Strategic Flood Consequence Assessment

Bridgend County Borough Council

v2

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This report describes work commissioned by Richard Matthams, on behalf of Bridgend County Borough Council, by an email dated 3rd December 2019. Amy Evans and Faye Tomalin of JBA Consulting carried out this work.

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Purpose

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Foreword

Bridgend County Borough Council (BCBC) are required to prepare a Strategic Flood Consequence Assessment (SFCA) to support the production of their Local Development Plan (LDP).

The SFCA creates a strategic framework for the consideration of flood risk when making planning decisions. It has been developed in accordance with Technical Advice Note 15 – Development & Flood Risk (TAN15), as well as additional guidance provided by Natural Resources Wales (NRW).

TAN15 advises a precautionary framework to guide planning decisions specifically aiming to direct new development away from areas thought to be at high risk of flooding. TAN15 promotes action through development plans, specifically the consideration of flooding issues during the preparation of Local Development Plans. Flood risk will therefore be a key consideration when sites are being considered for allocation.

The underlying objective of the approach detailed in TAN15 is to steer development away from areas at risk of flooding – so as to decrease and not increase the risk of flooding to people, businesses, property and the natural environment – and to thereby reduce the reliance on long-term maintenance of built flood defences. In order to develop areas at risk from flooding, developments must be in line with the Local Authority's development strategy. Furthermore, the risks to the development, including residual risks following any mitigation measures, must satisfy certain acceptability criteria as set out in Section 7 of TAN15. It is also expected that development proposals will contribute to a reduction of flood risk.

A SFCA is essential in enabling a strategic and proactive approach to flood risk management. The assessment allows us to understand current flood risk on a wide-spatial scale and how this is likely to change in the future in response to climate change.

The main objective of the Bridgend County Borough Council SFCA is to provide flood risk information;

- so that an evidence-based and risk-based, precautionary approach can be adopted when making planning decisions, in line with TAN15;
- that will inform the Sustainability Appraisal/Strategic Environmental Assessment and Habitats Regulations Assessment and ensure flood risk is taken into account when considering sites and land use policies at the local development plan:
- to identify the level of detail required for site specific flood consequence assessments and allow BCBC to determine the acceptability of flood risk in relation to emergency planning capability level;
- to enable BCBC to make informed decisions regarding capacity and flexibility of the 'Regeneration Led Spatial Strategy' including application of the TAN15 justification test where necessary for the allocation of strategic development sites;
- to facilitate the production of local 'standing advice';
- to identify surface water issues and the suitability of sustainable drainage (SuDS) techniques;

1 Introduction

1.1 Commission

This Bridgend County Borough Council (BCBC) SFCA update has been developed to inform the replacement Local Development Plan (LDP 2018-2033). The updated SFCA builds on the previous 2010 SFCA. It provides a robust evidence-base to the development of LDP policies and land allocation decisions. This update is carried out in accordance with the Welsh Government's development planning guidance, Planning Policy Wales (PPW)[1], Technical Advice Note 15: Development and Flood Risk[2] (TAN 15) and Welsh Government Chief Planning Officers letters and Welsh Government FCA Climate Change allowances.

The SFCA will be used in informing development in Bridgend County Borough, including any future review of the Bridgend Local Development Plan (LDP).

1.2 Purpose of the SFCA

As a Lead Local Flood Authority (LLFA) and a Local Planning Authority (LPA), Bridgend County Borough Council is required to produce a SFCA. This SFCA update will be used to inform the development of the new Bridgend Local Development Plan.

The aims and objectives of the SFCA are:

- To inform development regarding the management of flood risk within the Council's Local Development Plan.
- To understand flood risk from all sources and to investigate and identify the extent and severity of flood risk throughout the County Borough. This assessment will enable the Council 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 surface water flood risk, using Natural Resources Wales' latest generation of surface water flood mapping.
- To enable the County Council to meet its obligations under Planning Policy Wales (PPW) and Technical Advice Note 15: Development and Flood Risk (TAN15).
- To supplement current policy guidelines and to provide a straightforward risk-based approach to development management in the area. This is aimed at Councillors, 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 Flood Consequence Assessments (FCAs) where necessary.
- To assist the Council in identifying specific areas where further and more detailed flood risk data and assessment work may be required.
- To provide an update to previous 2010 SFCA's using new and updated flood risk information to summarise flood risks to existing allocated sites in the Local Development Plan.

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 a Flood

[1] Planning Policy Wales, Edition 10, December 2018
[2] Technical Advice Note 15: Development and Flood Risk, July 2004

Consequence Assessment, are required. It is also worth noting that the presence of flood zones in an area, be it fluvial, tidal or surface water, does not mean that development simply cannot happen. 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.

1.3 Use of the SFCA in Land Use Planning

Guidance on development and flood risk is given in Technical Advice Note (TAN15) and Planning Policy Wales. These documents require that flood risk be considered through the application of the precautionary framework, which guides development away from areas of high risk of flooding.

It must be noted that the guidance provided in this document does not supersede guidance provided in TAN15 or other plans or policies. The information and procedures are simply provided as an interpretation of this guidance for the preparation of the Local Development Plan (LDP).

A precautionary approach should be undertaken when making land use planning decisions regarding flood risk. This is partly due to the considerable uncertainty surrounding flooding mechanisms and how flooding may respond to climate change. It is also due to the potentially devastating consequences of flooding to the people and property affected.

The information presented in this SFCA should be used to inform more detailed flood consequence assessment for all new developments where required by TAN15.

Developers should be referred to the SFCA at the start of any pre-application consultation with the LPA. Where developers promote development outside of the allocated areas identified in the LDP and within flood risk areas defined by the SFCA they are responsible for;

- demonstrating compliance with TAN15 notably the Justification Test if required.
- providing an assessment of the impact of flooding on the development and of the development on flood risk elsewhere
- satisfying the LPA that flood risk to the development and the impact of the development on flood risk elsewhere will be appropriately managed.

This will require the preparation of site-specific Flood Consequences Assessments (FCAs). The level of information in FCAs should be proportionate to the degree of flood risk and the scale, nature and location of the proposed development. The SFCA provides information already available which should be considered in the production of site-specific FCAs. In these instances, the SFCA allows the LPA to identify the level of detail required for site- specific FCAs in particular locations.

2 SFCA Study Area

2.1 Overview of Bridgend County Borough

Bridgend County Borough lies at the geographical heart of South Wales. Its land area of 25.5km^2 stretches 20km from east to west and includes the Llynfi, Garw and Ogmore valleys, Bristol Channel coastline and a mix of urban and rural communities as shown in Figure 2-1. According to the 2011 Census, Bridgend County Borough has a population of 139,200 – up from 128,700 in 2001. The largest town is Bridgend, followed by Maesteg and the seaside resort of Porthcawl. Some of these settlements are designated conservation areas in order to preserve or enhance their special character or appearance.

Outside of the main settlements, which are generally found within the river valleys, the land is a mixture of grassland, forest (predominantly coniferous) and scrubland. Other habitats are present including ancient woodlands; unimproved wet grasslands; chalk grassland; rocky gorges; coastal sand dunes; and saltmarsh. Sites receiving statutory designations make up only 4.8% (1215 hectares) of the county borough's land area, but the previous local plan identified 18 Landscape Conservation Areas for reasons of scenic and amenity value which together cover some 3,062 hectares or 12% of the County Borough.

To the north of Bridgend, the landscape is dominated by very steep topography with the land reaching heights of over 500m. The high ground is sparsely populated and covered with rough grassland and coniferous trees with smaller areas of scrub and non-coniferous trees. Roads and settlements are generally present only in the valleys. The underlying geology is, almost without exception, a mixture of mudstone, sandstone and siltstone.

The industrialisation of the Ogmore valley, especially in the 19th century, severely damaged much of the natural environment in the main river and many of its tributaries. Coal mining in particular severely affected the river and the Rivers Garw and Llynfi. Although mining activity in the area has now ceased many disused mines still exist today and may affect hydraulic pathways below and on the surface.

The locality's position within the Cardiff Capital Region, and the historical transport links that facilitate key connections to Cardiff and Swansea, have proved critical to the County Borough developing as a major regional employment hub, with specific strengths in advanced manufacturing.

Figure 2-1 shows the county boundary and main settlements and rivers.

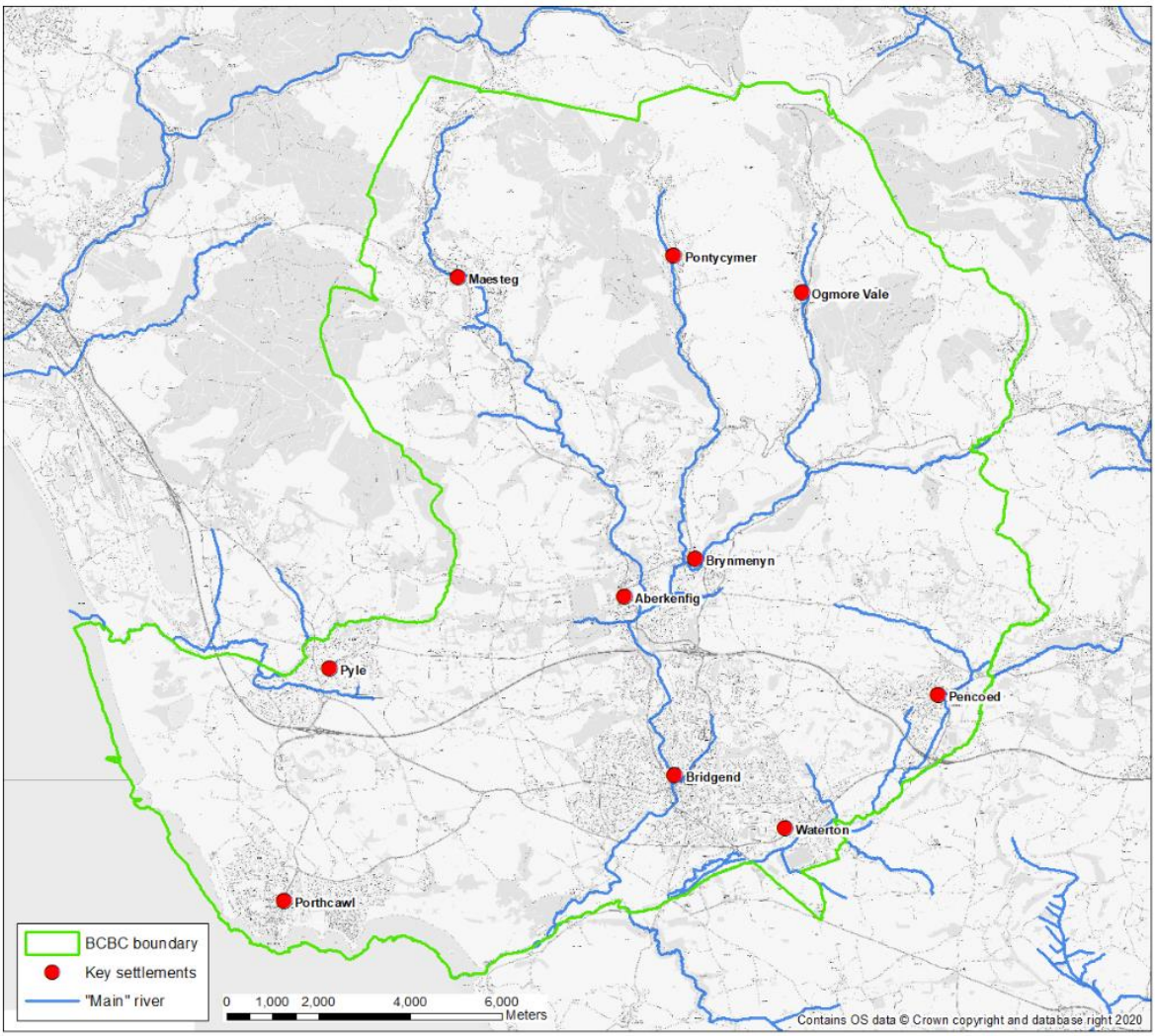


Figure 2-1 Settlement Boundary and Key Features

2.2 Topography

The topography varies from the low lying, fairly flat, coastal areas to the west of Bridgend, to the steep valleys to the North of Bridgend where elevations reach over 500mAOD.

In the north, ground rising above 200mAOD is reasonably flat at the highest points but quickly falls away into steep-sided valleys with slopes as steep as 1 in 2. The valley bottoms are well defined and generally in the order of 200m wide. Most development in the northern part of BCB is concentrated within these valleys.

From Abergarw southwards, the land is noticeably flatter, with lower ground levels and wider river valleys. In the southern half of the county, there are some areas of isolated high ground, notably at Cefncribwr and Brackla (Bridgend). The land below 40mAOD is generally fairly flat and includes Kenfig Burrows, Kenfig, North Cornelly, South Cornelly, Porthcawl, Newton, Merthyr Mawr, Merthyr Mawr Dunes and parts of Bridgend and Pencoed.

All topographic information (with the exception of some river cross-sections) has been derived from LIDAR (Light Detecting and Ranging) data sourced from NRW which has a vertical RMSE (root mean square error) in the order of ±0.10m. The 2m LiDAR data covers the majority of the county borough, with the exception of some small patches, as shown in Figure 2-2. The LiDAR clearly demonstrates the valleys towards the northern boundary of the area, and the low-lying fairly flat coastal area.

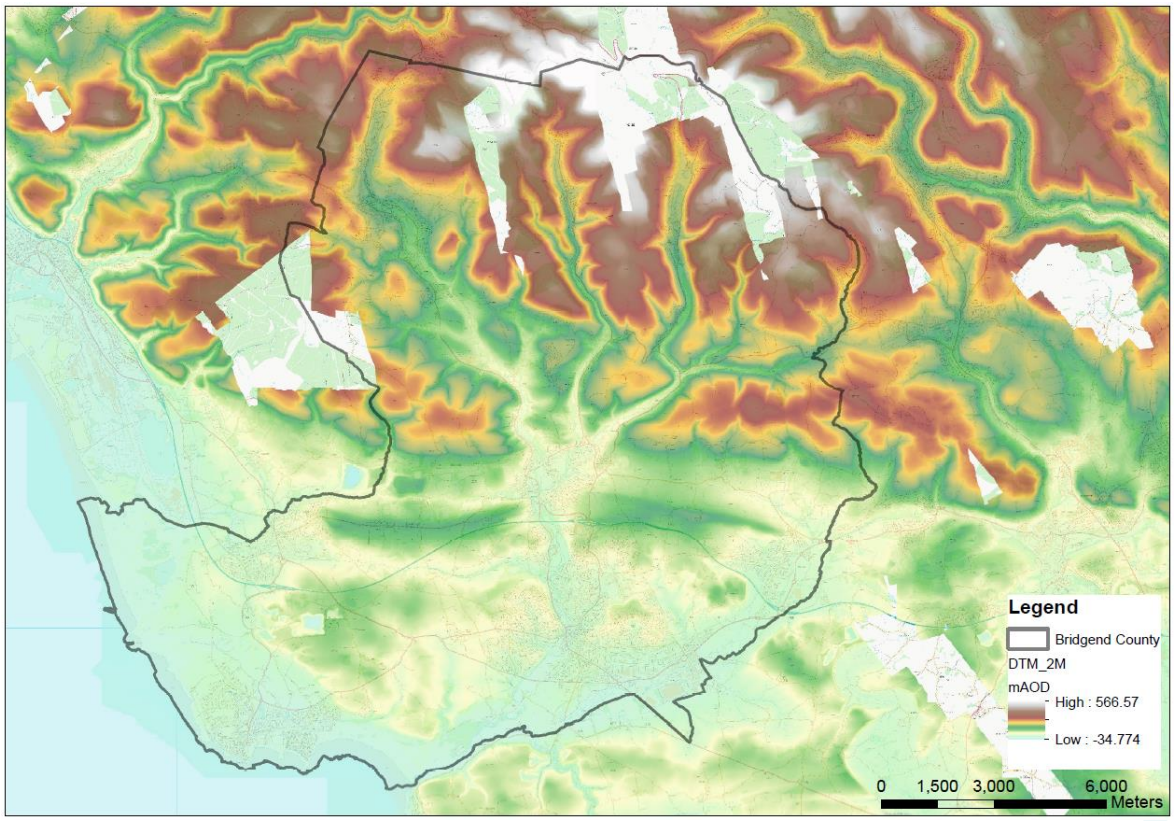


Figure 2-2 NRW 2m LiDAR of Bridgend County Borough

2.2.1 Solid and Drift Geology

The solid geology of BCB is dominated by sedimentary rocks. The most common types are 'mudstone, siltstone and sandstone', which have varying properties. Mudstone is formed from fine grains of clay and mud and is highly impermeable. Siltstone is formed from larger particles which are predominantly silt. Sandstone is formed from even larger 'sand sized' particles. In contrast to mudstone and siltstone rock types, sandstone is usually porous enough to allow percolation and can store large volumes of water. These rocks underlie almost all of the land north of Bridgend and are rarely found elsewhere.

'Mudstone, siltstone and sandstone' occupies a distinct 2.5km thick band running from east to west to the south of Abergarw and some areas in the north, although 'sandstone' predominates in the north.

The developed area of Bridgend is primarily underlain by 'limestone and mudstone interbedded', with some areas of 'shell-limestone' and 'sandstone'. Limestone is composed largely of mineral calcite: either grains formed from skeletal remains of marine organisms (shell-limestone), or non-granular formations created by chemical precipitation. Although limestone is non-porous it is soluble in weak acid solutions and over geological timescales a wide variety of features develop such as fractures, caves, gorges and sinkholes. This propensity for erosion often provides drainage pathways for water through the limestone. Interbedding occurs when beds (layers or rock) of a particular lithology lie between or alternate with beds of a different lithology. The mixed geology underlying Bridgend is likely lead to varied permeability characteristics.

To the east of Bridgend there is a large area underlain with 'conglomerate' and a smaller area underlain with 'limestone'. Conglomerate is usually a sedimentary rock consisting of small pieces of preformed rocks (often gravel) which have become cemented together within a finer-grained matrix. It typically has a very low porosity and is effectively impermeable when considering drainage.

To the west of Bridgend, the geology is dominated by 'limestone and 'conglomerate' with smaller amounts of 'ooidal limestone'. Ooidal Limestone is formed from ooids, which are small, spheroidal, "coated" (layered) sedimentary grains, usually composed of calcium carbonate.

Around Cornelly and the Kenfig Burrows the underlying geology is predominantly 'conglomerate' and 'mudstone'. The area around Porthcawl is dominated by 'conglomerate' and 'limestone' and between Porthcawl and Bridgend are isolated pockets of 'Ooidal Limestone'.

The drift geology of BCB is a mixture of clay, silt, gravel, peat and sand. Clay is formed of particles smaller than 3.9µm, although it has a high void ratio its chemical structure is particularly effective at holding water and consequently drainage through clay is effectively non-existent. Silt is formed from particles larger than 3.9µm but smaller than 62.5µm. Sand is composed of fine rock and mineral particles between 62.5µm and 2mm. Sand generally drains very well. Gravel is any loose rock with a particle size of between 2mm-64mm. Due to its large size, accumulations of gravel have significant voids and generally drain particularly well. Peat is an accumulation of partially decayed vegetation matter that forms in acidic anaerobic environments. This occurs where water levels are at or near the surface for the majority of the year. It is particularly effective at retaining water and drains poorly.

The majority of the main rivers run through 'clay, silt, sand and gravel' bands which vary from narrow 20m bands in upland areas to 500m bands close to the coast. In the upland areas these bands generally sit within larger bands of 'diamicton', which is defined as unsorted and unstratified sedimentary deposits.

There are small isolated pockets of peat in the northern part of BCB which are generally in forested areas and presumed to coincide with localised depressions in topography. In the low-lying coastal areas and estuarine parts of the River Ogmore the drift geology is almost entirely sand.

2.3 Strategic Regeneration

The SFCA has been undertaken over the whole of BCBC administrative boundary so that the Council can make a comparative assessment of flood risk. This allows consideration of flood consequences and the vulnerability of developments in accordance with the principles of TAN15 when allocating land for development and making decisions on the acceptability of planning applications.

The existing LDP was adopted in 2013 and covers the period 2006-2021. Whilst a Replacement LDP is required for the 2018-2033 period, it needs to and will very much build upon the first adopted Plan for the County Borough.

The settlement structure of the County Borough still broadly reflects its agricultural and industrial heritage. Bridgend is the pivotal town, linking up with the three Valleys, the former port of Porthcawl and the growth areas around the Valleys Gateway, Pyle and Pencoed.

The Well-Being of Future Generations Act (Wales) 2015 is a key piece of legislation which aims to further improve the social, economic, environmental and cultural wellbeing of Wales now and in the longer term. Edition 10 of Planning Policy Wales (PPW 10) sets out the land use planning policies and overarching sustainable development goals for Wales, revised to contribute towards the statutory well-being goals of the Well-being of Future Generations Act.

Key settlements and regeneration areas identified are:

- Bridgend
- Maesteg

- Valleys Gateway (including Aberkenfig, Bryncethin, Brynmenyn, Coytrahen, Sarn, Tondu and Ynysawdre)[3]
- Porthcawl
- Pencoed
- Pyle, Kenfig Hill and North Cornelly
- Waterton

The strategic regeneration settlements listed are therefore the focus of the SFCA.

There are also eight strategic development sites identified within the County Borough which are assessed in greater detail. These sites have been identified as sites of strategic importance for the delivery of new homes across the borough and are generally proposed for 250 or more new homes.

Additionally, as part of the LDP process, landowners and developers have submitted details of sites that they wish to be considered for use or re-use. These sites are referred to as Candidate sites and can be nominated for a particular land use, such as residential, employment etc. The Council may also put forward sites for inclusion within the LDP as a landowner within the county. The known Candidate Sites have been assessed in terms of flood risk and are contained in Appendix B.

[3] Even though the Valleys Gateway is classified as a Main Settlement, planned growth will not be channelled towards this area and will instead be directed towards the other four Main Settlements and the Primary Key Settlement.

3 The Planning Framework and Flood Risk Policy

3.1 Introduction

On the 18th September 2013, BCBC adopted its Local Development Plan (LDP). The replacement LDP 2018-2033 is currently being prepared and will follow on from the previous plan with updated information and a clear strategy.

This Strategic Flood Consequence Assessment (SFCA) should be used to inform the replacement LDP process and to ensure proposed developments are steered towards the lowest possible flood risk zone. Planning Policy Wales (PPW) administers the production of Technical Advice Notes (TAN), of which TAN15: Development and Flood Risk provides guidance in relation to flooding. LPAs should take into account the guidance provided in TAN15 when preparing their LDPs and when assessing individual planning applications.

As well as TAN15 and the local plans identified above, there are a number of other plans and policies which will influence and will be influenced by the SFCA.

Figure 3-1 illustrates the links between legislation national policy, statutory documents and Flood Consequence Assessments. The figure shows that whilst the key pieces of legislation and policy are separate, they are closely related and their implementation should aim to provide a comprehensive and planned approach to asset record keeping and improving flood risk management within communities.

