin can be found in Appendix D.
- 3.9 NRW mapping indicates that flood flows spill out of Black Brook and onto Ffordd y Bont, continuing east along the road. Flooding is also shown along Corwen Road and appears to be a combination of surface water (rainfall) and out of channel flooding from Byr Brook. Byr Brook is shown to overtop at the Scrap Metal Merchant Yard with flood flows directed onto Corwen Road, continuing north-east. The points where out of channel flooding from Byr Brook and Black Brook occurs is associated with the locations of culvert inlets. The culverts therefore play a key role in flooding at this location.

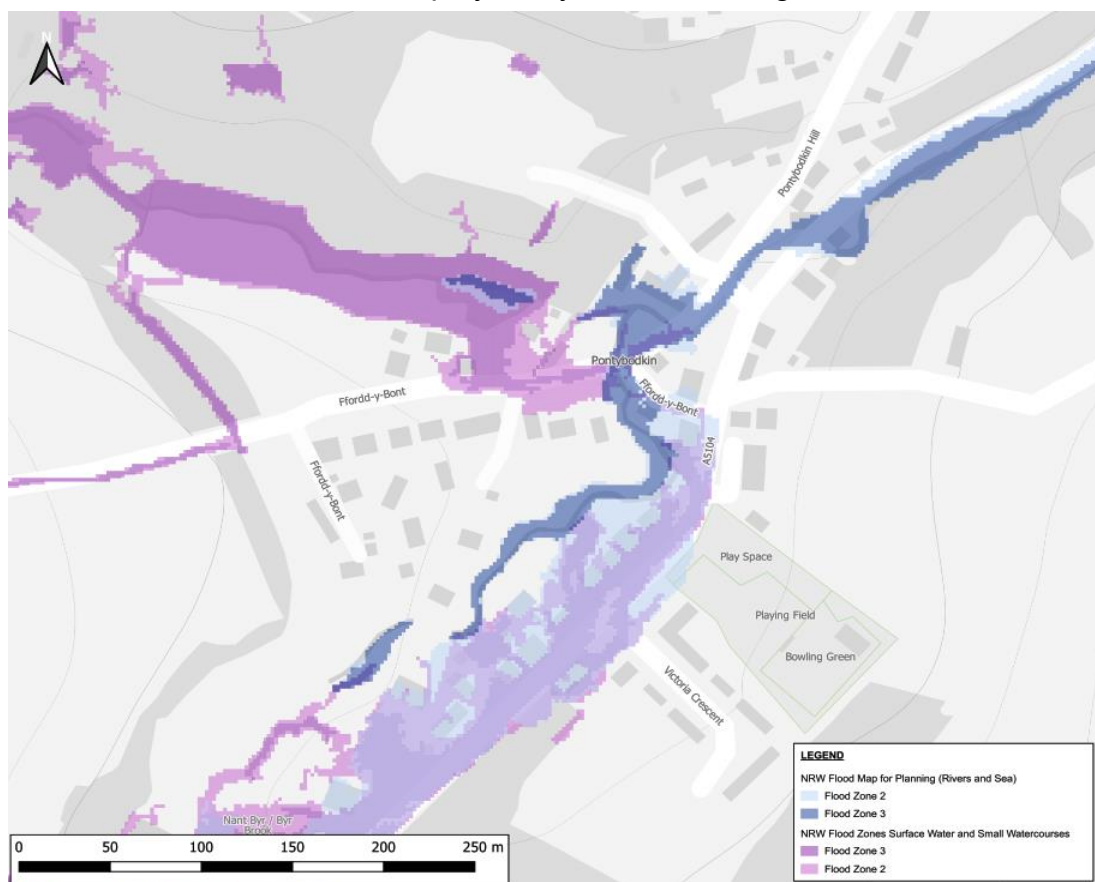


Figure 8 - NRW Flood Map for Planning – Rivers, Sea, Surface Water and Small Watercourses Map

Contains OS Data © Crown Copyright (2024) Contains Natural Resources Wales Information © Natural Resources Wales⁶ And Database Right. All Rights Reserved.

⁶ NRW Flood Risk Map - <https://flood-map-for-planning.naturalresources.wales/>

4.0 Flood Locations, Descriptions and Mechanisms

Ffordd y Bont

- 4.1 Based on the findings of the community engagement exercise and stakeholder engagement, the flooding to properties along Ffordd y Bont is attributed to surface water accumulation on the road. The surface water is derived from rainfall runoff from undeveloped / agricultural land upstream of Ffordd y Bont. Surface water flows on Ffordd y Bont enter Byr Brook and are reported to cause exceedance of the watercourse at the culvert inlet north of Ffordd y Bont.
- 4.2 During community engagement it was identified that there were service ducts crossing the watercourse after the culvert, approximately 1m above the invert level of the channel. These ducts may have blocked with large debris and branches within the channel, causing an obstruction which would have caused water to exceed the channel capacity.
- 4.3 High soil saturation levels prior to Storm Babet meant that runoff from the catchment upstream of the Ffordd y Bont culvert was rapid, meaning the watercourse would have conveyed large flows of water.

