Mid Wales – Strategic Flood Consequences Assessment (Stage 1)

Final Report

November 2022

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Contract

This report describes work commissioned by Claire Seddon, on behalf of Powys County Council, on behalf of all planning authorities in Mid Wales, by a letter dated 5th April 2022. Charlotte Lickman and Hannah Booth of JBA Consulting carried out this work.

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Purpose

This document has been prepared as a Final Report for the Authorities (listed under acknowledgements). JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

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JBA would like to acknowledge LPA and LLFA staff from the Local Planning Authorities Unitary Authorities and Planning Authorities listed below:

- Powys County Council
- Ceredigion County Council
- Brecon Beacons National Park Authority

We would also like to thank Dŵr Cymru Welsh Water, Hafren Dyfrdwy, Natural Resources Wales, and the Welsh Government for their input into the SFCA.

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Executive summary

This Stage 1 Strategic Flood Consequences Assessment (SFCA) has been commissioned by 3 Local Planning Authorities (LPAs) in Mid Wales, listed as follows:

- Powys County Council
- Ceredigion County Council
- Brecon Beacons National Park Authority

Typically, SFCAs are completed in three stages, with an increasing level of detail required in the analysis at each stage.

This Stage 1 SFCA is a desk based study which collates existing information to undertake a broad assessment of potential flood risks across the entire study area from all sources of flooding. The study identifies areas at potential high risk from flooding as well as providing details of historical flood events and details of any flood risk management structures or procedures present.

This SFCA also provides information on the opportunities to slow and store water as part of natural flood management, as well as guidance on implementing Technical Advice Note 15 (TAN-15) and managing flood risk in a development site.

Study area

Mid Wales is stated to be the green heart of Wales, covering more than a third of the total area of the country but only containing 1/15th of its population. Most of the region consists of remote upland areas used for farming and forestry.

In the context of this report Mid Wales covers approximately 7000km² and is formed of 2 Unitary Authorities which are Ceredigion County Council and Powys County Council, along with the Brecon Beacons National Park Authority. Only those areas of the Brecon Beacons National Park which are located within the Powys County Council boundary will be covered by the SFCA, rather than the entire extent of the national park.

Policy and strategy

Key legislation and policies have been reviewed as part of the SFCA, this includes national policies and strategies such as the National Flood and Coastal Erosion Risk Management (FCERM)Strategy for Wales, Future Wales: The National Plan 2040 and Planning Policy Wales (Edition 11). Regional documents such as Shoreline Management Plans and Catchment Flood Management Plans have also been reviewed to understand specific flood risk and coastal erosion policies in the region.

TAN-15 and other flood risk policy has also been reviewed and outlined with regard to flood risk in this section.

Flood Risk

The SFCA has identified the risk of flooding from all sources across the study area and has provided information relating to the sources of information used to understand this flood risk. The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

A review of flood risk has been undertaken from all sources of flooding in each of the three LPA areas. This assessment should be used in conjunction with the mapping appendices in order to understand flood risk at a strategic scale.

Further Technical Advice Note-15 (TAN-15) guidance

On the direction of the Minister for Climate Change, provided in guidance accompanying the decision note to delay the implementation of TAN 15, this SFCA has been prepared in accordance with the updated TAN-15 due to be implemented from June 2023. Further clarifications and advice has subsequently been issued by Welsh Government (WG) and Natural Resources Wales (NRW).

This SFCA provides guidance on how LPA's within the region intend to interpret and apply the new TAN-15.

The guidance and recommendations within this chapter are based on the following:

- Ministerial letter; 23rd November 2021. Announcement of the suspension of the new TAN-15 to 1st June 2023.
- Chief Planner letter; 15th December 2021. Advice to LPA's on the suspension of TAN-15, key implications and actions for LPA's.
- Various consultations with WG and NRW during the preparation of the SFCA.

Requirements for a Flood Consequences Assessments (FCA)

Site-specific FCAs are carried out by (or on behalf of) developers to assess the risk and consequences of flooding to a proposed development site and the risk and consequences of that development on flood risk elsewhere. Advice on preparing an FCA has been provided as part of this report.

Flood risk mitigation and flood response planning

TAN-15 outlines the complementary role that planning and building regulations have in flood management, and the requirement for the use of flood mitigation and damage resistant measures to ensure the consequences of flooding are acceptable. Any new development in Zones 2 and 3 and TAN-15 Defended Zones must have resilience to flooding built-in at site and property level. Where possible, development should still be directed to Flood Zone 1 (where there is a lower risk of flooding). Highly vulnerable development in Flood Zone 3 is not considered to be acceptable due to the associated consequences of flooding and planning applications must not be proposed.

Flood response planning is one option to help manage flood related incidents. From a flood risk perspective, flood response planning can be broadly split into three phases: before, during, and after a flood. These measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to, and recover from flooding.

Advice and guidance on Working with Natural Processes and Natural Flood Management has also been prepared.

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Abbreviations

Abbreviation	Definition
AEP	Annual Exceedance Probability – the chance of an event with a particular magnitude occurring in each and every year
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
CIRIA	Construction Industry Research and Information Association
DAM	Development Advice Map – shows areas at risk of flooding from rivers and the sea for the purposes of land-use planning
DCWW	Dŵr Cymru Welsh Water
FAA	Flood Alert Area
FAS	Flood Alleviation Scheme

Abbreviation	Definition
FCA	Flood Consequences Assessment
FBC	Full Business Case
FCERM	Flood and Coastal Erosion Risk Management
FMfP	Flood Map for Planning
FRAW	Flood Risk Assessment Wales
FRMP	Flood Risk Management Plan
FSA	Flood Storage Area
FWMA	Flood and Water Management Act
FWA	Flood Warning Area
FWS	Flood Warning Service
GI	Green Infrastructure
HD	Hafren Dyfrdwy
IDD	Internal Drainage District
JBA	Jeremy Benn Associates
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
Main River	A watercourse shown as such on the Main River Map, and for which NRW has responsibilities and powers
NFF	National Flood Forum
NFM	Natural Flood Management
NRD	National Receptor Database
NRIM	National Reservoir Inundation Mapping
NVZ	Nitrate Vulnerable Zones
Ordinary Watercourse	All watercourses that are not designated Main River. Local Authorities or, where they exist, IDDs have similar permissive powers as Natural Resources in relation to flood defence work. However, the riparian owner has the responsibility of maintenance.
PFRA	Preliminary Flood Risk Assessment
PPW	Planning Policy Wales (Edition 11)
RBMP	River Basin Management Plan
RMA	Risk Management Authorities
SAB	SuDS Approval Body
SFCA	Strategic Flood Consequences Assessment
SMP	Shoreline Management Plan
SuDS	Sustainable Drainage Systems
TAN-15	Technical Advice Note 15 – Development, Flooding and Coastal Erosion. Guidance for Local Planning Authorities to reduce flood risk and develop away from high risk areas.
WFD	Water Framework Directive
WWNP	Working With Natural Processes

1 Introduction

1.1 Project Overview

This Stage 1 Strategic Flood Consequences Assessment (SFCA) has been commissioned by three Local Planning Authorities (LPAs) in Mid Wales, consisting of:

- Ceredigion County Council
- Powys County Council
- Brecon Beacons National Park Authority

This SFCA provides a robust evidence-base to inform the forthcoming Mid Wales Regional Strategic Development Plan (SDP) and the LPA's individual Local Development Plans (LDP), it will inform the development of both policies and land allocation decisions. The SFCA has been carried out in accordance with the Welsh Government's development planning guidance, Planning Policy Wales Edition 11(PPW), Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15) Draft December 2021 and associated Welsh Government Chief Planning Officers letters, and Welsh Government Flood Consequences Assessment (FCA) Climate Change allowances.

1.2 Stages of Strategic Flood Consequences Assessments (SFCA's)

To provide a robust assessment of the potential flood risk, SFCAs should involve the collection, analysis, and presentation of all the available information from all sources of flood risk in the study area.

Typically, SFCAs are completed in three stages, with an increasing level of detail required in the analysis at each stage. The three stages of SFCAs are summarised below in Figure 1-1:

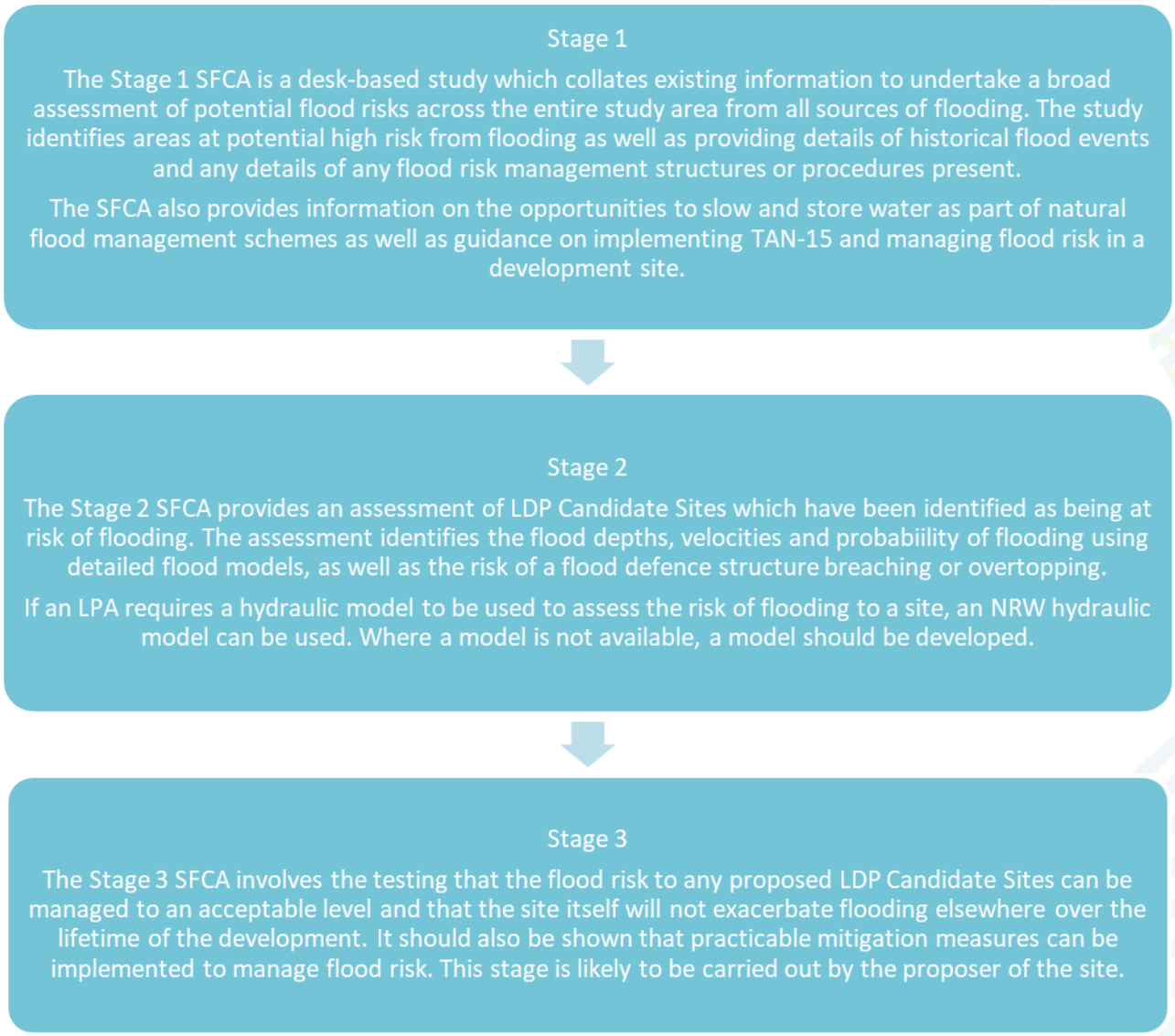

Figure 1-1 Outline of the SFCA process

1.3 Strategic Flood Consequences Assessment Objectives

This report fulfils the aims and objectives of the Stage 1 SFCA as follows:

- To inform development regarding the management of flood risk within the Local Planning Authorities Individual Local Development Plans and a Regional Strategic Development Plan.
- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the Stage 1 study area. This assessment will enable the Authorities to steer development away from those areas where flood risk is considered greatest, ensuring that areas allocated for development can be developed in a safe, cost effective, and sustainable manner.
- To evaluate and consider flood risk from fluvial, tidal, and surface water sources, using Natural Resources Wales recently published Flood Map for Planning (FMfP). Other sources of flooding including groundwater and artificial sources such as reservoirs and sewers are also considered.
- Considers the role and integrity of coastal defences and provides an understanding of the risks posed by coastal flooding and erosion, making reference to Shoreline Management Plan (SMP) policies and the Welsh National Marine Plan.
- To enable the Authorities to meet their obligations under PPW and Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15).

- To supplement current policy guidelines and to provide a straightforward risk-based approach to development management in the area. This is aimed at Councillors, Local Planning Authorities, the public, and developers.
- To provide a reference document to which all parties involved in development planning and flood risk can reliably turn to for initial advice and guidance.
- To develop a report that forms the basis of an informed development management process that also provides guidance on the potential risk of flooding associated with future planning applications and the basis for site specific FCAs where necessary.
- To assist the Authorities in identifying specific areas where further and more detailed flood risk data and assessment work may be required.
- To provide an update to the authorities' previous SFCAs (where applicable) using new and updated flood risk information to summarise flood risks to each Authority area to inform the authorities individual Local Development Plans.
- To produce maps showing the flood risk to settlements provided by the Local Planning Authorities.

It is important to highlight that this SFCA is strategic in nature and makes use of the most current available information. This SFCA should be used as a starting point for planners, developers, and the public to initially consider development and flood risk and whether more detailed, site specific assessments of flood risk, such as an FCA, are required. It is also worth noting that the presence of flood zones in an area, be it fluvial, tidal, or surface water, or presence of groundwater flood risk does not mean that development simply cannot happen. Although, sites located within areas of lower risk should be considered in preference to areas at higher risk as part of the development planning process and a more detailed assessment of flood risk may be required to ensure that risks can be effectively managed.

1.4 Stakeholder Engagement

The following stakeholders have been consulted during the preparation of this Stage 1 SFCA:

- The 3 authorities listed in Section 1.1 in their role as:
    - Local Planning Authorities; and
    - Lead Local Flood Authorities (including SAB)
- Natural Resources Wales
- Welsh Government
- Dŵr Cymru Welsh Water (DCWW)
- Hafren Dyfrdwy

1.5 Structure of the Strategic Flood Consequences Assessment

Section	Contents
1. Introduction	Provides a background to the study, defines objectives, outlines the approach adopted and the consultation performed.
2. Study Area	Includes an overview of the study area including information on the topography, geological, and hydrological characteristics of the area.
3. Policy and Strategy	Includes information on the implications of recent changes to planning and flood risk policies and legislation, as well as documents relevant to the study.
4. Understanding of Flood Risk	Introduces the assessment of flood risk and provides an overview of the different types and sources of flooding in the study area.
5. Flood and Coastal Erosion Risk Review	Provides a review of flood risk from all sources for each LPA area.
6. Further Technical Advice Note-15 Guidance	Provides guidance on how LPAs within the region can interpret and apply the new TAN-15.
7. Coastal Erosion Risk Management	Provides information on the role and integrity of coastal defences and an understanding of the risks posed by coastal flooding and erosion.
8. Requirements for a Flood Consequences Assessment	Outlines what an FCA is and the requirements for an FCA.
9. Flood Risk Mitigation and Flood Response Planning	Outlines the flood warning services in the study area and provides advice for emergency planning, evacuation plans, and safe access and egress.
10. Working with Natural Processes and Natural Flood Management	Includes information on areas which could be suitable for implementing natural flood management measures.
11. Conclusions and Recommendations	A summary of the key report findings and recommendations for next steps
Appendices	Outline, individual and settlement maps for each LPA.

2 Study Area

2.1 Geographic Extent

Mid Wales is stated to be the green heart of Wales, covering more than a third of the total area of the country but only 1/15th of its population. Most of the region consists of remote upland areas used for farming and forestry.

In the context of this report Mid Wales covers approximately 7000km² and is formed of 2 Unitary Authorities which are Ceredigion County Council and Powys County Council, along with Brecon Beacons National Park Authority. Only those areas of the Brecon Beacons National Park which are located within the Powys County Council boundary will be covered by the SFCA, rather than the entire extent of the national park, as shown by the grey shaded are in Figure 2-1.

Mid Wales study area stretches from Cardigan in the west to Presteigne in the east. Snowdonia National Park forms much of the northern boundary of mid Wales with the Brecon Beacons National Park found to the south. Ceredigion boarders the coast as shown below in Figure 2-1. Powys also has a section of coastline to the north west of the county, along the River Dyfi close to Machynlleth.

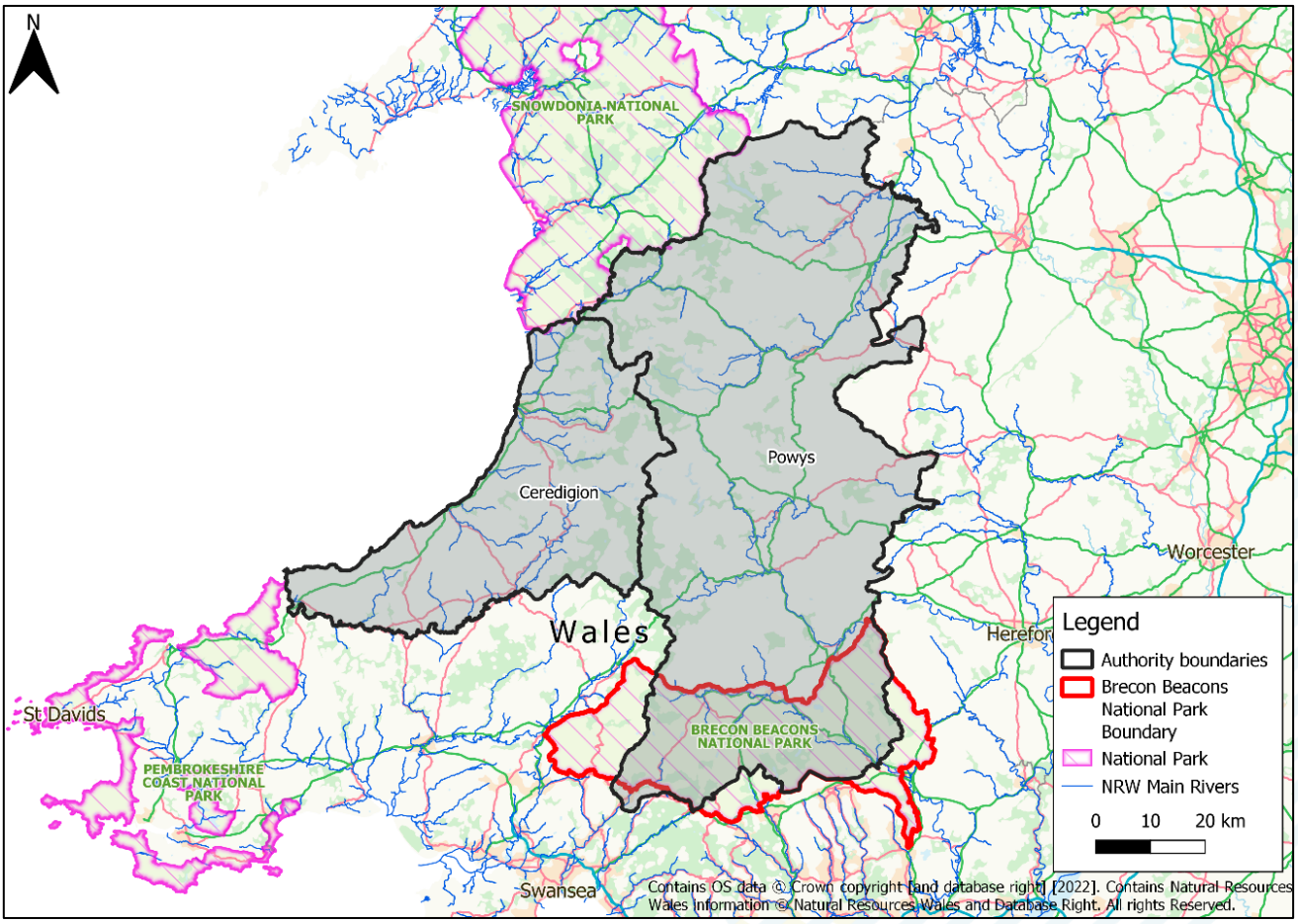

Figure 2-1 Study area

The population of Mid Wales as of mid-2020 (latest available data) was approximately 205,925[1], split between Ceredigion (72,895) and Powys (133,030) inclusive of the Brecon Beacons National Park. The 3 LPA's that form the Mid Wales Region have their own distinct settlements; a summary of which is provided below in Table 2-1.

