

# Denbighshire County Council Preliminary Flood Risk Assessment Flood Risk Regulations (2009)



## Revision Schedule

### Preliminary Flood Risk Assessment June 2011

Rev	Date	Details	Prepared By	Approved by
01	May 2011	Draft Report	<b>Wayne Hope</b> Senior Engineer – Flood Risk Management	<b>Stuart Davies</b> Head of Highways and Infrastructure
02	June 2011	Final Report	<b>Wayne Hope</b> Senior Engineer – Flood Risk Management	Communities Scrutiny Committee

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## Executive Summary

Under the Flood Risk Regulations (2009), Denbighshire County Council, as a Lead Local Flood Authority (LLFA), is required to carry out a Preliminary Flood Risk Assessment (PFRA) to identify areas in Denbighshire at risk of flooding with significant consequences.

The PFRA process is aimed at providing a high level overview of flood risk from local flood sources, including surface water, groundwater, ordinary watercourses and canals. As a LLFA, Denbighshire County Council must submit its PFRA to the Environment Agency for review by 22 June 2011. The methodology for producing this PFRA has been based on the Environment Agency's Final PFRA Guidance and WAG's Guidance on selecting Flood Risk Areas, both published in December 2010.

There is a high risk of flooding from local sources across Denbighshire. Based on national surface water modelling, approximately 1,600 properties are estimated to be at risk from flooding to a depth of 0.3m during a rainfall event with a 1 in 200 annual chance of occurring.



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# 1 Introduction

## 1.1 Preliminary Flood Risk Assessment

The purpose of this Preliminary Assessment Report is to provide an assessment of potential flood risks for which Denbighshire County Council, as Lead Local Flood Authority, has responsibility. These include the risk of flooding from surface water, ground water, ordinary watercourses and small reservoirs. Flood risk is the combination of the probability of a flood occurring and the consequences the flooding should it happen. This report does not consider flooding from main rivers, the sea or large raised reservoirs, except where these impact on other sources of flooding.

The Flood Risk Regulations (2009) transpose the provisions of the EC Floods Directive (Directive 2007/60/EC) on the assessment and management of flood risk into domestic law in England and Wales. The aim of the Regulations is to reduce the likelihood and consequence of flooding. Part 2 of the Regulations requires the preparation of a Preliminary Assessment Report and the identification of Flood Risk Areas.

## 1.2 Aims and Objectives

The aims and objectives of this Preliminary Flood Risk Assessment Report are to identify areas in Denbighshire where there is a significant risk of flooding from ordinary watercourses, surface water, groundwater and canals is significant. The report will inform the Council's roles and responsibilities under the Flood Risk Regulations and Flood and Water Management Act, and will support the local flood risk management strategy.

## 1.3 Study Area

The study area for this PFRA is defined by the administrative boundary of Denbighshire County Council. The geographical extent of the study area is illustrated in Figure 1-2.

The administrative area of Denbighshire County Council covers approximately 844 km<sup>2</sup> and has a population of approximately 97,000.

The study area falls across the Dee River Basin District and the Western Wales River Basin District and is served by two water companies, Dwr Cymru Welsh Water and Dee Valley Water. The study area is also served by Environment Agency Wales.

Denbighshire is bordered to the north by the Irish Sea, to the east by Flintshire County Council and Wrexham County Borough Council, to the south by Powys County Council and to the west by Gwynedd County Council and Conwy County Borough Council.

Figure 1-2: Denbighshire County Council administrative area



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## **2 Lead Local Flood Authority Responsibilities**

### **2.1 Partnership and Communication**

In order to develop this report, Denbighshire County Council has formed partnerships and communication links with Environment Agency Wales, Dwr Cymru Welsh Water, British Waterways, North Wales Fire and Rescue, and Network Rail. In addition, the Council has engaged with members of the public through the distribution of a Flood Survey questionnaire to Town and Community Councils.

### **2.2 Governance**

This report and annexes have been approved by the Communities Scrutiny Committee of Denbighshire County Council.