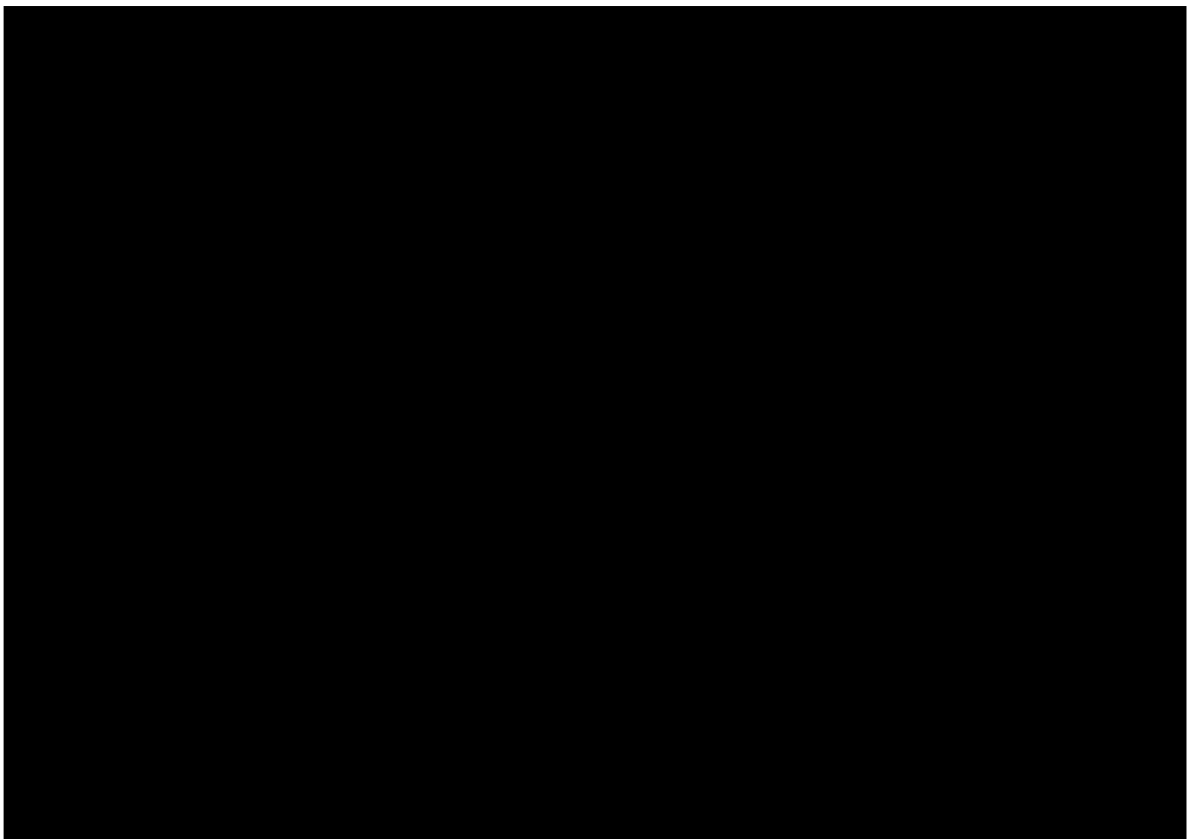


Figure 9 – Ffordd y Bont Area
Contains OS Data © Crown Copyright (2024)

Corwen Road

- 4.4 Based on the findings of the community engagement exercise and stakeholder engagement, the flooding to properties along Corwen Road was likely caused by a combination of excessive surface water flowing northeast down Corwen Road, and by flood flows on Corwen Road derived from an exceedance of the Byr Brook culvert inlet at the Scrap Metal Merchants yard. There were reports that flood flows accumulated behind the culvert inlet before spilling onto Corwen Road. Several properties along Corwen Road were affected by this flooding, however there are limited reports of internal property flooding.
- 4.5 Multiple neighbours reported that properties along Corwen Road experienced internal flooding. Several properties along Corwen Road are situated at a lower elevation than the road, leading to floodwater from the road entering these properties. The thresholds of the properties affected are considerably lower compared to those of neighbouring properties that remained unaffected. The majority of the properties that did not suffer from internal flooding along Corwen Road are situated above the road level and/or have thresholds which are raised.
- 4.6 Residents reported that water flowed rapidly down Corwen Road, entering properties to a depth of approximately 100mm. There were also reports of sewage being present in the floodwater.
- 4.7 Residents took measures to redirect water from their properties using available materials in the absence of sandbags. There were reports indicating that water flowed through driveways and into rear gardens, with solid garden walls obstructing its escape.
- 4.8 There were reports of flooding from other sources including highway drainage and sewers. It is likely that flooding from these sources occurred as a result of inflow from fluvial flood flows and overland flows. Combined sewers and highway gullies are not designed to accommodate fluvial flood flows. A summary of the causes of the flooding is provided in Figure 10.

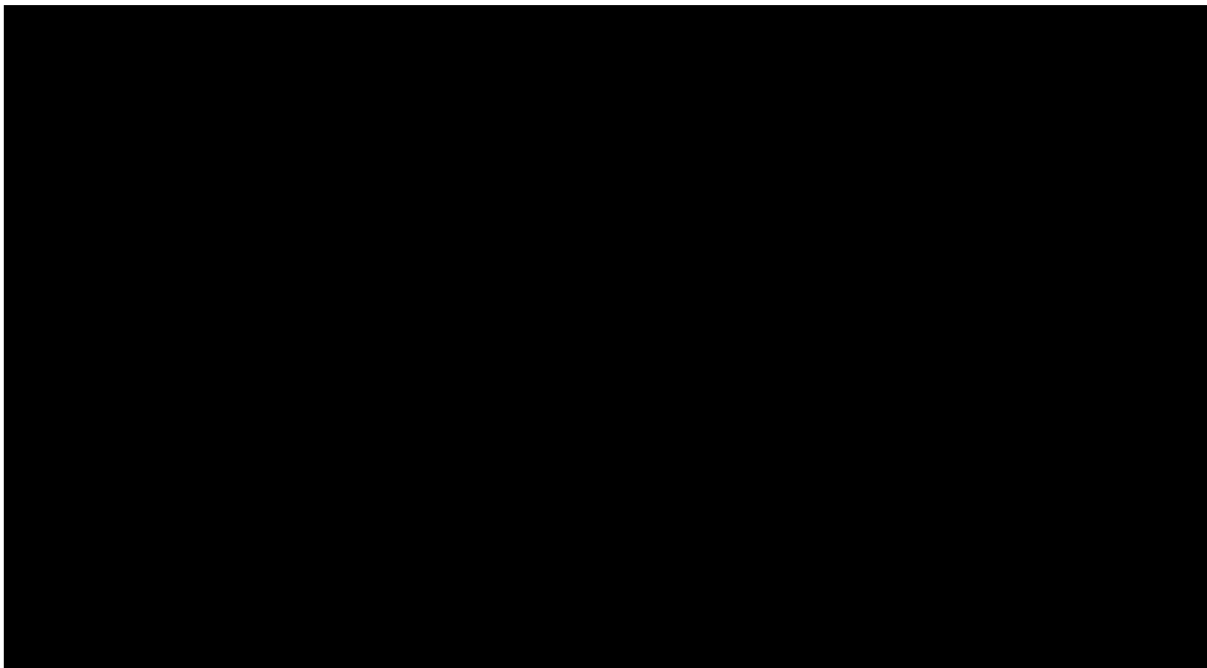


Figure 10 - Corwen Road Area
Contains OS Data © Crown Copyright (2024)

5 Relevant Parties Communication Register

- 5.1 The table below provides the details of communications that have taken place with relevant parties up to the time of writing this report. Relevant parties are considered to be all authorities and stakeholders directly involved and responsible for flood risk management, property owners affected by the flood event, and all parties who may be able to provide information salient to the flood investigation.

Table 4 - Relevant Parties Communications Register

Contact	Communications
Local Residents	Community engagement undertaken on 20/08/2024. Questionnaires returned to Waterco.
Flintshire County Council (FCC)	Shared details of call logs and confirmed flooding locations.
Dŵr Cymru Welsh Water DCWW	Meeting on the 19/02/2024 to share information of flood locations and sources.
Natural Resources Wales (NRW)	Email consultation from NRW with information on flood locations and sources. NRW also shared data from North Wales Fire and Rescue (on callouts / flood locations).
North Wales Fire & Rescue	

6.0 Conclusions

- 6.1 Waterco Ltd were appointed by FCC to prepare a Flood Investigation Report for Pontybodkin following flooding from Storm Babet on the 20th of October 2023.
- 6.2 Internal flooding was confirmed at 2 properties along Corwen Road and 1 along Ffordd y Bont.
- 6.3 The flooding at Ffordd y Bont was primarily attributed to surface water runoff, in addition to the flooding originating from the culvert of the Byr Brook watercourse below Ffordd y Bont.
- 6.4 The two main sources of flooding were a result of overland flows resulting in exceedance of the Black Brook culvert at Ffordd Y Bont and exceedance of the Byr Brook culvert at the scrap metal yard which caused flooding to properties along Corwen Road.
- 6.5 Rainfall experienced during Storm Babet was prolonged and steady, and high levels of rainfall throughout October meant soils were already saturated which led to faster runoff rates. Flooding can be attributed to uncontrolled surface water run-off from land in the upper catchment flowing down on the highway infrastructure resulting in flooding to properties in the flow paths.
- 6.6 Surcharge of the Byr Brook culvert near the Scrap Metal Merchants yard may have been associated with debris accumulation at the culvert inlet, however, the debris may have been transported during the flood event causing the blockage in the event or may have been present prior to the storm event, there is no evidence to support either scenario.
- 6.7 A total of 3 internal flooding incidents were reported in Pontybodkin during Storm Babet.