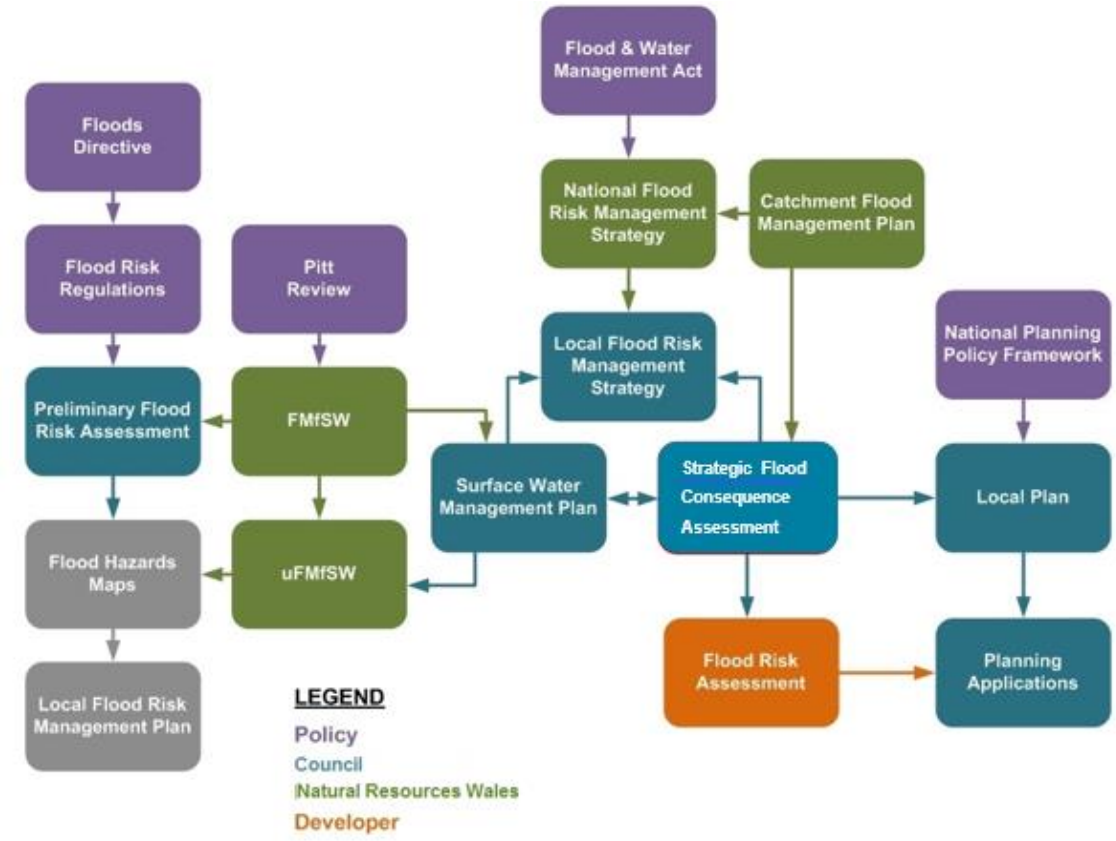


Figure 3-1 Key Documents and Strategic Planning Links - Flood Risk

The first tier of flood risk management in Wales is the National Flood Risk Strategy. The first national strategy was released in 2011, in line with the requirements of the Flood and Water Management Act 2010. This strategy is currently being updated, with the update still in draft form. Consultation on the strategy was undertaken in 2019. The draft strategy recognises that with climate change, we can expect more frequent and severe floods, rising sea levels and faster rates of erosion. The consultation document recognises that flood defences are not the sole answer for managing risk, with a focus on wider resilience, prevention and awareness of risk to determine how to manage both land and water. By promoting provision of information, natural flood management schemes and greater collaboration across catchments and multi-agency working, the strategy hopes to further reduce risk and create better, more sustainable schemes to deliver wider wellbeing benefits.

Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs) represent the second 'tier' in the strategic flood risk management process, providing the overall framework within which more detailed assessments, such as the BCBC SFCA are undertaken. The SFCA covers specific land uses and is better able to influence flood risk management policies to address local issues, although CFMPs may be better placed to guide flood risk management policies on a catchment scale.

The SFCA does not eliminate the need for more detailed flood consequence assessments (FCAs) of individual proposed development sites. More detailed FCAs will still be required in accordance with TAN15. Rather, the SFCA will provide additional information for these FCAs to draw upon and identify more detailed issues associated with flood hazards and flood consequences. This chapter discusses the national and local plans and policies relevant to developments and flood risk within BCB.

3.2 Legislation

3.2.1 EU Floods Directive and the Flood Risk Regulations

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.

Natural Resources Wales (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.

3.2.2 Bridgend Preliminary Flood Risk Assessment

The PFRA for Bridgend was published in 2011 and updated in 2017. Since the 2011 publication, no floods have caused locally significant consequences to cause a major update to the original PFRA document.

Bridgend County Borough has no areas that reach the thresholds required to nominate indicative flood risk areas, although there are areas across the borough which are at risk of flooding. From the records available to inform the PFRA, no incident is

considered to have had significant harmful consequences (although any incident will have consequences for those involved).

There is, however, a high risk of flooding from local sources across the Borough and based on nation surface water modelling, approximately 1250 properties and 650 business are estimated to be at risk from flooding to a depth of 0.3m during a rainfall event with a 1 in 200 annual chance of occurring.

3.2.3 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 we manage our water resources.

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, ground water and ordinary watercourses) and a strategic overview role of all flood risk for Natural Resources Wales.

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 Duties

Responsibility	Description
Local Strategy for Flood Risk Management	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 Local 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. The LFRMS for Bridgend was published in September 2013.
Investigating Flood Incidents	The LLFA has a duty to investigate and record details of significant flood events in their area. This duty includes identifying risk management authorities and their functions and how they intent to exercise those functions in response to a flood. The responding risk management authority must publish the results of its investigation and notify other relevant risk management authorities.
Asset Register	The 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	The Act provides the LLFA with powers to designate structures and features that affect flooding or coastal erosion. 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	The Act establishes each LLFA as a SuDS Approval Body (SAB). The SAB has responsibility for the approval of proposed 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.

3.2.4 Sustainable Drainage Systems (SuDS)

Disposal of surface water 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 and 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 3-2. 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.

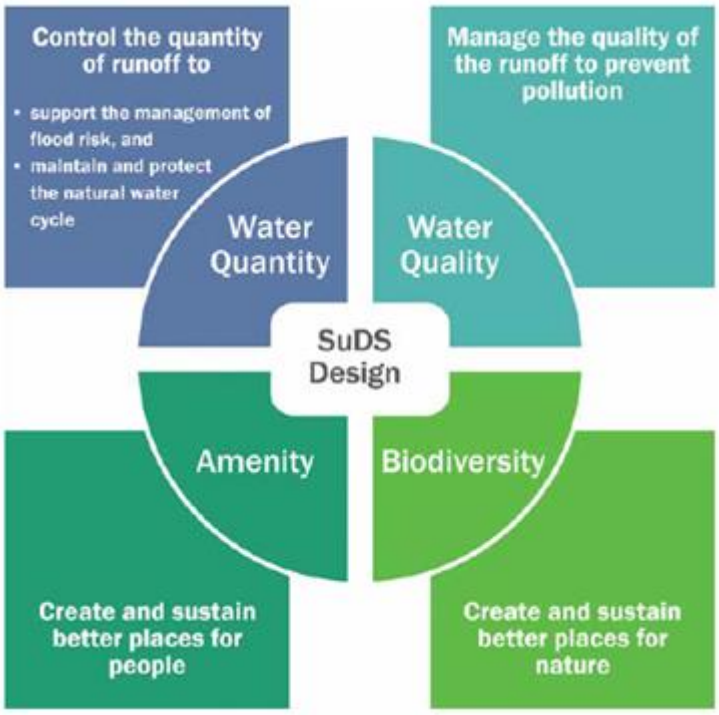


Figure 3-2 The Four Pillars of SuDS Design

There are mandatory standards for SuDS and design guidance is 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)
- Planning Policy Wales – Edition 9, November 2016
- The Building Regulations 2010 Part H: Drainage and Waste Disposal
- Sewers for Adoption 7th Edition

3.2.5 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 Western Wales River Basin District covers the whole county borough of Bridgend. This first RBMP for this basin was published by Environment Agency Wales in 2009. The main responsibility for BCBC is to work with Natural Resources Wales to develop links between river basin management planning and the development of Local Authority plans, policies and assessments. In particular, the programme of actions (measures) within the RBMP highlights the need for:

- Water Cycle Studies to promote water efficiency in new development through regional strategies and local development frameworks,
- Surface Water Management Plan implementation,
- Considering the WFD objectives (achieving good status or potential as appropriate) in the spatial planning process, including LDDs and Sustainable Community Strategies, and
- Promoting the wide scale use of Sustainable Drainage Systems (SuDS) in new development.

Since the first RBMP in 2009 there has been a second cycle plan for Western Wales which was published in 2016 by Natural Resources Wales. This document is the first update to that plan and will subsequently be reviewed in 2021 when a further update will be published. River basin management is a continuous cycle of planning and delivery. The purpose of this management plan is to protect and improve the water environment for the wider benefits to people and wildlife.

The current status of the RBMP in 2015 allows us to review progress made during the last six years and set out the foundation for this next cycle of river basin planning. Current status is assessed on the standards, methodologies and waterbody network introduced for the second cycle of River Basin Management Planning. In 2015, 225 waterbodies which is equivalent to 40% are in good or better overall status. 425 water bodies which is equivalent to 74% have an objective of good status or better to be achieved by 2021 however, there is a large degree of uncertainty that such a significant increase in achieving good status or better will be observed by 2021.

3.2.6 Well-being 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.

3.3 Planning Policy

3.3.1 Planning Policy Wales

Planning Policy Wales Edition 10 (PPW 10) 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 a 5-year supply of land for housing judged against the general

objectives and the scale and location of development provided for in the development plan.

Paragraph 13.2.4 of PPW refers to "flood risk and climate change' and states that '*Local Planning Authorities should take a strategic approach to flood risk and the catchment as a whole. They should ensure that new development is not exposed unnecessarily to flooding therefore, by considering flood risk in terms of the cumulative impact of the proposed development in the locality, on a catchment wide basis (river catchment and coastal cell), and, where necessary, across administrative boundaries.*"

Paragraph 13.3.2 continues that "*when drawing up policies and proposals for their area Local Planning Authorities must acknowledge that government resources for flood and coastal defence projects 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.

3.3.2 Technical Advice Note 15: Development and Flood Risk

Technical Advice Note 15: Development and Flood Risk (TAN15) sets out the criteria against which the consequences of a development in an area at risk of flooding can be assessed.

TAN15 was introduced in 2004 by the Welsh Assembly Government. It is technical guidance related to development planning and flood risk using a sequential characterisation of risk based on the Welsh Government's Development and Flood Risk Advice Map (DAM). 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.

As part of this process, TAN15 requires that a Flood Consequence Assessment (FCA) be produced for all developments within a flood risk area. Areas considered to be at flood risk are shown on the Development Advice Map (DAM) produced by the Welsh Government.

TAN15 Draft Consultation 2019

In October 2019 Welsh Government consulted on a draft update to TAN15. The consultation is now closed and at the time of writing Welsh Government were yet to respond to the consultation or set out a clear timetable for implementing changes to TAN15. However, it is relevant to signpost to what are likely to be significant changes to policy. Notable changes are expected to include:

- Replacing the Development Advice Map with a new Wales Flood Map, to be maintained by Natural Resources Wales. The Wales Flood Map will show areas at high/medium risk (Zone 3), low risk (Zone 2) and very low risk (Zone 1) as three separate flood zones. This will support a move from the current precautionary framework to a risk-based approach.
- Integrating surface water mapping into the new Wales Flood Map, to replace the Zone B advisory classification contained within the Development Advice Map.
- Changes to the Development Categories, including a new 'water compatible development' category. Land-uses such as renewable energy have been added to the guidance, and some development types have changed categories.
- Emphasising the importance of the Development Plan and highlighting the need for comprehensive Strategic Flood Consequences Assessments to inform development strategies, site selection and planning policies.
- Guidance on how major regeneration initiatives affecting communities located in areas of flood risk should be progressed through national and regional levels of the planning system.
- Guidance in relation to the justification and acceptability tests has been updated to make it clear that planning authorities should not consider proposals for highly vulnerable development in high and medium risk areas (Zone 3).

The consultation on TAN15 was explicit in stating that it does not replace extant guidance within Technical Advice Note 15, published in 2004, and that Development Plans and planning decisions should continue to refer to these documents, until such a time as an updated TAN15 is published by the Welsh Government. Consequently, this SFCA is based upon the current 2004 version of TAN15.

3.3.3 Development Advice Maps

DAM (Development Advice Map) zones are defined in TAN15. There are three DAM Zones (A, B & C). Zone C is further divided to account for existing infrastructure and flood defences. The descriptions provided in TAN15 (Figure 3-3) detail how the DAM zones were first defined. Flood Zones can be refined for SFCAs and Flood Consequence Assessments where more detailed information is available. DAM zones influence key planning decisions and determine the requirements for Flood Consequence Assessments depending on the zone in which development is to be placed.

Zone B is based on British Geological Society (BGS) mapping of sedimentary deposits, which at one time would generally have been transported and laid down by a hydraulic process. At the inception of the Development Advice Map, when national scale modelling techniques were in their infancy, the zone was used to apply an additional check against Zone C. In practice Zone B is rarely used and its function has been superseded by advances in flood modelling that give greater confidence to the mapping of Zone C. This point is confirmed by the current TAN15 consultation that

proposes to remove Zone B in the next update to TAN15. Consequently, Zone B has not be explicitly referred to in this SFCA.

Description of Zone		Use within the precautionary framework
Considered to be at little or no risk of fluvial or tidal/coastal flooding.	A	Used to indicate that justification test is not applicable and no need to consider flood risk further.
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further.
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

Figure 3-3 DAM Zones as defined by TAN15

3.3.4 The Justification Test

First and foremost, development should be directed away from areas of flood risk. However, there is recognition within TAN15 that this is not always practical or the most sustainable course of action. Consequently, in high risk areas (Zone C) only those developments which can be justified on the basis of the tests outlined in Section 6 and Section 7 of the TAN should be considered. Collectively these requirements are referred to as the Justification Tests, the key requirements are reproduced in Figure 3-4 below.

Whilst the Justification Test does allow a potential pathway to development in areas of flood risk, paragraph 6.2 makes it clear that Highly Vulnerable Development is not acceptable in Zone C2 in any circumstances.

6 Justifying the location of development

6.1 Much urban development in Wales has taken place alongside rivers and in the coastal plain. It is therefore inevitable, despite the overall aim to avoid flood risk areas, that some existing development will be vulnerable to flooding and fall within zone C. Some flexibility is necessary to enable the risks of flooding to be addressed whilst recognising the negative economic and social consequences if policy were to preclude investment in existing urban areas, and the benefits of reusing previously developed land. Further development in such areas, whilst possibly benefiting from some protection, will not be free from risk and could in some cases exacerbate the consequences of a flood event for existing development and therefore a balanced judgement is required.

6.2 New development should be directed away from zone C and towards suitable land in zone A, otherwise to zone B, where river or coastal flooding will be less of an issue. In zone C the tests outlined in sections 6 and 7 will be applied, recognising, however, that highly vulnerable development and Emergency Services in zone C2 should not be permitted. All other new development should only be permitted within zones C1 and C2 if determined by the planning authority to be justified in that location. Development, including transport infrastructure, will only be justified if it can be demonstrated that:-

i. Its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement[1]; **or**,

ii Its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and,

iii It concurs with the aims of PPW and meets the definition of previously developed land (PPW fig 2.1); and,

iv The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

Figure 3-4 The Justification Test as stated in TAN15

The means of demonstrating compliance with the requirements of the Justification Tests is through the preparation of a Flood Consequence Assessment (FCA). FCA's should be prepared in accordance with Section 7 and Appendix 1 ('Assessing Flooding Consequences') of TAN15.

The Local Authority will need to ensure that any candidate sites included in the Local Development Plan have a reasonable prospect of satisfying the Justification Tests.

3.3.5 Acceptability Criteria

The Justification Tests consist of four parts. The fourth part concerns ensuring that the potential consequences of flooding are acceptably low. The management and assessment of these consequences is set out in Appendix 1 of the TAN15. These requirements are collectively referred to as the Acceptability Criteria.

Whilst there are many elements to the acceptability criteria, all of which must be considered and satisfied, there are two criteria which are particularly important and relevant to a strategic assessment of flood risk and development. This are described below:

A1.14 Threshold Frequencies of Flooding

Paragraph A1.14 of TAN15 advises that most development should be designed to be flood free during the 1% fluvial flood (i.e. a fluvial flood with a 1 in 100 chance of occurring in any year) and the 0.5% tidal flood (i.e. 1 in 200 chance in any year event). TAN15 advises that development relating to Emergency Services should be designed to be flood free for the 0.1% flood (i.e. with a 1 in 1000 chance of occurring in any year). There is, therefore, a frequency threshold of flooding below which inundation of any development should not be allowed.

Table 3-2, which should not be regarded as prescriptive, provides indicative guidance as to what that frequency threshold could be for different types of development described in terms of annual probability of occurrence.

Table 3-2 Threshold Frequencies of Flooding (reproduced from TAN15)

Type of Development	**Threshold Frequency (Years)**	
	Fluvial	Tidal
Residential	1%	0.5%
Commercial/Retail	1%	0.5%
Industrial	1%	0.5%
Emergency Services	0.1%	0.1%
General Infrastructure	1%	0.5%

A1.15 - Exceedance conditions

Paragraph A1.15 of TAN15 recognises that "*Beyond the threshold frequency proposed development would be expected to flood under extreme conditions. However even with adequate mitigation measures in place it may still not be sensible to allow particular development to take place. For instance, it would not be sensible for developments to be built in areas where the velocity and depth of floodwaters was such that structural damage was possible or that people could be swept away by the flood.*"

A table of guidance, as provided in A1.15, is set out in Table 3-3 below. It is important to stress that the values provided in A1.15 are indicative, and reflect conditions in which, given the presence of adequate warnings and preparation, appropriately equipped personnel could undertake emergency activities. However, they are not definitive. Each site must therefore be considered individually, and a judgement taken in the context of the particular circumstances which could prevail at that site. It is for the decision maker to arrive at this judgement, informed by an FCA, the advice of NRW and other consultees.

Table 3-3 Indicative exceedance conditions (reproduced from TAN15)

Type of development	Maximum depth of flooding (mm)	Maximum rate of rise of floodwaters (m/hr)	Maximum speed of inundation of flood risk area (hrs)	Maximum velocity of floodwaters (metres/sec)
	Property Access			Property Access
Residential (habitable rooms)	600 600	0.1	4	0.15 0.3
Commercial & Retail	600 600	0.3	2	0.15 0.3
Industrial	1000 1000	0.3	2	0.3 0.45
Emergency Services	450 600	0.1	4	0.15 0.3
General Infrastructure	600 600	0.3	2	0.3 0.3

NOTE. The above figures are indicative and reflect conditions in which, given the presence of adequate warnings and preparation, appropriately equipped personnel could undertake emergency activities. However they are not definitive. Each site must therefore be considered individually and a judgement taken in the context of the particular circumstances which could prevail at that site.

3.3.6 Presence of Flood Defences

The presence of flood defences complicates understanding of risk as the actual risk may be reduced. However, where residual risk exists, if defences are breached or overtopped for example, then areas may be considered to be extremely vulnerable due to the speed of flooding. In such cases TAN15 suggests that NRW advises the LPA on the likely flooding consequences and the LPA must make a decision on acceptability of proposed development. Taking into account climate change and extreme flood risks as a result of climate change. Where development is allowed, measures to manage the risk must be put in place which may include developers taking responsibility for the ongoing maintenance of flood defences (TAN15 paragraph 7.5). Detailed assessment of the flood risks and function of defences should be carried out by in site specific FCAs to inform decision making.

3.3.7 Applying TAN15 for an SFCA

TAN15 is therefore fairly prescriptive and presents a series of tests that a development must satisfy before being deemed acceptable. Figure 3-5 shows a flow chart of the TAN15 procedure for assessing suitability of areas for development. These considerations can be used during site specific FCAs and during this SFCA.

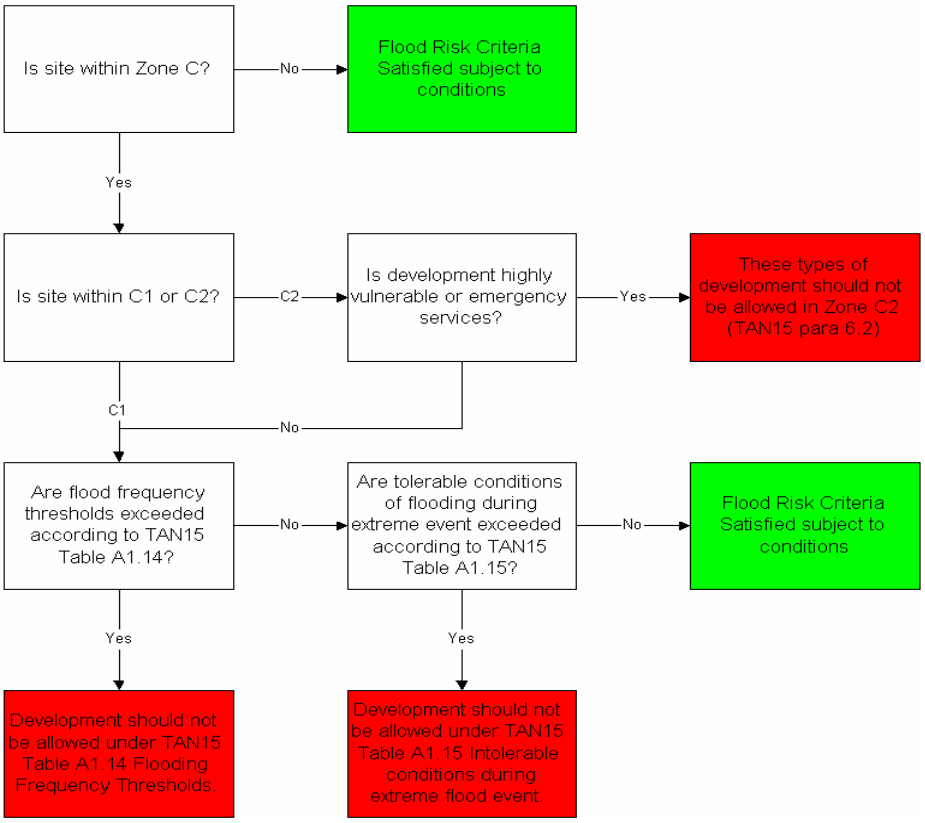


Figure 3-5 Flow Chart of TAN15 Procedure for Assessing Acceptability of Developments in Relation to Flood Risk

Application of TAN15 should in the first instance advocate moving development out of areas of high risk to areas of lower risk. Following this approach, any development within Zone C (the 0.1% AEP flood extent) should be avoided. To limit the occurrence of flooding issues in planning decisions, land within Zone C (in particular Zone C2) should not be allocated for development where possible.