## 3 Methodology and Data Review

### 3.1 Data Collection

The following authorities and organisations were identified and contacted to share data for the preparation of this report: Denbighshire County Council (Highways and Emergency Planning Departments), Town and Community Councils, Dwr Cymru Welsh Water, Environment Agency Wales, British Waterways, North Wales Fire and Rescue Service.

Figure 3-1 shows an example of the questionnaire which was sent to Town and Community Councils.

**Figure 3-1: Example of questionnaire sent to Town and Community Councils**



**Questions**

Please state your Town/Community Council:.....

	Event 1	Event 2	Event 3	Event 4
Q1 Location of flooding event. (Postcode/ house number or road junction etc.)				
Q2 Date of flooding Day/Month/Year				
Q3 Event type: Surface water or drainage flooding				
Q4				

## 3.2 Data Sources

Table 3-2 catalogues the relevant information and datasets held by partner organisations and provides a description of each of the datasets.

**Table 3-2: Relevant Information and Datasets**

	Dataset	Description
Environment Agency Wales	Areas Susceptible to Surface Water Flooding	The first generation national mapping, outlining areas of risk from surface water flooding across the country with three susceptibility bandings (less, intermediate and more).
	Flood Map for Surface Water	The updated (second generation) national surface water flood mapping which was released at the end of 2010. This dataset includes two flood events (with a 1 in 30 and a 1 in 200 chance of occurring) and two depth bandings (greater than 0.1m and greater than 0.3m).
	Flood Map (Rivers and the Sea)	Shows the extent of flooding from rivers with a catchment of more than 3km <sup>2</sup> and from the sea.
	Areas Susceptible to Groundwater Flooding	Coarse scale national mapping showing areas which are susceptible to groundwater flooding.
	National Receptors Dataset	A national dataset of social, economic, environmental and cultural receptors including residential properties, schools, hospitals, transport infrastructure and electricity substations.
	Indicative Flood Risk Areas	Nationally identified flood risk areas, based on the definition of 'significant' flood risk described by Defra and WAG.
	Historic Flood Map	Attributed spatial flood extent data for flooding from all sources.
	Conwy & Clwyd and River Dee Catchment Flood Management Plans (CFMPs)	CFMPs consider all types of inland flooding, from rivers, groundwater, surface water and tidal flooding and are used to plan and agree the most effective way to manage flood risk in the future.
Denbighshire County Council	Strategic Flood Consequence Assessment (SFRA)	SFRAs contain useful information on historic flooding, including local sources of flooding from surface water, groundwater and flooding from canals.
	Historical flooding records	Historical records of flooding from surface water, groundwater and ordinary watercourses.
	Anecdotal information relating to local flood history and flood risk areas	Anecdotal information from authority members regarding areas known to be susceptible to flooding from excessive surface water, groundwater or flooding from ordinary watercourses.
Town and Community Councils	Anecdotal information from Town and Community Councils in Denbighshire	Anecdotal information on flood risk, flood history and local flood hotspots.
North Wales Fire & Rescue	Historic flooding records	Records of historic flooding events from the Fire Service's call out history records including location, incident type and response given.

North Wales Police	Anecdotal information	Video footage from North Wales Police helicopter during floods affecting Denbighshire in autumn 2000.
Dwr Cymru Welsh Water	DG5 Register	DG5 Register logs and records sewer flooding incidents.
British Waterways	British Waterway's canal network	Detailed GIS information on the British Waterway's canal network, including the location of canal centrelines, sluices, locks, culverts, etc.
	Records of canal breaches and overtopping events	Records of historical canal breaches and canal overtopping events For Llangollen branch




### 3.3 Data Limitations

Denbighshire County Council has only recently implemented a formal procedure for collating historic geo-referenced flooding data. Previously, information about historic flooding was collected informally and held in a number of separate databases. For communities where historic flooding has been locally significant, in depth enquiries were carried out as part of the project appraisal study process. These enquiries were generally successful in gaining an understanding of both the causes and consequences of local flooding.