[1] https://statswales.gov.wales/Catalogue/Population-and-Migration/Population/Estimates/Local-Authority/populationestimates-by-localauthority-year

Table 2-1 Key settlements in Mid Wales

County	Key Settlements	Other Settlements
Ceredigion	**Urban Service Centres** Aberaeron (Llywyncelyn) Aberystwyth/Llanbadarn Fawr/ Waunfawr/ (Penparcau) Cardigan Lampeter Llandysul Newcastle Emlyn (Adpar) Tregaron **Rural Service Centres** Aberporth/Parcllyn Bow Street Cenarth Devil's Bridge Felinfach/ Ystrad Aeron Llanarth Llanilar Llanon Llanrhystud Llanybydder (Carmarthenshire) New Quay Penrhyncoch Pontarfynach Pontrhydfendigaid Talybont Y Borth	**Linked settlements** Aberarth Aberbanc Alltyblacca Bethania Betws Bledrws Betws Ifan Beulah Blaenannerch Blaenplwyf Blaenporth Brongest Bronnant Bryngwyn Brynhoffnant Caerwedros Capel Bangor Capel Dewi (S) Capel Seion Cellan/Fisher's Arms Cilcennin Ciliau Aeron Cnwch Coch Coedybryn Commins Coch Cribyn Croeslan Cross Inn (Llan-non) Cross Inn (New Quay) Cwm Cou Cwrtnewydd Dihewyd Dolybont Drefach Eglwysfach Ferwig Ffostrasol Ffos-y-ffin Gilfachreda Goginan Gorsgoch Gwbert Henllan Highmead Horeb Llanafan Llanddewi Brefi Llandre Llandyfriog Llandygwydd Llanfarian Llanfihangel y Creuddyn Llangeitho Llangoedmor Llangorwen Llangrannog

County	Key Settlements	Other Settlements
		Llangwyryfon Llangybi Llanwnen Llechryd Lledrod Llwynygroes Maenygroes Maesymeillion Mydroilyn Nebo Oakford Pennant Penparc Pentre'r Bryn Pentrellwyn/Gorrig Plwmp Ponterwyd Pontgarreg Pontrhydygroes Prengwyn Rhydlewis Rhydowen Rhydyfellin Sarnau Silian Talgarreg Talsarn Tanygroes Tre Taliesin Tre'r Ddol Tresaith Ynyslas Ysbyty Ystwyth Ystrad Meurig
Powys	**Towns** Builth Wells and Llanelwedd Knighton Llandrindod Wells Llanfair Caereinion Llanfyllin Llanidloes Llanwrtyd Wells Machynlleth Montgomery Newtown Presteigne Rhayader Welshpool Ystradgynlais	**Large Villages** Abercrave Abermule Arddleen Berriew Bettws Cedwain Boughrood & Llyswen Bronllys Caersws Carno Castle Caereinion Churchstoke Clyro Coelbren Crew Green Crossgates Forden and Kingswood Four Crosses Glasbury Guilsfield Howey Kerry Knucklas Llanbrynmair

County	Key Settlements	Other Settlements
		Llandinam Llandrinio Llanfechain Llangurig Llangynog Llanrhaeadr-ym-Mochnant Llansantffraid-ym-Mechain Llansilin Llanymynech Llanyre Meifod Middletown New Radnor Newbridge on Wye Penybontfawr Pontrobert Three Cocks Trefeglwys Tregynon Trewern
Brecon Beacons National Park	Brecon Crickhowell Hay-on-Wye Sennybridge and Defnnog Talgarth	Bwlch Cefn Bryn Brain Crai Gilwern Govilon Libanus Llanbedr Llanfihangel Crucorney Llangors Llanigon Llanspyddid Pencelli Pennorth Pontneddfechan Pontsticill Talybont on Usk

Land use outside of key settlement areas is predominantly agricultural, or areas dominated by forest and moorland across the Mid Wales region. The Brecon Beacons National Park covers 16% of the southern extent of the Powys County Council area. Development within the national park is tightly controlled, therefore settlements tend to be smaller in this area and land use is either agricultural or forests and moorland.

Key infrastructure in the area includes the A487 crossing from southwest Ceredigion to the northeast. The A44 crosses from Aberystwyth in the northwest into central Powys. In Powys the A470 crosses from northwest to southeast and the A483 crosses southwest to northeast. A regular train service connects Aberystwyth in Ceredigion to Shrewsbury via Powys. The Heart of Wales line crosses Powys from Shrewsbury heading southwest towards Swansea.

2.2 Topography

The topography varies from low lying flat, coastal areas in the west along the Ceredigion coastline and the estuary of the River Dovey, to the heights of the mountains in the Brecon Beacons National Park and the massif of the Cambrian Mountains, which forms the boundary between Powys and Ceredigion. Much of Powys is dissected upland terrain. In the north, the Berwyn Hills dominate the landscape, whilst in the east, the upland Radnor Forest and the wide lowland of the Severn valley marks the boundary with Shropshire in England. In the South, the Black Mountain, Central Brecon Beacons and the Black Mountains form a distinct upland area. The highest

elevation within the county of Powys is 886m AOD at Pen Y Fan in the Brecon Beacons National Park Authority area. In Ceredigion the highest topographic point is 741m AOD at Pen Pumlumon Arwystli in the north of the county.

Topographic information, as shown in Figure 2-2, has been derived from OS Terrain 50 mapping which is a digital terrain model of the landscape. This dataset has been used in combination with LiDAR data from NRW as it provides greater coverage of the study area.

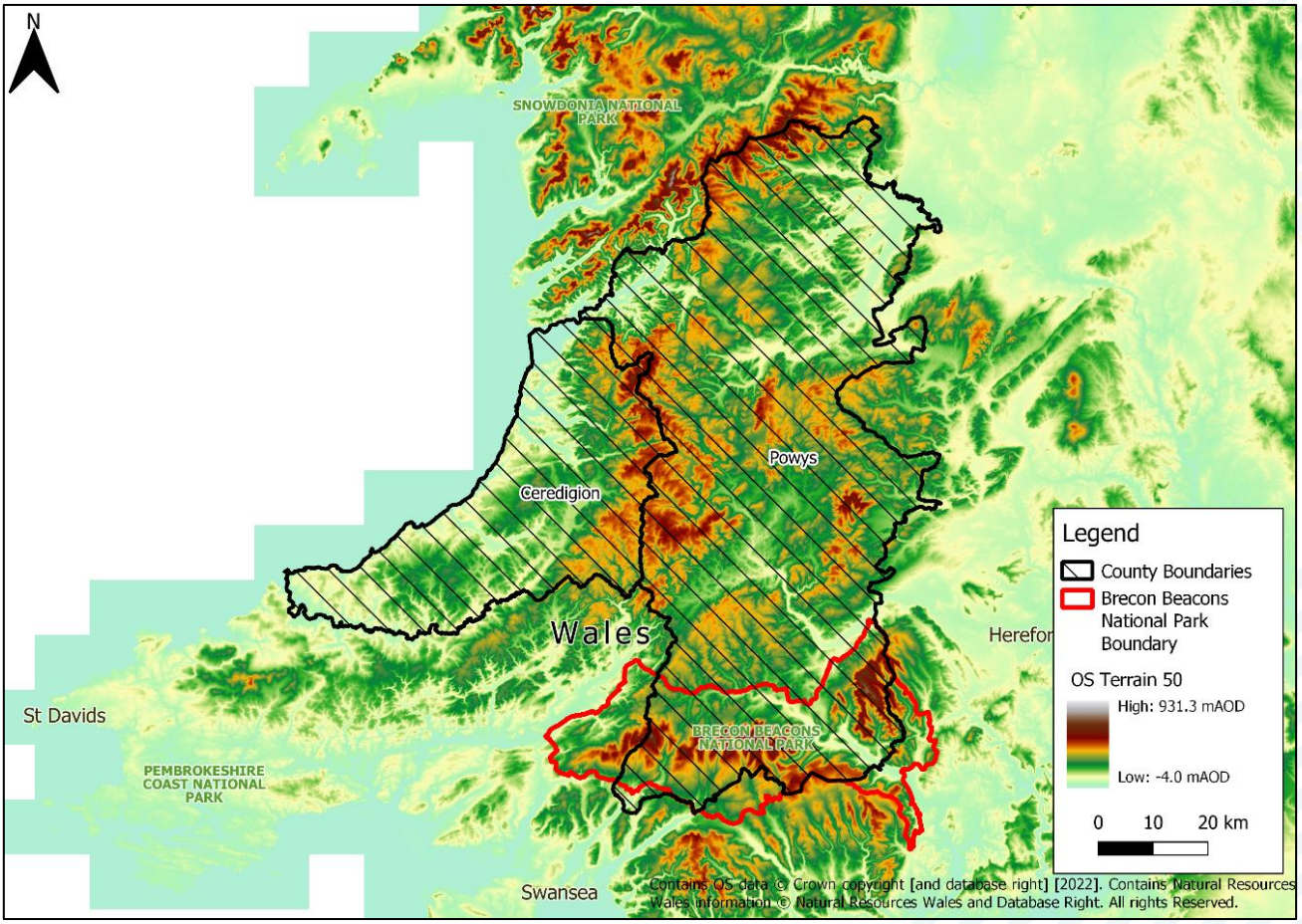

Figure 2-2 Natural Resource Wales OS Terrain 50

2.3 Geology, Hydrogeology and Soils

Mid Wales has a very varied bedrock geology predominantly dominated by Ordovician and Silurian-age rocks of the Welsh Basin. Much of Ceredigion is underlain by Lower Silurian Llandovery-age rocks, which pass eastwards into Powys into younger Wenlock and Ludlow-age strata where sandstone and gritstone can be found. Older Mid-Late Ordovician Caradoc-age rocks outcrop south of the Dovey estuary and south-west from Llandrindod Wells. These strata are compromised of mainly grey to grey-brown interbedded mudstone, siltstone and sandstone and some limestones.

Younger Devonian and Carboniferous age rocks are found in the south of Mid Wales. Much of south Powys and the Brecon Beacons National Park is underlain by Devonian -age "Old Red Sandstone", interbedded reddish brown coloured sandstones, mudstones and siltstones of varying proportions. Along the southern boundary of the Brecon Beacons National Park, the Carboniferous limestone forms distinctive scarps and contains extensive cave systems. The youngest rocks in the mid-Wales area are the basal sandstones and lowest economic coal seams of the Carboniferous-age South Wales Coal Measures basin on the southern boundary of the Brecon Beacons National Park and around Ystradgynlais.

Ordovican age volcanic rocks are found in the vicinity of Builth Wells in central Powys.

Given the dominantly argillaceous (clay- and silt-dominated) nature of the bedrock, the sub-surface is relatively impermeable, the mudstone and siltstone being very fine-grained. The sandstone beds tend to be thin and poorly interconnected, although locally may be an important

source of water. They also tend to be "tight" with relatively poor porosity. However, the interbedded nature of the strata can give rise to numerous spring lines where sandstone beds overlie the less permeable mudstones and siltstones.

However, fault zones can provide water pathways through even argillaceous rocks and are potentially important local water sources from which significant flow can be obtained.

Much of Wales has been glaciated numerous times over the last two Million years (the Quaternary) and other than in the highest mountains, extensive spreads of superficial deposits will be encountered, particularly in the valleys. In the uplands of the Cambrian Mountains and the Brecon Beacons, extensive spreads of glacial Till (diamicton) and remobilised Till and bedrock material (Head) are likely to encountered, underlying blanket peat bogs. The lower valley sides and valley floors of Ceredigion and Powys including the glaciated valleys of the rivers Usk, Wye, Dovey, Teifi, Ystwyth and Rheidol are infilled with glacial deposits, comprising Till, Morainic Deposits and glacio-fluvial sand and gravel, overlain by finer-grained sands and silts of River Terrace Deposits and modern floodplain Alluvium. The Dovey estuary contains a mix of interbedded fluviatile, marine and estuarine deposits reflecting post-glacial fluctuations in sea level. Lowland raised peat bogs can be found at Borth and Tregaron.

Across Mid Wales soils are largely described as 'freely draining acid loamy soils', 'Slowly permeable seasonally wet acid loamy and clayey soils' and 'Freely draining acid loamy soils over rock'. In the upland areas of the Cambrian Mountains the soils most likely to be found are 'Very acid loamy upland soils with a wet peaty surface' and 'Blanket bog peat soils'. Large areas of the Brecon Beacons National Park are also covered in 'Slowly permeable wet very acid upland soils with a peaty surface'.

There has been a long history of extractive industries in Mid Wales. Ceredigion and central Powys is at the heart of the Central Wales ore belt, where lead, silver, zinc and barytes were worked until the early 20th century, leaving extensive underground workings and elevated metal levels in some rivers. In the south, coal mining by deep mining and open cast extraction has continued until recently. There remain a number of active bedrock quarries which are important sources of aggregates and dimension stone. Around Cardigan and near Llanybydder soft, well-sorted glacial sand and gravel is extensively worked

2.4 Watercourses and Catchments

The main river catchments in Mid Wales are: South West Wales, Wye, Severn Uplands and Usk, as shown in Figure 2-3.

Very small parts of the Loughor to Taf, Teme, Ogmore to Tawe and South East Valleys are also included in the study area boundary, but due to their minor coverage in this study area, they have not been discussed in detail below.

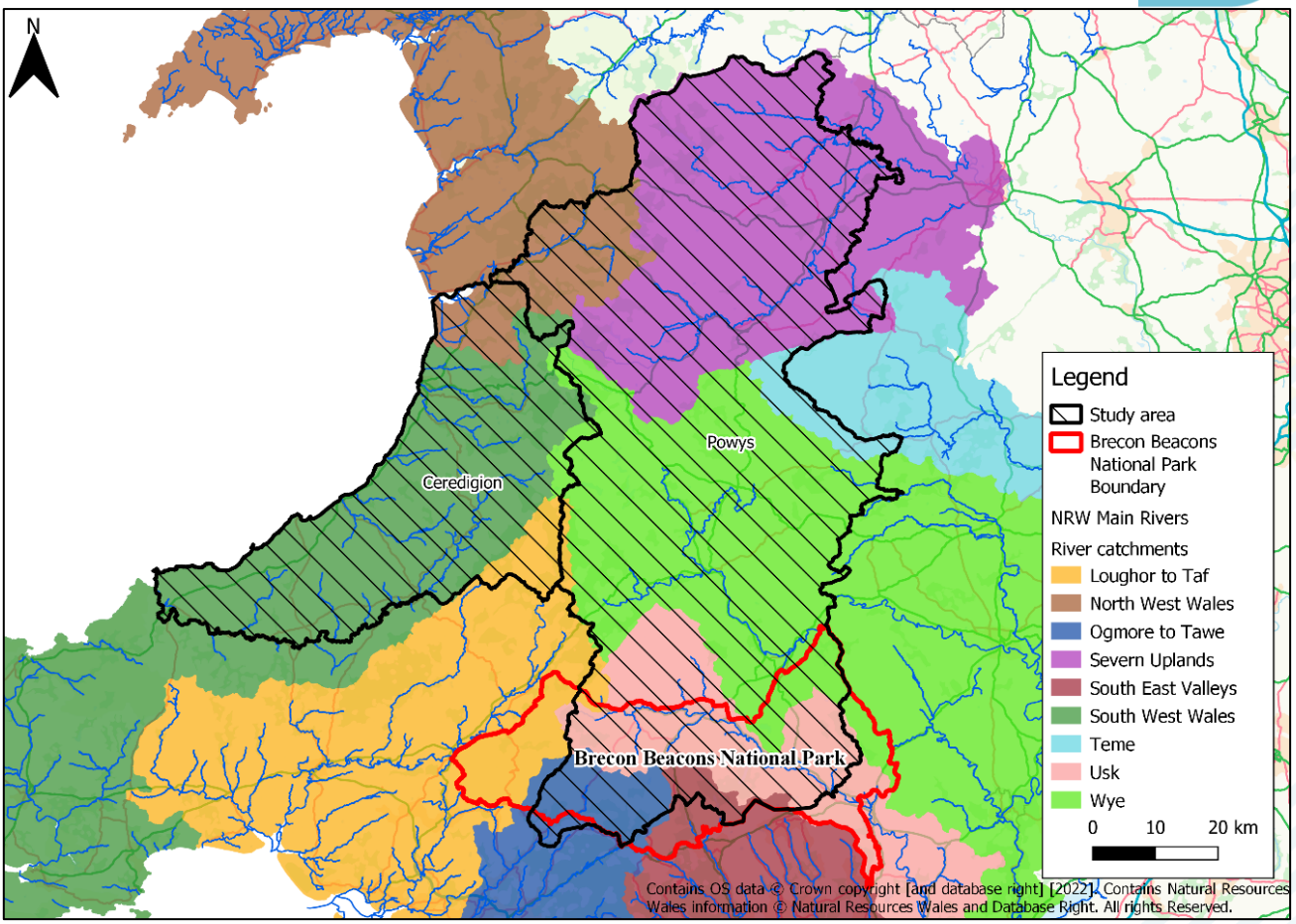

Figure 2-3 River catchments in Mid Wales

South West Wales

The South West Wales catchment covers a number of counties in South West and Mid Wales and includes several major watercourses. However, within this report the main watercourses in discussion are the Rivers Teifi, Ystwyth, Rheidol and Aeron.

The River Teifi has its source in the Cambrian Mountains before flowing in a south-easterly direction along the southern boundary of Ceredigion and entering the sea at Cardigan. The rivers Ystwyth and Rheidol also have their source in the Cambrian Mountains before flowing in a north-westerly direction towards the west coast of Ceredigion, before entering the sea at Aberystwyth. The river Aeron also flows north-westerly towards the west coast of Ceredigion, before entering the sea at Aberaeron.

Wye

The River Wye is formed of several tributaries with their source in mid Powys. The two main tributaries that form the River Wye are the Ifron and Ithon. The River Irfon converges with the Wye in the town of Builth Wells in central Powys. From this point the Wye predominantly flows in a southerly direction before flowing east and crossing the county boundary into Herefordshire.

The River Lugg, also found in the Wye catchment, rises near to the village of Llangunllo, central Powys, and flows in a general south easterly direction towards Presteigne, before flowing into the county of Herefordshire.

Severn Uplands

The Severn Uplands catchment consists of the River Severn, which flows in a north-easterly direction, the River Vyrnwy also flowing in a north-easterly direction and the River Tanat. The River Tanat is sourced near to the Cyrniau Nod Mountain, north of Lake Vyrnwy, and flows in a generally easterly direction to Llanyblodwel before flowing south and converging with the River Vyrnwy near to Llansantffriad-ym-Mechain. The River Vyrnwy joins the River Severn along the Wales/England border near Crewgreen (10km north east of Welshpool), before crossing the boundary into Shropshire.

Usk

The Usk catchment has its source in the west of the Brecon Beacons National Park before flowing in a south-easterly direction entering into Monmouthshire just south of the village of Glangrwyney.

North West Wales

The River Dovey is sourced from the lake of Creiglyn Deifi and flows in a general south westerly direction before discharging into the sea at Aberdyfi. It forms the boundary between Powys and Gwynedd, crossing into Ceredigion west of Morben.

Tawe

The River Tawe has its source in the central area of the Brecon Beacons National Park and flows in a southerly direction through Glyntawe where the Nant Haffes converges with the River Tawe. The river continues to flow in a southerly direction through Abercraf and through Ystradgynlais where the Afon Geidd converges with this watercourse. The River Tawe continues to flow southwards leaving the Powys boundary to the south of Ystradgynlais.

Teme

The River Teme rises in the Radnor Forest and Shropshire Hills and flows south-eastwards through the town of Knucklas in Powys. The Ffrwdwen Brook converges with the River Teme in Knucklas before flowing in a south easterly direction through Knighton in Powys. The River Teme then crosses the border into Shropshire.

3 Policy and Strategy

3.1 Legislation

3.1.1 European Union Floods Directive and the Flood Risk Regulations

The European Flood Directive (2007) sets out the EU's approach to managing flood risk and aims to improve the management of the risk that floods pose to human health, the environment, cultural heritage and economic activity.

The Directive was translated into Welsh law by the Flood Risk Regulations (FRR) 2009 and outlines the requirement for Natural Resources Wales and Lead Local Flood Authorities (LLFA) to create Preliminary Flood Risk Assessments (PFRAs), with the aim of identifying significant Flood Risk Areas.

PFRAs should cover the entire area for local flood risk (focusing on ordinary watercourses, surface water and groundwater flooding). Where significant Flood Risk Areas are identified using a national approach (and locally reviewed), the LLFA are then required to undertake flood risk hazard mapping and Flood Risk Management Plans (FRMPs).

The FRMP will need to consider objectives for flood risk management (reducing the likelihood and consequences of flooding) and measures to achieve those objectives.

NRW have produced National Flood Hazard Mapping which is based on generalised modelling as part of Flood Risk Assessment Wales. They have been created for three sources of flooding – rivers, the sea, surface water and small watercourses. The maps show flood depth, velocity, hazard, and extent for high, medium, and low risk scenarios.

NRW has implemented one of the exceptions for creating PFRAs, etc for Main Rivers and coastal flooding, as they already have mapping (i.e. Risk of Flooding from Rivers and Sea Map) and plans (i.e. CFMPs) in place to deal with this. NRW has therefore focused their efforts on assisting LLFAs through this process.

3.1.2 Flood and Water Management Act

The Flood and Water Management Act (FWMA) was passed in April 2010. It aims to improve both flood risk management and the way water resources are managed.

The FWMA creates clearer roles and responsibilities and instils a more risk-based approach. This includes a new lead role for Local Authorities in managing local flood risk (from surface water, groundwater and ordinary watercourses) and a strategic overview role of all flood risk for Natural Resources Wales. Within this study area there are two Lead Local Flood Authorities (LLFA), Ceredigion County Council and Powys County Council. Powys County Council has responsibility for the areas of the Brecon Beacons National Park, that fall within the Powys boundary.

The content and implications of the FWMA provide considerable opportunities for improved and integrated land use planning and flood risk management by Local Authorities and other key partners. The integration and synergy of strategies and plans at national, regional and local scales, is increasingly important to protect vulnerable communities and deliver sustainable re-generation and growth. Table 3-1 provides an overview of the key LLFA responsibilities under the FWMA.