7.0 Recommendations

7.1 Table 5 sets out the recommended actions required following the flooding of October 2023 and the stakeholder required to undertake each action.

Table 5 - Recommendations

Ref	Stakeholder	Action
01	FCC Highways Authority	Inspect the existing culvert inlets along Byr Brook / Black Brook on a frequent basis and remove debris as required.
02	FCC Highways Authority	Undertake a CCTV condition survey of the culvert at the Scrap Metal Merchants yard. Take remedial action as required.
03	FCC Highways Authority	Increase frequency of gully cleansing in affected areas, for example along Corwen Road.
04	FCC LLFA	Communicate with local communities to raise awareness of flood resilience measures that can be implemented to help protect properties.
05	FCC LLFA	Review condition of the ordinary watercourses discussed in this report and inform the riparian landowners if any issues are identified.
06	FCC LLFA	Subject to funding, consider a scheme for flood management measures to aim to manage and reduce flood flows from Black Brook and Byr Brook.
07	DCWW	Review customer complaints and investigate the associated sections of public sewer system to remove any blockage / significant debris following the October 2023 event.
08	Property Owners / Residents	Consider the implementation of property level flood resilience measures. These could include; the installation of non-return valves to prevent ingress of floodwater on private drainage systems and installing flood barriers or flood doors.

APPENDIX A

Photographic Record

Photo No.1

Date: 10th September 2024

Description: Culvert upstream of Scrap Metal Merchants yard, where bridge collapsed during Storm Babet.

Source: Waterco Site Visit



Photo No. 2

Date: 10th September 2024

Description: Former bridge that was swept away during flooding of Storm Babet.

Source: Waterco Site Visit



Photo No. 3	
Date: 10th September 2024 Description: Closer view of bridge in Photo No. 4 Source: Waterco Site Visit	

Photo No. 4	
Date: 10th September 2024 Description: Fully obstructed screen along Byr Brook at NGR: 326949, 359136 Source: Waterco Site Visit	

Photo No. 5	
Date: 10th September 2024 Description: View of other side of screen shown in Photo No. 6 Source: Waterco Site Visit	

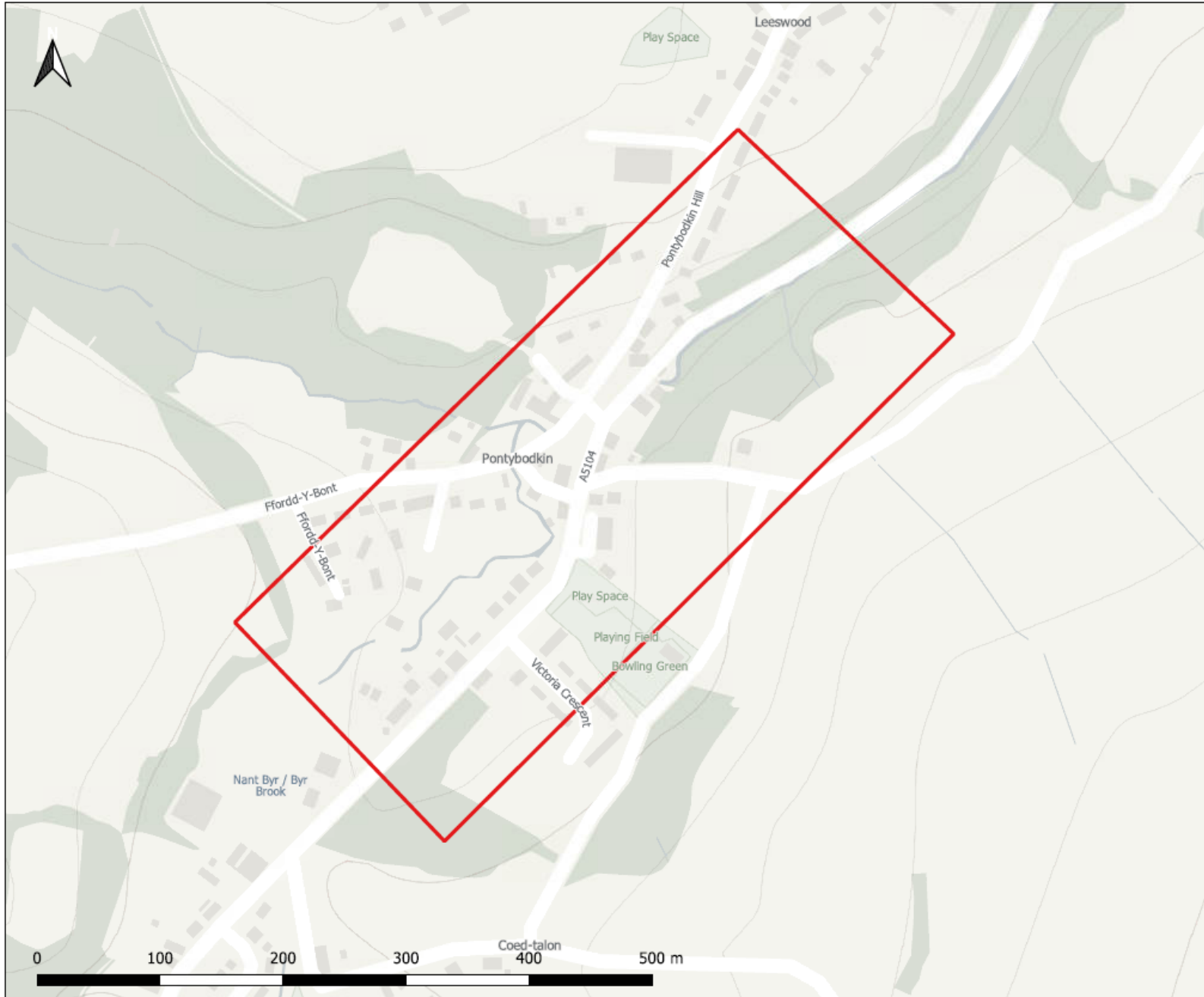
Photo No.6	
Date: 10th September 2024 Description: Partially silted culvert at NGR: 326915, 359117 Source: Waterco Site Visit	

Photo No. 7	
Date: 10 th September 2024	
Description: View of clear channel in watercourse off Tir y Fron Lane.	
Source: Waterco Site Visit	