### 3.4 Quality Assurance, Security and Data Restrictions

The quality of the data that Denbighshire County Council has collated has been received from professional partners or reliable resources and is, therefore, considered, to be good. The security of data is a key consideration when it comes to collecting, collating and storing sensitive data. All data collected is stored on local servers which are password protected. A summary table illustrating the restrictions on the use of this data is included in Table 3-4.

**Table 3-4: Summary of data restrictions and licensing details**

Organisation	Restrictions on Use of Data
 Asiantaeth yr Amgylchedd Cymru Environment Agency Wales	The use of some information provided is restricted to Denbighshire County Council. The use of other data is unrestricted.
 Dwr Cymru Welsh Water	The use of information provided to be restricted to Denbighshire County Council.
 British Waterways	The use of information provided to be restricted to Denbighshire County Council.

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## 4 Past Flood Risk

### 4.1 Overview of Past Flooding in Denbighshire

Flood records across Denbighshire were collected from the data sources described in Table 3-2. A summary map highlighting the locations of these past flood events is illustrated in Figure 4-1. These flood events came from a range of flood sources, described below.

#### **Ordinary Watercourse Flooding**

The majority of historic flooding data collated by Denbighshire County Council relates to flooding from ordinary watercourses. Communities that have been affected in the past include Ruthin, Denbigh, Llangollen, Corwen, Gwyddelwern, St Asaph, Dyserth, Llanbedr Dyffryn Clwyd and Pwll Glas.

#### **Surface Water Flooding**

Surface water flooding occurs when heavy rainfall exceeds the capacity of local drainage networks and water flows across the ground. Information on surface water flooding incidents tends to be less reliable than that for other causes of flooding, primarily because the source of flooding can be difficult to determine. In particular, some areas of Rhyl and Prestatyn have been prone to surface water flooding.

#### **Interaction with Main Rivers and the Sea**

Anecdotal evidence suggests that flooding from ordinary watercourses and due to surface water is exacerbated by high levels in main rivers and by high tides.

#### **Sewer Flooding**

Flooding records provided by Dwr Cymru Welsh Water flooding records show that a total of 282 sewer flooding events have occurred throughout Denbighshire since 1999. There are currently fewer than 10 properties in Denbighshire on DCWW's DG5 register.

#### **Canal Flooding**

There has been a history of breaches to the Llangollen Canal between 1945 and 1985. The 1945 breach washed away a section of railway which led to the death of an engine driver.