It is, however, accepted that there may be times where development within Zone C (in particular Zone C1) may be required, satisfying the conditions of the Justification Tests and Acceptability Criteria. Consideration of detailed and specific mitigation measures cannot be made during an SFCA as these are site specific and can be complex. However, consideration of the unmitigated flooding criteria will give a good indication of whether mitigation is likely to be effective. For example, it is less likely that a site, which is at frequent risk from deep and fast flowing water can be successfully mitigated, achieving the tolerable criteria and limiting wider impacts are likely to be difficult to achieve.

Clearly the SFCA does not remove the need for site specific FCAs for individual developments as more detailed assessments would be required to produce a greater understanding of flood risk at any particular site. This would include detailed proposals for mitigating flood risk and achieving the flood risk tolerable criteria.

The information provided in this SFCA allows the LPA to have a good understanding of flood risk across the key areas of the County. This information should inform spatial planning decisions, ideally to avoid Zone C areas or, where it is necessary, to look at development in Zone C with a better understanding of achievable mitigation.

3.3.8 Local Development Plan

The Bridgend Local Development Plan (LDP) contains policies and proposals for the development and use of land within the County Borough. The existing LDP is for the period 2013-2021. This LDP is due to be updated, as required by the Planning and Compulsory Purchase Act 2004. Work commenced formally in 2017. It will include a Spatial Strategy, Strategic Policies and a monitoring procedure to implement the Vision and Objectives. This will provide the core framework to meet the development needs of BCBC. This completed SFCA will help support the vision and strategy.

Local Development Plan preferred strategy for 2018-2033 was published in September 2019. This is the basis for a full detailed strategy that will be created for the county borough.

3.4 The 2013 Local Development Plan

Within the existing LDP, there are several policies which refer to flood risk and erosion across the county borough:

Policy EV15 refers to development within the coastal zone that will only be permitted where it meets, amongst other criteria –

- it is not at risk from, nor will it exacerbate, flooding or erosion risk.

Policy ENV16 states that new development in areas identified as being liable to flooding will not be permitted, unless it can be demonstrated that:

- They can be properly protected by approved engineering works and/or by other flood protection measures;
- Such remedial measures will not put others at risk of flooding; and
- The development, including any remedial measures, can be sympathetically assimilated into the environment in terms of its siting, scale, design and landscaping, without any detrimental impact on acknowledged sites of archaeological or historic interest, and habitats and species of importance to biodiversity can be safeguarded.

3.5 The 2018 Local Development Plan – Preferred Strategy

The preferred strategy was published for consultation in September 2019. Whilst this strategy has not yet been adopted, it provides a good indication of the proposed policies for the county borough with relation to erosion and flood risk. The preferred strategy highlights flood risk as a key environmental issue across Bridgend:

- **LS4:** Significant areas along all the main rivers and watercourses of the County Borough are identified as being at risk of flooding. The existing urban areas of Aberkenfig and Pencoed are highly constrained by floodplains. There is also a risk of tidal flooding and storm surges in parts of Porthcawl and along the coast.

Several strategic objectives and visions have been prepared for the preferred strategy, including the consideration of flood risk across the county borough:

- **Strategic Policy 3:** Mitigating the impact of climate change – directing development (particularly vulnerable uses) away from flood risk areas, and avoiding development that increases the risk of flood and coastal erosion, including through the deployment of sustainable urban drainage systems where relevant

In order to support the implementation of the Strategic Objectives and Visions of the preferred strategy, 35 Specific LDP Objectives have been devised to address these.

- **SOBJ 4:** to protect and enhance distinctive and natural places
- **OBJ 4e:** To manage development in order to avoid or minimise the risk and fear of flooding and enable and improve the functionality of floodplains

3.6 Flood Risk Management Plans, Strategies and Policies

3.6.1 Catchment Flood Management Plans

Catchment Flood Management Plans are an essential component of future flood risk management. The plans are key to delivering the flood risk management outcomes of Welsh Assembly Government (WAG) and Defra. A Catchment Flood Management Plan 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, councils and others need to take now and, in the future, to ensure adequate response and adaptation to the increasing and changing flood risk.

Catchment Flood Management Plans 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 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.

The Ogmore to Tawe CFMP[4] has the following policy options:

1. Areas of little or no flood risk we will continue to monitor and advise.
2. Areas of low to moderate flood risk we can generally reduce existing flood risk management actions.
3. Areas of low to moderate flood risk we are generally managing existing flood risk effectively.
4. Areas of low, moderate or high flood risk we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change
5. Areas of moderate to high flood risk we can generally take further action to reduce flood risk
6. Areas of low to moderate flood risk we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits.

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.

BCB is divided roughly equally within three separate management units, as shown in the legend in Figure 3-6.

4 Ogmore to Tawe Catchment Flood Management Plan (January 2010)
https://www.npt.gov.uk/ldpexamination/SWW04%20Ogmore%20to%20Tawe%20CFMP%20(EA%20Wales%202010).pdf

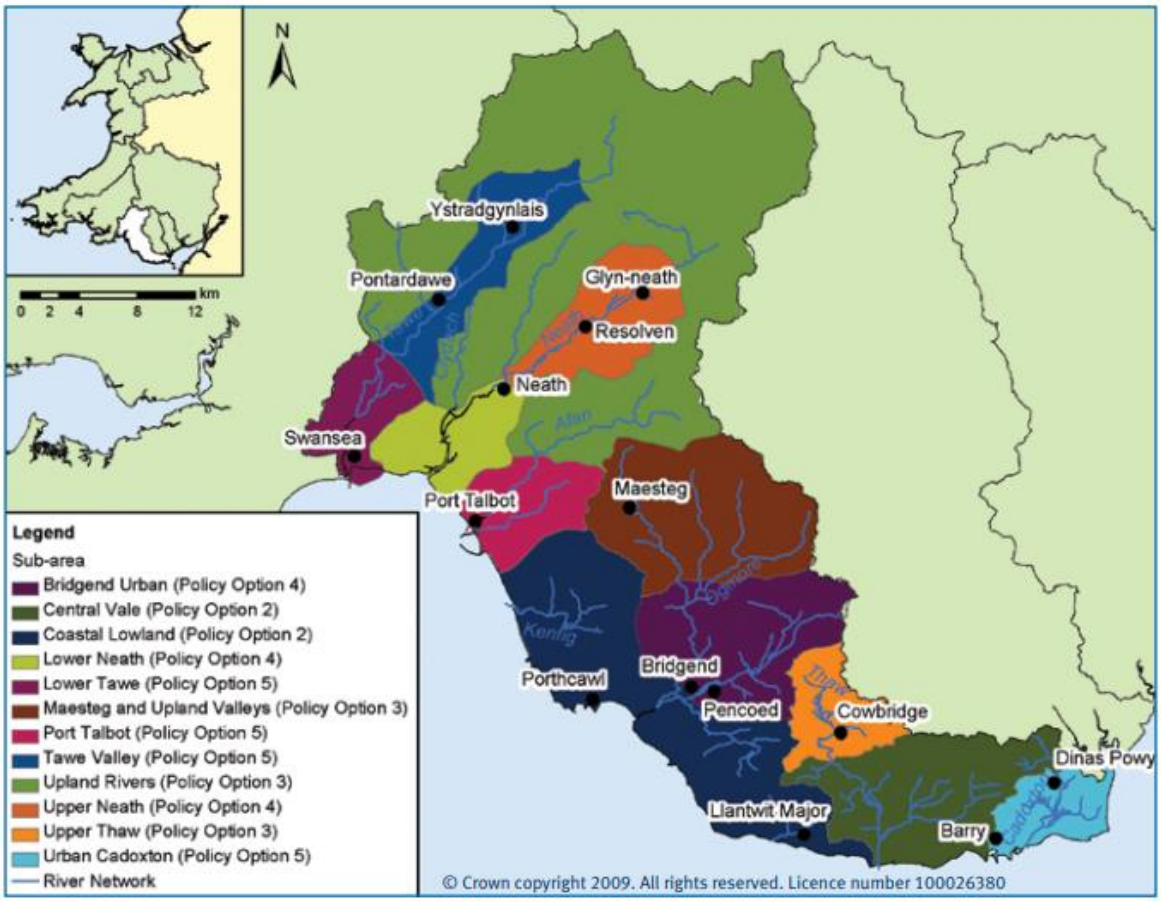


Figure 3-6 Management Units in the Ogmore to Tawe CFMP (EA Wales, 2010)

The western part of the county falls within the coastal lowlands policy unit. The selected policy for this area is:

Policy Option 2 – areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.

The northern part of the county falls within the Maesteg and Upland Valleys policy unit. The selected policy for this area is:

Policy Option 3 – areas of low to moderate flood risk where we are generally managing existing flood risk effectively.

The central part of the county falls within the Bridgend Urban Policy Unit. The selected policy for this area is:

Policy Option 4 – areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.

3.6.2 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, historic and natural environment in a sustainable manner. SMPs are 'coastal' companion documents to the 'inland' Catchment Flood Management Plans. 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.

The coastal area of BCB falls within the 2010 Lavernock Point to St. Ann's Head SMP2. The coast of Bridgend is covered by three policy units (PU). Table 3-4 below details the extents of these units and the preferred policies for each.

Table 3-4 SMP Policy Units

Policy Scenario Area	Policy Unit	Location	Short-term Policy (0-20 years)	Medium term Policy (20-50 years)	Long-term Policy (50-100 years)
6 Nash Point to Porthcawl	PU 6/2	Ogmore River to Newton (Merthyr Mawr)	Allow the coast to evolve and retreat naturally through Managed Realignment		
7 Porthcawl to Sker Point	PU 7/1	Newton	Hold the Line through maintaining existing defences until they reach the end of the effective life	Allow the coast to evolve and retreat naturally through no active intervention	
	PU 7/2	Newton Point to Rhych Point (Trecco Bay)	Hold the Line through maintaining existing low grade defences	Hold the line through construction of new defences in association with the development of the Trecoo Bay caravan park	
	PU 7/3	Rhych Point to Porthcawl Point	Hold the line through maintenance and upgrading the existing defences, and extend as necessary to the east, to ensure that the risk of flooding and erosion is managed		
	PU 7/4	Porthcawl	Hold the line through maintenance and upgrading the existing defences to ensure that the risk of flooding and erosion is managed. It is assumed that there would be no active intervention along currently undefended stretches of coastline		
	PU 7/5	Hutchwns Point to Sker Point	Allow existing defences to fail and allow the coast to evolve and retreat natural through no active intervention	Once defences have failed, the coast will be allowed to evolve and retreat naturally through no active intervention	
8 Sker Point to Swansea Docks	PU 8/1	Sker Point to Afon Cynfig	Enable the dune system to function naturally with minimal interference, but allow localised dune management if necessary, through managed realignment		

3.6.3 Local Flood Risk Management Strategies

LLFAs have responsibility for developing a Local Flood Risk Management Strategy (LFRMS) for their area covering local sources of flooding. The LFRMS produced must be consistent with the National Strategy. It will set out the local organisations with responsibility for flood risk in the area, partnership arrangements to ensure co-ordination between these, an assessment of the flood risk and plans and actions for managing the risk.

The Bridgend Local Flood Risk Management Strategy was approved by the Minister for Natural Resources and Food in September 2013 and has the following aims:

- Reduce the impact of flooding on individuals, communities, businesses and the environment
- Raise awareness and engage people in responding to flood and coastal erosion risk

- Provide an effective and continual response to flooding and coastal erosion
- Prioritise investment in communities most at risk

These objectives align with national strategy objectives, and NRW plans and strategies.

3.6.4 Surface Water Management Plans

In June 2007, widespread extreme flooding was experienced in the UK. The Government review of the 2007 flooding, chaired by Sir Michael Pitt recommended "Local Surface Water Management Plans (SWMPs) … coordinated by local authorities, should provide the basis for managing all local flood risk."

The Governments guidance document[5] for SWMPs defines a SWMP as:

- A framework through which key local partners with responsibility for surface water and drainage in their area, work together to understand the causes of surface water flooding and agree the most cost-effective way of managing surface water flood risk.
- A tool to facilitate sustainable surface water management decisions that are evidence based, risk based, future proofed and inclusive of stakeholder views and preferences.
- A plan for the management of urban water quality through the removal of surface water from combined systems and the promotion of SuDS.

As a demonstration of its commitment to SWMPs as a structured way forward in managing local flood risk, Defra announced an initiative to provide funding for the highest flood risk authorities to produce SWMPs.

BCBC has not produced a SWMP. The LFRMS should however recommend locations where SWMPs may be needed, in areas where there is significant surface water flood risk and / or development pressure.

3.6.5 Natural Resources Wales: Flood Consequence Assessments

NRW assess FCAs and any other supporting flood risk documentation that accompany planning application consultations to identify whether the applicant has met the requirements of Planning Policy Wales and TAN15.

Natural Resources Wales produced an FCA and modelling good practice guide in 2015 to provide good preparation advice for developers and their consultants who are writing flood risk documentation to support development planning proposals associated with flood risk.

Most development proposals require planning permission from the Local Planning Authority (LPA). In gaining that permission, any development shown to be at risk of flooding will need to comply with the Welsh Government's Planning Policy Wales and Technical Advice Note 15 (TAN15). In some circumstances, a formal Flood Defence Consent or Environmental Permit is also required, either from NRW for locations at risk of flooding from main rivers or the sea, or from a Local Authority for ordinary watercourses such as streams.

Information on whether a location is at river or coastal flood risk can be found by referring to the Welsh Government's development advice map. Further detail on all sources of flood risk can be found on NRW's flood maps.

5 Surface Water Management Plan Technical Guidance - https://www.gov.uk/government/publications/surface-water-management-plan-technical-guidance

3.7 Roles and Responsibilities

The responsibilities for the Risk Management Authorities (RMA) under the Flood and Water Management Act and Flood Risk Regulations, and relevant plans and strategies for Bridgend are summarised below.

3.7.1 Natural Resources Wales

- Natural Resources Wales has a strategic oversight role for all forms of flooding, and power to request information from any partner in connection with its risk management functions.
- Exercise its flood or coastal erosion risk management functions in a manner consistent with the National Strategy and Local Strategies.
- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA.

3.7.2 Bridgend County Borough Council as a LLFA

- Must develop, maintain, apply and monitor a strategy for local flood risk management. This must be consulted on with all RMAs, the public and all other partners with an interest in local flood risk.
- Coordinate local flood risk management between relevant authorities and partners.
- Request information from others when it is needed in relation to their flood risk management functions.
- Where it considers this necessary or appropriate, the LLFA must investigate flooding incidents in its area.
- Establish and maintain a record of structures within their area that have a significant impact on local flood risk.
- Empowered to designate structures and features that affect flooding.
- Establish a SuDS Approving Body (SAB)
- Undertake works to manage flood risk from surface runoff and groundwater.
- Powers in relation to Ordinary Watercourses remain with district authorities.
- Exercise their flood and coastal erosion risk management functions in a manner consistent with the National Strategy and the Local Strategy.
- Permitted to agree the transfer of responsibilities for risk management functions (except the production of a Local Strategy) to other RMAs.
- Contribute to sustainable development.
- Consider flooding issues that require collaboration with neighbouring LLFAs and other RMAs.

3.7.3 Bridgend County Borough Council LPA

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies.
- Must be consulted on Local Strategies, if affected by the strategy, by the LLFA.
- Has a duty to be subject to scrutiny from the LLFA.
- Has a duty to cooperate and share information with other RMAs.

3.7.4 Bridgend Highways Authority

- Duty to act consistently with the National Strategies and Local Strategies.
- Responsibility for ensuring effective drainage of local roads in so far as ensuring drains and gullies are maintained.

- Must be consulted on Local Strategies, if affected by the Strategy, by the relevant LLFA.

3.7.5 Welsh Water

- Has a duty to act in a manner that is consistent with the National Strategy and have regard to Local Strategies.
- Must be consulted on Local Strategies, if affected by the strategy, by the relevant LLFA.

3.7.6 Members of the Public

- Must be consulted on Local Strategies by the LLFA.
- The public have a key role in ensuring Local Strategies are capable of being successfully delivered within the community. They should actively participate in this process and be engaged by the LLFA.

3.7.7 Riparian Owners

A riparian owner is someone who owns land or property alongside a river or other watercourses including a culvert. A watercourse is any natural or artificial channel through which water flows, such as a river including where rivers flow through a culvert, brook, beck, or mill stream.

Riparian owners have statutory responsibilities, including:

- Maintaining river beds and banks;
- Allowing the flow of water to pass without obstruction; and
- Controlling invasive alien species.

Further guidance for riverside property owners can be found in Natural Resources Wales's booklet 'A guide to your rights and responsibilities of riverside ownership in Wales' published in January 2017.

3.7.8 Private Developers

- Have a vital role in ensuring effective local flood risk management by avoiding development in areas at risk of flooding. Local Strategies should form a key element of local planning guidance.
- Providing proportional FCA for development proposals put forward for inclusion within the Local Plan and Development Management.
- Demonstrating appraisal of SuDS techniques and surface water flooding.
- Consulting with Risk Management Authorities on issues of flood risk.

4 Understanding Flood Risk

4.1 Sources of Flooding

Flooding is a natural process and can happen at any time in a wide variety of locations. It constitutes a temporary covering of land not normally covered by water and presents a risk when people and human or environmental assets are present in the area that floods. Assets at risk from flooding can include housing, transport and public service infrastructure, commercial and industrial enterprises, agricultural land and environmental and cultural heritage. Flooding can occur from many different and combined sources and in many different ways. Major sources of flooding include:

- **Fluvial (rivers)** - inundation of floodplains from rivers and watercourses; inundation of areas outside the floodplain due to influence of bridges, embankments and other features that artificially raise water levels; overtopping or breaching of defences; blockages of culverts; blockages of flood channels/corridors.
- **Tidal** - sea; estuary; overtopping of defences; breaching of defences; other flows (e.g. fluvial surface water) that could pond due to tide locking; wave action.
- **Surface water** - surface water flooding covers two main sources including sheet run-off from adjacent land (pluvial) and surcharging of piped drainage systems (public sewers, highway drains, etc.)
- **Groundwater** - water table rising after prolonged rainfall to emerge above ground level remote from a watercourse; most likely to occur in low-lying areas underlain by permeable rock (aquifers); groundwater recovery after pumping for mining or industry has ceased.
- **Sewer** – Exceedance or failure of the foul and combined sewer network.
- **Artificial Sources** - reservoirs; canals; industrial processes; burst water mains or failed pumping stations.

Different types and forms of flooding present a range of different risks and the flood hazards of speed of inundation, depth and duration of flooding can vary greatly. With climate change, the frequency, pattern and severity of flooding are expected to change and become more damaging.

4.2 Likelihood and Consequence

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

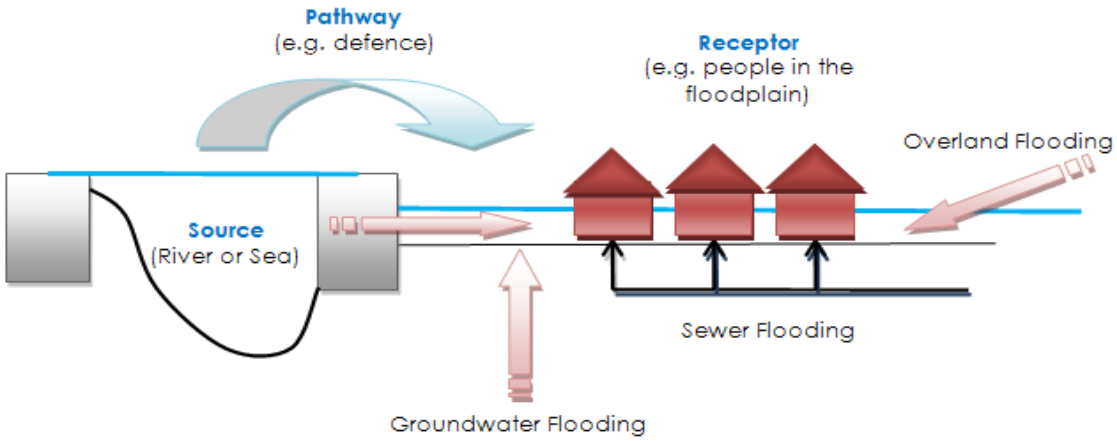


Figure 4-1 Source-Pathway-Receptor Model

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.

4.2.1 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 a hundred years, i.e. it has a 1% chance of occurring in any one year, not that it will occur once every hundred years.

Considered over the lifetime of development, such an apparently low frequency or rare flood has a significant probability of occurring. For example:

- A 1% flood has a 26% (1 in 4) chance of occurring at least once in a 30-year period - the period of a typical residential mortgage
- And a 49% (1 in 2) chance of occurring in a 70-year period - a typical human lifetime

4.2.2 Consequence

The consequences of flooding can result in fatalities, damaging property, disrupting 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). Flood risk is then expressed in terms of the following relationship:

Flood risk = Probability of flooding x Consequences of flooding

4.2.3 Risk

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 flood defences) and the vulnerability of receptors as mentioned above.

4.2.4 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.

4.2.5 Residual Risk

Even when flood defences are in place, there is always a likelihood that these could be overtopped in an extreme event or that they could fail or breach. Where there is a consequence to that occurrence, this risk is known as residual risk. Defence failure can lead to rapid inundation of fast flowing and deep floodwaters, with significant consequences to people, property and the local environment behind the defence.

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 always be a residual risk from flooding if these defences overtopped or failed that must be taken into account. Because of this, it is never appropriate to use the term "flood free".

5 Assessment Data and Methodology

5.1 Flood Risk in BCB

Information concerning the six types of flooding (river, sea, land, groundwater, sewer and artificial sources) has been collated and analysed for the whole of the study area.

The assessment has aimed to characterise flood risk today and into the future. A 100-year time horizon has been assessed and is considered appropriate for land use planning.

Natural Resources Wales (NRW) and other key stakeholders have been contacted throughout the SFCA process in an attempt to gather as much relevant information as possible.

The methodology proposed for the updated SFCA was based on the best use of the available information without new hydraulic modelling. Each dataset was reviewed with regard to its accuracy and the most appropriate datasets were used to define flood risk across BCB under varying conditions.

The published Development Advice Map (DAM) zones were used as the starting point for the SFCA. The most up to date NRW flood zones were used to build on the existing Development Advice Maps (DAMs) during the appraisal of flood risk. Further 1D-2D or 2D only hydraulic modelling of the strategic areas of Bridgend, Valleys Gateway, Porthcawl, Pencoed, Maestag and Pyle, Kenfig Hill and North Cornelly, and Waterton have been used to determine flood risk in these areas. It is important that the source and limitations of flood data is considered whenever using it to inform a land use planning decision.