Photo No. 8	
Date: 10 th September 2024	
Description: View of clear culvert inlet of watercourse off Tir y Fron Lane.	
Source: Waterco Site Visit	

APPENDIX B

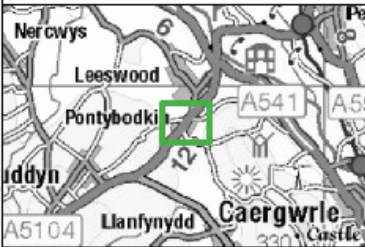
Location Plan and Ariel Image



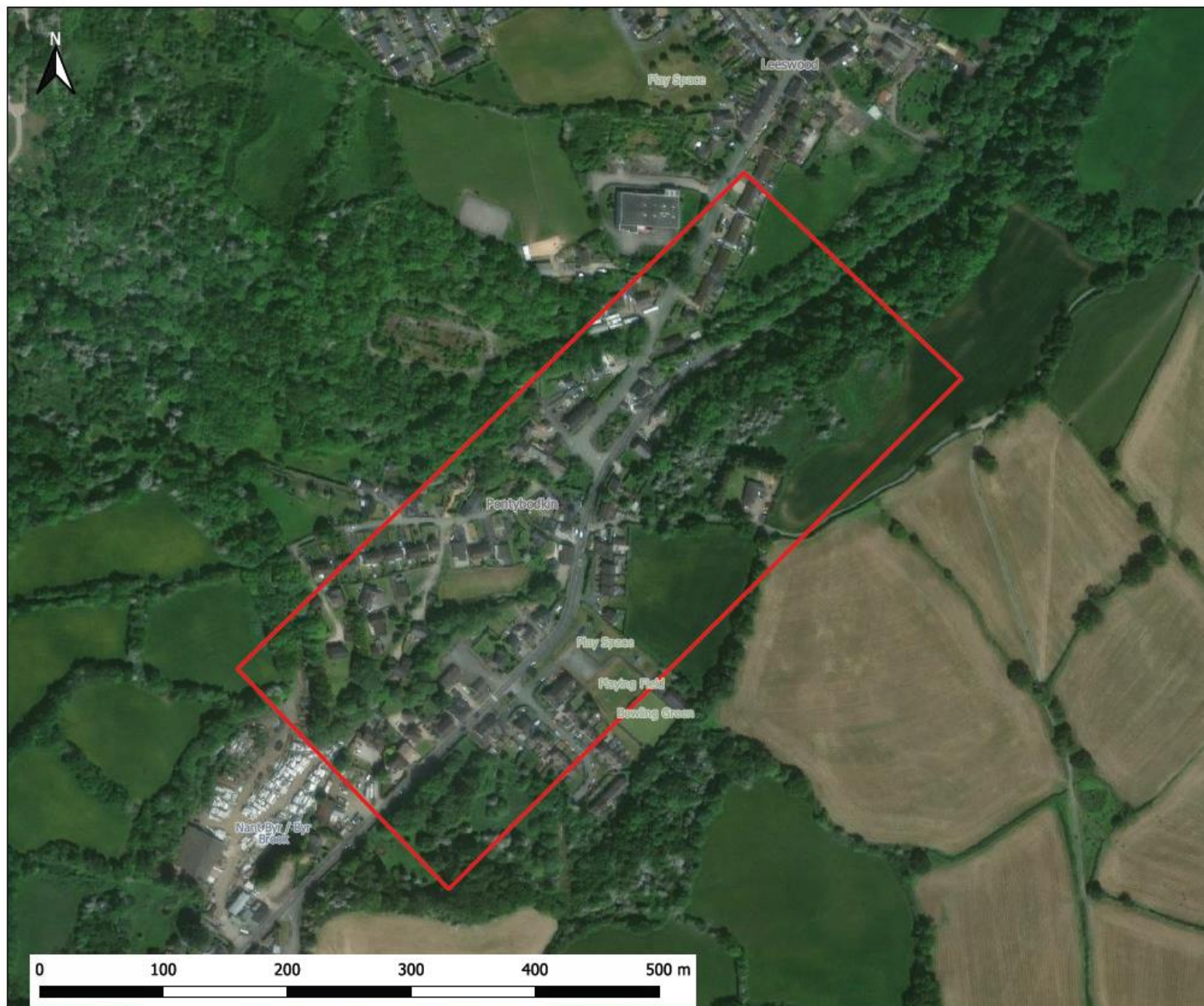
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

 Site Boundary



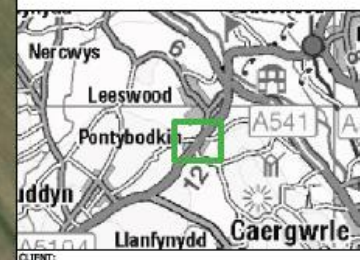
CLIENT: Flintshire County Council			
 www.waterco.co.uk			
SCHEME: 15972-Pontybodkin S19 Flood Investigation Report			
PLOT TITLE: Location Plan			
PLOT STATUS: FINAL		DATE: 19-09-2024	
DRAWN: EJ	CHECKED: SW	APPROVED: MW	PLOT SCALE AT A3: 1:3000
PLOT NAME: 15972_Location_Plan			REVISION: -



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

 Site Boundary



CLIENT:

Flintshire County Council



SCHEME:

15972-Pontybodkin S19 Flood Investigation Report

PLOT TITLE:

Aerial Plan

PLOT STATUS:

FINAL

DATE:

19-09-2024

DRAWN:

EJ

CHECKED:

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MW

PLOT SCALE AT AS:

1:3000

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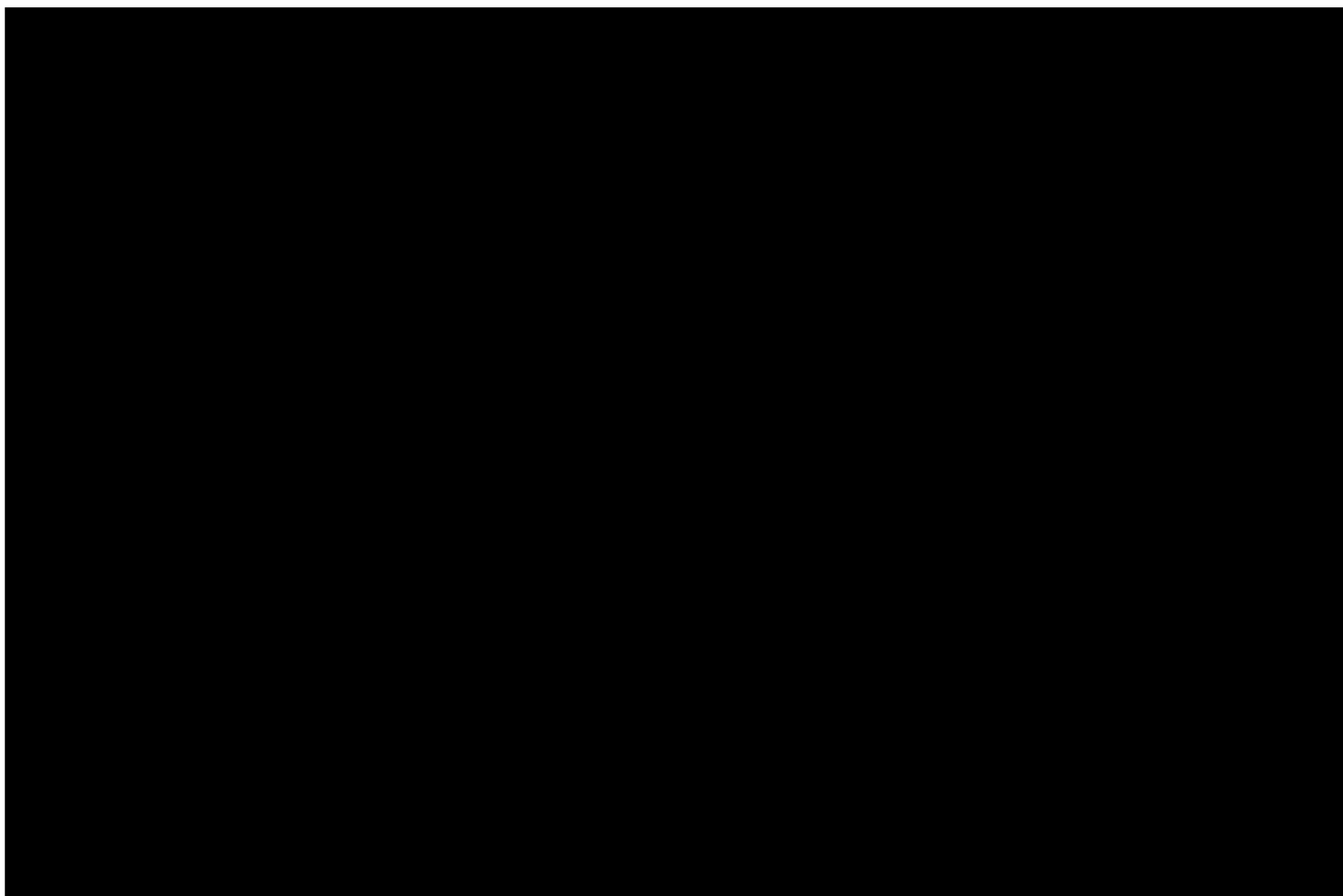
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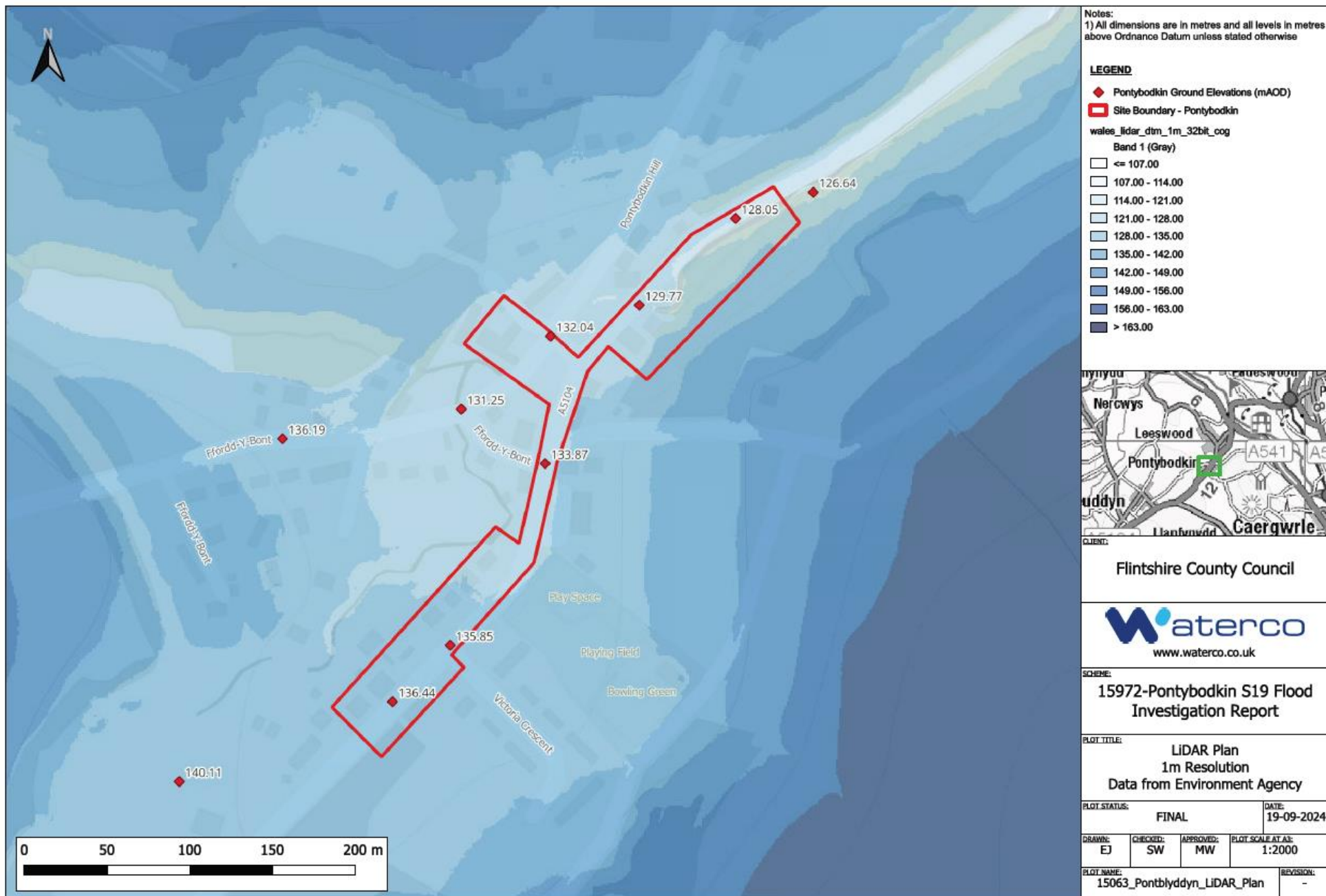
APPENDIX C