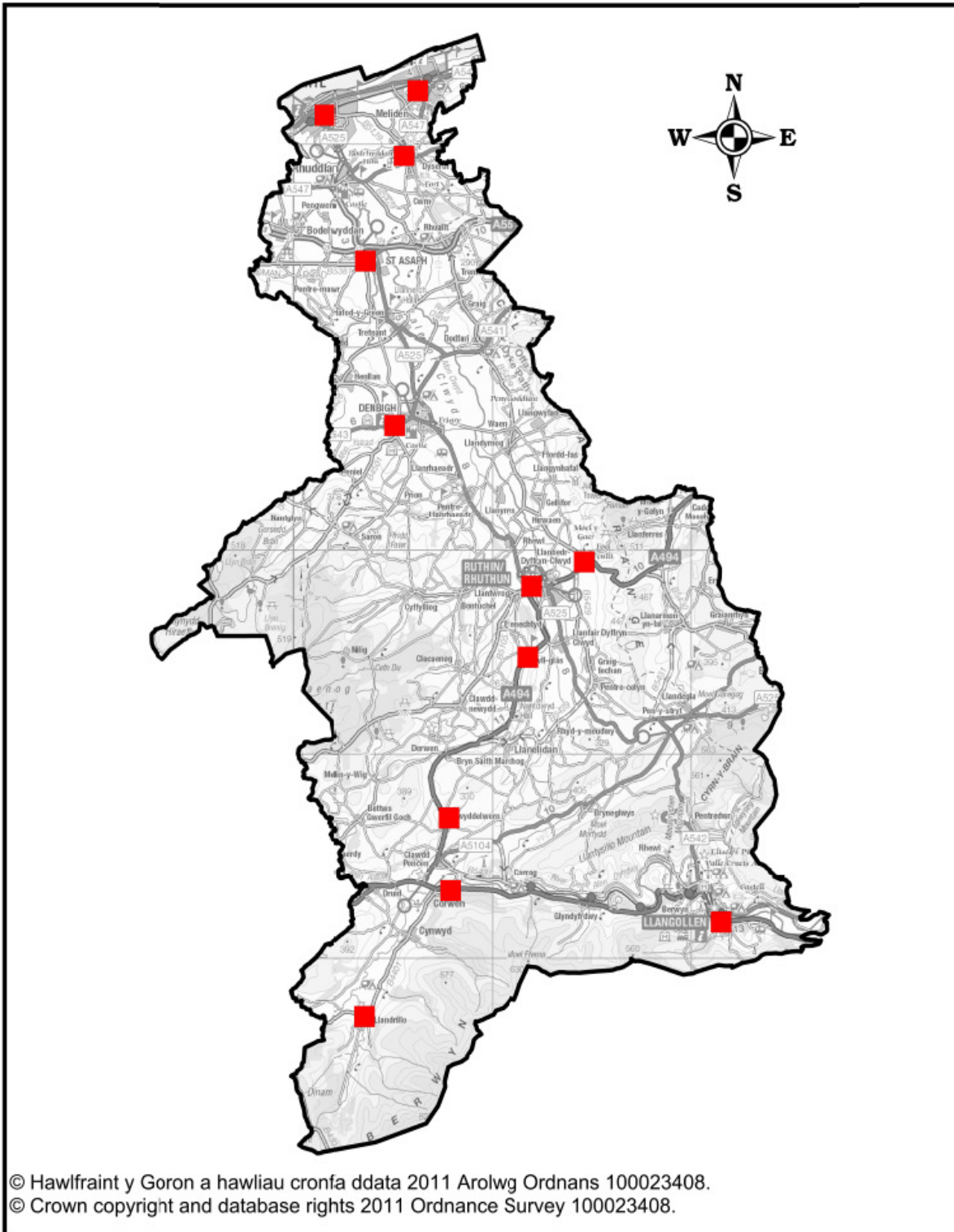
#### **Groundwater Flooding**

There is no recorded history of significant groundwater flooding in Denbighshire.

### 4.2 Significance of Past Flooding

For the purpose of this report, a locally significant event is defined as one where 5 or more residential properties are flooded. Where works have been undertaken to alleviate flooding problems or where an incident does not meet the criteria of significance, that particular incident does not form part of this report. Locations considered to remain at significant risk are detailed in Annex 1 and summarised in Table 4-1.

Figure 4-1: Locations of Past Flooding in Denbighshire



**Table 4-1: Summary of past flooding with significant harmful consequences**

Flood ID	Name	Description
1	Prestatyn	13 residential properties flooded by surface water at various locations in Prestatyn in 2007.
2	Dyserth	5 residential properties flooded from Afon Ffyddion in 2000.
3	St Asaph	7 residential properties flooded from Glascoed Stream in 2000.
4	Llanbedr	7 residential properties flooded from un-named watercourse in 2000.
5	Corwen	23 residential properties flooded from Afon Nant y Cawrddu in 2000.

## 5 Future Flood Risk

### 5.1 Overview of Future Flood Risk

#### Ordinary Watercourse Flooding

Denbighshire County Council carried out a Strategic Flood Consequence Assessment in 2007 and has, since autumn 2000, carried out catchment studies for a number of ordinary watercourses which have a history of flooding. The results of this work are consistent with the Environment Agency's Flood Map, which shows that a number of properties are at risk from ordinary watercourse flooding.

#### Surface Water Flooding

No local information is currently available on surface water flood risk in Denbighshire. The Environment Agency has produced a national assessment of surface water flood risk in the form of two national mapping datasets. The first generation national mapping, Areas Susceptible to Surface Water Flooding contains three susceptibility bandings for a rainfall event with a 1 in 200 chance of occurring. The national methodology has since been updated to produce the Flood Map for Surface Water a revised model containing two flood events (1 in 30 annual chance and 1 in 200 annual chance) and two depth bandings (greater than 0.1m and greater than 0.3m). The Flood Map for Surface Water is illustrated in Figure 5-1, highlighting areas at risk of surface water flooding in the future.