Table 3-1 Key LLFA Responsibilities

Responsibility	Description
Developing a Local Flood Risk Management Strategy	The LLFA is required to develop, maintain, apply and monitor its local strategy for flood risk management in its area. The local strategies will build on information such as national risk assessments and will use consistent risk-based approaches across different Authority areas and catchments. The Local Strategy will not be secondary to the National Strategy; rather it will have distinct objectives to manage local flood risks important to local communities.
Investigating Flood Incidents	An LLFA has a duty to investigate and record details of 'significant flooding' in its area, under Section 19 of the FWMA. The National Strategy for FCERM in Wales states that the Welsh Government expects Section 19 reports to be undertaken where 20 or more homes in one area experience internal flooding. However, Local Authorities may choose a lower threshold as it is noted that smaller scale floods are still capable of causing significant damage. What constitutes significant flooding is defined by each LLFA. This duty includes identifying Risk Management Authorities (RMA) and their functions and how they intend to exercise those functions in response to a flood. The responding RMA must publish the results of its investigation and notify other relevant RMAs.
Asset Register	An LLFA has a duty to maintain a register of structures or features, which are considered to have an effect on flood risk, including details on ownership and condition as a minimum. The register must be available for inspection and the Secretary of State will be able to make regulations about the content of the register and records.
Works Powers	The Act provides the LLFA with powers to do works to manage flood risk from surface water runoff, groundwater and ordinary watercourses, consistent with the local Flood Risk Management Strategy for the area.
Designation Powers	Schedule 1 of the Act provides the LLFA with powers to designate structures and features that affect flooding or coastal erosion. Only those structures and features related to flood risk management in respect of ordinary watercourse, surface water and groundwater flooding can be designated by LLFA under this Act. The powers are intended to overcome the risk of a person damaging or removing a structure or feature that is on private land and which is relied on for flood or coastal erosion risk management. Once a feature is designated, the owner must seek consent to alter, remove or replace it.
SuDS Approval Body	Schedule 3 of the Act establishes each Authority as a SuDS Approval Body (SAB). This is mostly likely to sit within the LLFA role but may be independent from this RMA. The SAB has responsibility for the approval of proposed surface water drainage systems in new developments and redevelopments, subject to exemptions and thresholds. Approval must be given before the developer commences construction. The SAB is also responsible for adopting and maintaining SuDS which serve more than one property, where they have been approved. Highways Authorities will be responsible for maintaining SuDS in public roads, to National Standards.

3.1.3 Sustainable Drainage Systems (SuDS)

Disposal of surface water runoff is a key consideration, whether a development site falls within a flood risk area or not. Intense development within a catchment could result in increased runoff which if not appropriately managed could result in increased flooding within and downstream of the study area. Consequently, the impact of new developments on flood risk needs to be managed to avoid any negative impacts to the development itself and to other assets within the catchment.

New developments can also increase pressure on sewer systems and urban drainage. It is therefore important to manage the impact of developments in a sustainable manner.

Sustainable Drainage Systems (SuDS) aim to mimic the natural processes of Greenfield surface water drainage by allowing water to flow along natural flow routes and also aims to reduce the runoff rates and volumes during storm events, whilst providing water treatment benefits. SuDS also have the advantage of providing Blue and Green Infrastructure, ecology and recreational benefits when designed and maintained properly.

Schedule 3 of the Flood and Water Management Act 2010 was enacted in Wales in January 2019, leading to the requirement for all new developments to incorporate the four pillars of SuDS design, shown in Figure **3-1**. The statutory requirement for SuDS approval and the associated approval process is separate from planning permission, although there is need for significant interactions and alignment between the two processes.

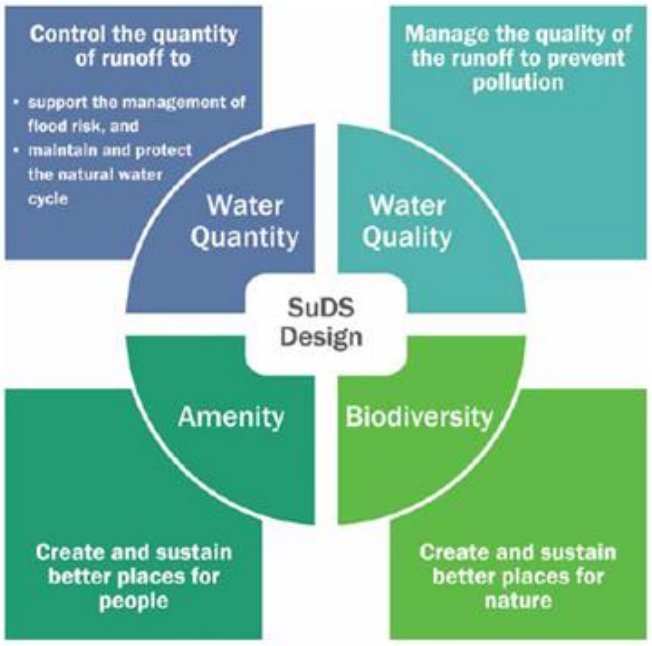

Figure 3-1 Four Pillars of SuDS (CIRIA, 2015)

There are a number of technical standards and design guidance for SuDS which are available in the documents listed below:

- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems (Welsh Government, 2018),
- C753 The SuDS Manual (Ciria, 2015),
- Rainfall Runoff Management for Developments – SC030219 (Environment Agency, 2013),
- PPW – Edition 11, February 2021,
- The Building Regulations 2010 Part H: Drainage and Waste Disposal,
- Design and Construction Guidance.

3.1.4 Water Framework Directive and Water Environment Regulations

The purpose of the Water Framework Directive (WFD) is to deliver improvements across Europe in the management of water quality and water resources. The first cycle of River Basin Management Plans (RBMP) and WFD required all inland and coastal waters to reach "good ecological status" by 2015 through a catchment-based system. Incorporating a programme of

measures to improve the status of all natural water bodies. There is an exception for "heavily modified water bodies", that are required to achieve "good ecological potential". The Water Environment Regulations (2003) transposed the WFD into law in England and Wales. Natural Resources Wales is leading on the delivery of the WFD in Wales.

The River Basin Management Plans for Mid Wales is discussed in more detail in Section 3.5.

3.1.5 Wellbeing of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 places a duty on all public bodies to safeguard the well-being of future generations. The duty is based on the principle of sustainable development and requires public bodies to think about the long-term impact of their decisions, whilst collaborating with others, communities, and each other. The seven well-being goals listed within the Act aim to present Wales with an opportunity to make a long-lasting and positive change to current and future generations.

In terms of flood risk management, it is therefore important to ensure that developments do not occur in areas at risk of flooding, or where the risk of flooding cannot be managed to an acceptable level. Additionally, any flood risk management works should not result in an increase of flooding elsewhere. A precautionary approach is undertaken in this SFCA to ensure that the well-being of future generations is not compromised as a result of proposed development.

3.2 National Policy

3.2.1 Future Wales – The National Plan 2040

Future Wales is a national development framework which sets the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system, including achieving decarbonisation and climate resilience. Future Wales sets a direction for where investment should be made in infrastructure and development and makes clear the importance of planning new infrastructure and development in a way that ensures opportunities are maximised and multiple benefits are achieved.

Policy 8 of Future Wales sets out considerations for the future of Wales in terms of Flood Risk. It states that Flood Risk Management that enables and supports strategic growth and regeneration in National and Regional Growth areas shall be supported. Additionally, Welsh Government will work with authorities and developers to plan and invest in new and improved infrastructure, promoting nature-based solutions as a priority, where opportunities for social, economic and environmental benefits are maximised when investing in flood risk management infrastructure.

Policy 8 highlights that flood risk is a constraining factor to development, especially as a result of a large number of Wales' towns and cities being located on the coast or located alongside major rivers. It identifies that the likelihood of rising sea levels and increased rainfall caused by climate change means the risk of flooding is projected to increase over the lifetime of the development and sustainable solutions will be required. The policy identifies that a strategic approach should be taken to prioritising development in places that are not at flood risk, followed by places where flood risk can be managed in an acceptable way. Policy 8 points towards the requirements of PPW and the requirements of Technical Advice Note 15: Development, Flooding and Coastal Erosion (TAN-15) to direct development away from areas at risk of flooding.

3.2.2 Planning Policy Wales

PPW Edition 11 (PPW 11) aims to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation. It is supplemented by a series of Technical Advice Notes (TANs).

PPW addresses a wide range of issues including the placemaking of sustainable settlements, the location of new development, the commitment to the re-use of land and promoting sustainability through good design.

PPW indicates that Local Authorities should recognise in their policies the housing needs of all and must ensure that sufficient land is genuinely available, or will become available, to provide

land for housing judged against the general objectives and the scale and location of development provided for in the development plan.

Paragraph 6.6.18 of PPW states that *'the provision of SuDS must be considered as an integral part of the design of the new development and considered at the earliest possible stage when formulating proposals for new development'.*

Paragraph 6.6.22 of PPW refers to `Development and flood risk' and states that *"Planning authorities should adopt a precautionary approach of positive avoidance of development in areas of flooding from the sea or from rivers."*

Paragraph 6.6.24 adds that *"planning authorities [should] take a strategic approach to flood risk and consider the catchment as a whole by providing a preliminary representation of flood risks, which inform decisions on the location of new development and the requirements necessary to support any applications which may be proposed."*

Paragraph 6.6.23 continues that *"Government resources for flood and coastal defences are directed at protecting existing developments and are not available to provide defences in anticipation of future development."* PPW then advises that a sustainable approach to flooding will involve avoiding development within areas at flood risk.

3.2.3 National FCERM Strategy for Wales

The National FCERM Strategy for Wales[2] was published in October 2020 and sets out how the Welsh Government intends to manage flood and coastal erosion risks in Wales over the next ten years. The Strategy has been drafted with a longer-term, strategic view, recognising the nature of flood and coastal erosion risk with respect to the challenges of climate change. It will work alongside other strategic plans for shoreline management, infrastructure and development planning.

With regard to managing flood and coastal erosion risk in Wales, the strategy sets out five high level objectives:

A. Improving our understanding and communication of risk;
B. Preparedness and building resilience;
C. Prioritising investment to the most at risk communities;
D. Preventing more people becoming exposed to risk;
E. Providing an effective and sustained response.

Each of these objectives are related to specific measures and actions outlined in the national strategy. NRW will report on the application of the national strategy through a Section 18 report every two years. This will be reviewed by the Flood and Coastal Erosion Committee. The last Section 18 report covered the years 2016 to 2019, it is unknown then the next report Section 18 report is expected.

3.2.4 National Resources Policy

The focus of the Natural Resources Policy (NRP)[3] is on improving the way Wales manages its natural resources and forms a key part of the delivery framework for the sustainable management of natural resources established by the Environment (Wales) Act. The NRP set out the opportunities and challenges that face Wales's Natural Resources and how these will be monitored and addressed. In relation to flooding the NRP highlights how careful management of ecosystems can play a crucial role in building resilience to the impacts of climate change such as flooding. It also highlights that there are opportunities to manage flooding by using natural flood risk management techniques across Wales with NRW aiming to increase the role of nature-based solutions in flood and water management.

2 https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales
3 https://gov.wales/sites/default/files/publications/2019-06/natural-resources-policy.pdf

3.3 Technical Advice Note 15: Development, Flooding and Coastal Erosion

Technical Advice Note 15: Development, flooding and coastal erosion (TAN-15) sets out the criteria against which the consequences of a development in an area at risk of flooding can be assessed.

TAN-15 also states that Local Planning Authorities should ensure development is set back appropriately from flood zones to allow for extreme surface water and small watercourse events.

TAN-15 was introduced in 2004 by the Welsh Government. It is technical guidance related to development planning and flood risk using a sequential characterisation of risk based on the Development Advice Map (DAM). An update to TAN-15, which is supported by the FMfP, was initially released in September 2021 for implementation from December 2021. However, on the 24th November 2021 Welsh Government suspended the implementation of the new TAN-15 until 1st June 2023.

On the direction of the Minister for Climate Change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 and associated FMfP due to be implemented from June 2023.

TAN-15 reflects the core principles of the National Strategy for Flood and Coastal Erosion Risk Management in Wales[4] to adopt a risk-based approach in respect of new development in areas at risk of flooding and coastal erosion. TAN-15 comprises technical guidance related to development planning and flood risk and provides a framework within which the flood risks arising from rivers, the sea and surface water, and the risk of coastal erosion can be assessed.

Its initial requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions. An indicative sequence to negotiating the various elements of TAN-15 is provided below in Figure 3-2.

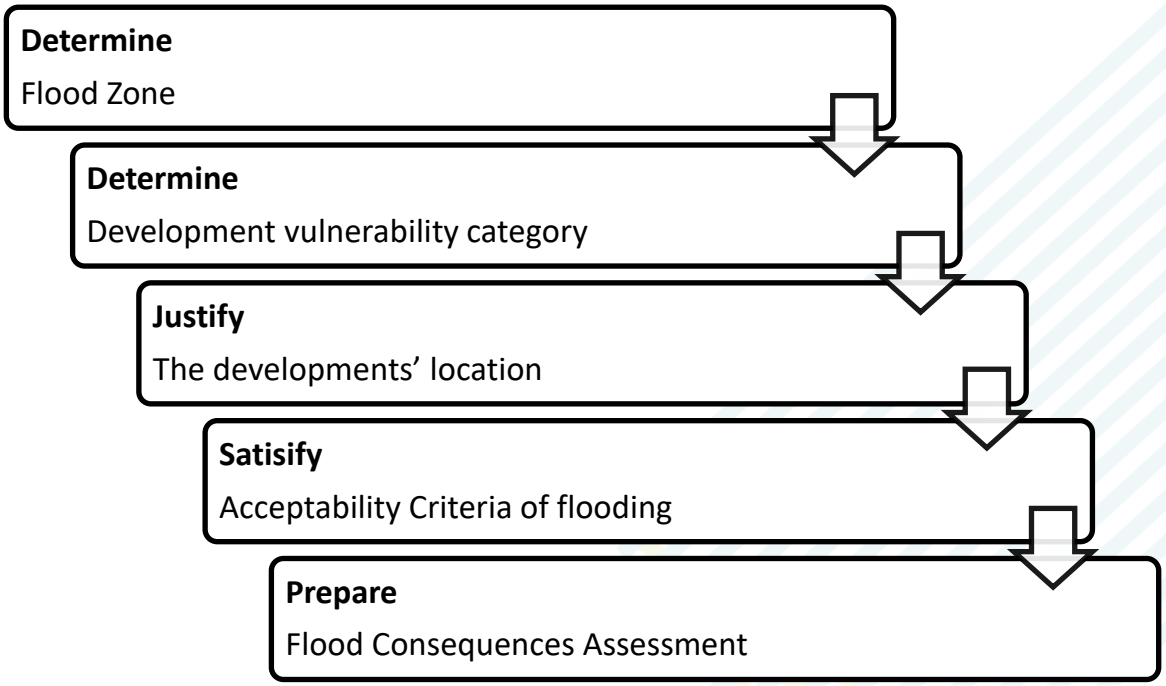

Figure 3-2 Navigating TAN-15 requirements

4 National Strategy for Flood and Coastal Erosion Risk Management in Wales. Welsh Government (October 2020) https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales

3.3.1 Flood Map for Planning

TAN-15 defines a number of flood zones based on the likelihood of flooding. Table 3-2 summaries the definition of the flood zones in the Flood Map for Planning (FMfP) [5]. The FMfP flood extents are based on the central estimates of climate change, assuming a 100-year lifetime of development.

Table 3-2 TAN-15 definition of FMfP flood zones[6]

Zone	Flooding from rivers	Flooding from the sea	Flooding from surface water and small watercourses
1	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year	Less than 1 in 1000 (0.1%) (plus climate change) chance of flooding in a given year
2	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change	Less than 1 in 200 (0.5%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change	Less than 1 in 100 (1%) but greater than 1 in 1000 (0.1%) chance of flooding in a given year, including climate change
3	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change	A greater than 1 in 200 (0.5%) chance of flooding in a given year, including climate change	A greater than 1 in 100 (1%) chance of flooding in a given year, including climate change
TAN-15 Defended zone	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from rivers of 1:100 (plus climate change and freeboard)	Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from the sea of 1:200 (plus climate change and freeboard)	Not applicable

Additionally, NRW has published a 'Recorded Flood Extents' layer which identifies areas that have been recorded as having flooded in the past. These records are from a number of evidence sources including Natural Resources Wales, its predecessors or other Risk Management Authorities. The datasets include flooding records from rivers, the sea, surface water and small watercourses.

3.3.2 Climate Change

Welsh Government publishes climate change guidance[7] for Flood Consequence Assessments. This was last updated in September 2021 to provide updated sea level allowances. Assessing the future effects of climate change is a key aspect of TAN-15 and any FCA required to support a planning application.

There are three sources of flooding that utilise different climate change allowances; these are:

- **River flooding** – Wales is divided into three river basin districts and peak river flow allowances are provided for each area. Recommendations are to use the central estimate (50th percentile) for the relevant river basin district. However, it is also advised that an assessment of risk should be undertaken using the upper end estimate (90th percentile). For the central estimate peak river flows in Wales are predicted to increase by 20-30% over the next 100 years.

5 https://flood-map-for-planning.naturalresources.wales
6 Source: Figure 2, TAN-15
7 Flood Consequences Assessments: Climate change allowances. Welsh Government (Sept 2021) https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

- **Flooding from the sea –** Estimated sea level rise is provided for each Authority area or can be calculated for specific sites through the UKCP18 User Interface. As a minimum, development proposals should be assessed against the higher central allowance (70th percentile) estimates to inform design levels. An assessment should also be made against the upper end allowance (95th percentile) to inform mitigation measures, access and egress routes and emergency evacuation plans. For the higher central estimate, sea levels along the Welsh coastline are predicted to increase by 0.91-1.01m over the next 100 years.
- **Surface water and small watercourses flooding** – Peak rainfall intensity allowances are provided for catchments less than 5km. Recommendations are to use the central estimate as a minimum, and where there is significant flood risk, the upper end estimate should also be used. The central estimate for increasing peak rainfall intensity is 20% over the next 100 years, and 40% for the upper estimate. The LLFA should be consulted where surface water and small watercourse flood risks are considered significant.

3.3.3 Lifetime of development

The climate change uplifts detailed above are provided for different epochs. Consequently, the anticipated lifetime of development can be critical in the assessment of climate change impacts and future flood risk. This is most relevant to flooding from the sea, where sea level increases are estimated on an annual basis with increases accelerating over time. With river and surface water flood risk most climate changes effects are predicted to occur in the next 50 years, without further increases thereafter. Climate change uplifts are based on current Welsh Government guidance at the time of writing this report and may be subject to change.

TAN-15 states that "*Generally, it is appropriate to think of new dwellings as having a lifetime of 100 years. Lifetimes for other types of development will vary, but 75 years is considered a reasonable rule of thumb.*"

It may be argued that many industrial developments have significantly shorter design lives than 75yrs. Therefore, in the cases of tidal flood risk there can be value in considering lifetimes of development less than 75yrs, although any deviation from the typical TAN-15 values will ultimately need to be agreed with the Local Planning Authority through the planning process.

3.3.4 Vulnerability classification

TAN-15 assigns one of three flood risk vulnerability classifications to a development, as shown in Table 3-3 below.

Table 3-3 Development vulnerability categories [8]

Development category	Types
Highly vulnerable development	All residential premises (including hotels, Gypsy and Traveller sites and caravan parks and camping sites). Schools and childcare establishments, colleges and universities. Hospitals and GP surgeries. Especially vulnerable industrial development (e.g. power generating and distribution elements of power stations, transformers, chemical plants, incinerators), and waste disposal sites. Emergency services, including ambulance stations, fire stations, police stations, command centres, emergency depots. Buildings used to provide emergency shelter in time of flood
Less vulnerable development	General industrial, employment, commercial and retail development. Transport and utilities infrastructure. Car parks. Mineral extraction sites and associated processing facilities (excluding waste disposal sites). Public buildings including libraries, community centres and leisure centres (excluding those identified as emergency shelters). Places of worship. Cemeteries. Equipped play areas. Renewable energy generation facilities (excluding hydro generation).
Water compatible development	Boatyards, marinas and essential works required at mooring basins. Development associated with canals. Flood defences and management infrastructure. Open spaces (excluding equipped play areas). Hydro renewable energy generation.

[8] Source: Figure 3, TAN-15

3.3.5 Justifying the location of development

TAN-15 states that the Local Planning Authority will need to be satisfied that a development's location is justified. This is determined through the application of the 'Justification Test'. The below summaries the Justification Test for development within the various flood zones.

Where a site falls into two or more flood zones the planning authority must make an assessment of the proposal, taking into account each of its proposed land uses, against each of the flood zones to which it applies, in accordance with the Justification Tests.

Zone 1

- All types of development are acceptable in principle. Planning authorities should develop locally specific planning policies for localised areas at risk of flooding.

TAN-15 Defended Zones

Development will be justified in the TAN 15 Defended Zones if:

- Its location meets the definition of previously developed land;

  and

- The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.

Zone 2 (rivers and sea)

Development will be justified in Zone 2 if:

- Its location meets the definition of previously developed land;

  and

- It will assist, or be part of, a strategy supported by the Development Plan to regenerate an existing settlement or achieve key economic or environmental objectives;

  and

- The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.

Zone 3 (rivers and sea)

Highly vulnerable development is not permitted in Flood Zone 3. Less vulnerable development will only be justified if:

- Its location meets the definition of previously developed land;

  and

- There are exceptional circumstances that require its location in Zone 3, such as the interests of national security, energy security, public health or to mitigate the impacts of climate change;

  and

- The potential consequences of a flooding event for the particular type of development have been considered and found to be acceptable in accordance with the criteria contained in section 11 of TAN-15.