BCBC and NRW will need to manage the update of the SFCA datasets in the future, as more detailed flood risk information becomes available.

5.2 Datasets Utilised

NRW and the LLFA hold a number of detailed 1D-2D hydraulic models and hydrological assessments that have been developed for flood hazard mapping studies. The most up-to-date model outputs typically inform the NRW flood zones and Development Advice Map (DAM). These detailed outputs are supplemented by generalised 2D modelling (JFLOW) results where more detailed assessments are absent. Table 5-1 provides a summary of all of the flood risk datasets used within the SFRA.

Table 5-1 Datasets Used in SFCA

Dataset	Source	Date of Data	Data Type
Flood Zones	NRW	2020	GIS
DAM Zones	NRW	2020	GIS
Historic Flood Outlines	NRW	2009	GIS
Areas Benefitting Defences	NRW	2020	GIS
Wales National Flood Risk Assessment (FRAW)	NRW	2018	GIS
Flood Defence Data	NRW	2020	GIS

Flood Warning Areas	NRW	2020	GIS
Updated Map for Surface Water	NRW	2013	GIS
River Ogmore in Bridgend Flood Model	NRW	2019	Estry-TUFLOW
Maesteg Flood Model	NRW	2012	Estry-TUFLOW
Pyle Flood Model	NRW	2012	Estry-TUFLOW
Aberkenfig & Brynmenyn Flood Model	NRW	2014	Estry-TUFLOW
Pencoed Flood Model	NRW	2018	Estry-TUFLOW
Porthcawl Flood Model	BCBC	2019	TUFLOW
Extreme Sea Levels	NRW	2019	GIS

5.2.1 Generalised flood modelling

In 2018-19 JBA supported NRW in developing a new national Flood Risk Assessment for Wales (FRAW) to deliver new generalised fluvial, pluvial and tidal flood maps for a range of present day and climate change scenarios. This study involved national generalised modelling, using a 2D raster flood spreading model (JFLOW) with limited 1D elements for fluvial and pluvial flood risks. Tidal risk was modelled using tidal projection modelling methods.

Lead Local Flood Authorities, including BCBC, were involved in the provision of local data to the FRAW project and the review of results.

Flood depth, velocity and hazard output were generated for a range of flood event return periods, both with and without climate change allowances. As with the current Flood Map, FRAW modelling ignores the presence of flood defences to produce 'undefended' results.

FRAW is yet to be publicly released although it has received technical sign-off. A public realise of FRAW is expected in late Summer 2020.

5.3 Tidal and Fluvial Flood Risk

5.3.1 Fluvial Flood Risk

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

- intense or 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 ground water tables;
- constrictions in the river channel causing flood water to backup;
- blockage of structures or the river channel causing flood water to backup; and
- 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;
- width and roughness of the floodplain; and
- 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, which are common within South Wales, 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.

5.3.2 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 defences occurs.

BCBC's coastline and associated areas of tidal flood risk is largely limited to the settlements of Newton/Porthcawl.

5.3.3 Detailed flood models

The key settlements of Bridgend, Maesteg, Valleys Gateway, Pencoed, Pyle, Kenfig Hill and North Cornelly and Waterton are at risk of flooding from rivers, whilst Porthcawl is at risk of tidal flooding.

Any available NRW detailed 1D-2D models available in these areas were used to inform the SFCA but no additional flood modelling was undertaken as part of the SFCA update. The flood model results for each key settlement is contained in Appendix A.

Due to their age, the detailed models covering Pyle, Aberkenfig & Brynmenyn may require updating (model hydrology, LIDAR and modelling methods) to inform detailed site-specific assessment, although the outputs are considered suitable for a strategic assessment of flood risk.

The extent and key parameters of the existing detailed flood models relevant to the SFCA are defined below. Where detailed flood modelling is not available the SFCA has been informed by broadscale modelling.

5.3.4 Bridgend Model

The extent of the 2019 1D-2D Bridgend model is shown in Figure 5-1. The flood model of Bridgend is a detailed Estry-TUFLOW model that has been developed iteratively since 2009, first developed by NRW and then subsequently updated by BCBC in 2019. At the time of this report the flood model used best available data and methods.

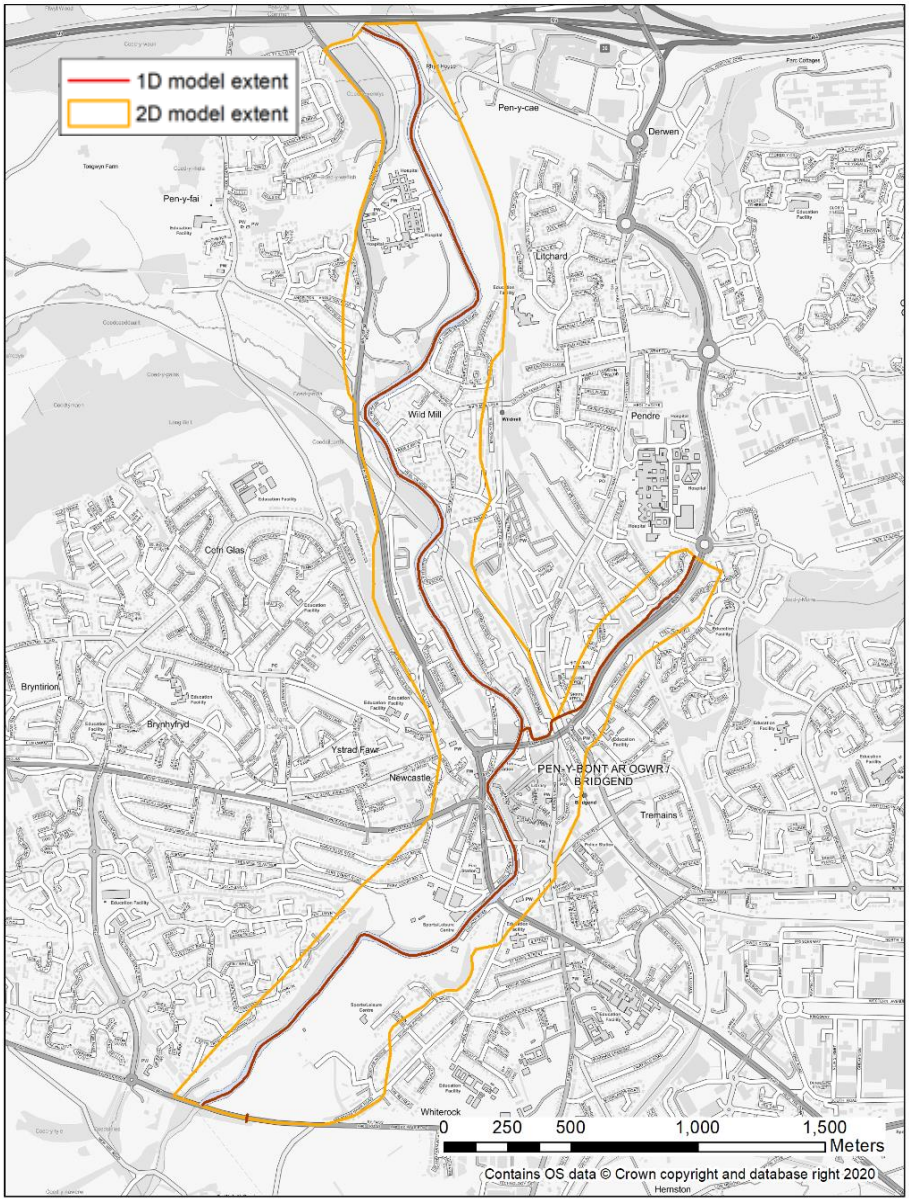


Figure 5-1: Bridgend 1D-2D model extent

5.3.5 Maesteg Model

The extent of the 2012 1D-2D Maesteg model is shown in Figure 5-2. As the Estry-TUFLOW flood model dates from 2012, some of the input data and methods will have been superseded. To support site specific assessments the model may require updating, including updates to the hydrology, LIDAR, base mapping and software versions.

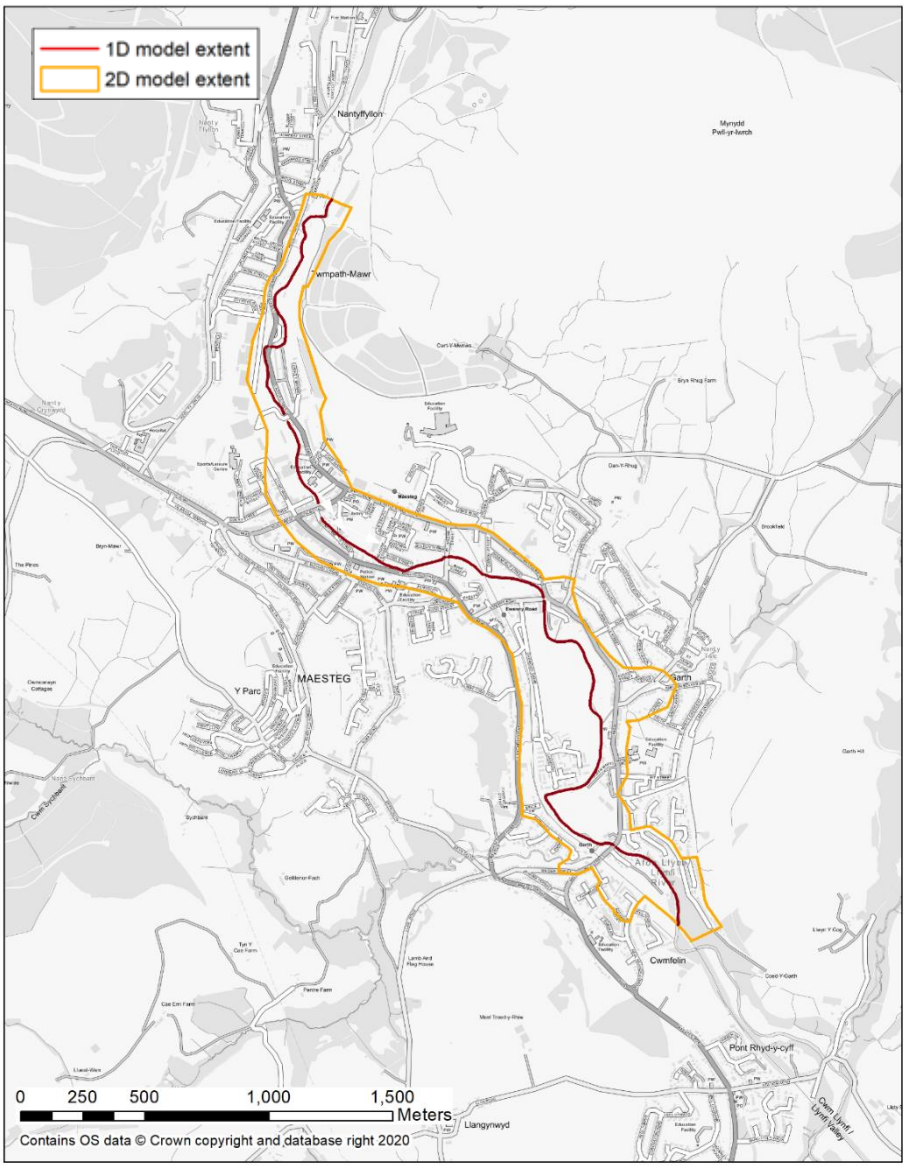


Figure 5-2 Maesteg Model Extent

5.3.6 Valleys Gateway Model (Aberkenfig & Brynmenyn)

The 2014 Aberkenfig and Brynmenyn flood model is detailed 1D-2D modelling which covers a large proportion of the valleys gateway strategic area including Aberkenfig, Bryncethin, Brynmenyn, Coytrahen, Sarn, Tondu and Ynysawdre as shown in Figure 5-3. As the Estry-TUFLOW flood model dates from 2014 some of the input data and methods will have been superseded. To support site specific assessments the model may require updating, including updates to the hydrology, LIDAR, base mapping and software versions.

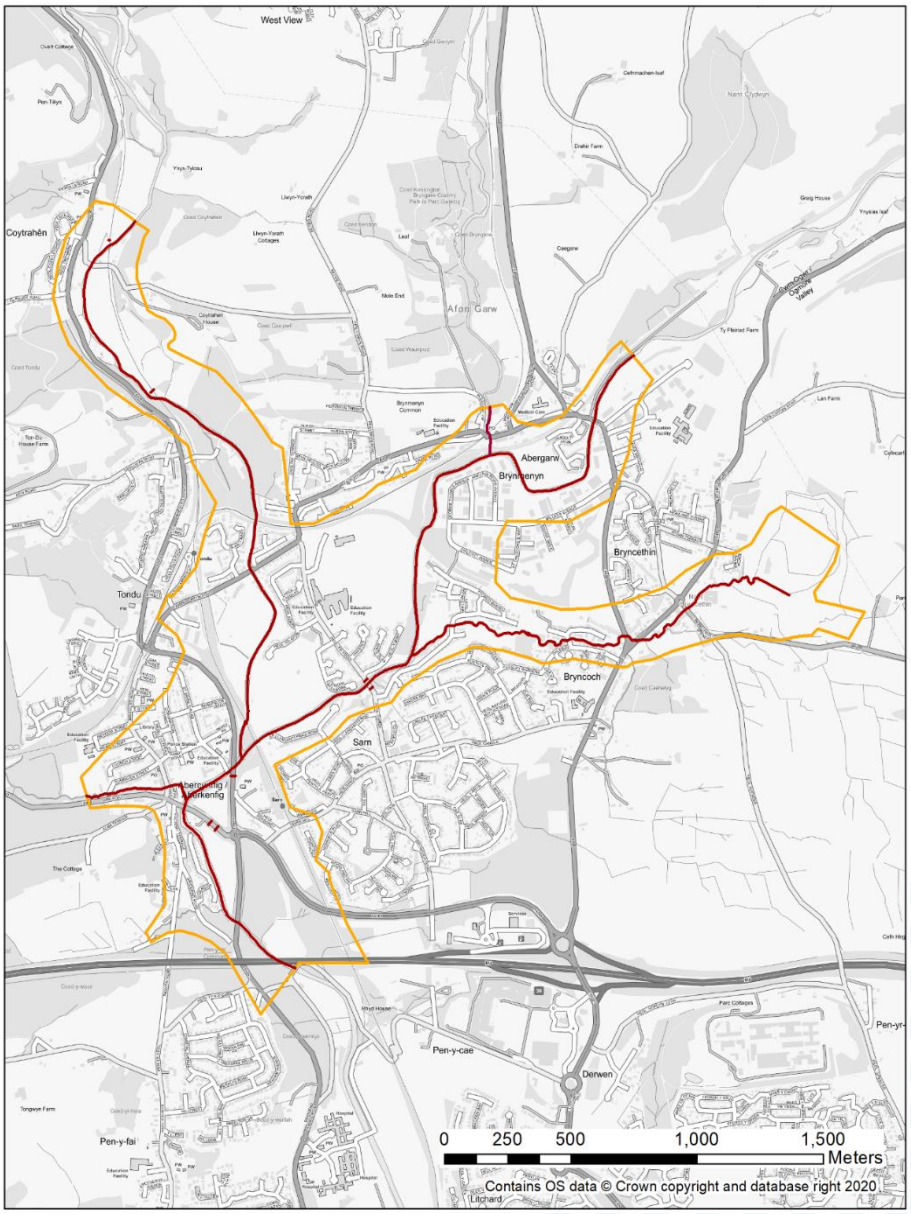


Figure 5-3: Valleys Gateway Model Extent

5.3.7 Pencoed Model

The Pencoed model is detailed 1D-2D modelling; the extent of which is shown in Figure 5-4. At the time of this report the Estry-TUFLOW flood model used best available data and methods. The model was last updated in 2018 to investigate the potential for a flood risk management scheme at Bont Newydd.

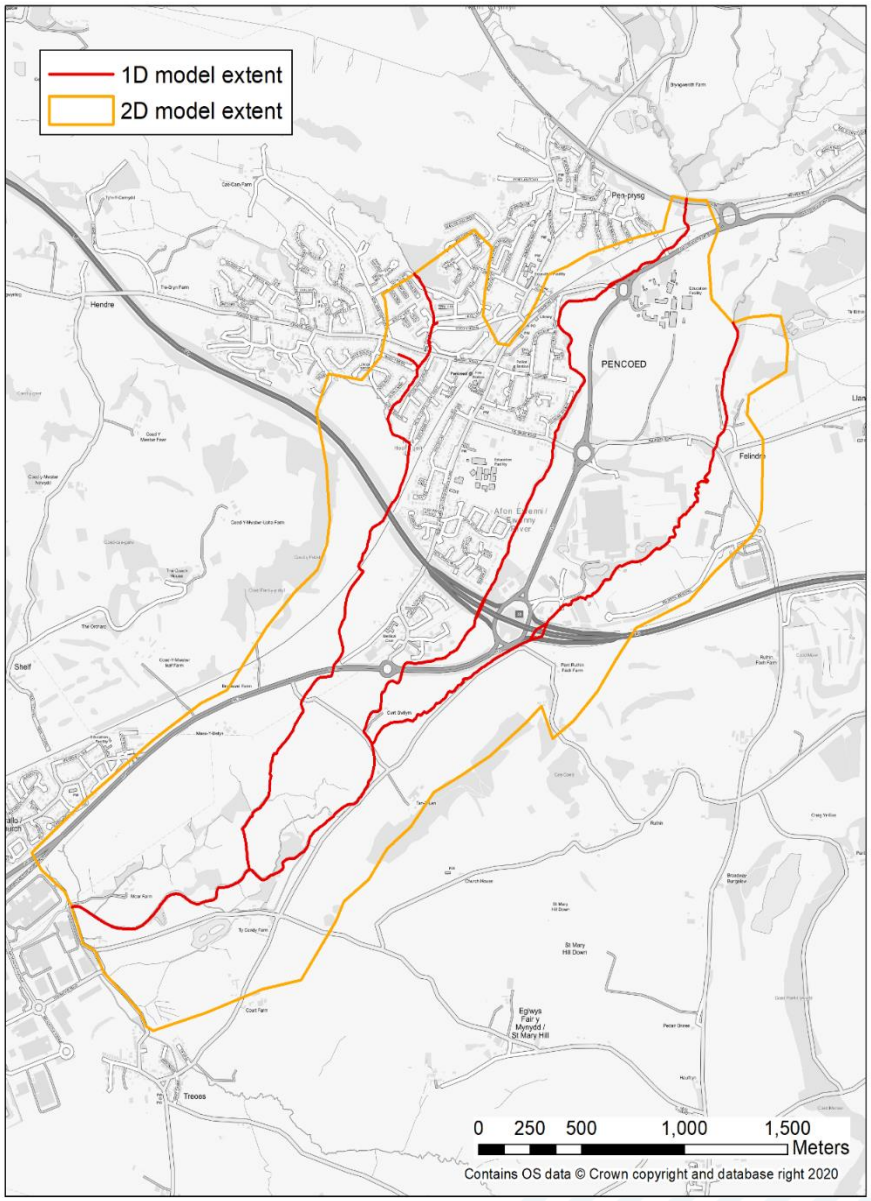


Figure 5-4: Pencoed Model Extent

5.3.8 Pyle, Kenfig and North Cornelly Model

The Pyle model is a detailed 1D-2D model which covers Pyle, North Cornelly and Kenfig Hill, as shown in Figure 5-5. As the Estry-TUFLOW flood model dates from 2012 some of the input data and methods will have been superseded. To support site specific assessments the model may require updating, including updates to the hydrology, LIDAR, base mapping and software versions.

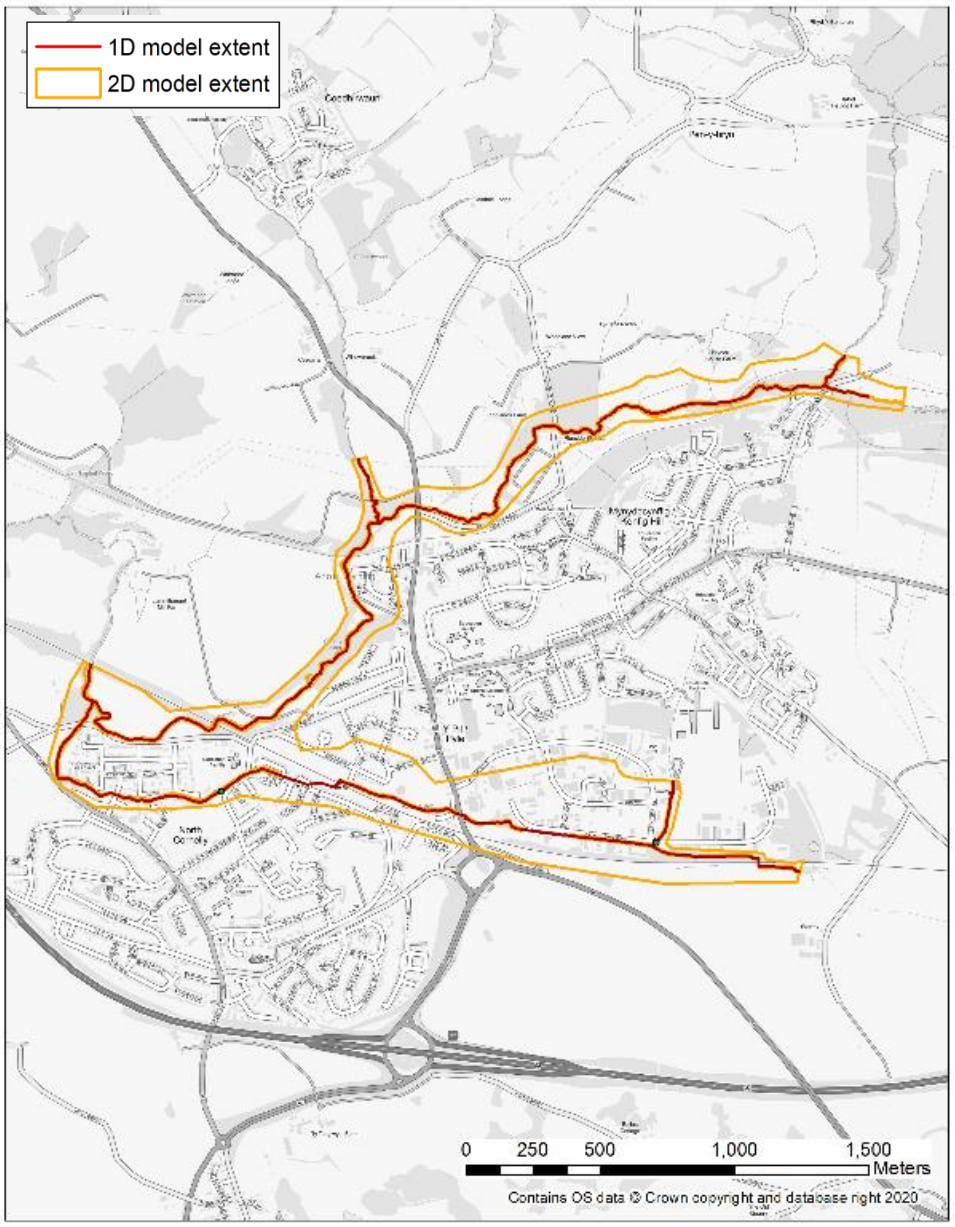


Figure 5-5 Pyle Model Extent

5.3.9 Porthcawl

The Porthcawl coastal flood model is a 2D TUFLOW hydraulic model developed in 2016 to support the Outline Business Case (OBC) for the Porthcawl coastal flood defence improvements. Although sea levels are applied to the model, the flood risk is predominantly the result of wave overtopping. Estimates of wave overtopping are informed by a wave transformation model and neural network wave overtopping calculations which are then applied to the 2D inundation model.