Using this dataset, the number of properties at risk of surface water flooding within Denbighshire has been estimated. For a rainfall event with a 1 in 200 annual chance of occurring, 5140 properties are at risk from flooding to a depth of 0.1m and 1579 properties are at risk from flooding to a depth of 0.3m. Of these properties at risk, 89% are residential properties. Further details on the potential harmful consequences of future flooding are included in Annex 2 of the Preliminary Assessment Spreadsheet.

Table 5-1 includes a comparison of the estimated number of properties at risk of surface water flooding in Denbighshire with neighbouring authorities.

**Table 5-1: Properties at risk from surface water flooding**

	Estimated number of properties at risk of surface water flooding ( <i>flooding to a depth of 0.3m from an event with a 1 in 200 annual chance of occurring</i> )
Denbighshire	1,579
Gwynedd	2,240
Conwy	2,050
Flintshire	1,092
Wrexham	1,393
Powys	0



### Canal Flooding

There is no available information on future flood risk from canals. However, British Waterways are currently working on a study to better understand the future flood risk from canals, which will be available to inform the second cycle of the PFRA process.

### Groundwater Flooding

There is no local information available which provides evidence on future groundwater flood risk in Denbighshire.

## 5.2 Locally Agreed Surface Water Information

As there is no local information on future flooding available, the 'locally agreed surface water information' is the Flood Map for Surface Water dataset, which gives an overview of the future flood risk from surface water in Denbighshire and is considered to be the most appropriate source of information. This dataset is illustrated in Figure 5-1. The local surface water drainage system has generally been designed to accommodate a 1 in 5 to 1 in 30 storm event.

## 5.3 Potential Consequences of Future Flooding

The Environment Agency has used the Flood Map for Surface Water mapping and the National Receptors Database to identify a number of areas across Wales that exceed a given threshold, described in Table 5-2 below.

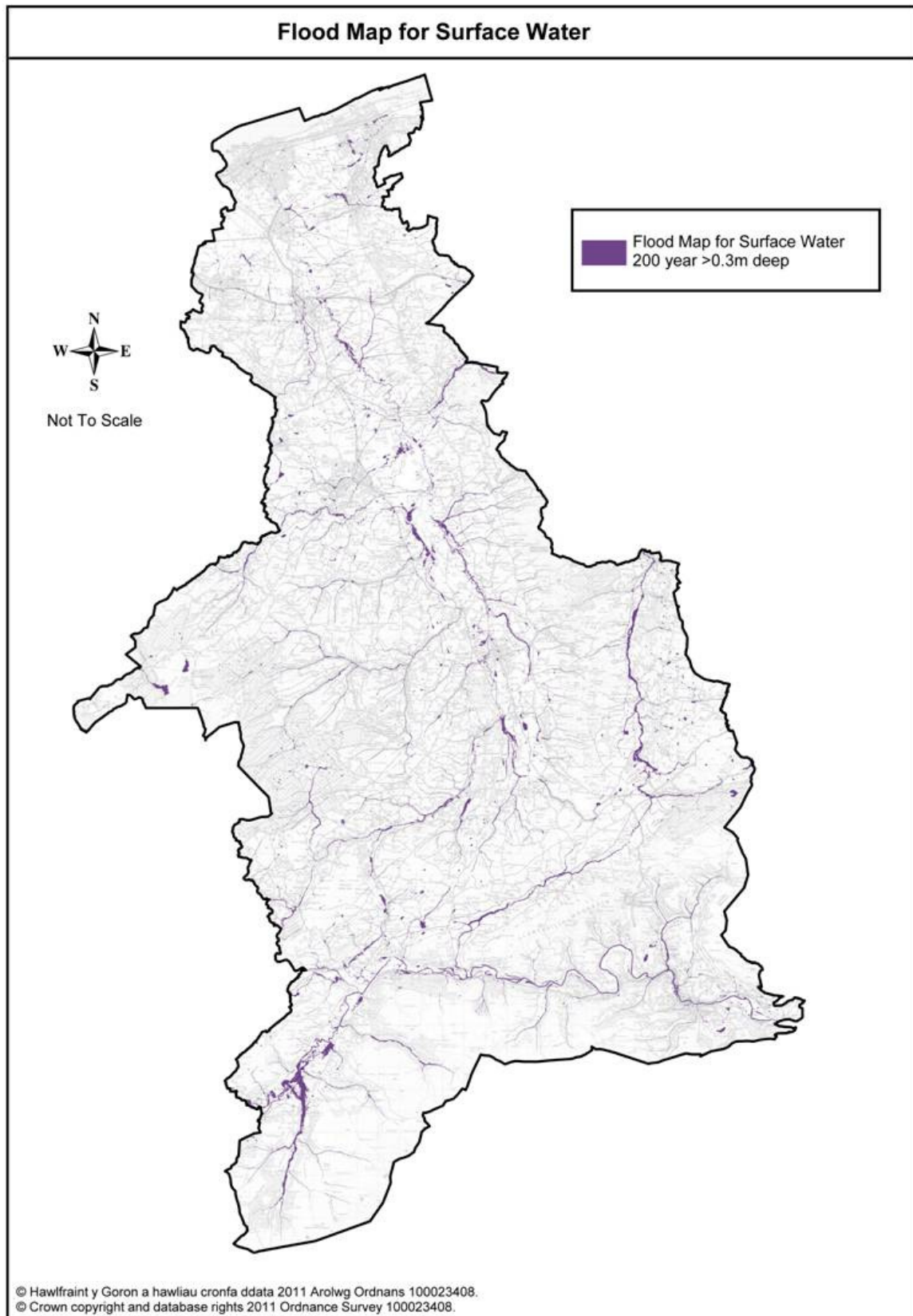
**Table 5-2: Flood risk threshold used to identify future consequences of flooding**