3.3.6 Acceptability of flood consequences

If the planning authority is satisfied that proposed development is justified in a flood risk area (Section 3.3.5), this justification will be in the knowledge that development may experience flooding and will need to be planned accordingly. A full understanding of the potential risks and consequences will be required to inform the planning authority in its decision making and to demonstrate that the criteria set out in the Justification Tests have been satisfied. This is

demonstrated through the production of a FCA, which is appropriate to the nature and scale of the proposed development (further details of which are provided in Section 8).

Whether a development should proceed or not will depend upon whether the consequences of flooding can be safely managed, including its effects on flood risk elsewhere. **This is with the exception of highly vulnerable development which is not permitted under any circumstances in Flood Zone 3.**

It is not appropriate to permit new development (other than water compatible development) in areas subject to significant flood depths or velocities or where safe access or egress cannot be achieved.

Accordingly, the planning authority will need to arrive at a judgement on the acceptability of the flooding consequences and they should only permit development where the developer has demonstrated that the risks and consequences of flooding are manageable and meet the 'Acceptability Criteria'.

There are three principal aspects to the Acceptability Criteria:

1. **Flood frequency requirements**. The frequency at which flooding is regarded to be acceptable. TAN-15 states that all developments must be designed to be flood free during the 1% river flood and 0.5% flooding from the sea events, with an allowance for climate change over the lifetime of development. See Table 3-4 for frequency thresholds.
2. **Tolerable conditions**. The flood conditions that are regarded to be acceptable during an extreme flood event with allowance for climate change. See Table 3-5.
3. **Avoidance of third-party impacts**. Development must not cause or exacerbate the nature and frequency of flood risk elsewhere up to and including the 0.1% extreme flood event plus climate change over the lifetime of development.

Table 3-4 Flood frequency requirements[9]

Vulnerability categories	Vulnerability categories	Flood event types - Rivers	Flood event types - Sea
Highly vulnerable development	Emergency services (command centres and hubs)	0.1% +CC (1 in 1,000)	0.1% +CC (1 in 1,000)
Highly vulnerable development	All other types	1% +CC (1 in 100)	0.5% +CC (1 in 200)
Less vulnerable development	All types of less vulnerable development	1% +CC (1 in 100)	0.5% +CC (1 in 200)
Water compatible development	Water compatible development (limited to those built elements of development that may be occupied by people)	1% +CC (1 in 100)	0.5% +CC (1 in 200)

[9] Source: Figure 6, TAN-15

Table 3-5 Tolerable conditions in an extreme flood event[10]

Type of development	Maximum depth of flooding (mm)	Maximum velocity of flood waters (m/s)
Highly vulnerable development	600	0.15
Less vulnerable development Infrastructure associated with highly vulnerable development e.g. car parks, access, paths and roads Water compatible development (limited to those built elements of development that may be occupied by people)	600	0.3

Note: The extreme flood event is defined as the 0.1% AEP flood event

3.3.7 Surface water and ordinary watercourse flood risk

Flooding is not confined to floodplains, as heavy rain falling on waterlogged ground or impermeable surfaces can cause localised flooding almost anywhere. Heavy rain can also result in drainage systems and ordinary watercourses, such as streams, reens and brooks quickly becoming inundated, leading to localised flooding. As the climate changes, this type of flooding will become more commonplace and more severe.

The FMfP includes two surface water and small watercourse flood risk zones. Zone 3 contains areas at highest risk, with Zone 2 areas facing a lower risk. Areas considered at minimal risk of flooding from these sources are in Zone 1.

Surface water and ordinary watercourse flood risk management are the responsibility of Lead Local Flood Authorities (LLFAs). The LLFA has an important role in advising on surface water and ordinary watercourse flood risks for its area. The LLFA is a non -statutory consultee to all planning applications and will pay particular attention to applications affected by surface water and ordinary watercourse flood risk. Applicants are advised to seek the LLFA's input at pre-application stage. This is advised whether the flood risk is potentially a reason for refusal, or not, and where the risk is proposed to be managed or mitigated.

A Flood Consequences Assessment will be required for any new development proposal located fully or partly in Flood Zones 2 and 3 – Surface Water and Small Watercourses. An assessment should also be undertaken for development on sites outside of these zones, but which has the potential to affect the course of surface water and/or excess water from ordinary watercourses. Planning authorities may provide specific local advice on this issue in Development Plans.

The Justification Tests do not apply to development in Flood Zones 2 and 3 of the Surface Water and Small Watercourses flood map. However, there is an expectation that the Acceptability Criteria will generally be applied in demonstrating the acceptability of flood risk. However, the degree of assessment required will depend on the nature, extent, perceived accuracy of the flood mapping, the potential severity and consequences of flooding, and ultimately the requirements of the LLFA.

3.4 Regional Policy

3.4.1 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMP) are an essential component of future flood risk management. The plans are key to delivering the flood risk management outcomes of Welsh Government and Defra. A CFMP is a high-level strategic planning tool, setting out the policies that will be adopted to manage flood risk for the next 50 to 100 years. The plans include actions that NRW, authorities and others need to take now and, in the future, to ensure adequate response and adaptation to the increasing and changing flood risk.

CFMP's have been developed for the whole of Wales and England. Each plan covers a single large catchment or a combined number of smaller catchments, with boundaries aligned to catchment boundaries. The plans consider all types of flooding and are based on a standard

[10] Source: Figure 7, TAN-15

approach to ensure they provide a consistent assessment of flood risk. They also cover tidally influenced flooding from rivers and estuaries.

The CFMPs look at the current level of flood risk and compare this to the predicted future flood risk. This allows a targeted approach in dealing with flood risk in areas that will need it the most. The CFMP process assesses how flooding might affect people, property and the environment. The CFMP policies should be considered when making land planning decisions.

Each CFMP is divided into a number of 'management units' which are defined as areas with similar sources, pathways and receptors of flooding. Each management unit is assigned a preferred flood risk management policy based on an appraisal of the social, economic and environmental damages of flooding.

The Mid Wales Region considered in this report falls into 4 Catchment Flood Management Plans:

- Wye and Usk,
- River Severn,
- North West Wales
- Pembrokeshire and Ceredigion.
- Ogmore and Tawe (including Thaw & Cadoxton

Wye and Usk Catchment Flood Management Plan

The Wye and Usk CFMP[11] highlights 7 sub areas in the CFMP which have different policy options. Table 3-6 discusses how 2 of the policy options relate to the authority of Powys, including the Brecon Beacons National Park. Policy units have been derived from the policy unit plan from the CFMP, contained in Figure 3-3.

Table 3-6 Wye and Usk policy options

Authority	Sub-area	Policy options
Powys and Brecon Beacons National Park	Upper Wye and Usk	Policy Option 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.
Powys and Brecon Beacons National Park	Lower Usk	Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level.

11 https://webarchive.nationalarchives.gov.uk/ukgwa/20140328155137mp_/http://cdn.environment-agency.gov.uk/gewa0110brjw-e-e.pdf

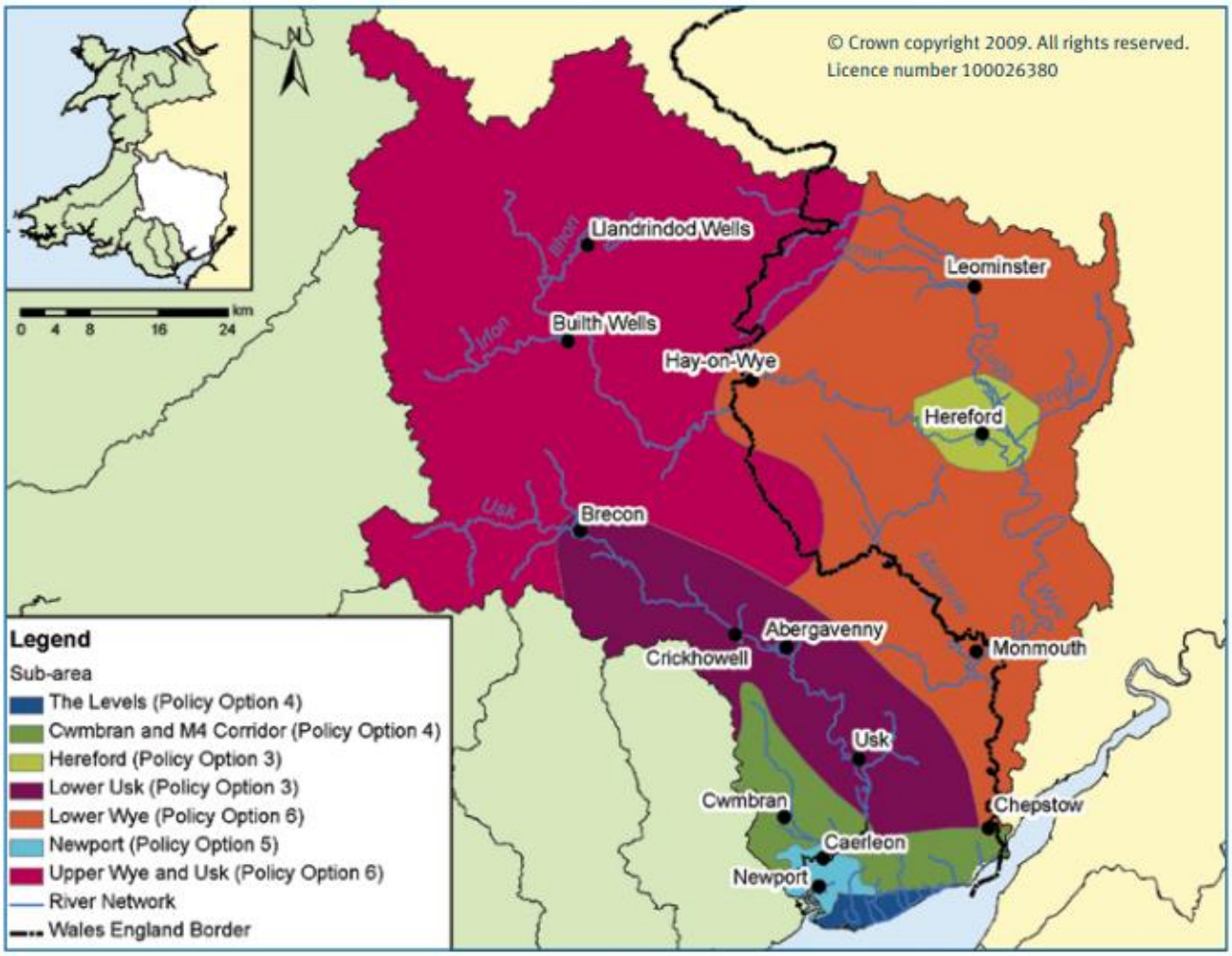

Figure 3-3 Extract of sub-areas from the Wye and Usk CFMP Page 12[11]

River Severn Catchment Flood Management Plan - Severn Uplands, & Vyrnwy Confluence

The River Severn CFMP[12] crosses the border between England and Wales and is split in to 9 sub catchments. Only 1 sub catchment falls within the study area of this report. Table 3-7 and Figure 3-4 provide further information.

Table 3-7 River Severn policy options

Authority	Sub-area	Policy options
Powys	Severn Uplands, and Vyrnwy Confluence	Policy Option 6 - Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment.

12 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/289103/River_Severn_Catchment_Management_Plan.pdf

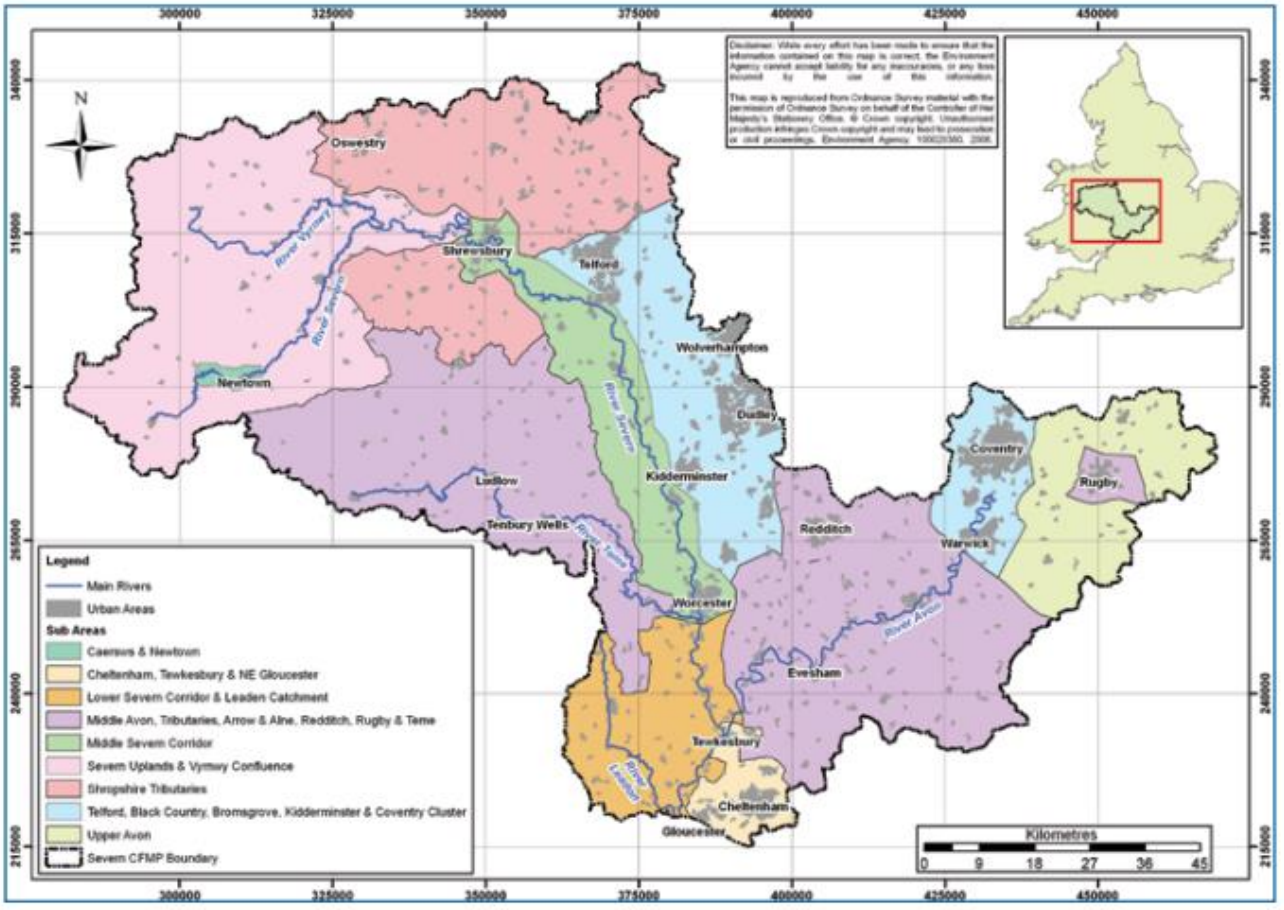

Figure 3-4 Extract of sub-areas from the River Severn CFMP Page 10[12]

North West Wales Catchment Flood Management Plan

Flood risk management in the North West Wales CFMP[13] is currently reliant on flood warning, development control and local defences at communities. Table 3-8 shows the different policy options for each sub-area in the catchment. Sub-areas have been derived from the sub-area plan from the CFMP, contained in Figure 3-5. Within the scope of this report, the authority covered by the North West Wales CFMP is Ceredigion as shown below.

Table 3-8 North West Wales policy options

Authority	Sub-area	Policy options
Ceredigion	Borth	Policy Option 5 - Take further action to reduce flood risk.
Ceredigion	Snowdonia	Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level.
Ceredigion	Upper Dyfi and Upper Wnion	Policy Option 1 - Areas of little or no flood risk where NRW will continue to monitor and advise

13 https://webarchive.nationalarchives.gov.uk/ukgwa/20140328155217mp_/http://cdn.environment-agency.gov.uk/gewa0110brkf-e-e.pdf

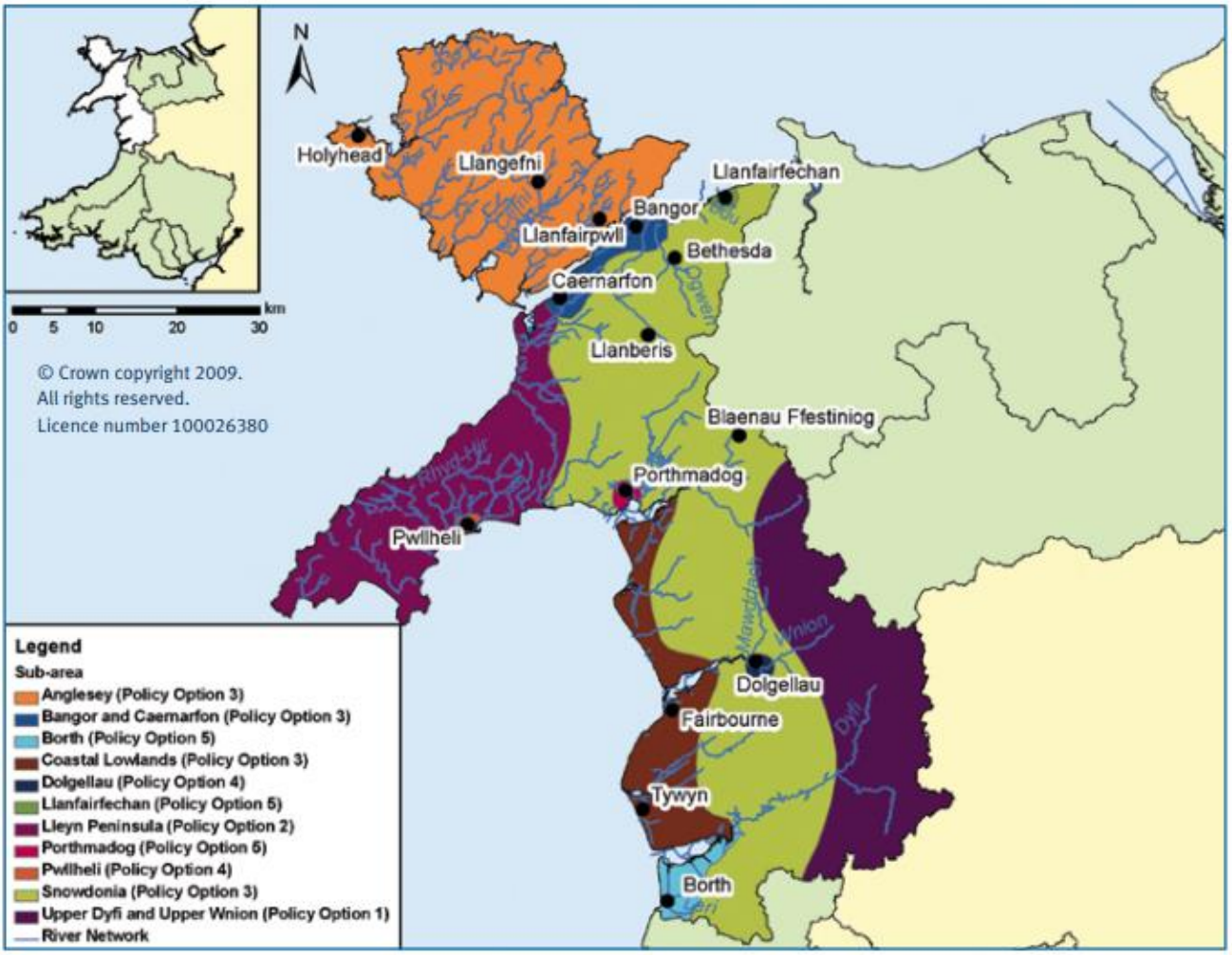

Figure 3-5 Extract of sub-areas from the North West Wales CFMP Page[13]

Pembrokeshire and Ceredigion Catchment Flood Management Plan

Flood risk management in the Pembrokeshire and Ceredigion catchment[14] is currently reliant on flood warning, development control and local defences at community level. Table 3-9 shows the different policy options for each sub-area in the catchment. Sub-areas have been derived from the sub-area plan from the CFMP, contained in Figure 3-6. Within the scope of this report, the authority covered by the Pembrokeshire and Ceredigion CFMP is Ceredigion as shown below.

Table 3-9 Pembrokeshire and Ceredigion policy options

Authority	Sub-area	Policy options
Ceredigion	Lower Teifi	Policy Option 4– Take further action to sustain the current level of flood risk into the future (responding to the potential increase in risk from urban development, land use change and climate change).
Ceredigion	Northern coastal rivers	Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level.
Ceredigion	Upper Teifi	Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level.