Reported Flooding Locations



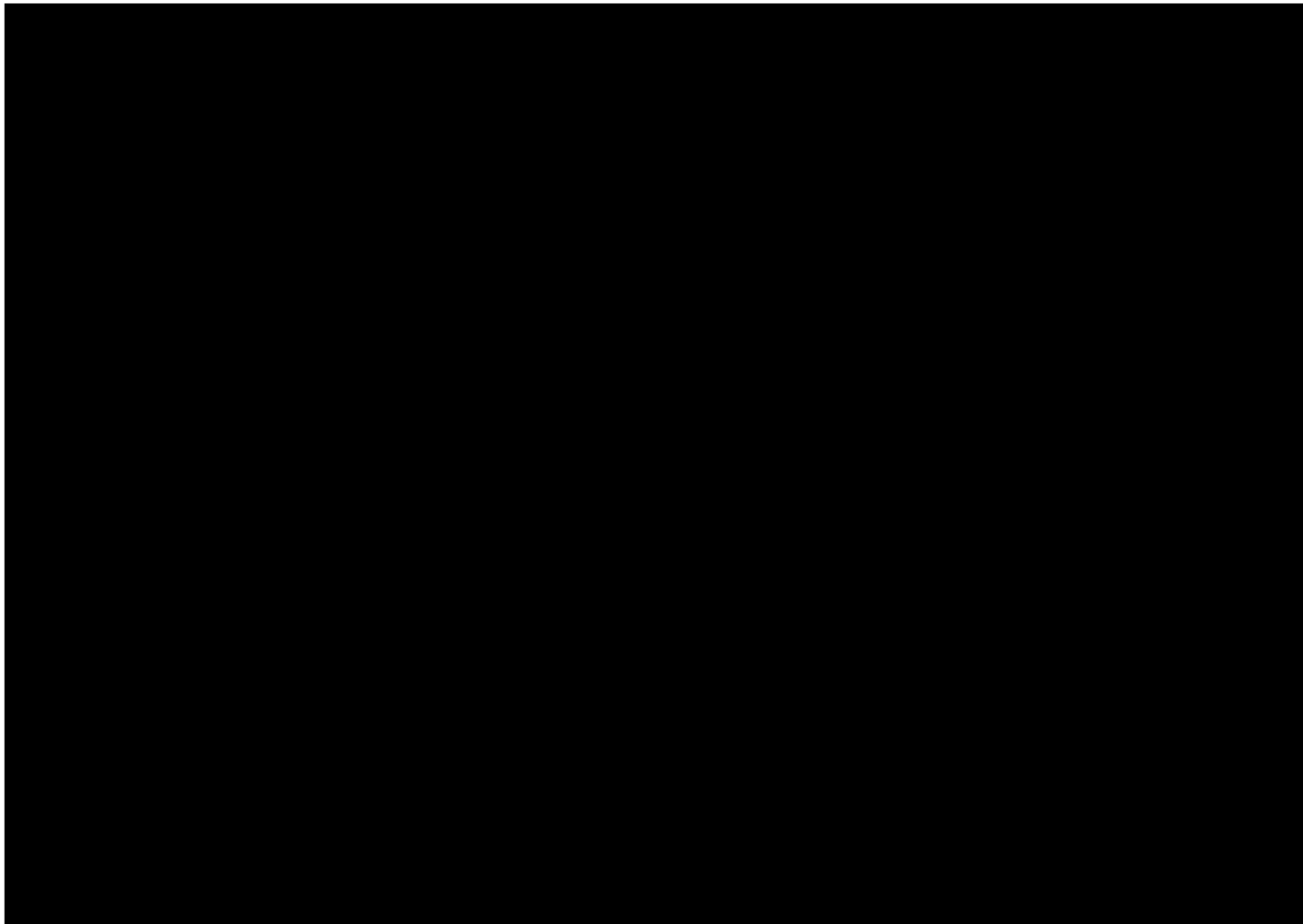
APPENDIX D

LiDAR Plan



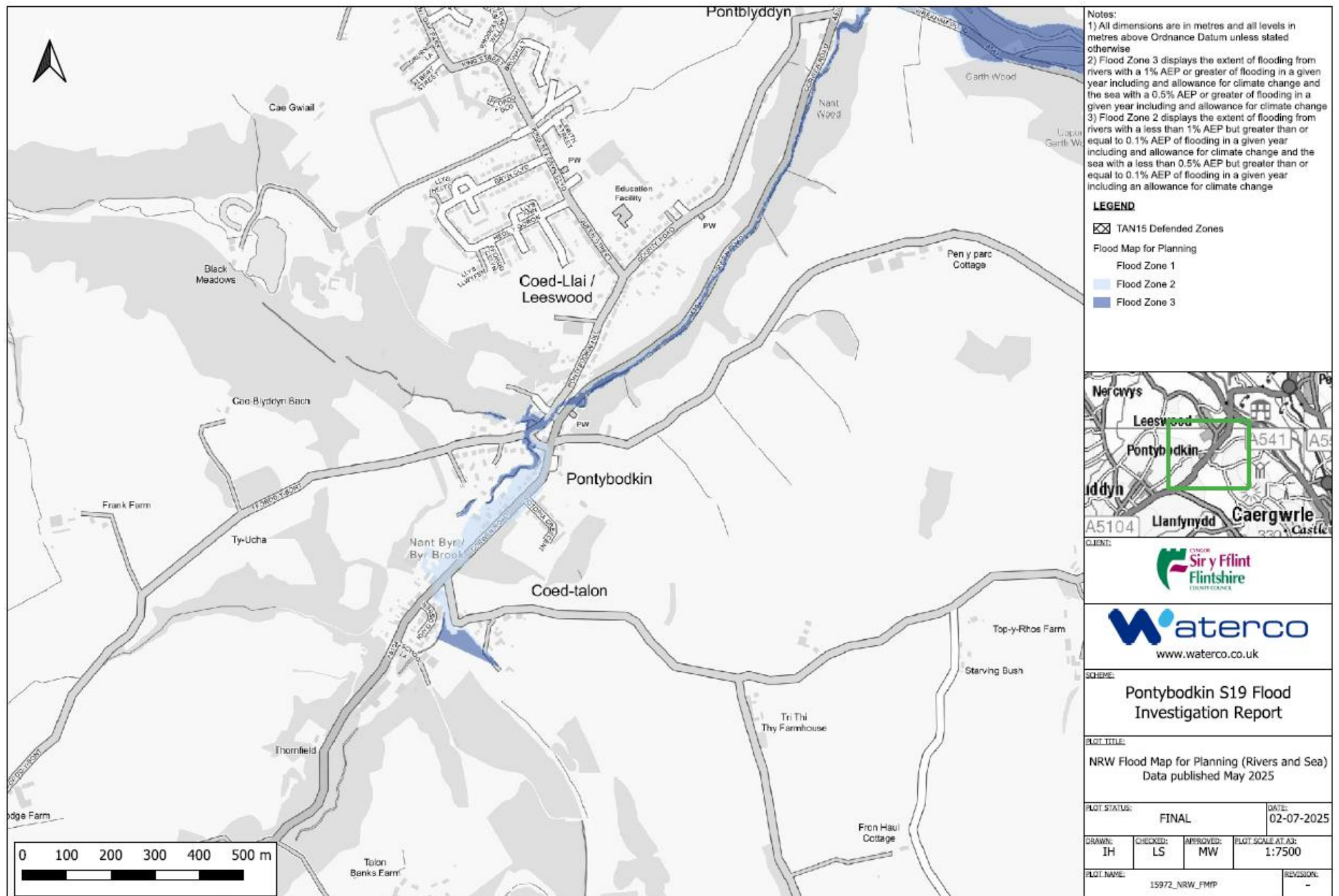
APPENDIX E

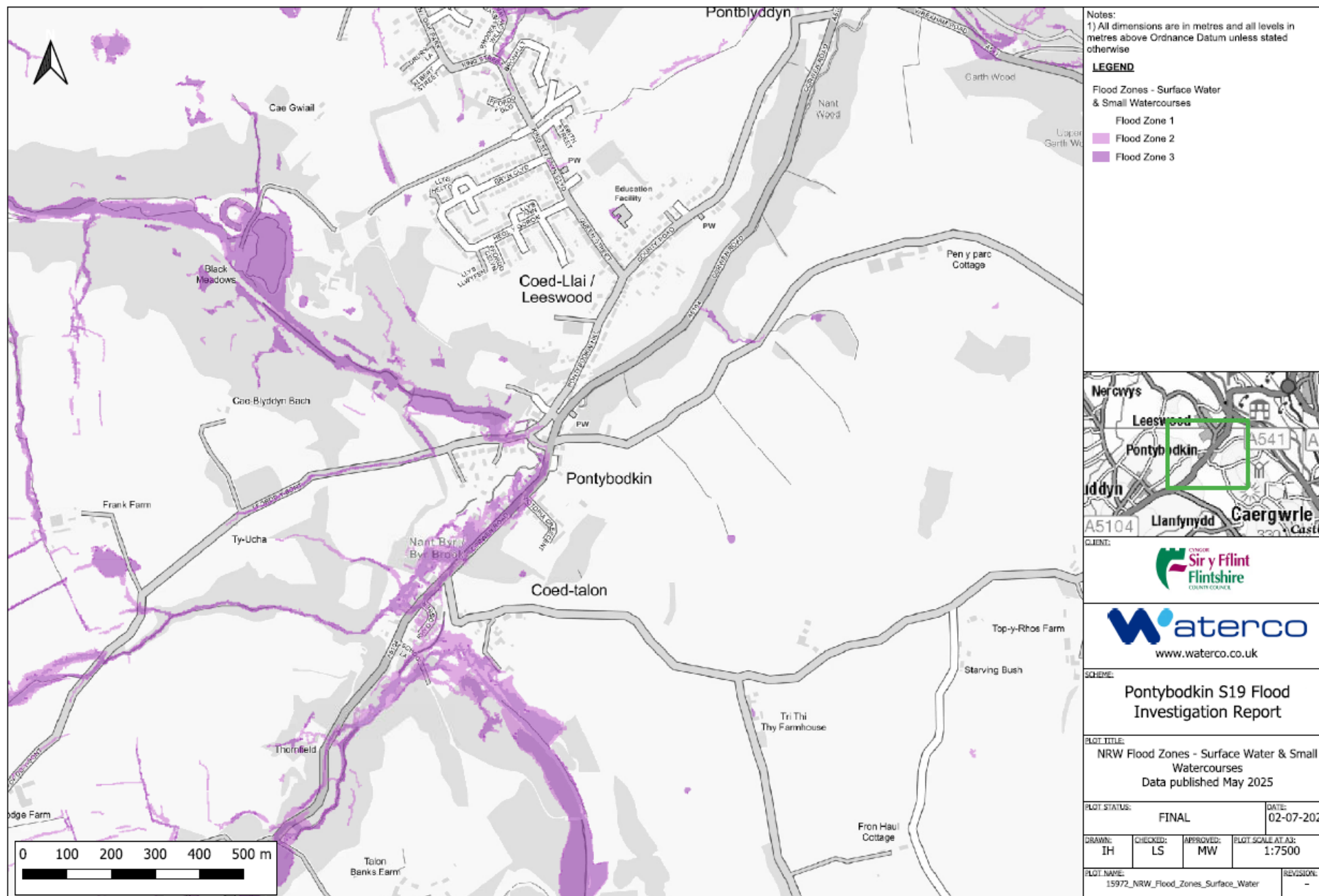
DCWW Sewer Plans

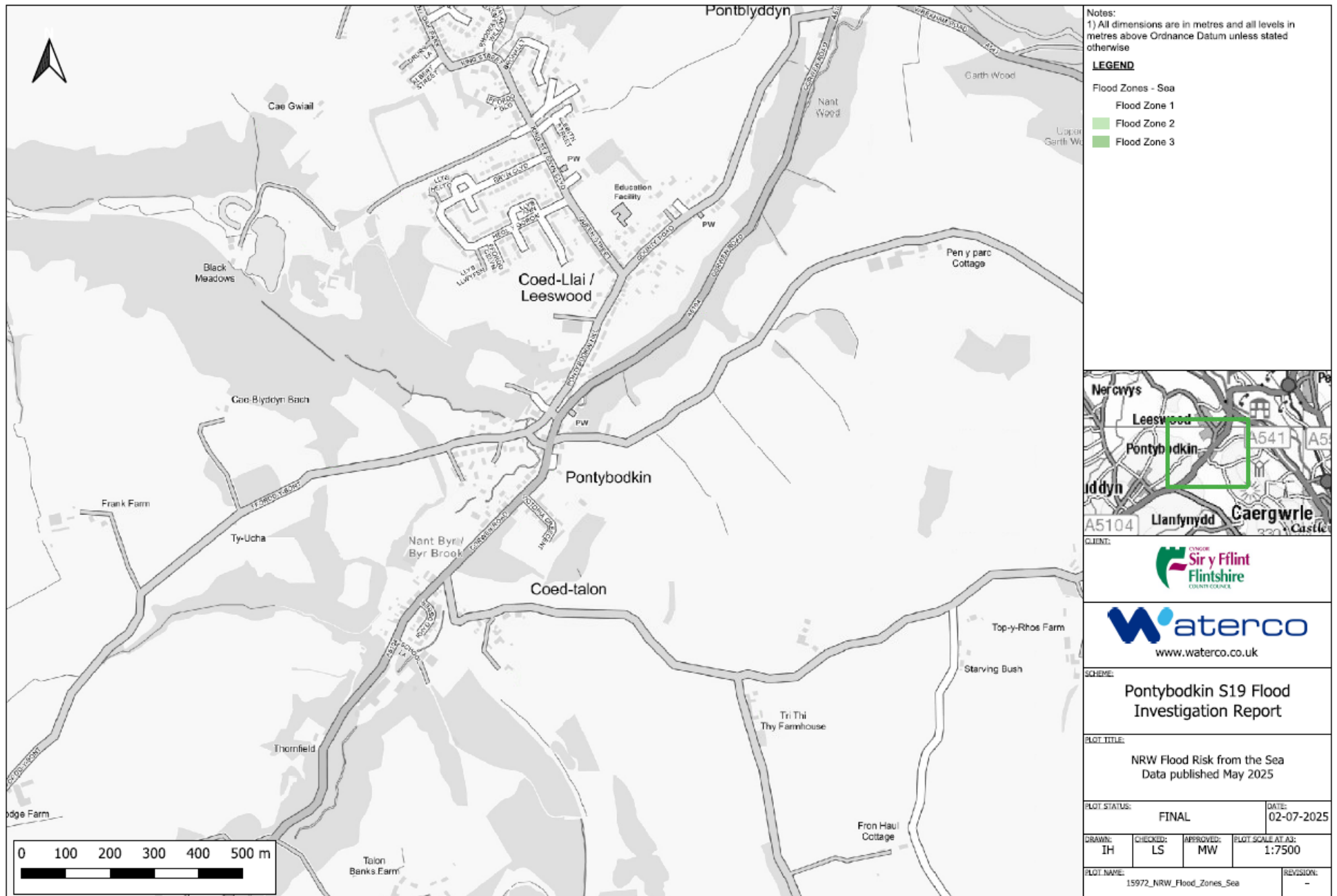


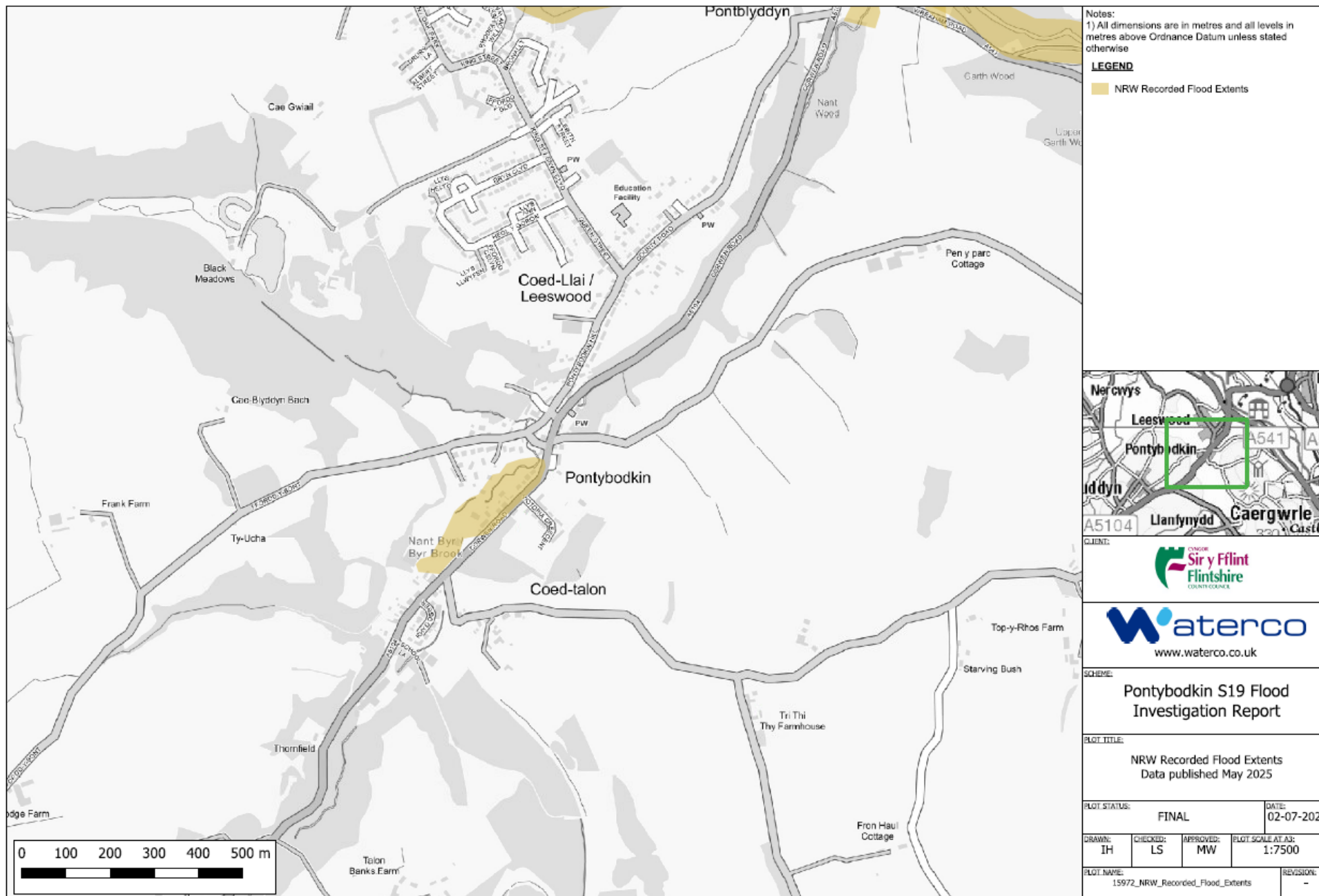
APPENDIX F

NRW Flood Maps









APPENDIX G

BGS Records

GeoIndex Report



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GeolIndex Onshore Data Source: NEIRC, Natural England, English Heritage and Ordnance Survey

Map Key

Bedrock geology 1:50,000 scale

	<u>CEFN MAWR LIMESTONE FORMATION - LIMESTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED</u>