'Significant harmful consequences' defined as greater than...	Description
200 people or	<i>Flooded to a depth of 0.3m during a rainfall event with a 1 in 200 chance of occurring (or 0.5%)</i>
20 businesses or	
1 critical service	

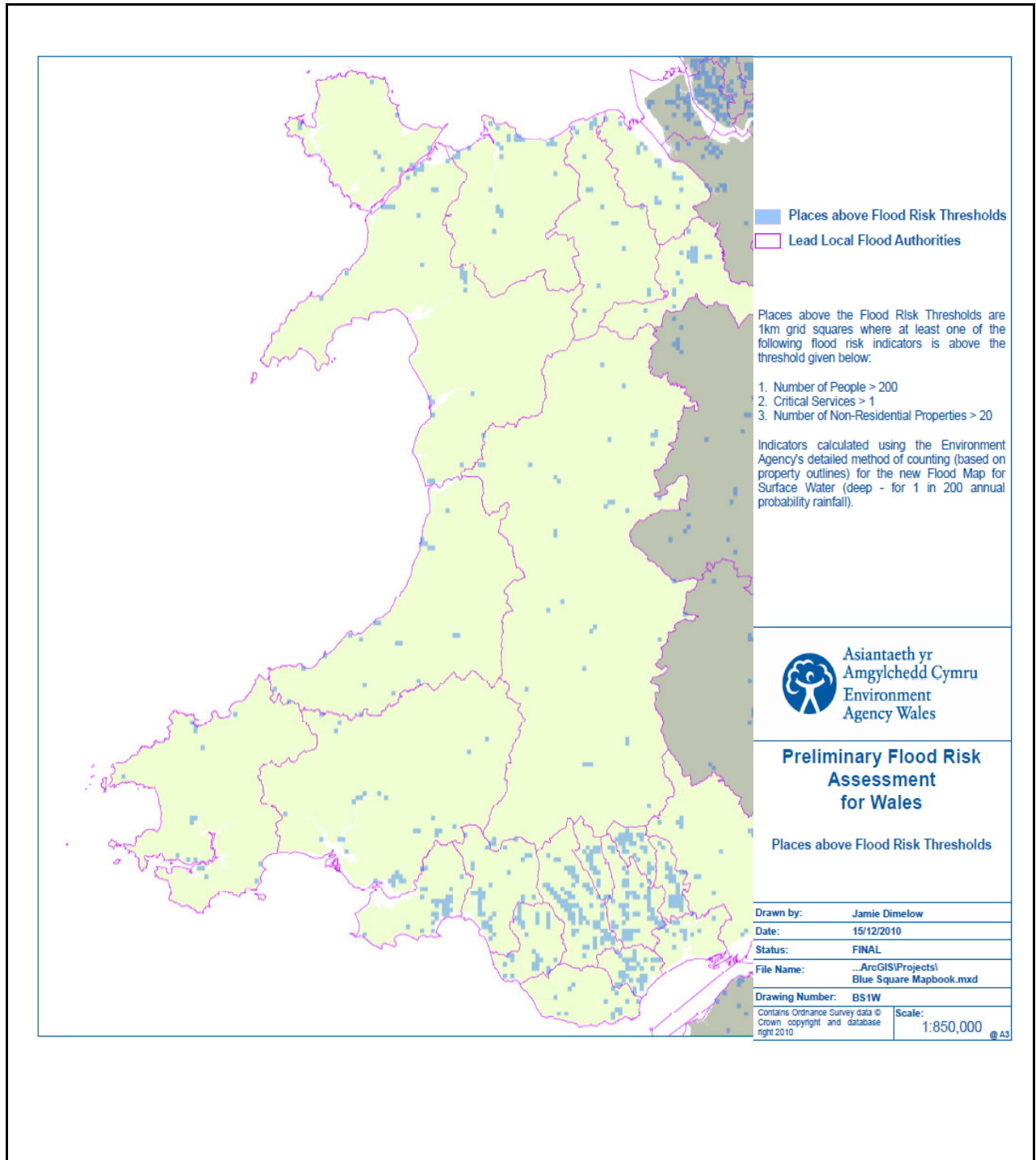
This assessment was carried out based on 1km national grid squares, and the grid squares that exceed the criteria were identified. The grid squares within Denbighshire where flood risk is considered to exceed this threshold are illustrated in Figure 5-2.



**Figure 5-1: Locally Agreed Surface Water Information (Flood Map for Surface Water)**



**Figure 5-2: Places in Wales above Flood Risk Thresholds**



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## 5.4 Effect of Climate Change and Long Term Developments

### The impacts of climate change

There is clear scientific evidence that global climate change is happening now. It cannot be ignored.

Over the past century around the UK we have seen sea level rise and more of our winter rain falling in intense wet spells. Seasonal rainfall is highly variable. It seems to have decreased in summer and increased in winter, although winter amounts changed little in the last 50 years. Some of the changes might reflect natural variation. However the broad trends are in line with projections from climate models.

Greenhouse gas (GHG) levels in the atmosphere are likely to cause higher winter rainfall in future. Past GHG emissions mean some climate change is inevitable in the next 20-30 years. Lower emissions could reduce the amount of climate change further into the future, but changes are still projected at least as far ahead as the 2080s.

We have enough confidence in large scale climate models to say that we must plan for change. There is more uncertainty at a local scale but model results can still help us plan to adapt. For example we understand rain storms may become more intense, even if we can't be sure about exactly where or when. By the 2080s, the latest UK climate projections (UKCP09) are that there could be around three times as many days in winter with heavy rainfall (defined as more than 25mm in a day). It is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

### Key Projections for Western Wales River Basin District

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are

- Winter precipitation increases of around 15% (very likely to be between 3 and 33%)
- Precipitation on the wettest day in winter up by around 12% (very unlikely to be more than 27%)
- Relative sea level at Swansea very likely to be up between 10 and 40cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 12 and 20%.

Increases in rain are projected to be greater near the coast than inland.