The flood modelling used within the SFCA is for the current situation at Porthcawl, as the new coastal defences have not yet been constructed and are proposed to be delivered in two stages. However, information from the OBC and flood model has been used to identify those areas predicted to benefit from the new coastal defences.

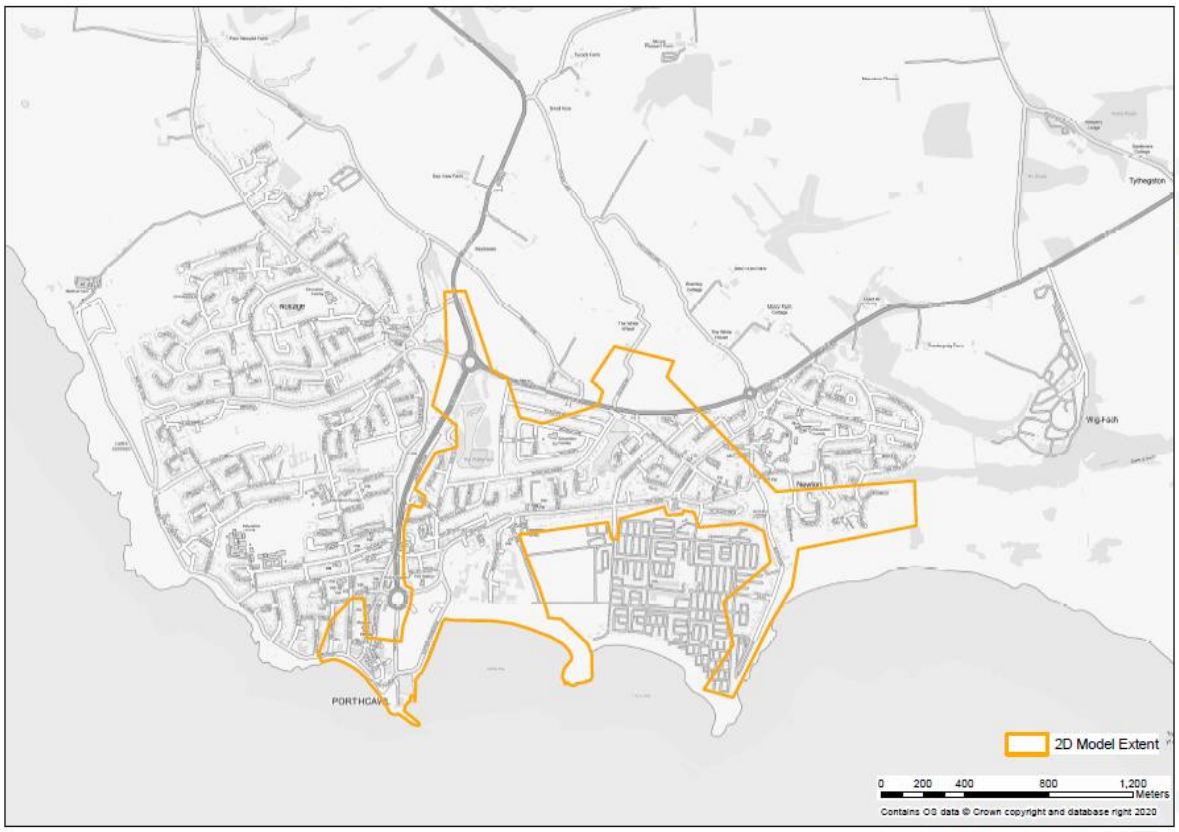


Figure 5-6 Porthcawl Model Extent

5.4 Surface Water Flood Risk Assessment

Surface water flooding occurs when intense, often short duration rainfall is unable to soak into the ground or enter drainage systems. It is made worse when soils are saturated so that they cannot accept any more water. 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 floodwater 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.

Historic records of surface water flooding have been taken from the Bridgend Preliminary Flood Risk Assessment and considered on a broad spatial scale. No new surface water flooding records have been incorporated into this SFCA update.

The NRW flood map currently displays surface water flood risk with a product named Risk of Surface Water Flooding map (RoFSW). The RoFSW dataset includes surface water flood outlines, depths, velocities and hazards for the following events:

- 1 in 30 year AEP event (high risk)
- 1 in 100 year AEP event (medium risk)
- 1 in 1000 year AEP event (low risk)

It is expected that RoFSW will shortly be replaced by FRAW data. FRAW adopts a very similar technical approach to RoFSW, whilst including a number of key improvements, including:

- Updated nationally consistent digital terrain model
- Models are run on hydrological catchments and not on the basis of 5km tiles reducing anomalies at model boundaries.
- Culverts and key hydraulic structures are explicitly modelled based on data provide by LLFA's.
- All surface water is extract from the models once it reaches a Main River, reducing confusion between fluvial and surface water flooding.
- A wider range of design events have been simulated, including the 1 in 10 year AEP event and climate change events.

Due to these significant improvements FRAW has been utilised within the SFCA to assess the risk of surface water flooding to strategic and candidate sites. Outputs from FRAW data for each key settlement is contained in Appendix A.

5.5 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 can lead 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, can lead to interruption and disruption of supply.

5.5.1 JBA Groundwater Flood Map

In Bridgend, flooding attributed directly to groundwater is extremely difficult to apportion as groundwater flooding usually occurs in combination with pluvial and fluvial flooding. As groundwater flooding occurs in low lying areas, basements of residential housing are usually impacted by this type of flooding. Historic flood event information contained within the Bridgend Preliminary Flood Risk Assessment identifies only two minor flood events where groundwater may have been a contributing factor.

The JBA Groundwater Flood Map is a high resolution product which provides a detailed assessment of groundwater flood hazard and is the main dataset used to assess the risk of groundwater flooding across Bridgend County in this SFCA. The map categorises the depth difference (m) into five feature classes based on the 100-year model outputs. Groundwater depth was modelled at a 5m resolution. Groundwater flood hazard has been classified into the below categories (Table **5-2**). It does not show the likelihood of groundwater flooding occurring and is not suitable for planning considerations at a site-specific level. It should only be used as a trigger for further investigation as to the possibility of groundwater flooding.

Table 5-2 Groundwater Flood Hazard Classification

Groundwater depth below ground level (m)*	**Class label**
0 to 0.025	Groundwater levels are either at or very near (within 0.025m of) the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots.
0.025 to 0.5	Groundwater levels are between 0.025m and 0.5m below the ground surface in the 100-year return period flood event. Within this zone there is a risk of groundwater flooding to surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally.
0.5 to 5	Groundwater levels are between 0.5m and 5m below the ground surface in the 100-year return period flood event. There is a risk of flooding to subsurface assets, but surface manifestation of groundwater is unlikely.

>5	Groundwater levels are at least 5m below the ground surface in the 100-year return period flood event, meaning there is a very low risk of groundwater flooding. Flooding from groundwater is not likely.
N/A	No risk. This zone is deemed as having a negligible risk from groundwater flooding due to the nature of the local geological deposits.

5.6 Sewer Flooding

Flooding from sewers occurs when rainfall exceeds the capacity of networks or when there is infrastructure failure. For the purposes of this SFCA sewer flooding is defined as any flooding which occurs in an urban area with a comprehensive sewer network. 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 (such as from climate change or due to new developments)
- Lack of capacity in sewer drainage networks due to events larger than the system design event
- Lack of maintenance of sewer networks which leads to a reduction in capacity and can sometimes leads 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 sever 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.

Historic records of sewer flooding have been taken from the Bridgend Preliminary Flood Risk Assessment and considered on a broad spatial scale. No new sewer flooding records have been incorporated into this SFCA update.

Dwr Cymru Welsh Water (DCWW) are a statutory consultee to the LDP. There is an expectation that DCWW will advise and comment on their sewer network capacity and the risk of new development contributing to changes in flood risk (both positive and negative).

5.7 Flooding from Artificial Sources

For the purpose of the SFCA, flooding from artificial sources has 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.

Providing 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.

The risk of reservoir flooding across BCB was identified using the NRW risk of reservoir flooding outline. The risk of reservoir flooding across BCB is low, with NRW mapping not identifying a risk of reservoir flooding to any of the key settlements within Bridgend.

5.8 Impact of Climate Change

The latest government guidance for climate change and flood risk is contained within Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales. The report was issued in December 2017 and informs appraisers and decision makers of new climate change allowances and broadly how these should be considered when assessing flood risk. The most important points to consider are;

- Updated figures for climate change allowance in the three main river basins in Wales (Table 2)
- Updated figures for climate change allowance for rainfall and mean sea level (Table 3 and 4).
- Use of sensitivity analysis to gauge uncertainty of flows, rainfall, wind and wave action on sea levels
- Response to climate change through either managed/adaptive or precautionary approaches. Note: in a SFCA, a precautionary approach is recommended.

UK Climate Change Projections (UKCP18)

This more recent study looks at probabilistic projections on the likely changes to the UK climate under a range of greenhouse gas emission scenarios.

The key findings from UKCP18 are:

- All areas of the UK are likely to get warmer, with a move towards warmer, wetter winters and hotter, drier summers.
- Little change in annual precipitation totals, but with the likelihood that more rain fall will be expected in the winter and less rainfall in the summer.
- Sea levels rise and are greater in the south of the UK than the north.

Application of Climate Change within the SFCA

The findings from the UKCP18 project have not superseded the 2017 government climate change guidance. As a result, the Adapting to Climate Change 2017 document has been followed for the SFCA.

The latest climate change guidance also provides guidance on how flows will change over time. River flows in catchments that are small or particularly urban are expected to increase by 15% in the timeframe from 2015 to 2039, 25% between 2040 and 2069, and 30% in the timeframe from 2070 to 2115.

Unlike previous climate change guidance, the latest guidance predicts that sea levels will rise at different rates over the next 100 years. The latest climate change guidance also provides guidance on how sea levels will change over time. Sea levels rise is predicted to be 3.5 mm/yr up to 2025, rising up to 14.5 mm/ year from 2086 to 2116.

Lifetime of Development

Paragraph A1.5 of TAN15 identifies that a proposed development must provide a safe and secure living and/or working environment throughout its lifetime. Natural Resources Wales advise that the lifetime of development for residential development is 100 years, and for other development it is considered to be 75 years.[6] It may be possible for the Local Planning Authority to deviate from this guidance, although this would need to be carefully and fully justified on a site specific basis.

5.9 Assessment of Flood Risk to Strategic and Candidate Sites - RAG

To assess the risk of flooding at each proposed strategic site and candidate site, a Red, Amber, Green Risk Rating has been used, as summarised in Table 5-3. This allows for a visual representation of the proportion of the site at risk from flooding and to allow for an initial screening of a proposed development site.

A risk rating defined from the methodology below does not provide a bypass for the requirements for a more detailed flood consequence assessment for the site but provides an indication of the level of risk to that site from a preliminary assessment of broadscale, publicly available data.

The DAM map has been used within this assessment to identify fluvial and tidal flood risk to a site. Any site within Zone C1 is deemed to have a lower risk of flooding when compared to sites in Zone C2 as a result of the presence of defences protecting the site. This therefore represents the "actual flood risk" which has therefore been taken into account within this assessment.

The FRAW data has been used to assess surface water flood risk to the site as the most up to date data available at the time of assessment.

It is the intention of this assessment to identify the likelihood of flood risk being managed on indented strategic and candidate sites:

- Red indicates the site is unlikely to pass the Justification Test
- Amber indicates the site is likely to pass the Justification Test, with care and the preparation of an appropriate FCA or surface water strategy
- Green indicates that there is negligible flood risk to a site

[6] Chief Planning Officer Letter (ref. WG0701-14), 9th January 2014

Table 5-3 RAG Criteria Description

Risk Category	Criteria Description (at least one of the criteria is met)	Category Overview
Red	Greater than 50% of the sites plan area is: • Within DAM Zone C2 • Within the surface water flood extent Known history of flooding on the site	The percentage of the site area flooded provides an indication of how the site complies with TAN15. Further work will be required to determine the full flood risk associated with the site. The underlying evidence base may need updating.
Amber	Greater than 5% and up to 50% of the sites plan area is: • Within DAM Zone C2 • Within the surface water flood extent Greater than 50% of the site plan area is • Within DAM Zone C1	
Green	Less than 5% of the sites plan area is: • Within DAM Zone C2 • Within the surface water flood extent No history of flooding in the site	Based on the assessment criteria, flood risk to these sites are likely to be acceptably managed. Flood risk to the site access routes and compliance with TAN15 in this regard will need to be confirmed.

6 Bridgend Flood Risk Overview

6.1 Sources of Flooding

Bridgend County Borough contains localised areas that are prone to flooding from a range of sources. The type of flooding is dependent on the interaction of rainfall, catchment characteristics and the sea. This SFCA considers six sources of flooding:

- Fluvial risk
- Tidal risk
- Groundwater
- Surface water
- Sewers
- Artificial sources

An overview of each source of flood risk for Bridgend County is described in the following section and in more detail in Chapter 7 of this report.

6.2 Fluvial Flood Risk

The River Ogmore, the River Llynfi and the River Ewenny are the main watercourses in BCB.

The River Ogmore (Afon Ogmore) runs roughly north to south from the Ogmore Vale and Pentre, past Bridgend and Ogmore. The River Ogmore is generally considered to start near the Cemetery Mountain, west of Treorchy, although it is known as the Ogwr Fawr, with the Ogwr Fach, coming from Gilfach Goch to the north merging near Blackmill. The River Llynfi (Afon Llynfi), the River Garw (Afon Garw) and finally the River Ewenny (Afon Ewenni) in its estuary are all tributaries of the Ogmore which flows into the sea between Ogmore-by-Sea and the Merthyr Mawr sand-dunes.

The River Llynfi runs for around 10 miles from its source north of Maesteg and flows generally southwards through the Llynfi Valley to the confluence with the River Ogmore and the River Garw at Aberkenfig. Its main tributaries are the Nant Cwm-du and Nant Cedfyw which enter on its left bank and the Nant Crynwydd, Nant Sychbant and Nant y Gadlys on its right bank.

The River Ewenny rises to the north east of Bridgend town, in South Wales, and flows past the village of Pencoed before entering the River Ogmore estuary just below Ogmore Castle. One of its main tributaries is the Afon Alun.

NRW is the main body which collects records of flooding from main rivers. NRW's Historic Flood Map identifies historic flooding to two key settlements; Bridgend and Pencoed. Information provided from the Historic Flood Map indicates that Bridgend Town Centre flooded in 1960 when channel capacity was exceeded. The event occurred prior to the construction of the current flood defences in the town. The Historic Flood Map also identifies flooding to three areas in Pencoed in October 1998. Flooding from the River Ewenny affected several residential properties in Heol Croesty towards the south of Pencoed, and to residential properties in Penybont Road and Glanyrafon Road towards the north-east of the Pencoed area. A third flood location for the 1998 event is identified to an ordinary watercourse, where a blockage to the culvert under Glyn-y-Mel resulted in flooding to several residential properties.

6.3 Tidal Flooding

A small area within Bridgend, largely consisting of properties in the Porthcawl area and land alongside the tidal Ogmore, is at risk of tidal flooding. The River Ogmore freely discharges into the sea and consequently water levels on the lower reaches are influenced by tide levels. The current normal tidal limit on the River Ogmore is a weir just downstream of Portobello Bridge approximately 2km from the coast. Tides may

affect flooding much further inland during extreme events especially if sea levels rise as predicted in the future.

NRW is the main body which collects records of flooding from the sea. NRW's Historical Flood Map reports two areas of historical flooding in Porthcawl. Both of these locations, along the Esplanade and West Drive towards the west of Porthcawl, flooded in the same event in May 2008.

6.4 Surface Water Flooding

Flooding from surface water can occur anywhere within BCB although it is less likely in areas where sand overlies a highly permeable rock stratum. Whilst the mechanisms for runoff are well understood, predicting flooding from land is more complicated than other forms of flooding such as flooding from rivers or the sea. Surface water flooding is more likely to occur where soils and geology are less permeable and where there is flat ground (or relatively flat ground receiving run off from steep ground).

Historic records of surface water flooding have been taken from the Bridgend Preliminary Flood Risk Assessment and are shown in Figure 6-1. Incidents of surface water flooding are concentrated in urban areas and are prevalent in all key settlements. No new surface water flooding records have been incorporated into this SFCA update.

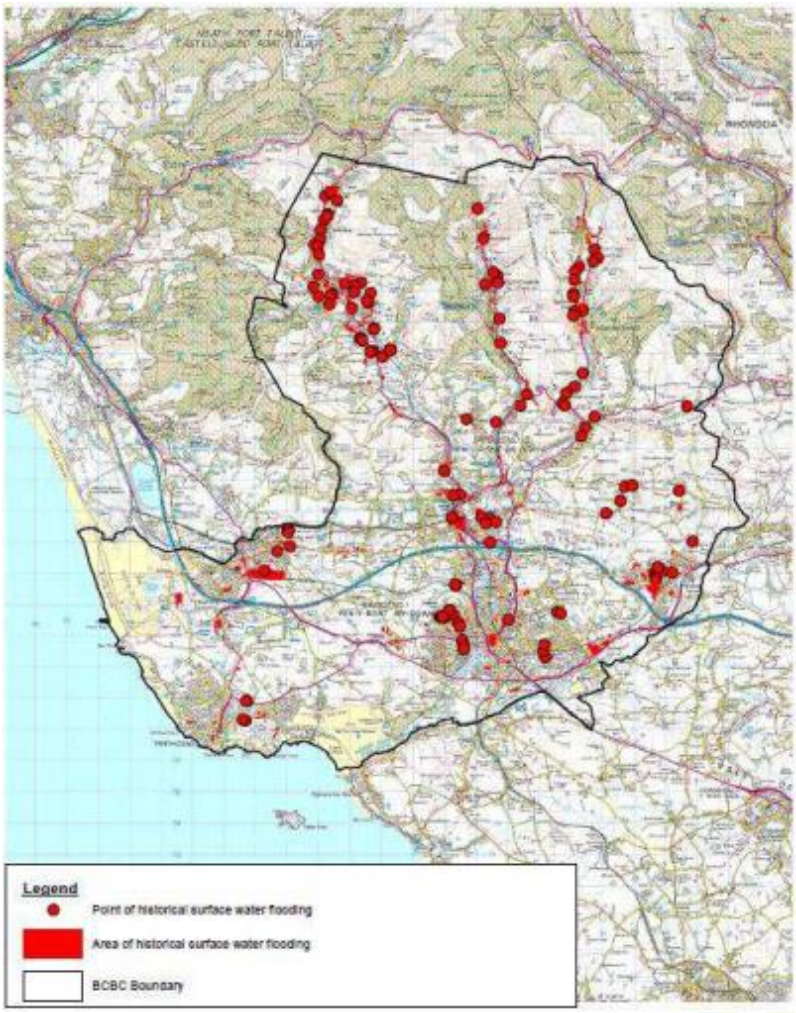


Figure 6-1 Historical Surface Water Flooding Locations (Bridgend County Borough Council, 2017)

6.5 Groundwater

For the purpose of the SFCA, groundwater flooding has been defined as flooding from sub-surface water. There are a number of mechanisms that can cause this type of flooding including regional groundwater rise, underground barriers to flow and rebound when pumping from mining activities ceases.

No records of groundwater flooding were made available at the time of writing. However, the large number of springs recorded on OS mapping and the variation of geology throughout the borough suggest that groundwater flooding could present significant risks to localised areas.

The majority of Porthcawl, Pencoed, Pyle and Maesteg have medium or low depths of groundwater flooding. Areas at high risk of groundwater flooding are present in small parts of the urban areas of the borough including parts of Maesteg, Aberkenfig and Brynmenyn. An area of high groundwater risk is also present to the north of Bridgend. The larger areas of groundwater are predominantly present outside of the urban areas in the borough.

6.6 Sewers

Flooding from sewers occurs when the man-made sewer system cannot convey the volume of water. This can occur due to extreme rainfall events, due to infrastructure failure or due to increased runoff from new developments. Predicting areas prone to sewer flooding is complex as flooding is localised and sewer systems are constantly being upgraded.

Historic records of sewer flooding have been taken from the Bridgend Preliminary Flood Risk Assessment and are shown in Figure 6-2. Incidents are concentrated in urban areas, in the key settlements of Bridgend, Maesteg, Porthcawl and Pencoed. No new sewer flooding records have been incorporated into this SFCA update.

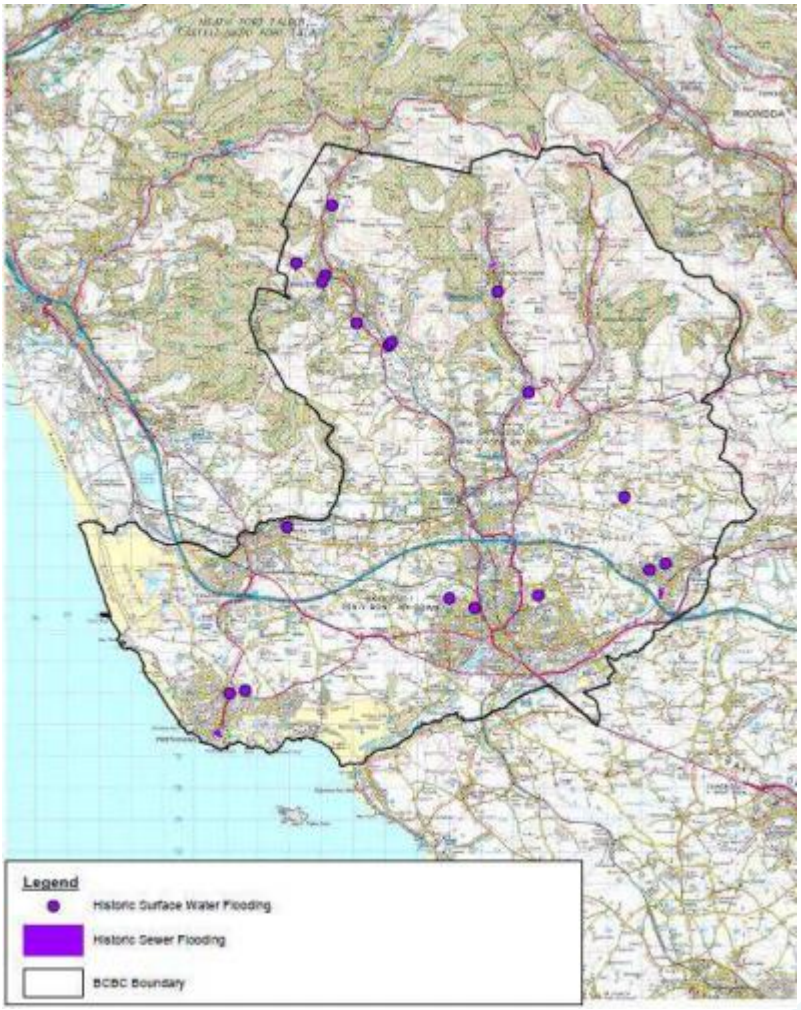


Figure 6-2 Historical Sewer Flooding Locations (Bridgend County Borough Council, 2017)

6.7 Artificial Sources

Artificial sources of flooding identified within BCB include numerous reservoirs across and upstream of the borough. However, no records of flooding from artificial sources have been found. Flooding may occur if reservoirs were to overtop, leak or breach. Whilst a breach of embankments has a very low probability, the consequences could be extremely severe.