	<u>PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>PENNINE LOWER COAL MEASURES FORMATION AND PENNINE MIDDLE COAL MEASURES FORMATION (UNDIFFERENTIATED) - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>ETRURIA FORMATION - MUDSTONE, SANDSTONE AND CONGLOMERATE</u>
	<u>MAIN SHALE BED (LLANGOLLEN AREA) - MUDSTONE</u>
	<u>CEFN-Y-FEDW SANDSTONE FORMATION - LIMESTONE</u>
	<u>MINERA FORMATION - LIMESTONE AND [SUBEQUAL/SUBORDINATE] SANDSTONE, INTERBEDDED</u>
	<u>GWESPYR SANDSTONE - SANDSTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED</u>
	<u>SALOP FORMATION - MUDSTONE, SANDSTONE AND CONGLOMERATE</u>
	<u>KINNERTON SANDSTONE FORMATION - SANDSTONE</u>
	<u>PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE</u>
	<u>MINERA FORMATION - SANDSTONE</u>
	<u>CEFN-Y-FEDW SANDSTONE FORMATION - SANDSTONE AND [SUBEQUAL/SUBORDINATE] ARGILLACEOUS ROCKS, INTERBEDDED</u>
	<u>BOWLAND SHALE FORMATION - MUDSTONE</u>
	<u>CEFN-Y-FEDW SANDSTONE FORMATION - CHERT</u>
	<u>HOLLIN ROCK - SANDSTONE</u>



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Map Key

Superficial deposits 1:50,000 scale

	<u>GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL</u>
	<u>GLACIOFLUVIAL ICE CONTACT DEPOSITS, DEVENSIAN - SAND AND GRAVEL</u>
	<u>GLACIOFLUVIAL SHEET DEPOSITS, DEVENSIAN - SAND AND GRAVEL</u>
	<u>TILL, DEVENSIAN - DIAMICTON</u>
	<u>ALLUVIUM - CLAY, SILT, SAND AND GRAVEL</u>
	<u>HEAD - CLAY, SILT, SAND AND GRAVEL</u>
	<u>RIVER TERRACE DEPOSITS (UNDIFFERENTIATED) - SAND AND GRAVEL</u>
	<u>ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL</u>
	<u>LACUSTRINE DEPOSITS - CLAY AND SILT</u>
	<u>PEAT - PEAT</u>
	<u>SUPERFICIAL DEPOSITS - SEDIMENT</u>