### Implications for Flood Risk

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters and more of this rain falling in wet spells may increase river flooding especially in the steep, rapidly responding catchments typical of Western Wales. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected. Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

### **Key Projections for Dee River Basin District**

If emissions follow a medium future scenario, UKCP09 projected changes by the 2050s relative to the recent past are:

- Winter precipitation increases of around 10% (very likely to be between 2 and 21%)
- Precipitation on the wettest day in winter up by around 8% (very unlikely to be more than 21%)
- Relative sea level at Hoylake very likely to be up between 7 and 38cm from 1990 levels (not including extra potential rises from polar ice sheet loss)
- Peak river flows in a typical catchment likely to increase between 7 and 12%

### **Implications for Flood Risk**

Climate changes can affect local flood risk in several ways. Impacts will depend on local conditions and vulnerability. Wetter winters and more of this rain falling in wet spells may increase river flooding along the Dee and its tributaries. More intense rainfall causes more surface runoff, increasing localised flooding and erosion. In turn, this may increase pressure on drains, sewers and water quality. Storm intensity in summer could increase even in drier summers, so we need to be prepared for the unexpected. Rising sea or river levels may increase local flood risk inland or away from major rivers because of interactions with drains, sewers and smaller watercourses. Where appropriate, we need local studies to understand climate impacts in detail, including effects from other factors like land use. Sustainable development and drainage will help us adapt to climate change and manage the risk of damaging floods in future.

### **Adapting to Change**

Past emission means some climate change is inevitable. It is essential we respond by planning ahead. We can prepare by understanding our current and future vulnerability to flooding, developing plans for increased resilience and building the capacity to adapt. Regular review and adherence to these plans is key to achieving long-term, sustainable benefits. Although the broad climate change picture is clear, we have to make local decisions against deeper uncertainty. We will therefore consider a range of measures and retain flexibility to adapt. This approach, embodied within flood risk appraisal guidance, will help to ensure that we do not increase our vulnerability to flooding.

### **Long Term Developments**

It is possible that long term developments might affect the occurrence and significance of flooding. However current planning policy aims to prevent new development from increasing flood risk. In Wales, Technical Advice Note 15 (TAN15) on development and flood risk sets out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is "to direct new development away from those areas which are at high risk of flooding." Adherence to Government policy ensures that new development does not increase local flood risk. However, in exceptional circumstances the Local Planning Authority may accept that flood risk can be increased contrary to Government policy, usually because of the wider benefits of a new or proposed major development. Any exceptions would not be expected to increase risk to levels which are "significant" (in terms of the Government's criteria).

## **6 Review of Indicative Flood Risk Areas**

The Environment Agency has not identified any indicative Flood Risk Areas for Denbighshire. The information provided by the EA has been reviewed and no changes to indicative Flood Risk Areas have been identified.

## **7 Identification of Flood Risk Areas**

Denbighshire County Council has reviewed the maps produced by WAG and the Environment Agency showing Flood Risk Areas in Wales and agrees that there are no Flood Risk Areas in Denbighshire.

## **8 Next Steps**

To comply with the Flood Risk Regulations (2009), Denbighshire County Council will review this report by 22<sup>nd</sup> June 2017. The review will be facilitated by reference to any amended data produced by the Environment Agency, or other risk management authority, and with reference to Denbighshire County Council's database of flooding incidents.

## 9 References

Flood and Water Management Act 2010

<http://www.legislation.gov.uk/ukpga/2010/29/contents/>

The Flood Risk Regulations 2009

<http://www.legislation.gov.uk/uksi/2009/3042/contents/made>

Preliminary Flood Risk Assessment (PFRA)

Final Guidance

Report – GEH01210BTGH-E-E

Environment Agency

<http://publications.environment-agency.gov.uk/>

Preliminary Flood Risk Assessment (PFRA)

Annexes to the final guidance

Report – GEH01210BTHF-E-E

Environment Agency

<http://publications.environment-agency.gov.uk/>

Selecting and Reviewing Flood Risk Areas for local sources of flooding

Guidance to Lead Local Flood Authorities

Flood Risk Regulations 2009

DEFRA / Welsh Assembly Government

<http://ww2.defra.gov.uk/environment/flooding/>

United Kingdom Climate Projections 2009 (UKCP09)

<http://ukclimateprojections.defra.gov.uk/>