6.8 Summary of Flood Risk in BCB

The dominant flooding source affecting BCB is flooding from rivers. The principal watercourses are the River Ogmore, the River Llynfi and the River Ewenny. Flooding from the sea is not currently a significant problem, however it may become more significant in the future as sea level rises. Although incidents of surface water flooding and sewer flooding are potentially significant, there is less certainty in assessing these risks at a strategic level. Flooding from artificial sources is also important due to the potential severity of consequences.

The communities most at risk of flooding, and therefore the focus of the SFCA, are:

- Bridgend – at risk of flooding from rivers, surface water, sewers and groundwater.
- Maesteg - at risk of flooding from rivers, surface water, sewers and groundwater.

- Brynmenyn - at risk of flooding from rivers, sewers, surface water and groundwater.
- Porthcawl / Newton at risk of flooding from tidal, surface water and sewers.
- Pencoed – at risk of flooding from rivers, surface water, groundwater and artificial sources.
- Pyle – at risk of flooding from rivers, surface water, groundwater and sewers.
- Waterton - at risk of flooding from rivers, surface water and groundwater.

7 Assessments key settlements, strategic and candidate sites

7.1 Bridgend

Settlement:	BRIDGEND		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Island Farm	0%	0.6%	Green
Land West of Bridgend	2.3%	2.8%	Green

Settlement / Strategic site description

Bridgend is identified as the Primary Key Settlement of the County Borough, serving as the main retail, commercial, service and employment centre for the whole of the County Borough. The town is bisected by the River Ogmore that flows through the centre of the town in a north to south direction. Bridgend is a major employment centre serving the whole of the County Borough and the wider region with a number of large-scale industrial estates. The transport infrastructure has been and continues to be a primary reason for inward investment projects into Bridgend, rendering the area attractive to house builders, retailers and employers.

Fluvial and Tidal Flood Risk

Overview

The NRW Historic Flood Map shows the approximate extent of significant flooding that took place in Bridgend from the River Ogmore in December 1960. Following this event extensive flood defences were constructed through the town which are now maintained by NRW. As a result of the flood defences most of the fluvial floodplain in Bridgend is categorised as Zone C1 and therefore all forms of development are possible if the requirement of the Justification Test can be satisfied. The limited areas of Zone C2 in Bridgend are highly functional floodplains generally not suitable to development.

The significant flood defence walls are predicted to protect most of the town centre from both a present day and future (climate change) 1% AEP event. However, during the 0.1% AEP event these flood defences are predicted to overtop resulting in significant flooding of the town centre with depths of over 1.5m. These significant flood depths are caused in part by the flood defences that prevent flood water from naturally returning to the river.

Bridgend Town Centre

Threshold of Flooding (A1.14)

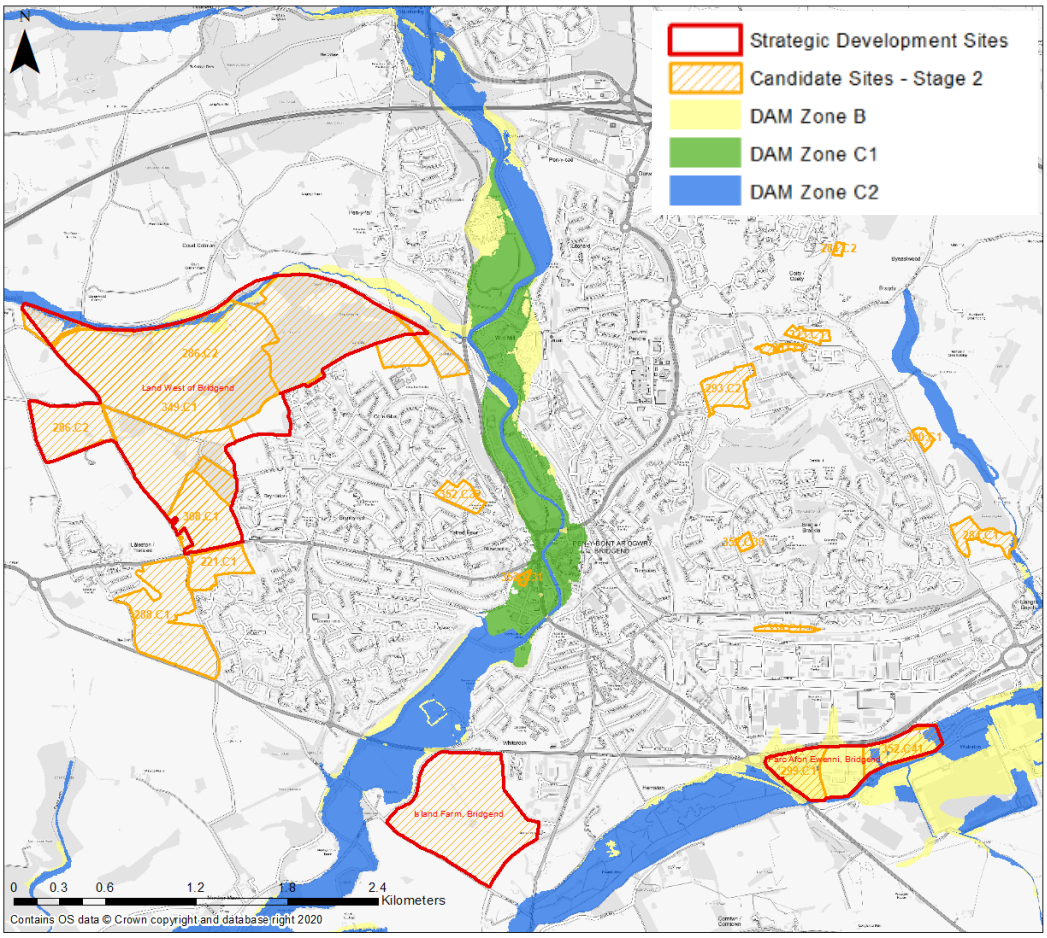
Development within Bridgend town centre is likely to meet the criteria of A1.14 to be flood free during the 1% AEP event allowing for climate change. Undefended areas of Bridgend categorised as Zone C2 are predicted to flood frequently and are therefore unlikely to pass the requirements of A1.14.

Flood Exceedance Conditions (A1.15)

The Bridgend model predicts that large areas of the town centre will flood to significant depths, greater than 1.5m, during the 0.1% AEP event. As a result, it is likely to be difficult for development in the town centre to meet the recommended flood exceedance conditions outlined in A1.15 of TAN15. The predicted flood extent and depths through Bridgend Town Centre can be seen in Appendix A.

Detailed Flood Consequence Assessments will be required to support development within the town centre and the significant flood risk associated with events that may overtop the flood defences will need very careful consideration. However, the requirements of A1.15 are indicative and "*each site must therefore be considered individually and a judgement taken in the context of the particular circumstances which could prevail at that site.*" It is therefore recommended that decision makers take extra care to consider the specific circumstances of

Bridgend town centre and the potential for well designed development to enhance the area whilst appropriately and reasonably managing the flood risk from exceedance events. Close attention should be paid to addressing the recommended FCA requirements set out at the end of the section.



Bridgend DAM Map

Strategic sites

Two strategic sites are located within the Bridgend Key Settlement. Both of these strategic sites are classified as 'Green' under the RAG assessment, indicating that flood risk to the site is likely to be acceptably managed. All the sites are locations in Zone A of the Development Advice Map in areas at little or no risk of tidal and fluvial flooding.

Risk of Flooding from Surface Water

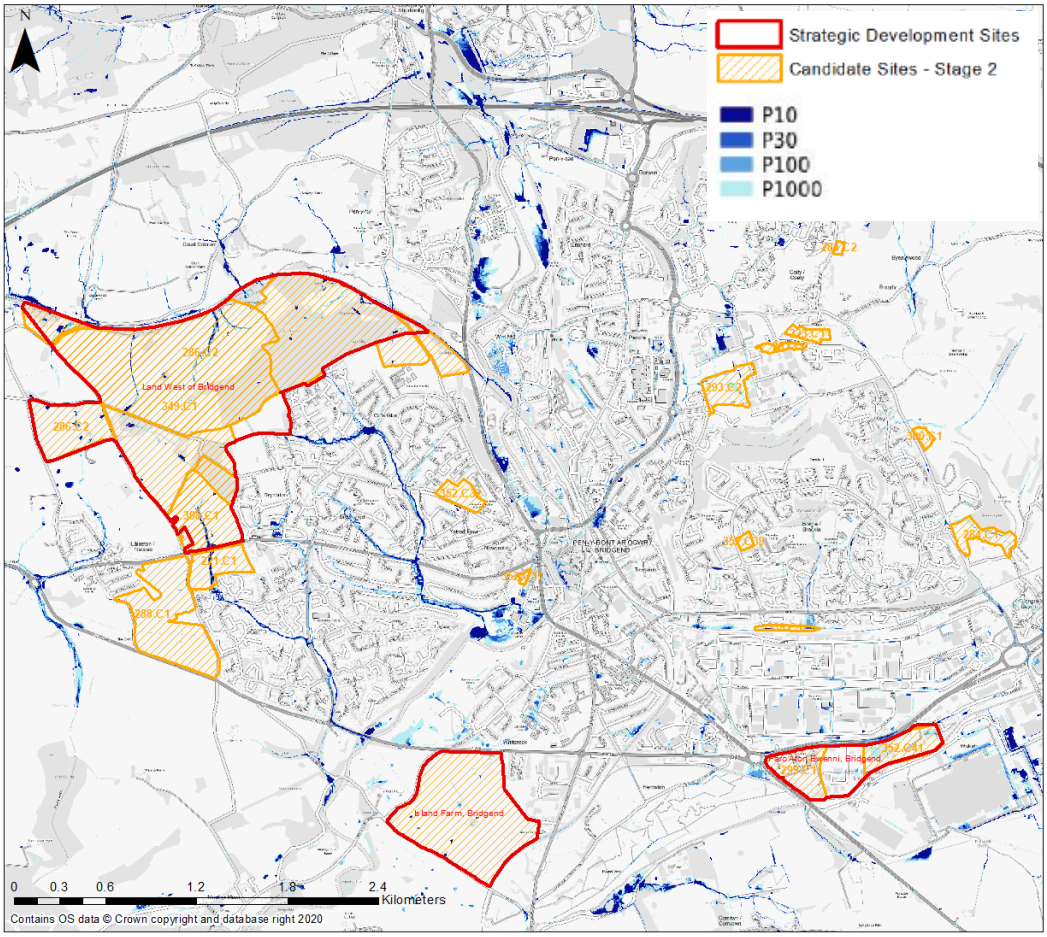
The Bridgend PFRA identifies surface water flood events in this area in October 1998 where 8 properties were affected internally, December 1999, October 2000 and October 2001.

Across Bridgend town, there are two main surface water flows paths identified from the FRAW data, namely through the suburbs of Bryntirion and Cefn Glas, and to the west of Bridgend, east of Laleston.

Bryntirion is located towards the south-east of Bridgend. Significant surface water ponding is identified in areas where the Nant Cefn-glas is culverted. A number of residential properties and main roads in the Bryntirion, Brynhyfryd, Cefn Glas and Pen-y-Fai areas are considered to be at a high risk of surface water flooding as a result of this surface water flow path. The flow path extends towards Newbridge Fields, near to the centre of Bridgend.

A key surface water flow path is also identified to the west of Bridgend, east of Laleston. Surface water flows originate from runoff ponding in a localised valley and flowing towards

an unnamed watercourse and the River Ogmore. Flows are largely confined to the river valley, within minimal properties affected.



Bridgend Risk of Flooding from Surface Water

Strategic sites

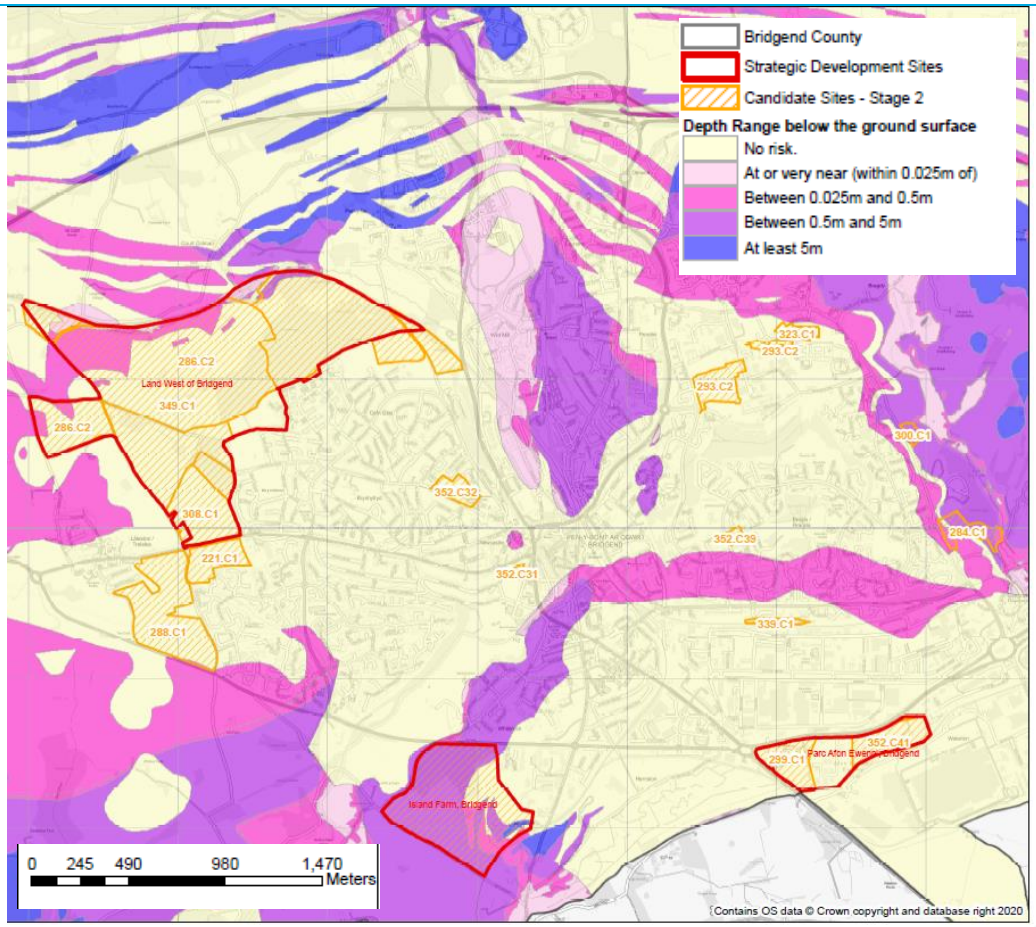
Two strategic sites are located within the Bridgend key settlement. Both of these sites are identified as 'Green' within the RAG assessment.

Island Farm has small areas of the site identified as at risk of surface water flooding. These areas correspond with topographic lows across the site and area therefore expected to be manageable through the use of SuDS and considerate site design.

Land West of Bridgend has two surface water flow paths flowing from south to north across the site. These flow paths correspond with topographic depressions across the site. These flow paths should be managed through the use of SuDS techniques.

Risk of flooding from Groundwater

The majority of the area is not at risk of groundwater flooding. There is the potential for groundwater flooding to surface and subsurface assets (groundwater levels at surface or very near the surface) in the north and eastern parts of the area.



Bridgend Groundwater

Strategic sites

Two strategic sites are located within the Bridgend key settlement. The majority of Island Farm has a groundwater depth of between 0.025m and 0.5m below ground level. Localised areas of this strategic site are shown to have groundwater within 0.025m of the ground surface. Groundwater levels may dictate the location and depth of SuDS assets proposed for any development on this site and should therefore be considered further.

Land West of Bridgend is predominantly not at risk of groundwater flooding. A small area of the site to the north western corner is shown to have groundwater between 0.025m and 0.5m of the ground surface. It is considered unlikely that groundwater shall have an effect on development proposals for this site.

Other sources of flood risk

Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site-specific basis.

Artificial: No artificial sources of flood risk have been identified for this area.

Flood Consequence Assessment Guidance

Flood Consequence Assessments within the Bridgend town centre should give particular regard to the following:

- The potential to further reduce flood risk in the area by the removal of the weir immediately downstream of the A4061 river crossing. Recent BCBC modelling studies have shown that the removal of this weir could significantly reduce the risk of flooding in the town centre in the 0.1% AEP event.
- Avoiding Highly Vulnerable Development on the ground floor of buildings.
- The application of property flood resilience measure to reduce the impact of flooding.

- Developing robust emergency flood plans for new development.
- Reducing net community flood risk through development and regeneration.
- The residual risk of bridge blockage or the failure of flood defences as advised by NRW.

7.2 Maesteg

Settlement:	MAESTEG		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Pont Rhyd-y-Cyff	0.9%	2.5%	Green

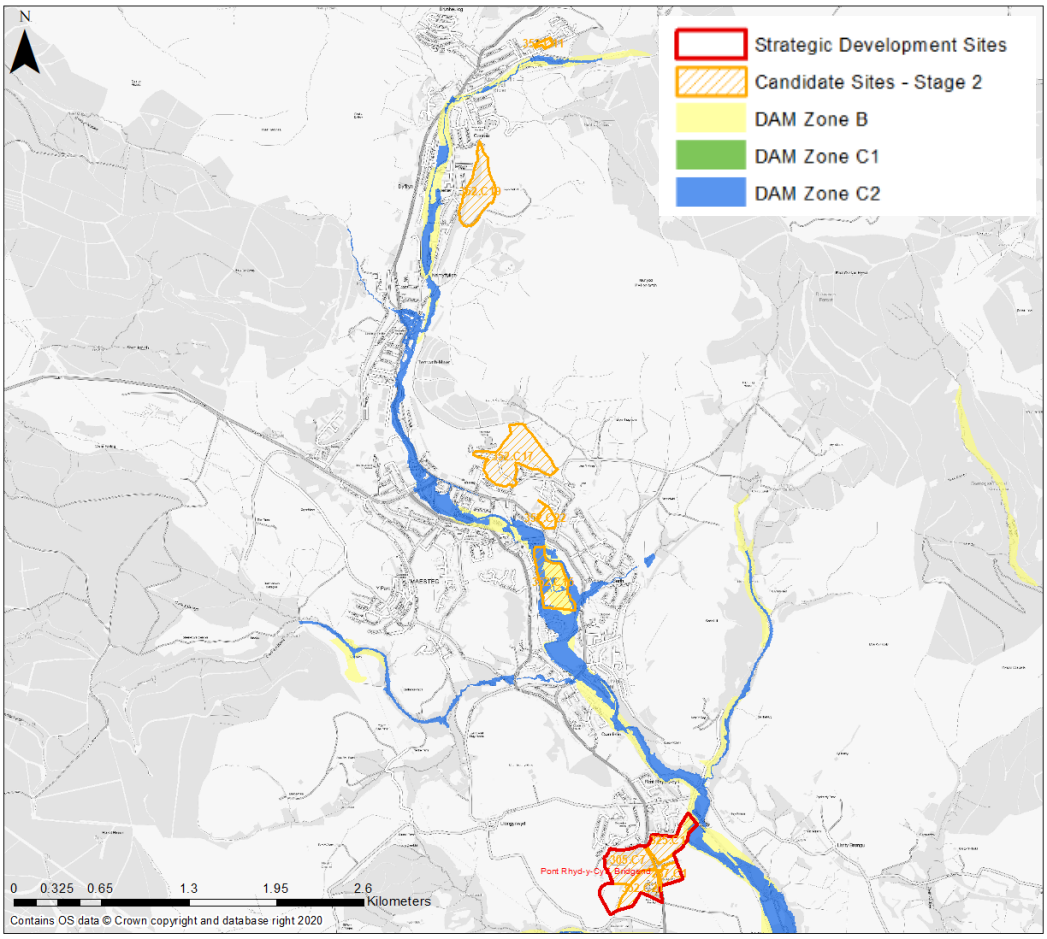
Settlement / Strategic site description

Maesteg is the second largest town in the County Borough, with the River Llynfi flowing in a southerly direction through the settlement. Maesteg is defined as a Key Hub settlement in the Wales Spatial Plan and is therefore a focus for development benefitting surrounding valley communities and smaller settlements. It has been identified as a Main Settlement in the within Bridgend County Borough due to its ability to grow sustainably, provide increased access to employment opportunities, housing, retail and tourism potential.

Fluvial and Tidal Flood Risk

Overview

Maesteg is at risk of flooding from the Nant y Cerdin and the River Llynfi. This assessment also covers the upstream areas of Nantyffyllon and Dyffryn and the downstream area of Pont Rhyd-y-cyff.



Maesteg DAM Map

The NRW Historic Flood Outline does not include any detail of historic flood events in the Maesteg area. The BCBC PFRA highlights two historic fluvial flood events. The first in

Salisbury road in October 2000, and the second in Llynfi Road in January 2008.

There are no areas of Zone C1 within Maesteg due to the absence of any formal flood defences. Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including acceptability Criteria.

A number of existing properties are within Zone C2 and Zone B of the DAM. These are generally situated on roads adjacent to the River Llynfi. These properties include highly vulnerable receptors such as the bus station, school, and numerous residential properties. In some areas, Zone C2 is occupied by playing fields and other open land.

Where detailed flood modelling exists through Maesteg, this shows that there is little difference between the flood extents of the 1% AEP plus climate event and the 0.1% AEP event. This suggests that a site in DAM Zone C2 may struggle to manage the requirements of A1.14 to be flood free in the 1% AEP plus climate change event. The predicted flood extent and depths through Maesteg can be seen in Appendix A.