14 https://webarchive.nationalarchives.gov.uk/ukgwa/20140328155212mp_/http://cdn.environment-agency.gov.uk/gewa0110brkl-e-e.pdf

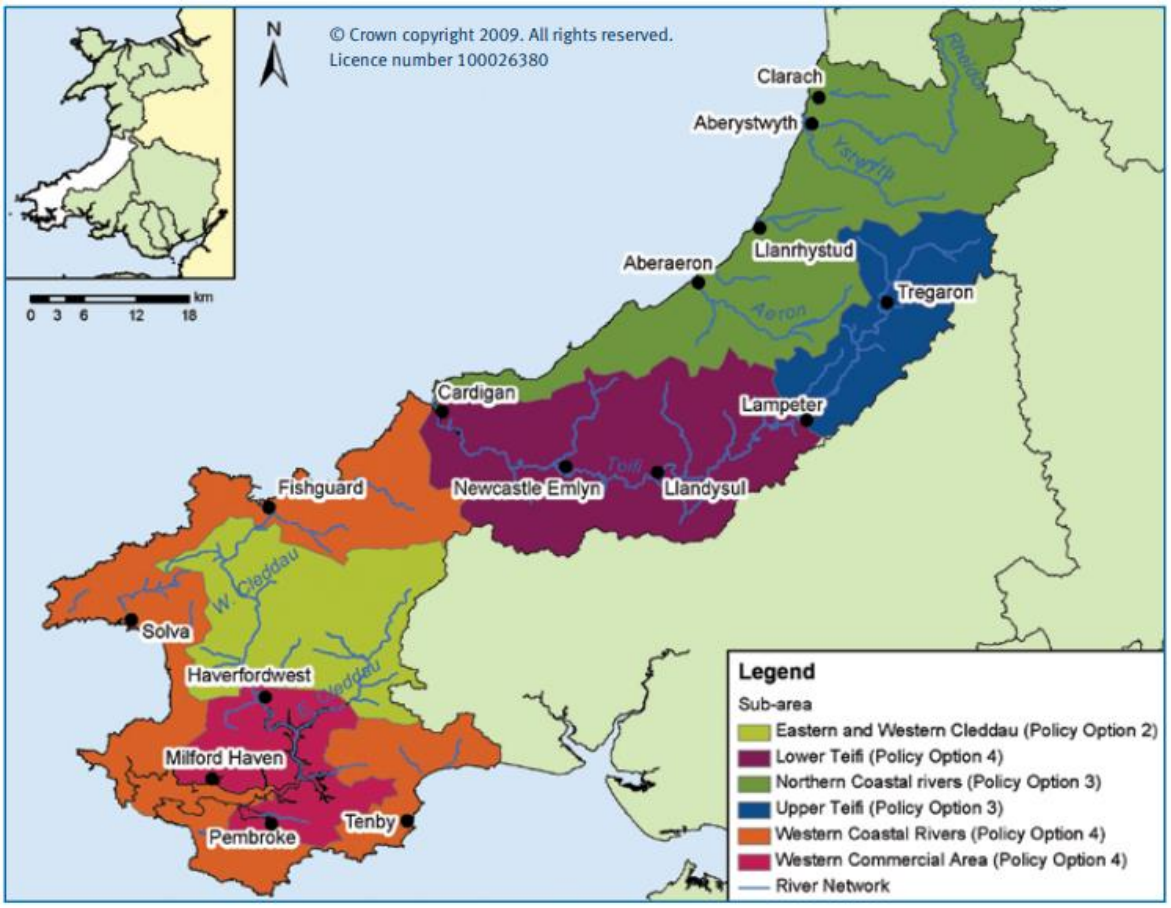

Figure 3-6 Extract of sub-areas from the Pembrokeshire and Ceredigion CFMP Page 12[14]

Ogmore and Tawe (including Thaw & Cadoxton) Catchment Flood Management Plan

The River Ogmore and Tawe (including Thaw & Cadoxton) Catchment Flood Management Plan is split in to 12 sub catchments. Only 2 sub catchments fall within the study area of this report. Table 3-10 and Figure 3-7 provide further information.

Table 3-10 Ogmore and Tawe policy options

Authority	Sub-area	Policy options
Powys	Upland Rivers	Policy Option 3 - Continue with existing or alternative actions to manage flood risk at the current level.
Powys	Tawe Valley	Policy Option 5 - Take further action to reduce flood risk.

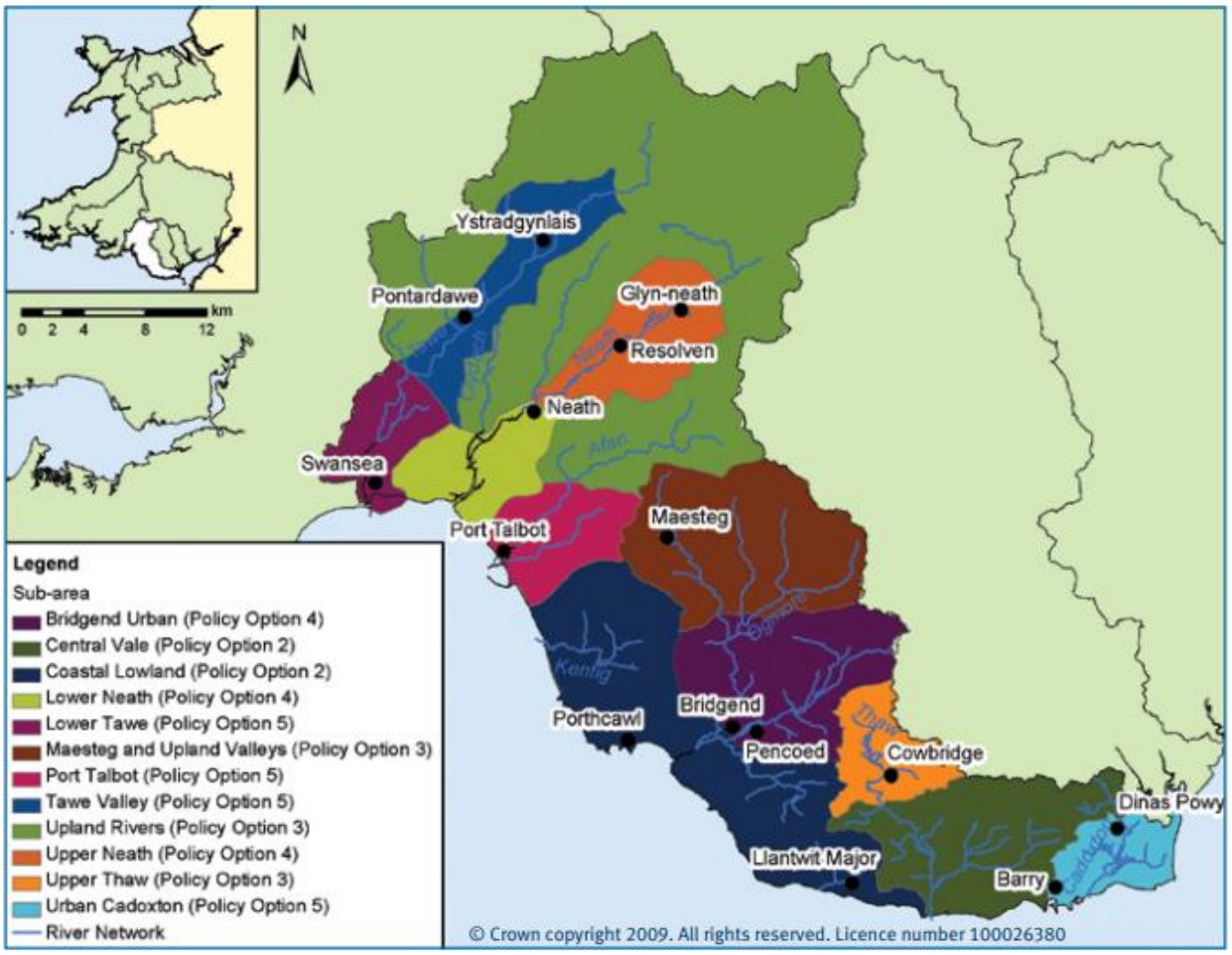

Figure 3-7 Extract of sub-areas from the Ogmore and Tawe (including Thaw & Cadoxton) CFMP Page 12[15]

3.5 River Basin Management Plans

It should be noted that River Basin Management Plans are currently in the process of being updated in Cycle 3 (2021-2027). As a result, the plans listed below may be outdated and the latest plans should be referred to once these are published. NRW 'Water Watch Wales' will include the latest information and mapping.

Western Wales River Basin Management Plan 2015-2021 – December 2015

The Western Wales River Basin Management Plan covers Ceredigion and the western vicinity of Powys, including the Brecon Beacons National Park. The plan focuses on the protection, improvement and sustainable use of the water environment in the river basin district for people and the environment. The report details the many actions needed be taken by NRW and the Welsh Government in order to manage issues such as pollution from towns, cities and wastewater, flooding and coastal erosions and invasive species.

Severn River Basin Management Plan

The Severn River Basin Management Plan covers the western vicinity of Powys, including Brecon Beacons National Park. The purpose of a river basin management plan is to provide a framework for protecting and enhancing the benefits provided by the water environment; it also informs decisions on land use planning. The plan contains 4 sets of key information:

[15] https://www.npt.gov.uk/ldpexamination/SWW04%20Ogmore%20to%20Tawe%20CFMP%20(EA%20Wales%202010).pdf

- establish the base line conditions of waterbodies;
- highlight areas of land and bodies of water that have specific uses that need special protection;
- sets out statutory objectives for waterbodies; and
- summary programme of measures to achieve statutory objectives.

River Dee Basin Management Plan 2015-2021– December 2015

The plan focuses on protecting and improving the water quality environment for people and wildlife. It includes the measures needed to achieve the objectives of the Water Framework Directive for the River Dee catchment. This river catchment crosses into the very northern tip of the Powys authority boundary.

3.6 Shoreline Management Plans

Shoreline Management Plans (SMP) provide a large-scale assessment of the risks associated with coastal processes and present a long-term policy framework to reduce these risks to people and the developed, historical and natural environment in a sustainable manner. SMPs are 'coastal' companion documents to the 'inland' CFMP's. SMPs are non-statutory plans and are produced by Coastal Groups made up of maritime local authorities and other bodies with coastal defence responsibilities or interests.

Local Planning Authorities should give particular regard to the locations where the SMP policies are for No Active Intervention / Managed Realignment. It would generally be inappropriate to see an intensification in development within areas that policy advises may be lost to coastal erosion or intentionally allowed to flood in the future.

St Ann's Head to Great Orme's Head Shoreline Management Plan 21

St Ann's Head to Great Orme's Head SMP provides a large-scale assessment of the risks associated with coastal erosion and flooding at the coast. It also included policies to help manage these risks to people in a sustainable manner. The plan splits the coastline from St Dogmaels and Castle Farm in North Wales to St Ann's Head in the south in to 309 policy units. The units relevant to Ceredigion are shown in Table 3-11.

Table 3-11 Policy units for St Ann's Head to Great Orme's Head SMP21 - Ceredigion

Policy Units	Policy Unit Name	Actions
5.6	Bryn-y-mor	No Active Intervention
5.7	Coronation Drive	Hold the Line until 2105 and Managed Realignment from there
5.3	Poppit Dunes and Pen-yr-Ergyd	Managed Realignment
5.8	Gwbert Road	Managed Realignment
PU5.9	Gwbert Cliffs	No Active Intervention
PU5.10	St Dogmaels and Castle Farm	No Active Intervention
PU5.11	Cardigan North	Hold the Line
PU5.12	Cardigan South	Hold the Line
PU5.13	Upstream of bridge north	Managed Realignment
PU5.14	Upstream of bridge north	Managed Realignment
PU5.15	Mwnt and Aberporth Cliffs	No Active Intervention
PU6.1	Aberporth Cliffs	No Active Intervention
PU6.2	Aberporth	Hold the Line

Policy Units	Policy Unit Name	Actions
PU6.3	Aberporth to Ynys –Lochtyn, cliffs	No Active Intervention
PU6.4	Tresaith	Hold the Line up to 2055 and Managed Realignment from there
PU6.5	Penbryn	No Active Intervention
PU6.6	Llangrannog	Hold the Line up to 2105 and Managed Realignment from there
PU6.7	Ynys-Lochtyn to New Quay Head	No Active Intervention
PU6.8	Cwmtydu	Hold the Line
PU7.1	New Quay Head to Traeth Dolau	Managed Realignment until 2105 and No Active Intervention onwards
PU7.2	Traeth y Dolau, New Quay Harbour to Penpolion.	Hold the Line
PU7.3	New Quay Bay	Managed Realignment
PU7.4	Llanina Point	Managed Realignment
PU7.5	Cei Bach	Hold the Line until 2105 and Managed Realignment from there
PU7.6	Carreg Ddu	No Active Intervention
PU8.1	Gilfach yr Halen to Pen y Gloyn	No Active Intervention
PU8.2	Aberaeron South Beach	Hold the Line until 2105 and Managed Realignment from there
PU8.3	Aberaeron Harbour	Hold the Line
PU8.4	Aberaeron North Beach	Hold the Line
PU8.5	Aberaeron to Aberarth	No Active Intervention
PU8.6	Aberarth	Hold the Line until 2055 and after that Managed Realignment
PU8.7	North Aberarth to Morfa Mawr	No Active Intervention
PU8.8	Llanon and Llansantffraed	Managed Realignment
PU8.9	Llanrhystud Bay	Managed Realignment
PU8.10	Llanrhystud bay to Carreg Ti Pw	No Active Intervention
PU9.1	Carreg Ti Pw to Allt Wen	No Active Intervention
PU9.2	Tan y Bwlch	Managed Realignment until 2105 and No Active Intervention from there
PU9.3	Aberystwyth Harbour	Hold the Line
PU9.4	Glanrafon Terrace	Hold the Line until 2105 after that No Active Intervention
PU9.5	Rheidol Valley south	Managed Realignment
PU9.6	Rheidol Valley north	Hold the Line
PU9.7	South Marine Terrace	Hold the Line
PU9.8	Castle Hill	Hold the Line
PU9.9	Marine Terrace and Victoria Terrace	Hold the Line until 2105, after this Hold the Line/ Advance the Line
PU9.10	Constitution Hill to Clarach	No Active Intervention
PU9.11	Clarach Bay	Managed Realignment
PU9.12	Glan y Mor Cliffs	No Active Intervention
PU9.13	Wallog	No Active Intervention

Policy Units	Policy Unit Name	Actions
PU10.1	Upper Borth	Managed Realignment
PU10.2	Borth Village	Hold the Line until 2105 after that Managed Realignment
PU10.3	Borth Golf Course	Hold the Line until 2055 after that Managed Realignment
PU10.4	Ynyslas	Managed Realignment until 2055 and No Active Intervention from there
PU10.5	Afon Leri	Hold the Line until 2105 after that Managed Realignment
PU10.6	Cors Fochno	Hold the Line until 2105 after that Managed Realignment
PU10.7	Dyfi Junction	Hold the Line until 2105 after that Managed Realignment
PU10.8	Morben Hall	Hold the Line
PU10.9	Machynlleth	Hold the Line until 2105 after that Managed Realignment

3.7 The Second State of Natural Resources Report (SoNaRR2020)

The second State of Natural Resources Report (SoNaRR2020)[16] has been complied by NRW to illustrate some of the key challenges, priorities and opportunities for the sustainable management of natural resources in Wales. This report can then be used to compare where Wales is now with where Wales needs to be. Of particular interest in this report is Aim 3 'Wales has healthy places for people, protected from environmental risks'. Under this aim the report highlights that 245,000 properties in Wales are at risk of flooding. The report highlights that there are opportunities for action to address the flooding issue by use of natural interventions, catchment wide approaches, maintaining sustainable flood defences and improving awareness and understanding of flood risk, to name a few.

3.8 Mid Wales area statement

The Mid Wales Area statement was published by NRW in March 2020 and is an ongoing project. The statement has been designed to 'act as a tool to help coordinate the key issues our natural environment faces, seek further opportunities and work collaboratively with partners and the public to better enhance our natural resources within the area.' The statement recognises that flooding from coastal, fluvial and surface water continues to threaten communities in Wales and this will only worsen with climate change. Already the number of flood events being witnessed across Mid Wales has increased with areas along the Ceredigion coast particularly at threat from rising sea levels. The statement highlights how Natural Flood Risk Management (NFRM) is one way to help address flood risk in Mid Wales.

3.9 Local Policy

All 3 local authorities were asked to confirm the latest versions of documents available for local policy. Due to disruption from COVID-19 some of the planned updates to these documents have not been carried out as yet; therefore, some of the information highlighted below may be out of date. Every endeavour has been made to find as accurate information as possible or highlight where information is likely to be out of date.

The following documents were available across the study area:

- Local Development Plan*
- Local Flood Risk Management Strategy
- Flood Risk Management Plan
- Strategic Flood Consequences Assessments
- Preliminary Flood Risk Assessment

[16] https://cdn.cyfoethnaturiol.cymru/media/693612/165960736_8330461_1785381.pdf

*The only document that applies to Brecon Beacons National Park Authority

The dates of these documents for each authority have been summarised in Table 3-12 below. Where possible links to each document are also provided.

The LDP policies related to flooding, coastal erosion, and climate change have been summarised in Table 3-13 for each authority.

Table 3-12 Authority Document Review

Authority	Adopted LDP	Local Flood Risk Management Strategy	Flood Risk Management Plan	Strategic Flood Consequences Assessments	Preliminary Flood Risk Assessment
Powys	2011-2026	2013-2017	N/A	2012	2011 2017 (Addendum only)
Ceredigion	2007-2022	2014	2017-2023	2009/2010	2011
Brecon Beacons National Park	2007-2022	N/A	N/A	N/A	2011 2017 (Addendum only)

Table 3-13 LDP policies

Authority	Adopted LDP	Adopted LDP Policies
Powys	2011 -2026	**LDP Objective 4 – Climate Change and Flooding** To support the transition to a low carbon and low waste Powys through all development, including the reduction of waste to landfill and by directing development away from high flood risk areas and, where possible, to reduce or better manage existing flood risk for communities, infrastructure, and businesses. **Policy DM5 – Development and Flood Risk** Development proposals must be located away from tidal or fluvial flood plains unless it can be demonstrated that the site is justified in line with national guidance and an appropriate detailed technical assessment has been undertaken to ensure the development is designed to reduce/avoid the threat and alleviate the consequences of flooding over its lifetime. **Policy DM6 – Flood Prevention Measures and Land Drainage** Development proposals must avoid unnecessary flood risk by assessing the implications of development within areas susceptible to all types of flooding.
Ceredigion		**Objective 9 (Environment and Climate Change)** To ensure development minimises Ceredigion's greenhouse gas contribution … to ensure that all developments are adaptive and resilience to the changing nature of the climate and work towards reducing the risk from flooding. **Objective 13:**

Authority	Adopted LDP	Adopted LDP Policies
		To encourage a sustainable approach to development in coastal locations while protecting the integrity of the area's natural and physical heritage. **Policy DM11: Designing for Climate Change** The LDP will help ensure that development addresses the implications of climate change by requiring that: 1. Justified development in the flood zone is resilient and adaptable to the effects of flooding; and 2. The long term sustainability of the development has been taken into account **Policy DM13: Sustainable Drainage Systems** Aims to improve upon the current requirement for SuDS. Aims to secure that the SuDS proposed is able to be grown as the development grows. **Policy DM23: Coastal Management** This policy helps to deliver Objective 9, by seeking to address and manage the effects of coastal flooding proactively. It also helps deliver Objective 13, by managing the changing coastline in a way as sustainable as possible, recognising the natural processes that occur.
Brecon Beacons National Park Authority	2007-2022	**Policy SP4: Climate Change** All developments must be resilient and adaptable to climate change, limit and mitigate the causes of climate change and contribute to the aim of carbon neutrality. **Objective 3.16.3 Location of Development Avoiding Areas Subject to Flooding** Proposals must be able to demonstrate any future flood risk and consequences have been managed in line with requirements of TAN-15. **Policy 58: Sustainable Drainage Systems (SUDS)** All proposals for new development will be required to consider the incorporation of appropriate Sustainable Drainage Systems. Where relevant it must be demonstrated that the SUDS proposed within the development and procedures for adoption and maintenance have been approved by the relevant drainage body.

4 Understanding of flood risk

4.1 Likelihood and Consequence

Flood risk is a combination of the likelihood of flooding and the potential consequences. It is assessed using the source – pathway – receptor model, as shown in Figure 4-1. This is a standard environmental risk model common to many hazards and should be the starting point of any flood consequences assessment. However, it should be noted that flooding could occur from many different sources and pathways, and not simply those shown in the illustration below.

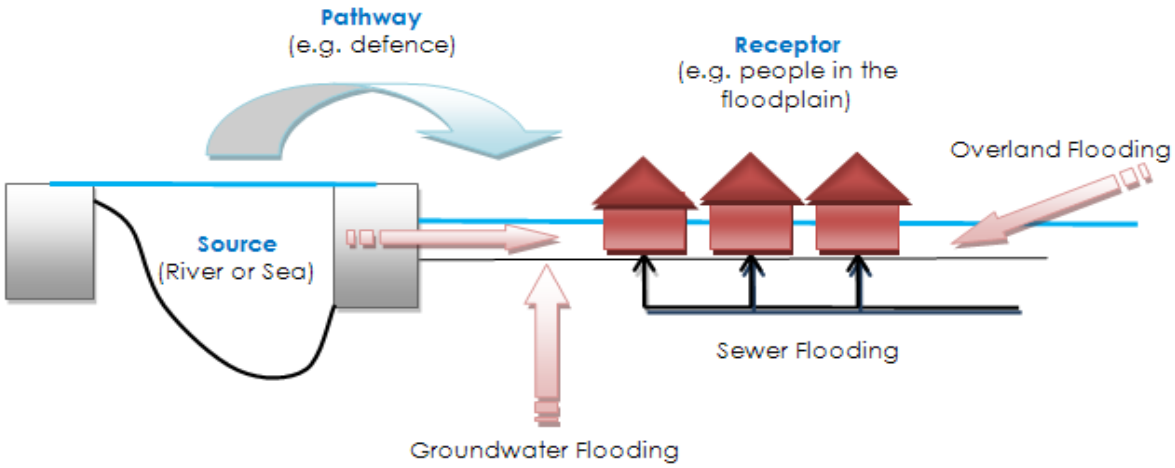

Figure 4-1 Source - Pathway - Receptor model

The principal sources are rainfall or higher than normal sea levels, the most common pathways are rivers, drains, sewers, overland flow, and river and coastal floodplains and their defence assets; the receptors can include: people, their property, and the environment. All three elements must be present for flood risk to arise. Mitigation measures have little or no effect on sources of flooding, but they can block or impede pathways or remove receptors.

The planning process is primarily concerned with the location of receptors, taking appropriate account of potential sources and pathways that might put those receptors at risk. It is therefore important to define the components of flood risk in order to apply this guidance in a consistent manner.