Strategic sites

There is one strategic development site within the wider Maesteg settlement area. The Pont Rhyd-y-Cyff strategic development site is proposed for mixed use development.

The site is largely unaffected by fluvial flood risk, with just 0.9% of the site covered by Zone C2 in the north east corner of the site closest to the River Llynfi. Although Less Vulnerable Development may be possible in the area, it is advisable that all built development is avoided in the area given its limited extent and close proximity of the river.

Risk of Flooding from Surface Water

Surface water detail

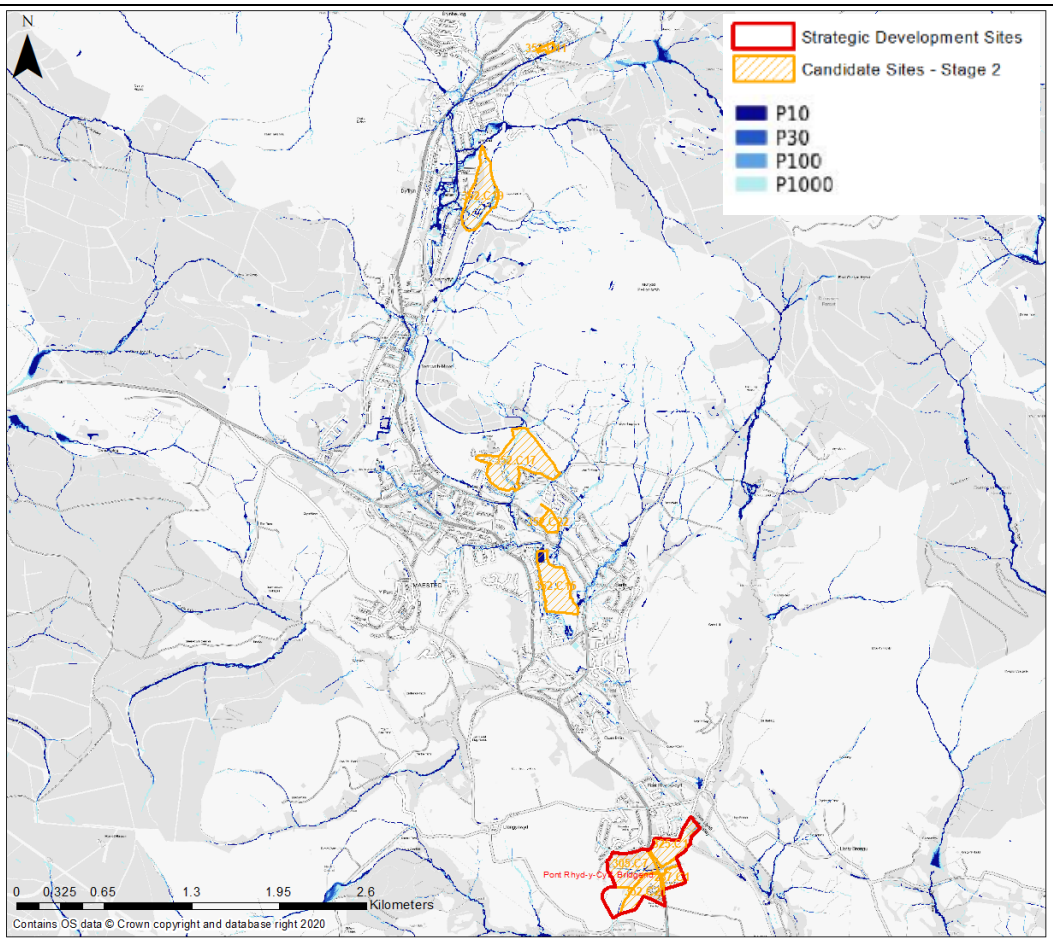
There is a widespread risk of surface water flooding across the wider Maesteg area as a result of the steep topography of the head of the valley combined with the flat valley bottom where development is primarily located. Many minor (ordinary) watercourses are likey to be heavily modified by historical development, contributing to this surface water flood risk.

A key surface water flow path is identified to the south of Caerau, flowing through Dyffryn at the confluence of a number of tributaries of the River Llynfi. The PFRA identifies surface water flood events to Spelter Industrial Estate, within this area, in October 1998, December 1998 and August 2001.

A key surface water flow path is also identified within the river corridor of an un-named ordinary watercourse where it is culverted through Nantyffyllon as it flows to its confluence with the River Llynfi.

Within Maesteg centre, surface water flooding is widespread. The PFRA identifies a number of historic flood incidents, including Mill View in September 1997 and September 2007, Neath Road in October 2000 and Heol y Bryn in February 1998 and April 2000.

Development within the existing settlement extent of Maesteg should take particular note of the surface water flood map to direct development and manage flood risk.



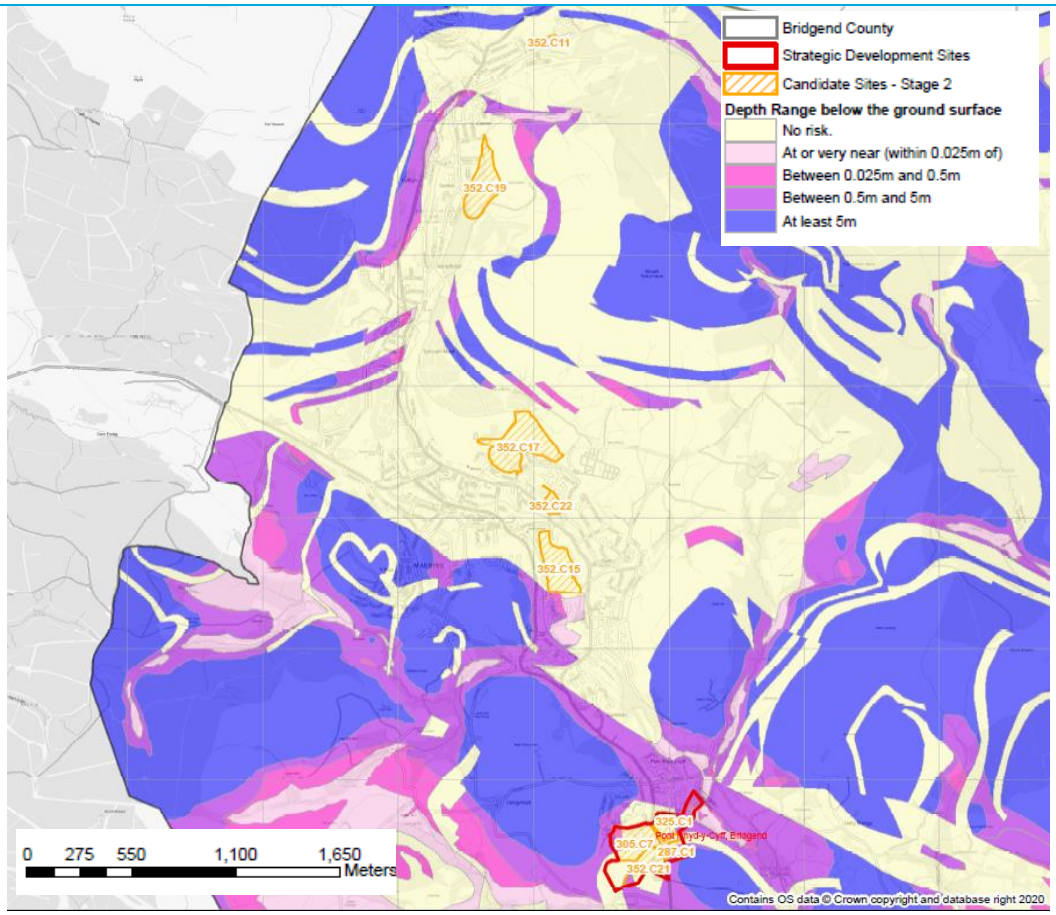
Maesteg Flood Risk from Surface Water

Strategic sites

Pont Rhyd-y-Cyf is a strategic site located at the southern extent of the Maesteg Key Settlement area. A depression in local topography forms a small valley from west to east across the site, extending from the site towards the River Llynfi. It is expected that with careful consideration, this risk of surface water flooding can be managed through the use of SuDS techniques and good design.

Risk of flooding from Groundwater

The majority of the key settlement is not at risk of groundwater flooding. Groundwater levels vary across Maesteg with levels ranging from at least 5m below ground to small areas of at or very near (within 0.025m of the surface) in the east and western parts of the key settlement.



Maesteg Groundwater

Strategic sites

Pont Rhyd-y-Cyf is a strategic site located at the southern extent of the Maesteg Key Settlement area. The majority of the site is not at risk of groundwater flooding. A small area to the north of the site is at low risk of flooding (between 0.5m and 5m). Groundwater is unlikely to affect development proposals for this strategic site.

Other sources of flood risk
Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site-specific basis. **Artificial:** No artificial sources of flood risk have been identified for this area.
Flood Consequence Assessment Guidance
There are no specific requirements or guidance for Flood Consequence Assessments in this area.

7.3 Valleys Gateway

Settlement:	**VALLEYS GATEWAY**
Strategic Site:	None

Settlement / Strategic site description

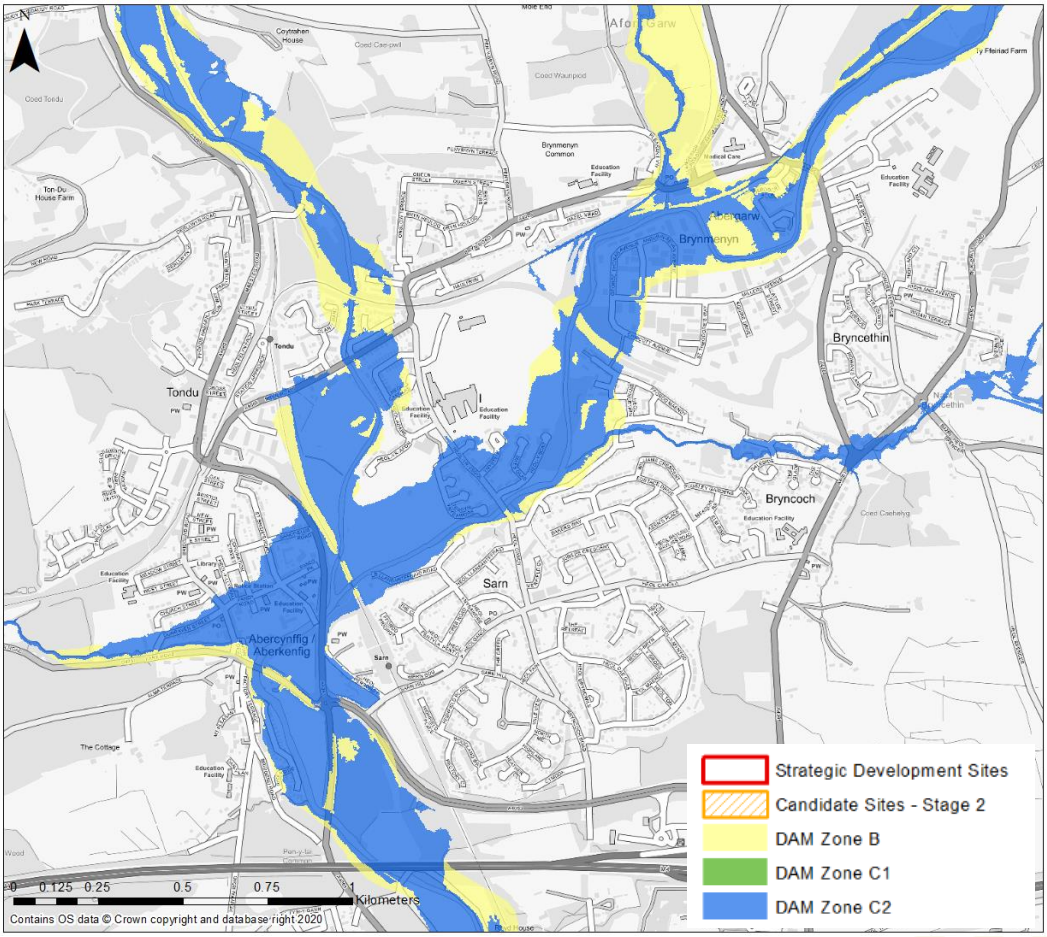
The Valleys Gateway is located at the centre of the County Borough and comprises several different communities of what is almost one continuous urban area north of Junction 36 of the M4. Valleys Gateway includes the settlements of Aberkenfig, Bryncethin, Brynmenyn, Coytrahen, Sarn, Tondu and Ynysawdre.

The area has not been identified in the Wales Spatial Plan as a 'key' settlement. However, the LDP Regeneration-Led Strategy recognises its strategic role in the context of the County Borough. Because of its central location and accessibility, especially to the more constrained and disadvantaged valleys of the Ogmore and Garw to the north, the LDP Strategy promotes this area as a focus for future employment and housing and as a centre for local retail opportunities, community facilities and other service provision. There are no strategic development sites identified within the Valleys Gateway areas of Aberkenfig, Bryncethin, Brynmenyn, Pyle, Sarn and Tondu.

Fluvial and Tidal Flood Risk

Overview

In Aberkenfig five rivers meet (River Ogmore, River Llynfi, River Garw, Nant Brynthecin and River Kenfig). Large areas are located within Zone C2, notably the north of Brynmenyn industrial estate, the Pandy Park Rugby Club and residential properties around Pandy Road and Maes Glas and Heol-y-bont. Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including acceptability Criteria.



Valleys Gateway DAM Map

There are some small stretches of flood defences within the Valleys Gateway, but most are privately maintained and generally have a standard of protection of between 20 and 50 years. The NRW flood map suggests patchy areas benefiting from flood defences at Brynmenyn Industrial Estate but this is not reflected by the DAM mapping Zone C1 classification.

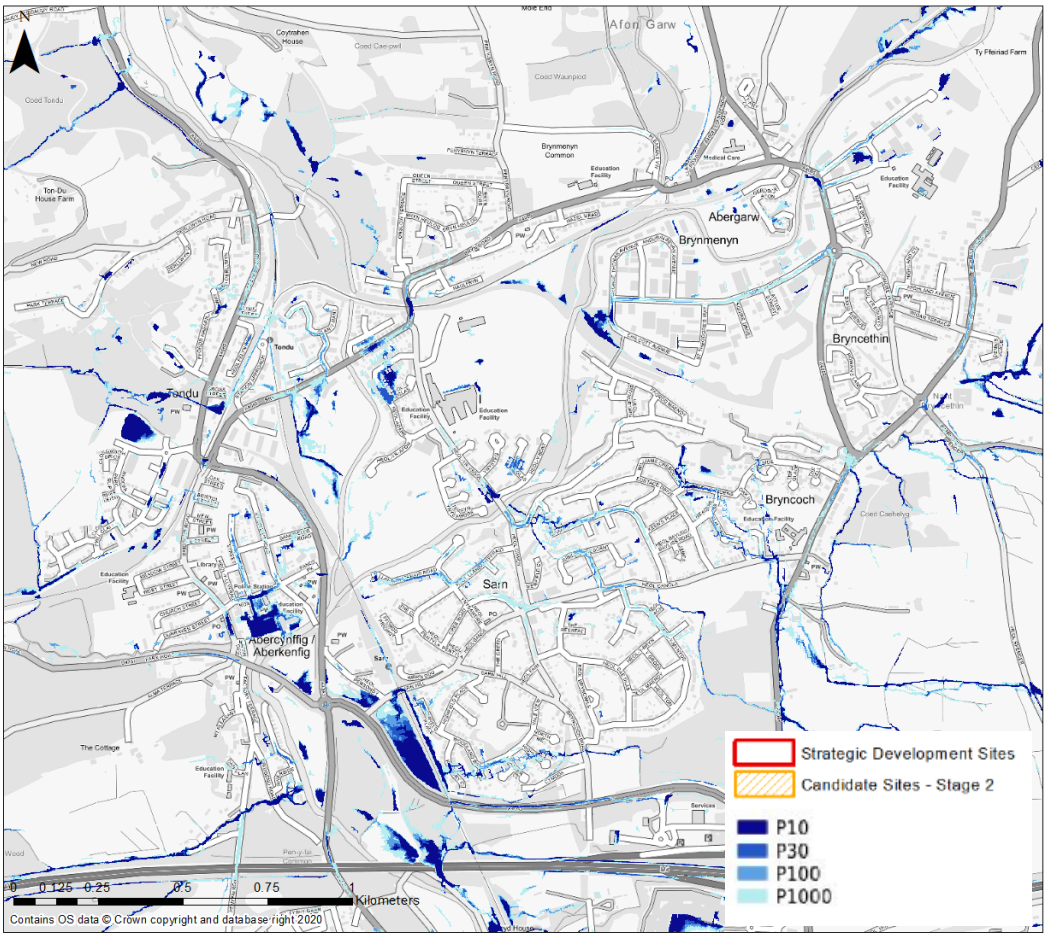
Acceptability Criteria

During the 0.1% AEP event depths of over 1.5m are modelled within the Pandy Road area, Heol-y-bont and within Brynmenyn industrial estate. As a result of this, in these areas it is unlikely that new developments will be able to meet the requirements of A1.14 and A1.15 of TAN15. The predicted flood extent and depths in the Valleys Gateway Area can be seen in Appendix A.

Risk of Flooding from Surface Water

The Bridgend Preliminary Flood Risk Assessment identifies several records of surface water flooding in the area, including:

- Mount Pleasant Cottages - October 2003, 3 properties internal
- Ogmore Vale – January 2011, 6 properties
- Bridgend Road – January 2001



Valleys Gateway Risk of Flooding from Surface Water

Within Pontycymer, surface water flow paths can be seen around the Nant Gelli-wern flowing into the residential areas of Gwaun-Bant, onto Oxford Street and towards the leisure centre. Significant surface water ponding can also be seen at the junction of Pant-y-Gog and an

unnamed road south of Fenton Place.

Within Ogmore Vale area, there are areas of significant surface water ponding around the school and sports ground, flowing from Dinam Street, Bwlch-y-Clawdd Road and Brookland Terrace within Price Town. A preferential flow path is also seen along Nant Cwmcyffog flowing towards the residential areas of Blandy Terrace and St John Street, within Ogmore Vale. Additionally, a flow path is seen from the Nant Cwn-y-Fuwch flowing towards Corbett Street and St John Street.

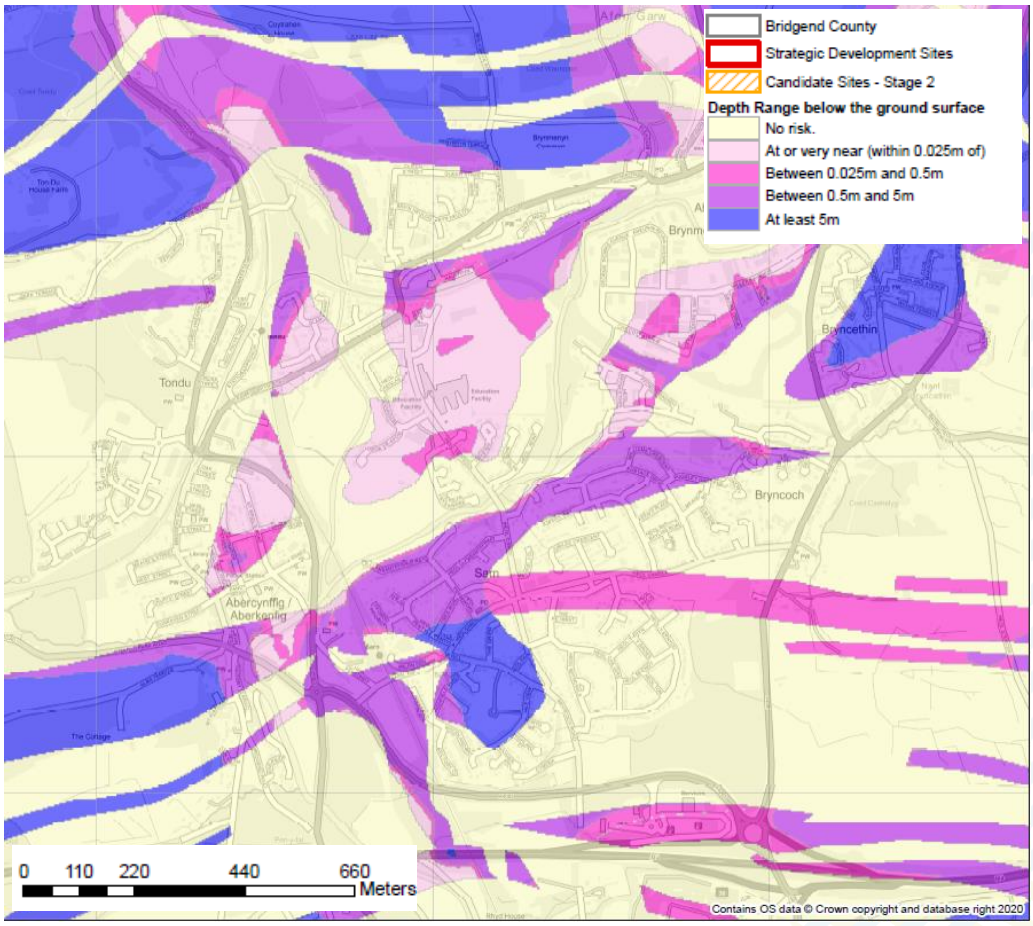
Within Aberkenfig, there is significant surface water flooding along Coronation Street and Pandy Road leading to ponding across sports fields and various educational facilities. Further areas of surface water ponding are located in the north-east of the locality along Bryn Road and the residential area of Heol Adare. Surface water ponding is also identified at the household recycling centre within the Tondu area of Aberkenfig, and to the undeveloped land east of the railway, south of Sarn Hill.

Strategic sites

There are no strategic sites within the Valleys Gateway key settlement.

Risk of flooding from Groundwater

The majority of the area is not at risk of groundwater flooding. Localised areas of shallow groundwater depths are present across the area which pose a risk of flooding to surface and below surface assets.



Valleys Gateway Groundwater

Strategic sites

There are no strategic sites within the Valleys Gateway key settlement.

Other sources of flood risk

Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site-

specific basis. **Artificial:** No artificial sources of flood risk have been identified for this area.
Flood Consequence Assessment Guidance
There are no specific requirements or guidance for Flood Consequence Assessments in this area.

7.4 Pencoed

Settlement:	PENCOED		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Pencoed Campus	15.2%	2.5%	Amber

Settlement / Strategic site description

Pencoed is located towards the eastern extent of the Bridgend County Borough area. The Ewenny River flows through Pencoed and, together with the railway line, presents a constraint to development. Currently all traffic travelling from the west of the railway must use either the level crossing on Hendre Road or the Penprysg Road bridge. Welsh Government are assisting the council in completing a feasibility study to draft long-term solutions to notorious traffic problems caused by the bottle neck at the level crossing. There is presently a moratorium on any development in the west of the town until a viable solution is determined.