4.1.1 Likelihood

Likelihood of flooding is expressed as the percentage probability based on the average frequency measured or extrapolated from records over a large number of years. A 1% probability indicates the flood level that is expected to be reached on average once in one-hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every one-hundred years. Low probability events can occur on subsequent days and in quick succession, for example with Storm Ciara, Dennis, and Jorge in 2020. This can also lead to antecedent conditions (such as saturated soils) that can exacerbate the impacts of flooding.

4.1.2 Consequence

The consequences of flooding can result in fatalities, damage to property, disruption to lives and businesses, with severe implications for people (e.g. financial loss, emotional distress, health problems). Consequences of flooding depend on the hazards caused by flooding (depth of water, speed of flow, rate of onset, duration, wave-action effects, water quality) and the vulnerability of receptors (type of development, nature, e.g. age-structure, of the population, presence and reliability of mitigation measures, etc).

4.1.3 Risk

Flood risk is expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

Flood risk is not static; it cannot be described simply as a fixed water level that will occur if a river overtops its banks or from a high spring tide that coincides with a storm surge. It is therefore important to consider the continuum of risk carefully. Risk varies depending on the severity of the event, the source of the water, the pathways of flooding (such as the condition of the flood defences) and the vulnerability of receptors as mentioned above.

4.1.4 Actual Risk

This is the risk 'as is', taking into account any flood defences that are in place for extreme flood events (typically these provide a minimum Standard of Protection (SoP)). Hence, if a settlement lies behind a fluvial flood defence that provides a 1 in 100-year SoP then the actual risk of flooding from the river in a 1 in 100-year event is generally low.

Actual risk describes the primary, or prime, risk from a known and understood source managed to a known SoP. However, it is important to recognise that risk comes from many different sources and that the SoP provided will vary within a river catchment. Hence, the actual risk of flooding from the river may be low to a settlement behind the defence but moderate from surface water, which may pond behind the defence in low spots and is unable to discharge into the river during high water levels.

4.1.5 Residual Risk

The existence of robust flood defences does not mean development should be allowed without further consideration of flood risks. Flood defences reduce the risk of flooding but do not eliminate it. The consequences of flooding can be particularly severe in the event of defences being overtopped or breached, resulting in rapid and hazardous flooding. Furthermore, hydraulic structures such as bridge and culverts can block, and pumps, sluices and flaps can fail to operate.

Although not a term used in TAN15, amongst flood risk professionals the term 'residual risk' is often used to describe the risks associated with asset or system failure.

Whilst the actual risk of flooding to a settlement that lies behind a fluvial flood defence that provides a 1 in 100-year SoP may be low, there will be a residual risk from flooding if these defences overtopped or fail that must be taken into account. Because of this it is never appropriate to use the term 'flood free'.

Where appropriate, a Flood Consequences Assessment should demonstrate that in the event of overtopping, breach or blockage the consequences of flooding can be managed to an acceptable level. This will be needed for sites that benefit from the type of defences that can be breached or blocked, including flood embankments, sea walls and culverts. NRW and/or the LLFA should be consulted at an early stage to discuss the requirement for residual risk assessment, technical assumptions and the application to the acceptability criteria.

4.2 Sources of Flooding

4.2.1 Fluvial Flood Risk

Flooding from rivers occurs when water levels rise higher than bank levels, causing flood water to spill across adjacent land (floodplain). The main reasons that water levels can rise in rivers are:

- Intense of prolonged rainfall causing runoff rates and flow to increase in rivers, exceeding the capacity of the channel. This can be exacerbated by wet antecedent conditions and elevated groundwater tables.
- Constrictions in the river channel causing flood water to backup.
- Blockage of structures or the river channel causing flood water to backup.
- High water levels and/or locked flood (tide) gates preventing discharge at the outlet of the river.

The consequence of river flooding depends on how hazardous the flood waters are and what the receptor of flooding is. The hazard of river flood water is related to the depth and velocity which depends on the:

- Magnitude of flood flows
- Size, shape, and slope of the river channel
- Types of structures that cross the channel

Flood hazard can vary greatly throughout catchments and even across floodplain areas. The most hazardous flows generally occur in steep catchments, and towards the bottom of large catchments. Hazardous river flows can pose a significant risk to exposed people, property, and infrastructure.

Whilst low hazard flows are of less of a risk to life, they can disrupt communities, require significant post-flood clean up, and can cause superficial and possibly structural damage to property.

4.2.2 Tidal Flood Risk

Flooding from the sea occurs when water levels in the sea rise above ground levels of coastal land. This can occur during normal high tides, when there are extreme atmospheric effects, and when wind action causes water levels of the sea to rise. Tidal flooding can be particularly severe, with rapid inundation, the possibility of multiple overtopping events and the increased damage caused by saltwater. These effects can be even more severe if a breach of sea defence occurs.

The risks posed by wave action during storm events, including the risks of overtopping of defences should be considered when assessing tidal flood risk. Consideration should also be made to joint probability flooding events, such as when high tide levels may occur at the same time as large fluvial flows and can be an important consideration in many locations.

4.2.3 Surface Water Flood Risk

Surface water flooding occurs when intense, often short duration rainfall is unable to soak into the ground or enter drainage systems and can be exacerbated when soils are saturated. The excess water then ponds in low points, overflows or concentrates in minor drainage lines that are usually dry. This type of flooding is usually short lived and associated with heavy downpours of rain. Often there is limited warning before this type of localised flooding occurs.

Drainage basins or catchments vary in size and shape, which has a direct effect on the amount of surface runoff. The amount of runoff is also a function of geology, slope, climate, rainfall, saturation, soil type, and vegetation. Geological considerations include rock and soil types and characteristics, as well as degree of weathering. Porous material (sand, gravel, and soluble rock) absorbs water more readily than fine-grained, dense clay or unfractured rock and has a lower runoff potential. Poorly drained material has a higher runoff potential and is more likely to cause flooding.

Water flowing over the ground surface that has not entered a natural channel or artificial drainage system is classified as surface water runoff or overland flow.

Flooding from land can occur in rural and urban areas, but usually causes more damage in the latter. Urban areas can be inundated by flow from adjacent farmlands. Flood pathways include the land and water features over which flood water flows. These pathways include minor drainage lines, roads, and even flood management infrastructure.

Developments that include significant impermeable surfaces, such as roads and car parks may increase the occurrence of surface water runoff.

Surface water flooding can affect all forms of the built environment, including property, infrastructure, agriculture, and the natural environment. It is usually short lived and will tend to last as long as the rainfall event. However, flooding may persist in low-lying areas where ponding occurs.

Flooding may occur as sheet flow or as rills and gullies causing increased erosion of agricultural land. This can result in 'muddy floods' where soil and other material are washed onto roads and properties, requiring extensive clean-up. Both rural and urban land use changes are likely to alter

the amount of surface water in the future. Future development is also likely to change the position and numbers of people and/or developments exposed to flooding.

4.2.4 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. Groundwater flooding can happen at point or diffuse locations, and it tends to be long in duration, developing over weeks or months and prevailing for days or weeks.

High groundwater levels can result from the combination of geological, hydrogeological, topographic, and recharge phenomena. Of the groundwater flooding mechanisms experienced in the SFCA area, rising groundwater levels in major aquifers as a result of long duration rainfall present the greatest and most extensive level of risk. The most common causes of groundwater flooding are:

- Rising groundwater levels in response to prolonged extreme rainfall
- Rising groundwater levels due to leaking sewers, drains, and water supply mains
- Increased groundwater levels due to artificial obstructions
- Groundwater rebound owing to rising water table and failed or ceased pumping
- Upward leakage of groundwater driven by artisan head
- Inundation of trenches intercepting high groundwater levels
- Other: alluvial aquifers, sea level rise, etc

The main impacts of groundwater flooding are:

- Flooding of basements of buildings below ground level – in the mildest case this may involve seepage of small volumes through walls, temporary loss of services, etc. In more extreme cases larger volumes may lead to the catastrophic loss of stored items and failure of structural integrity.
- Overflowing of sewers and drains and surcharging of drainage networks leading to overland flows causing significant but localised damage to property.
- Flooding of buried services or other assets below ground level, or prolonged inundation of buried services, leading to interruption and disruption of supply.

4.2.5 Sewer Flooding

Flooding from sewers occurs when rainfall exceeds the capacity of networks or when there is infrastructure failure. This includes combined and surface water sewers, sewer pumping stations and water treatment facilities.

The main causes of sewer flooding are:

- Lack of capacity in sewer drainage networks due to original under-design or an increase in demand (for example, due to climate change or new developments)
- Lack of capacity in sewer drainage network due to events larger than the system design event
- Lack of maintenance of sewer networks which lead to a reduction in capacity and can sometime lead to sewer blockage
- Water mains bursting/leaking due to a lack of maintenance or as a result of damage
- Groundwater infiltration into poorly maintained or damaged pipe networks
- Restricted outflow from the sewer systems due to high water levels in receiving watercourses or the sea

The impact of sewer flooding is usually confined to relatively small, localised areas. However, flooding associated with blockage or failure of the sewer network can be rapid and unpredictable.

Drainage systems often rely on gravity assisted dendritic systems which convey water in trunk sewers located at the lower end of the catchment. Failure of these trunk sewers can have serious consequences as water from surcharged manholes will flow into low-lying land that may already be suffering from other sources of flooding.

Consequences for affected properties and individuals can be particularly severe for those affected by sewer flooding. Sewer flooding is likely to have a high concentration of solid, soluble and insoluble contaminants. These contaminants can have serious health impacts on residents of flooded properties and are typically significantly more destructive to personal possessions. Flooding of sewers can also lead to contaminated water entering nearby watercourses, having an adverse effect on the biota in receiving environments.

4.2.6 Flooding from Artificial Sources

For the purpose of the SFCA, flooding from artificial sources have been defined as flooding from non-natural or artificial sources of flooding such as reservoirs, canals, and lakes where water is retained above natural ground level.

The spatial and temporal extent of flooding from artificial sources can be highly variable. For example, the likelihood of a new reservoir failing is very small compared to that of a canal embankment that is over one hundred years old. However, whilst the probability is low, the consequences of a reservoir failing could be catastrophic.

Reservoirs are artificially created ponds or lakes that are formed by building a dam across a watercourse. If a dam fails, then water can escape from the reservoir resulting in land or properties being flooded. In order to ensure that reservoirs are properly maintained and to minimise the possibility of reservoir failure, large reservoirs in Wales (those storing more than 10,000 cubic metres of water) are regulated under the Reservoirs Act 1975, where amended by the Flood and Water Management Act 2010. This legislation, which is enforced by Natural Resources Wales, requires reservoirs to be routinely inspected and maintained to an appropriate standard.

Provided that a reservoir is properly maintained, the likelihood of it failing and causing flooding is extremely low. However, in the very unlikely event of a dam collapse, a large volume of water could be released, quickly flooding a large area and possibly causing significant property damage.

4.2.7 Impact of Climate Change

Coastal development is limited by risks including flooding, erosion and land instability, with over 400 homes at risk due to coastal erosion in Wales. TAN-15 states that development should be avoided where coastal erosion presents a risk over the lifetime of development. Additionally, local planning policies for coastal areas should reflect Planning Policy Wales, Future Wales – The National Plan 2040, the Welsh National Marine Plan, the National Strategy for FCERM, Shoreline Management Plans and other relevant strategies. Where coastal erosion does present a risk, Risk Management Authorities must be consulted to provide advice.

Climate change is causing more frequent and more severe flooding to occur in Wales. The Climate Change Committee provides independent advice to the Welsh Government on setting and meeting carbon budgets and preparing for climate change. It has stated that it expects the climate in Wales to become warmer and wetter, with significant increases in the sea level around the coast and the frequency and intensity of storm events. This will increase the risk of flooding and it is also reasonable to expect the incidence and seriousness of flood events to increase.

Table 4-1 below shows how Climate Change has been assessed for each source of flooding within the SFCA. Even if an area is not currently at flood risk, the impact of climate change on the extent of flooding should be considered.

Table 4-1 Assessment of Climate Change for all sources of flooding

Source	Data Source	Climate Change Allowance
Rivers	NRW FMfP for Rivers	The FMfP displays predicted future flood risk under the central climate change estimate. Detailed FCAs will be required to consider a range of climate change scenarios, including upper end estimates, making reference to the Welsh Government guidance on climate change allowances for planning purposes.
Sea	NRW FMfP for the Sea	The FMfP displays predicted future flood risk under the central climate change estimate. Detailed FCAs will be required to consider a range of climate change scenarios, including upper end estimates, making reference to the Welsh Government guidance on climate change allowances for planning purposes.
Surface Water and Small Watercourses	NRW FMfP for Surface Water and Small Watercourses	The FMfP displays predicted future flood risk under the central climate change estimate. Detailed FCAs be required to consider a range of climate change scenarios, including upper end estimates, making reference to the Welsh Government guidance on climate change allowances for planning purposes.
Groundwater	No data sets available.	The impacts of climate change on groundwater flooding problems, and those watercourses where groundwater has a large influence on winter flood flows, is much more uncertain. Milder wetter winters may increase the frequency of groundwater flooding incidents in areas that are already susceptible, but warmer drier summers may counteract this effect by drawing down groundwater levels to a greater extent during the summer months. The effect of climate change on groundwater levels for sites in areas where groundwater is known to be an issue should be considered at the planning application stage.
Sewers	No data sets available.	Climate change is likely to result in an increase in sewer flooding incidences as a result of its interaction with other flood risk sources (including surface water and groundwater) where flooding from this source is increased as a result of climate change. Where sewer flooding is known to be an issue should be considered at the planning application stage.
Reservoirs	No data sets available.	Some reservoir functions (i.e. the use that the reservoir is put to) may be relatively vulnerable to climate change, particularly where they rely on existing yields, flood flows or water quality of source waters. However, there are a number of systems that are already in place (e.g. the Water Resources Management Plan) that contain methods for identifying impacts and adapting to climate change as part of the normal ownership and operation process.

Source	Data Source	Climate Change Allowance
		In most cases, the form of the dam is resilient to the effects of climate change if the reservoir structure is well engineered with an appropriate factor of safety.

4.3 Roles and responsibilities for managing flood risk

Flood and Coastal Erosion Risk Management in Wales involves a number of organisations. The roles and responsibilities of these organisations is outlined in The National Strategy for Flood and Coastal Erosion Risk Management in Wales[17]. There are 28 Risk Management Authorities (RMAs). These RMAs are:

- NRW (Including Internal Drainage District [IDD])
- The 22 Local Authorities as Lead Local Flood Authorities (LLFA) and Highway Authorities
- Two water companies
- The Welsh Government (as highway authority for trunk roads)

The basic responsibilities of key stakeholders in Wales are set out below in Figure 4-2, taken from the National Strategy.

Figure 4-2 Overview of Roles and Responsibilities (taken from the National Strategy for Flood and Coastal Erosion Risk Management

RMAs all have a duty to help deliver the objectives of the National Strategy as well as powers and responsibilities in terms of the risks they manage. There are also places where these roles and

[17] Welsh Government (2020) The National Strategy for Flood and Coastal Erosion Risk Management in Wales. Taken from: https://gov.wales/sites/default/files/publications/2021-03/the-national-strategy-for-flood-and-coastal-erosion-risk-management-in-wales.pdf

responsibilities interact or are shared. The specific roles and responsibilities for each organisation are outlined in the National Strategy.

There are two IDDs (under the governance of NRW), across the Mid Wales area which manage water levels for ordinary watercourses, drainage channels, pumping stations and control structures. The IDDs are operated in accordance with the Land Drainage Act (1991). The two IDD's in Mid Wales are Powysland IDD and Borth Bog IDD.

4.4 Sources of information used in preparing the Strategic Flood Consequences Assessment

4.4.1 Historical flooding

The historical flood risk across the study area has been assessed using information of recorded incidents provided by the stakeholders of the SFCA, including flood reports from LLFA and DCWW, and NRW's 'Recorded Flood Extents' dataset. This has been supplemented with other information from the existing SFCAs, PFRAs, LFRMPs and Flood Investigation reports which have either been provided by the stakeholders or are publicly available.

4.4.2 Natural Resources Wales – Flood Map for Planning

The NRW FMfP Flood Zones have been consulted for this SFCA and are described in Section 3.3.1. The FMfP Flood Zones 2 and 3 show the potential extent of flooding, assuming no defences are in place. The TAN-15 Defended Zones show areas that benefit from RMA flood defences with a minimum standard of protection of 1 in 100 years (present day) for rivers, and 1 in 200 year (present day) for the sea.

4.4.3 Flood Defences

The NRW FMfP Flood Defences GIS dataset has been consulted for this SFCA. The data set identifies flood defences that have been built to protect against flooding from rivers and the sea. The defences dataset provides information on standard of protection and condition of the asset. Engineered defences usually have a standard of protection, which is the return period of a flood event against which the defence should be effective.

4.4.4 Groundwater

JBA has developed a range of Groundwater Flood Map products at the national scale. The 5m resolution JBA Groundwater Map has been used within the SFCA. The modelling involves simulating groundwater levels for a range of return periods (including 75, 100, and 200-years). Groundwater levels are then compared to ground surface levels to determine the head difference in meters. The JBA Groundwater Map categorises the head difference (m) into five feature classes based on the 100-year model outputs. These are outlined in Table 4-2.

Table 4-2 JBA Groundwater flood risk map categories

Flood depth range during a 1% AEP flood event	Groundwater flood risk
Groundwater levels are either at or very near (within 0.025m of) the ground surface.	Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
Groundwater levels are between 0.025m and 0.5m below the ground surface.	There is the possibility of groundwater emerging at the surface locally.
Groundwater levels are between 0.5m and 5m below the ground surface.	Groundwater may emerge into subsurface assets but surface manifestation of groundwater is unlikely.
Groundwater levels are at least 5m below the ground surface.	Flooding from groundwater is not likely.

It is important to note that the modelled groundwater levels are not predictions of typical groundwater levels. Rather they are flood levels i.e. groundwater levels that might be expected after a winter recharge season with 1% AEP, and so would represent an extreme scenario. The

maps also assess the risk of groundwater emergence and not of resulting groundwater flooding. For groundwater flooding to occur it is often necessary for groundwater to have nowhere to go without ponding and flooding an area first.

It should be noted that as the JBA Groundwater Flood Map is based on national modelling it should only be used for general broad-scale assessment of the groundwater flood hazard in an area and it is not explicitly designed for the assessment of flood hazard at the scale of a single property. In high-risk areas a site-specific risk assessment for groundwater flooding is recommended to fully inform the likelihood of flooding, this may include review of historical flood records, historical borehole logs, consultation with the LLFA and groundwater monitoring.

A high-risk groundwater zone does not automatically preclude the use of infiltration techniques for Sustainable Drainage Solutions (SuDS), although they are less likely to be suitable. A site-specific assessment of the potential for infiltration techniques shall always be required by the SAB.

4.4.5 Sewers

Historical records of sewer flooding have been taken from historical flooding records provided by DCWW and Hafren Dyfrdwy Severn Trent and considered on a broad spatial scale.

4.4.6 Reservoirs

The risk of inundation due to a reservoir breach or failure of reservoirs within the areas has been assessed using the NRW's 'Flood Risk from Reservoirs dataset'. The shading on the map shows the worst-case scenario for the area that could be flooding if a large reservoir were to fail and release the water it holds.

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in Wales, NRW ensure that reservoirs are inspected regularly, and essential safety work is undertaken.

The reservoir flood maps do not indicate the likelihood of a flood occurring.

4.4.7 Working With Natural Processes

Nature based solutions should be considered as a way of managing flood risk where possible. More information and mapping to help identify potential areas for working with natural processes to reduce fluvial flood risk have been developed as part of the research project 'Working with Natural Processes – the evidence base'. More information can be found in the mapping appendices and Section 10. The Welsh Information for Nature-based solutions[18] website offers more detailed information on Natural Flood Management and its suitability for areas within Wales.

18 https://storymaps.arcgis.com/collections/036c04ccb85948d2abe7312de75ad318?item=1

5 Flood & Coastal Erosion Risk Review

Under Section 7.4 of TAN-15, the risk of flooding from all sources must be considered as part of an SFCA, including flooding from the sea, rivers, land, groundwater, sewers, artificial sources and coastal erosion. Using the datasets identified in Section 4, this Section provides a strategic assessment of the flood risk across the study area from each source. For each source of flooding, where appropriate, the impact of climate change on the source of flooding is described.

A high-level review of flood risk has been undertaken for each of the 3 local authorities in Mid Wales, these reviews can be found in the appendices and assess the risk of flooding from all sources for each area. These should be used in combination with the broad scale and individual area mapping for each authority. These appendices and the predominant flood risk for each Local Planning Authority are summarised in Table 5-1.

Table 5-1 Summary of flood risk information

Local Planning Authority	Appendix	Predominant flood risks
Brecon Beacons National Park	A	Fluvial flood risk
Ceredigion	B	Fluvial and tidal flood risk
Powys	C	Fluvial flood risk

6 Further Technical Advice Note-15 Guidance

6.1 Introduction

On the direction of the Minister for Climate Change, provided in guidance accompanying the decision notice to delay its implementation, this SFCA has been prepared in accordance with the updated TAN-15 due to be implemented from June 2023. Further clarifications and advice have subsequently been issued by Welsh Government and NRW. The following chapter seeks to capture the latest advice and understanding of the new TAN-15. Additionally, guidance is provided on how LPAs within the region intend to interpret and apply the new TAN-15.

The guidance and recommendations within this chapter is based on the following:

- Ministerial letter; 23rd November 2021. Announcement of the suspension of the new TAN-15 to 1st June 2023.
- Chief Planner letter; 15th December 2021. Advice to LPAs on the suspension of TAN-15, key implications and actions for LPAs.
- Various consultations with WG and NRW during the preparation of the SFCA.

6.2 Flood Map Challenge

The FMfP is routinely updated by NRW with best available information on flood risks from the sea and rivers. These updates are published every six months. While many updates are undertaken by NRW's modelling and mapping teams, there is an established process for other parties to submit their own flood risk modelling data where it provides a more accurate assessment of flood risk. This is referred to as the Flood Map Challenge (FMC) process.

NRW publish through their website comprehensive guidance on the FMC process[19]. This guidance includes detailed specifications for the FMfP Zones, hydraulic modelling standards and supporting documentation requirements. Nevertheless, it is advised that NRW are consulted before embarking on a FMC and it is likely that expert technical advice will be required to undertake most FMCs.

Currently there is no agreed process for challenging the flood map for small watercourses and surface water.

Where a FMC has been accepted by NRW, but not yet published online, NRW will respond to statutory planning consultations advising the LPA on the risks and consequences of flooding based on the best available information which would be the modelling from the FMC. This would include confirming what flood zone the site will be shown in from the next update. As such the LPA may give material weight to accepted FMCs when applying the justification tests of TAN-15.

6.3 Use of Defended Zones and Flood Defences

6.3.1 Definition of Defended Zones[20]

TAN-15 defended zones show areas of land that benefit from formal flood defences that are owned and maintained by Risk Management Authorities.

Flood defences built before 1 January 2016 must have the following level of protection:

- 1 in 100 (1% AEP) chance of occurring in any given year for rivers
- 1 in 200 (0.5% AEP) chance of occurring in any given year for the sea

Flood defences built after 1 January 2016 should meet the previous level of protection but also include:

- An allowance for a design freeboard (an added allowance for defence height to cover uncertainty in modelling)
- An allowance for the effects of climate change

19 https://naturalresources.wales/flooding/challenging-our-flood-maps/?lang=en

20 Advice from NRW's website. https://naturalresources.wales/flooding/challenging-our-flood-maps/?lang=en (accessed 03/05/2022)

The consequence of the above is that new Defended Zones will need to be of a higher standard than many existing Defended Zones. Furthermore, it may not be possible to assign a Defended Zone to new flood defence schemes that take a more adaptive approach to climate change, such as is commonly applied to coastal flood defence schemes which is further outlined below in Section 6.3.2. Further guidance around this matter may be forthcoming and we recommend that NRW's website is consulted for the latest guidance.

Where new flood defences are planned for through a development, this will not result in new or extended Defended Zones until NRW are satisfied that the qualifying defences provide an acceptable standard of protection, and it is strongly advised that NRW are consulted with at the earliest stage about the scheme.

6.3.2 Private flood defences

Private defences and other defences not managed by an RMA do not generate TAN-15 Defended Zones, but in some instances deliver a similarly robust standard of protection.

Where an authority has confidence in the robustness of the defence and have aspirations for development in areas benefitting from those defences, they are encouraged to use their powers as an RMA as stated in the Flood and Water Management Act 2010: Using the Designation of 3rd Party Assets, to take responsibility for the asset.

6.3.3 Adaptive pathways

Climate change induced sea level rise is predicted to have significant consequences for many coastal areas. Risk Management Authorities often respond to this risk, the inherent uncertainties, and engineering investment challenges by taking a 'managed adaptive' approach to FCERM investment. This approach allows for staged investment in flood defences, planning for and implementing measures as sea levels increase. There are a range of economic, engineering, maintenance, and practical advantages to this approach.

In the absence of further TAN15 guidance, currently no regard can be given to future FCERM investment plans or strategies for flood defence improvements as such future investment cannot be assured. Consequently, it is recognised that it may be difficult to satisfy the Acceptability Criteria of TAN-15 over the lifetime of development in these areas. This has particular significance for residential development, with its 100-year lifetime of development. Although it should be noted that the primary purpose of new flood defences is to defend existing communities rather than to create new developable areas.

Whilst TAN-15 is currently clear how this will impact on new development, an LPA may give consideration to probable FCERM improvement when considering the merits of change of use, conversions and replacement development (refer to Section 6.4).

6.3.4 Future flood defence

Welsh Government have advised local authorities that they should prepare a pipeline of likely works as part of the local flood strategy, with recognition of how the climate projections will bring more areas into flood risk and increase the depth and velocities of flooding in the future.

The Welsh Government flood and coastal erosion risk programme invites applications which reduce risk to communities as set out in the National Strategy and associated guidance. **The programme does not provide funding to enable new development in areas at risk of flooding.** Furthermore, TAN-15 states that developments reliant on the defences must not commence prior to the completion of construction work and the new Defended Zones being in place.

It is, however, recognised that there is a need to develop resilience in town centres and for nationally significant infrastructure, where they face new or increased flood risks as a result of climate change. It is likely a multi-agency approach, with the support of the private sector where appropriate, will be required to deliver such outcomes, whilst remembering that new flood defences will have to satisfy the qualifying criteria for Defended Zones.

Policy 8 of Future Wales – the National Plan 2040 demonstrates the Welsh Government's support for the sustainable management of flood risk in national and regional growth areas. Enabling areas in Zones 2 or 3 (Rivers and Sea) to become Defended Zones through the use of new nature-based solutions or improvements to existing flood defences, or other solutions is supported. This

will provide important protection to existing development and enable redevelopment and renewal to take place in a sustainable and responsible way.[21]

The SFCA can play a valuable role in identifying existing investment FCERM plans, as well as identifying flood investment opportunities and priorities that might align with development aspirations.

Current pipeline of Flood and Coastal Erosion Risk Management (FCERM) projects

NRW and LLFA's have been approached to provide details of any significant FCERM plans within the region that are likely to be delivered in the next five years. Details of the projects are summarised in Table 6-1. Some of these projects may be in or nearing construction, whereas others may be in their infancy without secure funding. Any proposed development within these areas would be advised to contact the relevant RMA to obtain up to date information. However, it should be noted that planning applications can only be assessed against defences currently in place, and aspirations to construct or improve defences would not be regarded as a material consideration. It should be noted that whilst this provides an indication of pipeline projects, this list is not exhaustive and is subject to frequent change. Details of FCERM investment plans are regularly published by Welsh Government, NRW and RMAs. Further work to establish a detailed pipeline of projects for each Authority will be undertaken for a Stage 2 SFCA or as a separate piece of work if a Stage 2 SFCA is not required.

Identification of pipeline projects should be undertaken in consultation with NRW, WG and other RMAs.

Table 6-1 Current pipeline of FCERM projects

Project name	Location / extent	RMA	Timescales
Cardigan Flood Risk Management Scheme	Ceredigion	NRW	Design from 2022 to 2023. Construction from 2023 to 2025
Pontfaen Flood Alleviation Scheme (FAS)	Powys	Powys LLFA	2023/24 (pending availability of grant funding)
Woodlands Avenue & Brynderwen FAS	Powys	Powys LLFA	Design & construction 2023/24 (pending availability of grant funding)
Gurnos (Ystradgynlais) FAS	Powys	Powys LLFA	FBC & construction 2023 to 2025 (pending availability of grant funding)
Crickhowell FAS	Brecon Beacons National Park	Powys LLFA	FBC & construction 2023 to 2025 (pending availability of grant funding)
Lowes Village FAS	Powys	Powys LLFA	Design & Construction 2023/24 (pending availability of grant funding)
Felindre (Cwmdu) FAS	Brecon Beacons National Park	Powys LLFA	Design & Construction 2023 to 2025 (pending availability

21 TAN15 7.18

Project name	Location / extent	RMA	Timescales
			of grant funding)
Plasnewydd (Llanfechain) FAS	Powys	Powys LLFA	Design & Construction 2023 to 2025 (pending availability of grant funding)
Legar Brook (Llangattock) FAS	Brecon Beacons National Park	Powys LLFA	Business Case 2023 (pending availability of grant funding)

6.3.5 Flood defences for development

Development should not rely on construction of new flood defences; particularly those that will remain in private ownership given the challenges of ensuring long term maintenance and renewal. However, there may be circumstances where an RMA may agree to adopt privately constructed defences if they provide a wider community benefit. However, areas will only be designated as Defended Zones if they meet the specific requirements of NRW and Welsh Government (See Section 6.3.1).

Development proposals may also be considered more favourably where they form part of a strategy of flood risk reduction to existing development. An example would be the redevelopment of previously developed riverside sites in such a way as to benefit existing properties set back further from the river.

Development within a flood zone will often require some form of flood mitigation, although it is essential that this is achieved without increasing flood risk to others. Flood mitigation approaches used should, wherever possible, be simple and passive, requiring little or no maintenance. Such approaches would include raising floor and ground levels, whilst recognising the need to not increase flood risk to others.

6.4 Urban Centres and Land Use – Resilience of Existing Communities

6.4.1 Change of use and conversion

The redevelopment of existing buildings in flood risk areas can present decision makers with difficult decisions. There may be circumstances where the planning authority may be sympathetic to changes of use of conversion proposals which bring clear benefits to the area and the building[22].

Change of use or conversion proposals that would introduce (or intensify) highly vulnerable development in Zone 3 (Rivers and Sea) must be considered carefully, and the risk of flooding to potential occupants and the property thoroughly assessed.

In assessing change of use and conversion proposals in any location outside Zone 1, decision makers should apply the section 11 test to satisfy themselves that the consequences of flooding have been considered and are acceptable. A FCA's commensurate with the scale and nature of the proposal will be required to enable the planning authority to reach its decision. If the proposed change of use of or conversion is not resilient and there is an unacceptable risk from flooding to people, the planning application will be refused.

6.4.2 Replacement development

Like applications for change of use and conversion, there may be circumstances where the planning authority may be sympathetic to replacement development that will result in no intensification of vulnerability and an overall reduction risk. Potential examples include a replacement dwelling that is designed to raise the property above predicted flood levels, or a replacement industrial unit that incorporates flood resilient design measures.

Recognising that TAN15 does not address the scenario of replacement development, the SFCA advises that LPA may wish to adopt a locally specific approach to considering replacement

22 TAN-15 para 14.10 & 14.11

development. In doing so it is advised, that like change of use and conversion application, the Justification Tests are not applied, but that the LPA consider the following:

- Justification for the sustainability of continuing development on the site.
- Risks associated with intensification of development.
- Compliance with Section 11 of TAN-15 applied in a manner commensurate with the scale and nature of the proposal.

6.5 Surface Water and Small Watercourse Risk

Recent advances in methods, data availability, and software have delivered significant improvements in the accuracy of surface water and small watercourse flood mapping in Wales, showing a good degree of correlation to known flood events However, as the risk mapping remains broadscale the intricacies of local topography, drainage, and small watercourse features means that the flood map for surface water and small watercourse flood risk can be prone to inaccuracies, although it is generally precautionary. Therefore, areas in the surface water and small watercourse flood zones should be carefully reviewed with knowledge of the location and limitations of the broadscale modelling approaches used. The LLFA can be an important source of knowledge in this regard.

Given the limitations in the accuracy of surface water and small watercourse flood risk and the varied nature of flooding (from sizable streams and culverts, to localised depressions), the Justification Tests do not apply to development proposals in surface water flood zones, although the risks should be taken seriously, appropriately investigated and managed. Development should be located away from areas of surface water flood risk where possible.

In cases of more than the very most minor surface water flood risk the LPA will expect planning applications to be supported by a proportionate FCA. The LLFA will be able to provide advice on the requirement and scope of an FCA for surface water and small watercourse flood risk.

Where the flood risk is related directly to the ponding of rainfall on the surface of a site it may be appropriate to assess and manage this risk through a Drainage Statement as described in TAN-15. There is a requirement for all Drainage Statements to demonstrate compliance with the Statutory Standards for SuDS in Wales. It is advisable for developers to consult with individual SABs with regards to their requirements for SuDS across their Authority area.

Where the flood risk is attributed to a small watercourse, this is likely to require an assessment similar to if the flood risk were from a Main River.

6.5.1 Critical drainage areas

An LLFA may choose to identify areas that have particularly significant drainage and/or surface water flood risk issues. These areas will be identified as Critical Drainage Areas (CDAs). In these areas an FCA will always be required, and specific requirements or guidance may apply. CDAs may be identified in Stage 2 SFCAs or Local Flood Risk Management Plans. No CDAs are identified in this Stage 1 SFCA.

6.6 Climate Change – lifetime of development

The planning authority should be satisfied that any development it allocates will be resilient to flooding and coastal erosion for the duration of its lifetime. Using the most up to date national climate change projections, coastal erosion maps and SMP policies, planning authorities should ensure new development will be safe places to live now and in the future.

Generally, it is appropriate to think of new dwellings as having a lifetime of 100 years. Lifetimes for other types of development will vary, but 75 years is considered a reasonable rule of thumb. Planning authorities should apply this principle in a precautionary manner in relation to all types of development[23].

The FMfP has been prepared based on an assumed lifetime of development of 100 years. Consequently, in coastal areas development of a lower lifetime may result in flood risk mapping quite different that indicated by the FMfP. In the case of non-residential development, it may be appropriate for the LPA to give consideration to how the Flood Zone would appear with a matching

23 TAN-15 para 7.15

lifetime of development when evaluating the Justification Tests, whilst always ensuring that development must be on previously developed land if in Zone 2 and 3 and giving due regard to coastal erosion risks and SMP policies.

In line with SMP policy, proposals to develop areas at risk of flooding/erosion and with a 'no active intervention' or 'managed alignment' policy in the SMP for any epoch relevant to the lifetime of the development should not be permitted.

7 Coastal Erosion Risk Management

7.1 Coastal erosion and flooding

It is acknowledged that coastal areas have unique characteristics which can provide opportunities for new development, this is particularly relevant to Ceredigion where there are a number of major coastal settlements. However, opportunities for further development may be constrained by flooding, coastal erosion, ground stability and the impacts of climate change.

Considering the sensitivity of these areas and the importance of development in coastal areas, this SFCA considers the role and integrity of coastal defences and provides an understanding of the risks posed by coastal flooding and erosion. Reference should also be made to the Shoreline Management Plan (SMP) policies set out in Section 3.6, the Welsh National Marine Plan[24] and flood risk mapping in the appendices.

7.2 Coastal erosion and development

As stated in TAN-15, Local Development Plans should clearly define coastal areas suitable for development and those that are subject to significant constraints. Sites should not be allocated for development in areas where there are risks from flooding, ground instability or coastal erosion over the lifetime of development. LPAs should ensure they have sufficient information and have considered all relevant technical advice.

In instances where sites are proposed by developers within coastal areas the onus rests on the developer to provide sufficient and appropriate information to demonstrate that proposed sites can be safely developed without significant adverse effects in line with SMP policies. Upgraded or strengthened coastal defences may be required in coastal areas where a 'hold the line' approach is advised in the SMP and reflected in the Development Plan, and any such works are likely to be the responsibility of the developer. Particular regard to residual flood and erosion risks may also be required.

The National Coastal Erosion Risk Management mapping produced by the Environment Agency shows erosion rates around the UK and where any active intervention is required. The mapping covers the large majority of the UK with the exception of most of Wales, therefore is not discussed further in this section.

Construction of sea defences often leads to increased development pressures in an area. Local Planning Authorities should be mindful that defences only reduce the risk of floods or erosion, and do not eliminate it. LPAs may wish to provide further detailed guidance in the form of Supplementary Planning Guidance where it may have a particular strategy for coastal areas.

The Welsh National Marine Plan produced by the Welsh Government acts as a guide for the sustainable development of Wales's marine area by setting out how proposals will be considered by decision makers. This plan should be considered by developers and LPA's for development in coastal area with particular attention paid to SOC_08 (Resilience to coastal change and flooding) and SOC_09 (Effects on coastal change and flooding).

24 https://gov.wales/sites/default/files/publications/2019-11/welsh-national-marine-plan_5.pdf

8 Requirements for Flood Consequences Assessments

8.1 What is a site-specific Flood Consequences Assessment?

Site specific FCAs are carried out by (or on behalf of) developers to assess the risk and consequences of that development to third party land.

FCAs are submitted with planning applications to demonstrate how the requirements of TAN-15 have been satisfied. An FCA should demonstrate how flood risk will be managed over the development's lifetime, taking into account climate change and the vulnerability of site users. The assessment can also be used to establish whether appropriate avoidance or mitigation measures can be incorporated within the development design. This ensures that over its lifetime, development minimises risk to life, damage to property and disruption to people living and working on the site, as well as not increasing flood risk elsewhere.

8.2 When are site-specific Flood Consequences Assessment's required?

Site specific FCAs are required in the following circumstances:

- Proposals for development (including minor development and change of use) in Flood Zones 2 and 3 of the FMfP, with the exception of highly vulnerable development in Flood Zone 3 which is not permitted;
- Proposals for development with TAN-15 Defended Zones;
- Proposals for development within critical drainage areas identified by the LLFA or LPA; and/or
- At the request of the LPA, NRW, or LLFA where there are reasonable flood risk concerns to proposed development not otherwise covered by the triggers above

In the case of minor flood risk from Surface Water and Small Watercourses, the LLFA may waive the requirement for an FCA, although there remains a requirement to consider flood risk in a SuDS approval body application.

An FCA may also be required by the LLFA or IDD for Ordinary Watercourse Consent or by NRW for a Flood Risk Activity Permit for main river watercourses. In these circumstances the Justifications Tests do not apply and the LLFA or NRW will be able to provide guidance on their requirements for a proportionate FCA.

8.3 Requirements of a site-specific Flood Consequences Assessment

Section 12 of TAN-15 sets out the requirements of an FCA.

The assessment of flood risk in the FCA should help the planning authority determine whether the risk and consequences of flooding are acceptable and can be appropriately managed over the lifetime of development. An assessment of a range of potential flooding scenarios up to and including the 0.1% AEP flood event should be included with an allowance for climate change in line with current Welsh Government guidance.

FCAs for development sites should follow the approach set out in Figure 9 of TAN-15 and guidance provided by NRW[25]. It would be prudent for developers to contact NRW and the LLFA to gather further information on any specific flood risks to the proposed development site.

25 https://naturalresources.wales/flooding/modelling-for-flood-consequence-assessments/?lang=en

9 Flood Risk Mitigation and Flood Response Planning

9.1 Flood risk mitigation

TAN-15 outlines the complementary role that planning and building regulations have in flood management, and the requirement for the use of flood mitigation and damage resistant measures to ensure the consequences of flooding are acceptable if the development can be justified. Any new development in Zones 2 and 3 and the TAN-15 Defended Zones must have resilience to flooding built in at site and property level, as stated in TAN-15 Section 13.2 (Resilient Design). Where possible, development should still be directed to Flood Zone 1, where there is a lower flood risk of flooding.

Potential measures to reduce and manage flood risk on a site are outlined below. Although it should be recognised that even with such measures it will not be possible to develop all sites in compliance with TAN-15 and the Acceptability Criteria.

9.1.1 Site level flood risk mitigation

Flood risk from all sources should be considered at an early stage in deciding the layout and design of a site to provide an opportunity to reduce flood risk within the development. Site level resistance and resilience measures should have the twin aim of reducing the amount of flood water that can enter the site and effectively managing any water that does reach the site so it does not impact on households and other occupiers/users.

Flood mitigation and resilience can involve the use of blue and green infrastructure and SuDS to deliver wider benefits alongside flood mitigation such as water quality, amenity and biodiversity.

9.1.1.1 Site layout and design

A sequential, risk-based approach should be applied to try and locate more vulnerable development use away from flood zones to higher ground, while more flood compatible development (e.g. landscaping, recreational space) is located in higher risk areas. However, water compatible or less vulnerable uses in floodplains should consider the nature of the development, flood depths and hazard including evacuation procedures and flood warning. The nature of risk to water quality may also need to be considered and mitigated in some cases, particularly with parking areas so accumulated hydrocarbons and other vehicle related pollutants are not released to the aquatic environment.

Waterside areas, or areas along known flow routes, can be incorporated into the masterplan as multi-functional green infrastructure, being used for recreation, amenity and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives. Landscaping should ensure safe access to higher ground from these areas and avoid the creation of isolated islands as water levels rise.

9.1.1.2 Raised floor levels

When designing the layout for a development, consideration should be given to the potential effects of flood risk and great care must be taken so that development is safe and there are no adverse effects elsewhere, including to existing land, property, or people. In areas potentially at risk from surface water flooding particular attention should be given to proposed ground levels, drainage design, and provisions for exceedance flows. Where there is a residual risk of flooding (from any source) to properties within a development the measures to address the effects would normally include raising internal floor levels above the minimum level specified by the building regulations so that potential risks are addressed. The raising of internal floor levels and threshold levels within a development reduces the risk of damage occurring to the interior, furnishings, and electrics in times of flood.

Section 11 of TAN-15 provides guidance on the frequency thresholds in which development must be flood free and the tolerable conditions for extreme flood events. The flood levels of development which is proposed within an area at risk of flooding should be set based on these requirements.

The additional height that the floor level is raised above the maximum water level is referred to as the 'freeboard'. Additional freeboard may be required because of risks relating to blockages to

the channel, culverts, or bridges. This should be considered as part of a site specific Flood Risk Assessment.

Single storey buildings such as ground floor flats or bungalows are especially vulnerable to rapid rise of water (such as that experienced during a breach). Figure 7 within TAN-15 displays the tolerable conditions in an extreme flood event (0.1% AEP), below which development may be acceptable. This risk can be reduced by use of multiple storey construction and raised areas that provide an escape route. However, access and egress can still be an issue, particularly when flood duration covers many hours or days. Similarly, the use of basements in areas at risk of flooding should be avoided.

9.1.1.3 Modification of ground levels

Modifying ground levels to raise the land above the required flood level is an effective way of reducing flood risk to a particular site in circumstances where the land does not act as conveyance for flood waters. However, care must be taken at locations where raising ground levels could adversely affect existing communities and property as this can result in significant changes to how flood water moves around the site, introducing flood risk to areas that were not at flood risk previously. Where ground levels are modified, mitigation measures must be considered to stop the introduction of new flood risk or off-site effects.

In most areas of fluvial risk, raising land above the floodplain would reduce or alter conveyance or flood storage in the floodplain and would likely impact flood risk downstream or on neighbouring land. Compensatory flood storage should be provided, and would normally be on a level for level, volume for volume basis on land that does not currently flood but is adjacent to the floodplain (in order for it to fill and drain). It should be in the vicinity of the site and ideally within the red line of the planning application boundary.

Compensatory flood storage may not be required for tidal inundation given the effectively infinite volume of the sea. However, it must be demonstrated that the tidal flooding is not affected by volume or conveyance changes, and this may require hydraulic modelling.

9.1.1.4 Buffer strips

The provision of a buffer strip to 'make space for water' allows additional capacity to accommodate climate change and ensure access to the watercourse, structures, and defences is maintained for future maintenance purposes. Additionally, keeping an open space alongside a development to segregate the built development from the watercourse is supported as it removes the responsibility from property owners to maintain (physically and financially) riverbanks. It also enables the avoidance of disturbing riverbanks, adversely impacting ecology and having to construct engineered riverbank protection. Building adjacent to riverbanks can also cause problems to the structural integrity of the riverbanks and the building itself, making future maintenance of the river much more difficult.

It is recommended that an undeveloped buffer strip alongside main rivers and ordinary watercourses is for maintenance purposes and that developers would explore opportunities for riverside restoration or public open space as part of any development.

A flood risk activity permit may be required for all works:

- On or near a main river
- On or near a flood defence structure
- On or near a sea defence
- In a floodplain

Further guidance on obtaining a flood risk activity permit and activities requiring a flood risk activity permit are available from the NRW website[26]. Buffer strips are also likely to apply in relation to land drainage consenting for ordinary watercourses and LLFAs and IDDs may have similar requirements i.e. for maintenance purposes.

26 https://naturalresources.wales/permits-and-permissions/flood-risk-activity-permits/environmental-permits-for-flood-risk-activities/?lang=en

9.1.1.5 Surface Water Management

Suitable surface water management measures should be incorporated into new development designs in order to reduce and manage surface water flood risk to and posed by the proposed development. This should be achieved by incorporating SuDS. SuDS are typically softer engineering solutions inspired by natural drainage processes such as ponds and swales which manage water as close to its source as possible.

The integration of SuDS into developments is an opportunity to achieve multiple positive outcomes, by combining crucial drainage and flood defence assets with green infrastructure and high-quality public realm. All new developments in Wales are now required to include Sustainable Drainage Systems which comply with National Statutory SuDS Standards. Developers must gain approval for their drainage from a SuDS Approval Body (SAB) before construction can begin. Further guidance on SuDS is available from the Welsh Government website[27].

9.2 Flood Response Planning

Flood response planning is one option to help manage flood related incidents. From a flood risk perspective, flood response planning can be broadly split into three phases: before, during, and after a flood. These measures involve developing and maintaining arrangements to reduce, control or mitigate the impact and consequences of flooding and to improve the ability of people and property to absorb, respond to, and recover from flooding. TAN-15 (Section 7.6) states that development plans must be based on a sound understanding of the emergency services' ability to respond to flooding, therefore key stakeholders and the emergency services should be consulted at SFCA stages 2 and 3 when considering specific allocations and policies.

Safety is a key consideration for any new development and includes residual risk of flooding, the availability of adequate flood warning systems for the development, safe access and egress routes, and evacuation procedures.

Further guidance on incorporating resistance and resilient into development through design is available from the Construction Industry Research and Information Association (CIRIA), including a Code of Practice and Guidance for Property Flood Resilience[28].

9.2.1 Property Level Flood Risk Mitigation

Property Flood Resilience (PFR) measures can be used to reduce the impact of flooding to a development where traditional flood defence schemes are not a viable option. PFR takes two forms, resistance and resilience measures. Resistance measures focus on trying to keep water out of a property using door barriers, flood doors, automatic airbricks, pumps and non-return valves. It is acknowledged that these measures do have a seepage allowance and so a small volume of water is still likely to enter a property with PFR measures, this is where resilience comes in. Resilience measures focus on accepting that water will enter the property and looks at ways to quickly return the property back to normal after a flood. This can include raising white goods and boilers above floor level, raising kitchen units and electric sockets, and using tiles for flooring instead of carpets.

Property Flood Resilience measures may be acceptable as a form of mitigation, but only in the context that the development passes the Justification Test and meets the acceptability criteria, as set out in the new TAN-15.

Developers should consider PFR measures for any new developments which flood in the 0.1% AEP plus climate change event and to ensure safety and security of residents. Further information on PFR can be found on the BeFloodReady[29] website and the National Flood Forum[30].

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27 https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/sustainable-drainage-systems-suds/?lang=en
28 The CIRIA Code of practice for property flood resilience C790 is available from www.ciria.org/Resources/Free_publications/CoP_for_PFR_resource.aspx
29 https://www.befloodready.uk/
30 National Flood Forum

9.2.2 Access and egress

TAN-15 requires safe access and egress is available to and from the development in all modelled scenarios. This should consider all sources of flood risk including surface water. As a minimum, safe access and egress routes should comply with the tolerable conditions (0.1% AEP plus climate change) of TAN-15 Figure 7). For any development where there is a flood risk to the development or the associated highways a flood response plan should be compiled to inform site occupants of a safe access and egress route to and from the site.

9.2.3 Flood Response Plans

A flood response plan should be created for any development where there is a flood risk to the development itself or the surrounding highways. The plan should detail the flood risk to the development, the actions occupants of the site should take before, during, and after flooding and the safe access and egress routes available during a flood under all conditions. The plan should always take a proactive rather than reactive approach i.e. if buildings on the site are at risk of flooding occupants should have already left their properties before flood water enters. The plan should be easy to follow giving clear instructions on what actions should be taken before, during, and after a flood.

9.2.4 Flood Alerts and Warnings

NRW operates a Flood Warning Service[31] for some areas deemed to be at risk of fluvial or coastal flooding. This service covers approximately 60% of properties at risk from these sources of flood risk, and NRW is continually working to extend this service. These warnings have been designed to give the public advance notice of flooding. Each flood alert and warning area is assigned an individual code to allow NRW to make flood alerts and warnings specific to areas at risk. The NRW FRAW mapping[32] can be used to show the specific codes that cover a potential development site.

A requirement of TAN-15 is that for proposed developments that are at risk of flooding, effective warning is provided. Therefore, occupants of these sites should be encouraged to sign up and receive Flood Alerts, Flood Warnings, and Severe Flood Warnings if available. If a flood event is forecast, alerts and warnings are issues by landline, mobile, text, or email using a set of four easily recognisable codes, as shown in Table 9-1. Generic advice and examples of actions to be taken on receipt of the alert or warning are shown in the Table 9-1. Using these warnings, along with local knowledge, site occupants are able to take effective action, to reduce the consequence of flooding.

31 https://naturalresources.wales/flooding/preparing-for-a-flood/?lang=en

32 https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0

Table 9-1 Flood codes and meanings

Flood code	What it means	What to do
 **Flood Alert**	Flooding is possible, be prepared	Be prepared to act on your flood plan. Prepare a flood kit of essential items. Monitor local water levels and the flood forecast on our website.
 **Flood Warning**	Flooding is expected, immediate action is required	Move family, pets and valuables to a safe place. Turn off gas, electricity and water supplies if safe to do so. Put flood protection equipment in place.
 **Severe Flood Warning**	Severe flooding and danger to life	Stay in a safe place with a means of escape. Be ready should you need to evacuate from your home. Co-operate with the emergency services. Call 999 if you are in immediate danger.
Warning no longer in force	Warning has been removed in the last 24 hours	Be careful. Floodwater may still be around for several days and could be contaminated If you've been flooded, ring your insurance company as soon as possible.

More information on how to register for flood alerts and warnings is available from the Natural Resources Wales website at: **https://naturalresources.wales/flooding/sign-up-to-receive-flood-warnings**

Alternatively, occupants can register by calling the 24-hour Floodline on: 0345 988 1188

It should be noted that the flood warning service is continually reviewed. It is recommended that site occupants check annually that they are signed up to receive the correct warnings by checking the website above.

10 Working With Natural Processes and Natural Flood Management

It should be noted that there are several terms for measures involving natural solutions to managing flood and coastal erosion risk, for clarity these are:

- Nature Based Solutions (NBS) – broad terms referring to the sustainable management and use of natural features to tackle socio-environmental challenges.
- Working With Natural Processes (WWNP)– terms for reducing flood and coastal erosion risk through implementing measures to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast.
- Natural Flood Management (NFM) – Use of natural processes to reduce the risk of flooding and coastal erosion.

This SFCA will focus on specific measures that can be used to manage flood and coastal erosion risk and will refer to the use of WWNP and NFM in the Mid Wales region. This section will provide an overview of different WWNP/ NFM measures that can be implemented and will provide a review of the WWNP mapping to understand the potential for using these techniques in each Authority area.

Working with Natural Processes (WWNP) aims to protect, restore and emulate the natural functions of catchments, floodplains, rivers, and the coast. This includes the use of Natural Flood Management (NFM) techniques. NRW has worked in partnership with the Welsh Government, Department for Environmental Food & Rural Affairs (DEFRA) and other public bodies to build an evidence base[33] setting out the current state of evidence for WWNP and outlining the effectiveness of different measures with regard to managing flood risk and delivering other benefits. Further research has been undertaken since the publication of this evidence report, leading to the development of knowledge and understanding around WWNP.

Nature-based solutions such as Natural Flood Management Techniques (NFM) are part of WWNP and can be used to retain water and attenuate flows that can otherwise contribute to flooding, Installation of temporary detention features such as leaky dams and large woody debris in watercourses across a catchment can help mitigate flood risk and improve the capability of the catchment to manage more extreme events.

NFM techniques can also involve restoring floodplains and river channels to a more natural state and retaining water in catchment headlands. These techniques often deliver multiple benefits such as habitat creation and improving water quality, making them sustainable solutions. Reference should be made to the CIRIA Natural Flood Management Manual (C802F)[34]. NFM techniques can include:

- Floodplain restoration and reconnection
- Re-naturalising rivers and removing redundant in-channel structures
- Installing run-off attenuation features such as large woody debris and leaky dams
- Planting riparian or catchment woodlands
- Land and soil management measures
- Restoring moorland, peatland, and woodland habitats in the headwaters
- Restoration and management of sand dunes, saltmarshes and mudflats

33 https://www.gov.uk/flo.ciria.org/ItemDetail?iProductCode=C802F&Category=FREEPUBS&WebsiteKey=a054c7b1-c241-4dd4-9ec1-38afd4a55683
34 https://www.ciria.org/ItemDetail?iProductCode=C802F&Category=FREEPUBS&WebsiteKey=a054c7b1-c241-4dd4-9ec1-38afd4a55683

Table 10-1 Examples of WWNP and NFM[35]

	
Leaky dam	Riparian woodlands
	
River restoration	Floodplain storage

10.1.1 Working with Natural Processes in Wales

Policy 8 of Future Wales – the National Plan 2040 demonstrates the Welsh Government's support for nature-based solutions. The National FCERM Strategy for Wales[36] emphasises the use of NFM and WWNP as a sustainable, catchment based approach to managing flood risk in a more sustainable way.

The new TAN-15 also acknowledges that natural flood and water management schemes can provide opportunities to slow and store water, along with appropriate land management. It recognises that this will become increasingly important with regard to the impacts of climate change and that options such as managed coastal realignment and floodplain restoration can contribute to the sustainable management of natural resources, mitigate future flood risk, and protect and enhance natural heritage.

The Minister for Environmental and Rural Affairs announced in a statement of 24 July 2020 that there would be at least £2m funding for NFM schemes in Wales that Risk Management Authorities

35 https://assets.publishing.service.gov.uk/media/6036c730d3bf7f0aac939a47/Working_with_natural_processes_one_page_summaries.pdf

36 https://gov.wales/national-strategy-flood-and-coastal-erosion-risk-management-wales

could apply for[37]. The aim of these pilot studies is to encourage both the understanding and delivery of NFM and provide a learning opportunity for RMAs and the Welsh Government.

10.1.2 Working with Natural Processes for new development

Developments can provide opportunities to work with natural processes of catchments, floodplains, rivers, and the coast to reduce flood and erosion risk, benefit the natural environment, and reduce the costs of schemes. Natural flood management requires integrates catchment management and involves those who use and shape the land. It also requires partnership working with neighbouring authorities, organisations and water management bodies.

It should be acknowledged that the use of NFM/WWNP techniques in isolation are unlikely to fundamentally alter a flood risk at a given site. However, when implemented on a catchment scale NFM/WWNP may be effective in combination with other measures.

Local Authorities can set their own local policies on the use of nature based solutions; this could be done through the Local Plan or through the Local Flood Risk Management Strategy. Consideration could be made to WWNP more generally, for example through implementing policies on daylighting of culverts or through achieving multiple benefits in new developments such as nature conservation and biodiversity.

Conventional flood prevention schemes may be preferred, but consideration of 're-naturalising' rivers and land upstream could provide cost efficiencies as well as considering multiple sources of flood risk; for example, reducing peak flows upstream such as through felling trees into streams or building earth banks to capture runoff, could be cheaper and smaller-scale measures than implementing flood walls for example. It should be noted that in some locations traditional flood defence schemes may be required where conventional schemes are most appropriate; however, WWNP can and should complement conventional schemes where possible.

10.1.3 Working with Natural Processes Opportunity Mapping

As part of the WWNP evidence base, opportunity mapping[38] has been developed to help identify opportunities for WWNP and NFM. The maps are intended to be used alongside the Working with Natural Processes Evidence Directory to help RMAs, developers, and planners think about the types of measures that may work best and potentially the best place to locate them. These maps require further work and development; however, initially they can be used as a starting point for consideration towards WWNP opportunities.

The maps cover a range of different WWNP measures, including:

- Floodplain reconnection
- Run-off attenuation and gully blocking
- Woodland planting covering, floodplain planting, riparian planting, and wider catchment woodland
- The WWNP maps are based entirely on open data and highlight the potential for WWNP derived from national fluvial, tidal, and surface water flood risk NRW datasets. As such, further work and studies would still be required to support the use of NFM at a particular location and the understanding of WWNP potential should be supplemented by local knowledge. The maps also do not cover all measures for working with natural processes, and users may wish to refer to other relevant information sources when identifying areas of opportunity.

10.1.4 Using the Working with Natural Processes opportunity mapping

Floodplain reconnection map

The floodplain reconnection map identifies areas of the floodplain that have become disconnected from their river and are no longer capable of, or have a reduced ability to, store water during

37 https://gov.wales/more-than-2million-natural-flood-management-schemes-across-wales

38 http://wwnp.jbahosting.com/BrowserUnsupported.aspx

times of flood. Areas suitable for floodplain reconnection tend to be rural areas at low risk of flooding (using the NRW Risk of Flooding from Rivers and Seas map) close to a watercourse.

Run-off attenuation features and gully blocking map

The run-off attenuation features map identifies areas where surface water naturally flows or accumulates and could help identify locations to temporarily hold back and intercept the flow using soft engineering approaches.

The run-off attenuation feature locations identified on the mapping are based on the premise areas of high flow accumulation in the Surface Water Flooding maps (from NRW mapping) are areas where the run-off hydrograph may be influenced by temporary storage (if designed correctly).

The gully blocking potential is based on run-off attenuation features on steeper ground with a gradient >6%. These areas where leaky barriers may be more beneficial than a deepened pond, raised bund, or grip blocking.

Tree Planting

Catchment woodland can intercept, slow, store, and filter water. This can help reduce flood peaks, flood flows (from 3 to 70%) and flood frequency.

Interventions involving tree planting seek to:

- Slow overland flow through the development of rougher ground surfaces
- Largely eliminate overland flow through enhanced infiltration rates via increased topsoil permeability and enhanced soil drying from enhanced evapotranspiration
- Remove water from the streamflow generating system via enhanced wet canopy evaporation ('interception loss') and enhanced transpiration.

10.1.5 Areas of working with Natural Processes in the Mid Wales

Maps showing the WWNP are provided in the appendices for each authority area. It should be noted that the mapping is broadscale therefore it should be used as a guide for areas where WWNP may be possible. Due to the broadscale nature of the mapping not all areas identified may be suitable for use with WWNP i.e. there is an existing development in the area.

Ceredigion

The maps show that the majority of land adjacent to the main rivers and smaller watercourses across the catchment are suitable for riparian woodland planting. Areas particularly identified are those high in the catchments close to the source of the watercourses and in and around small rural settlements. In larger settlements such as Cardigan and Aberystwyth, riparian woodland planting potential is focused in areas outside of the main settlement, likely due to the availability of space.

Large areas of Ceredigion have been identified as being suitable for wider catchment woodland planting. In particular coastal areas around Aberaeron and the River Aeron where land is flatter. Fewer areas of wider catchment woodland planting potential have been identified in the very north of the authority boundary, potentially connected to the higher topography of the Cambrian mountains.

Large areas of floodplain woodland planting potential are found around the River Teifi, particularly around Lampeter. Similarly on the upper reaches of the River Aeron large areas have been identified as suitable for woodland planting potential. The reaches of the Rivers Rheidol and Ystwyth just east of Aberystwyth also identified as having woodland planting potential.

Across the county numerous locations are shown to be suitable for Runoff Attenuation Features during the 1% AEP event, most densely populated along the upper catchment of the River Teifi.

Powys

The maps show that the majority of land adjacent to the main rivers and smaller watercourses across the catchment are suitable for riparian woodland planting. Areas particularly identified are those high in the catchments close to the source of the watercourses and in and around small rural settlements. In larger settlements, such as Welshpool and Builth Wells, riparian woodland

planting potential is focused in areas outside of the main settlement, likely due to the availability of space.

Large areas of Powys have been identified as being suitable for wider catchment woodland planting. The majority of the areas identified as suitable are found in the upland areas of the Rivers Wye, Irfon and Severn, particularly around Llandrindod Wells. Towards the south of the authority boundary, just north of the Brecon Beacons National Park, fewer areas of land are identified as being suitable for wider catchment woodland planting. This is likely to be due to the steep topography in the area.

Areas for floodplain woodland planting potential are largely identified around the River Severn and River Vyrnwy in the north of the catchment due to the flat floodplains in these areas. Several areas around Caersws where the River Severn joins with two other tributaries are also identified as being suitable for floodplain woodland planting. Areas on the River Wye between Llyswen and Hay on Wye where the floodplain is wide and flat have been identified as areas suitable for floodplain woodland planting.

Across the county numerous locations are shown to be suitable for Runoff Attenuation Features during the 1% AEP event, most densely populated along the upper catchment of the River Wye near Llanwrtyd and south-west of Penybont, and along the River Severn near Caersws.

Brecon Beacons National Park

The maps show that the majority of land adjacent to the main rivers and smaller watercourses across the catchment are suitable for riparian woodland planting. This is particularly true for the River Usk where areas for riparian planting have been identified from the outskirts of Brecon, through Talybont on Usk to Crickhowell, including the smaller tributaries that feed in to the River Usk.

Large areas of the Brecon Beacons National Park have been identified as being suitable for wider catchment woodland planting. The largest concentrations found in the south west of the Park around the River Tawe. The River Senni is also surrounded by large areas that have been identified as being suitable for wider catchment woodland planting before the River converges with the River Usk in Sennybridge.

Floodplain woodland planting potential is largely identified in the wider flatter floodplains of the River Usk, particularly around Crickhowell and Talybont on Usk. Upper areas of the Usk catchment and its associated tributaries also have areas suitable for floodplain woodland planting potential.

Across the Park numerous locations are shown to be suitable for Runoff Attenuation Features during the 1% AEP event, particularly in the south-west of the park.

11 Conclusion and Recommendations

11.1 Conclusion

This Stage 1 SFCA delivers a strategic assessment of all sources of flooding across the Mid Wales region. It also provides an overview of policy and guidance for planners, developers, and other stakeholders. This SFCA provides a robust evidence base to inform the Authorities' individual Local Development Plans and will inform the development of LDP policies and land allocation decisions.

The Stage 1 SFCA also sets out flood risk to each of the three authority areas in Mid Wales (Appendices A-C), this is based on the best available information such as the Flood Map for Planning and the latest climate change projections. It identifies ways of mitigating flood risk where appropriate and identifies opportunities to slow and store water through utilising WWNP/NFM techniques.

11.2 Recommendations

It is anticipated that Local Authorities in the Mid Wales region will need to progress to a Stage 2 or Stage 3 SFCA to provide a sufficiently robust evidence base to support their Local Development Plans.

A Stage 2 SFCA will provide an assessment of LDP Candidate Sites which have been identified as being at risk of flooding. The assessment considers the application of the Justification Test, including the potential for a site to satisfy the acceptability criteria. This may be informed by detailed flood risk information on flood depths, velocities and probability of flooding, as well as the risk of a flood defence structure breaching or overtopping.

The Stage 3 SFCA will involve testing whether the flood risk to any proposed LDP Candidate Sites can be managed to an acceptable level and that the site itself will not exacerbate flooding elsewhere over the lifetime of the development. It should also be shown that practical mitigation measures can be implemented to manage flood risk. This stage is likely to be carried out by the proposer of the site to support development proposals in high or complex flood risk areas.

It is anticipated that the majority of Local Planning Authorities in the region are likely to require a Stage 2 assessment but not all may need to progress to a Stage 3 assessment.

Appendices

JBA consulting

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
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