The preferred strategy presents Pencoed as a main settlement and as an attractive employment site. Although not identified as an area of significant growth, Pencoed is seen as an important settlement with important retail, community service and employment provision that meets the needs of its population and the surrounding area. Pencoed will benefits from its proximity along the A473 to the significant areas of growth and opportunity identified within Bridgend, especially in terms of access to jobs and higher-level services, enabled by its rail access, the M4 and strategic highway improvements along the A473.

Fluvial and Tidal Flood Risk

Overview

Pencoed is at risk of flooding from the River Ewenny and the Ewenni Fach. NRW historic flood outlines indicate that that there is a history of flooding in Pencoed, with flooding to three large areas of settlement in 1998. The primary source of this flood risk was fluvial.

Within the strategic area of Pencoed a large area of land falls within Flood Zone C2, including a number of residential properties to the west of the A473. There is no Zone C1 in Pencoed due to the absence of formal flood defences.

Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including Acceptability Criteria.

Threshold of Flooding (A1.14)

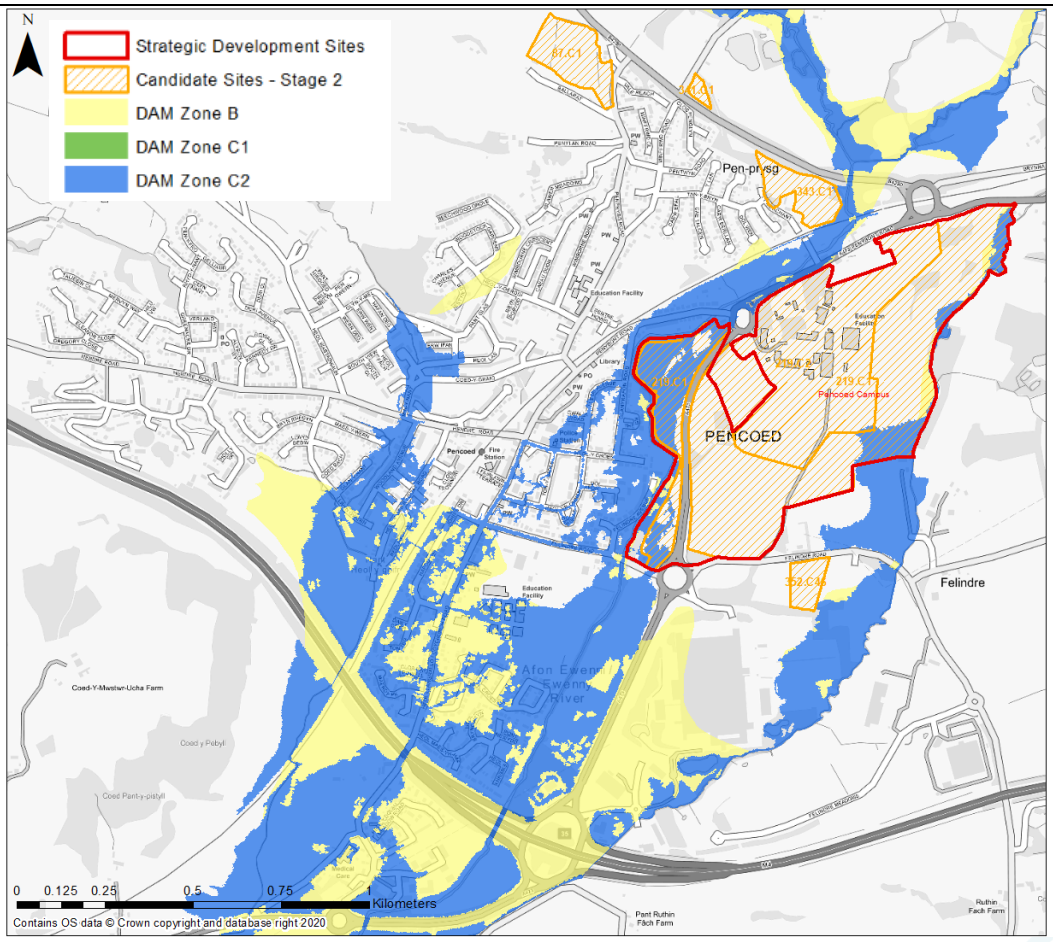
During the 1% AEP event, flooding is generally limited to a number of highways but does affect properties on Pentbont Road and Glanyrafon Road. The floodplain impacted by the 1% AEP event to the south of the M4 and A473 is extensive.

When considering climate change, flood zones are not expected to increase significantly.

In general, across Pencoed, development is likely to meet the requirements of A1.14 of TAN15. However, where development is proposed in areas at risk in the 1% AEP plus climate change event flood mitigation measures may be challenging to implement without causing an increase in flood risk elsewhere.

Flood Exceedance Conditions (A1.15)

The 0.1% AEP modelled flood event impacts far larger areas of Pencoed than the 1% AEP event, particularly to the east of the railway line. However, many of these areas experience very shallow flooding during this extreme event. Therefore, locations within the 0.1% AEP extent, but not a risk of more frequent flooding are likely to satisfy the requirements of A1.15. The predicted flood extent and depths through Pencoed can be seen in Appendix A.



Pencoed DAM Map

Strategic sites

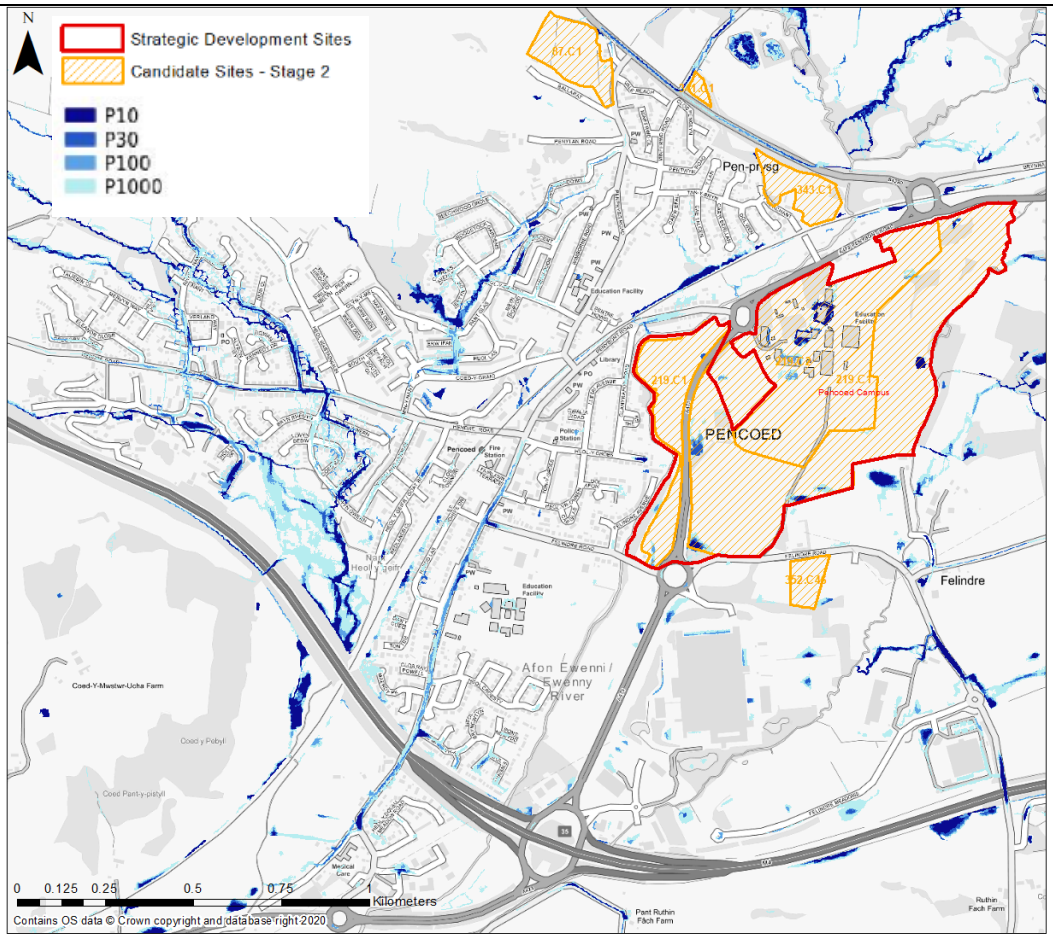
Pencoed Campus is a large strategic site located to the north-east of Pencoed. The site is classified as 'Amber' within the RAG assessment as a result of a fluvial flood risk to the site. The DAM map identifies areas of Zone C2 along the eastern and western boundaries of the site, whilst detailed modelling presents a reduced risk to the site where only the western boundary is affected by flooding during the 1% AEP event plus climate change. The majority of the site is unaffected by fluvial flood risk and suitable for all development types. Development within the limited flood risk areas should proceed with caution. Built development should not take place within the floodplain unless essential and of a low vulnerability.

Risk of Flooding from Surface Water

There is a widespread risk of surface water flooding in Pencoed. This is caused the relatively steep topography to the northwest of the town combined with relatively flat areas in the southeast of the town. Additionally, many minor (ordinary) watercourses are heavily modified by historical development.

A key surface water flow path is identified to the southwest of Pencoed where the Nant Heol Y Geifr flows in a number of small channels in a southerly direction towards the River Ewenny, through an existing residential area. The PFRA identifies surface water flood events in this area, where a number of properties in Woodstock Gardens experienced surface water flooding in October 1998, February 1999 and December 1999.

Development within the existing settlement extent of Pencoed should take particular note of the surface water flood map to direct development and manage flood risk.



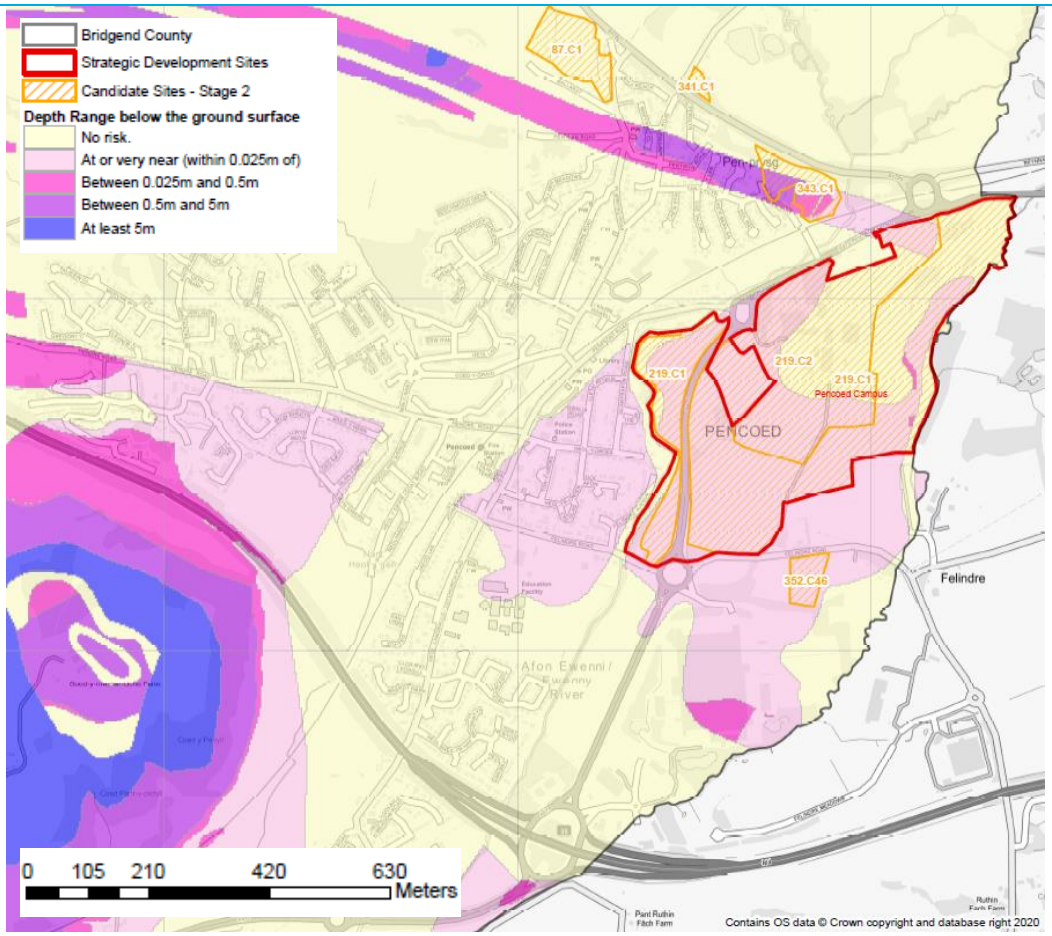
Pencoed Flood Risk from Surface Water

Strategic sites

Pencoed Campus is a strategic site located within the Pencoed Key Settlement. Limited areas of the site are at high risk of surface water flooding and there are no significant surface water flow paths. It is expected that this risk of surface water flooding can be managed through the use of SuDS techniques and good design.

Risk of flooding from Groundwater

A significant proportion of Pencoed is at high risk of groundwater flooding (groundwater levels are at or very near to 0.025m below the surface). The other areas of Pencoed are not at risk of groundwater flooding.



Pencoed Groundwater

Strategic sites

Pencoed Campus is a strategic site located within the Pencoed Key Settlement. The majority of the site is has shallow groundwater depths (at or near, within 0.025m of the surface) with the area to the north east not at risk of groundwater flooding. The risk of groundwater flooding should be considered further in any development proposals and may dictate the depth of SuDS assets across the proposed development site

Other sources of flood risk

Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site-specific basis.

Artificial: No artificial sources of flood risk have been identified for this area.

Flood Consequence Assessment Guidance

- The LLFA should be consulted on the requirement for an FCA for sites located in areas of surface water flood risk, but otherwise in DAM Zone A.
- Development in areas of very shallow fluvial flooding in the 0.1% AEP event may need to acknowledge the inherent uncertainty in flood modelling urban environments where flooding is less than the typical curb height or property threshold (ie. <150mm). Consequently, a more pragmatic view as to the realisation of third-party impacts may be justified.

7.5 Pyle, Kenfig and North Cornelly

Settlement:	PYLE, KENFIG AND NORTH CORNELLY		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Land East of Pyle	1.8%	2.4%	Green
Waun Bant Road and Pen y Castell Farm	0%	3.4%	Green

Settlement / Strategic site description

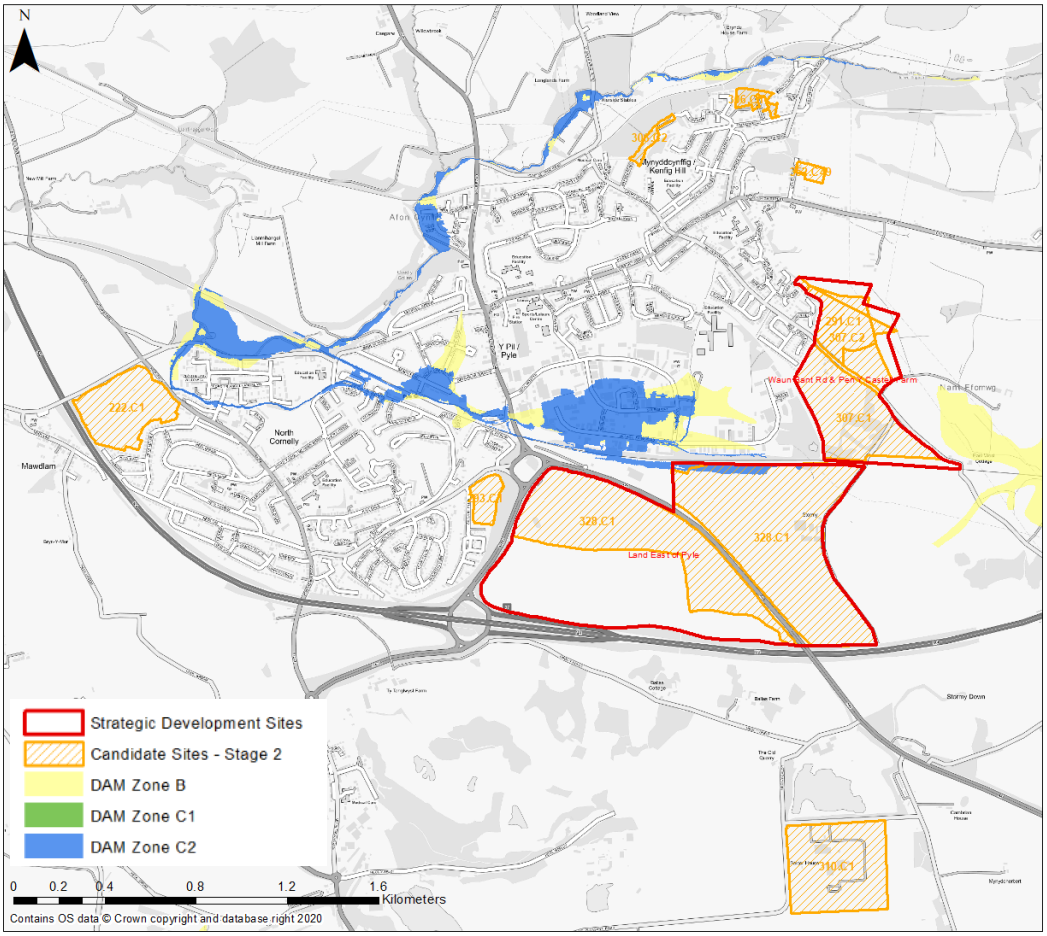
Pyle, Kenfig and North Cornelly are located towards the west of Bridgend County Borough, with the River Kenfig flowing in a westerly direction to the northern boundary of the settlement area and the Afon Fach flows in a westerly direction through the heart of Pyle.

The settlement is a focal point for services, transport and community activity. The preferred strategy states that Pyle, Kenfig and North Cornelly demonstrates capacity for sustainable growth based on their accessibility, availability of amenities and employment provision in the context of their existing population bases.

Fluvial and Tidal Flood Risk

Overview

The River Kenfig (Afon Cynffig) and Afon Fach flow through Pyle and confluence north of North Cornelly. There are no formal flood defences within Pyle, Kenfig and North Cornelly. The NRW Historic Flood Outline does not include any detail of historic flood events in the Maesteg area. The BCBC PFRA highlights a historic flood event at village farm Industrial Estate in June 1998 as a result of capacity issues to a culverted section of watercourse.



Pyle, Kenfig and North Cornelly DAM Map

The key settlement was extensively flood modelled by NRW in 2012 and this modelling now informs the DAM and Flood Map. The are no formal flood defences in the key settlement and therefore all flood risk areas are classed as DAM Zone C2. Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including acceptability Criteria.

The DAM captures three main flood risk areas with the settlement:

- Village Farm Industrial Estate. Significant areas of the industrial estate are at flood risk due to the low-lying topography and under capacity of the heavily modified watercourses.
- Pyle Train Station area. The area around the train station is predicted to flood, particularly upstream of the culvert under the mainline. This effects the station and surrounding residential properties.
- Ffynon Y Maen. The low-lying areas on Ffynon Y Maen and the surrounding residential streets are at risk from the Afon Cynffig.

Development should be directed away from areas of Zone C2 wherever possible. However, there is a realisation that development of Village Farm Industrial Estate is necessary to sustain the business that currently occupy the site. Consequently, it may be appropriate to apply greater latitude to the indictive guidance of A1.14 and A1.15 as it applied to this site, provided that development does not increase the vulnerability of development and will contribute to an overall improvement in flood resilience within the Estate. The predicted flood extent and depths through Pyle, Kenfig and North Cornelly can be seen in Appendix A.

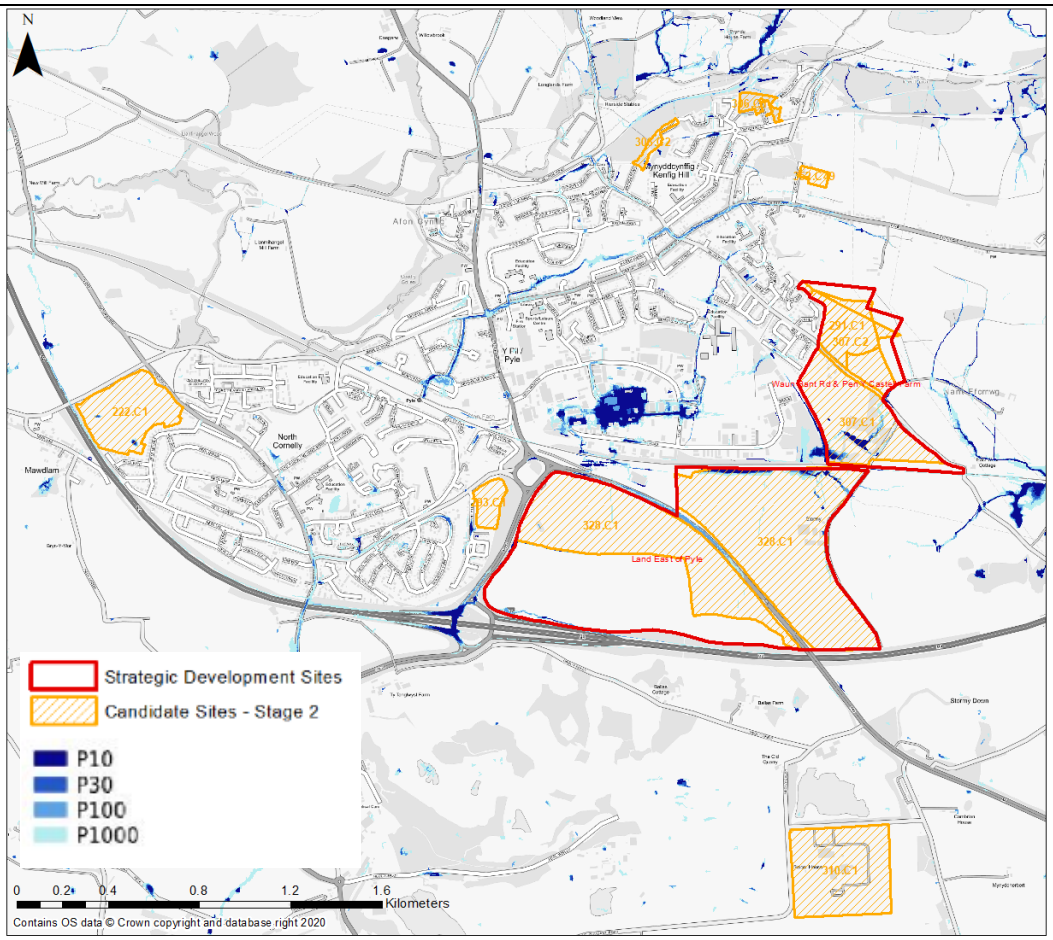
Strategic sites

There are two strategic sites located within the Pyle, Kenfig and North Cornelly Key Settlement. Both sites are classified as 'Green' under the RAG assessment, indicating that flood risk to the site is likely to be acceptably managed.

Risk of Flooding from Surface Water

There are two notable areas of surface water flood risk within the Pyle, Kenfig and North Cornelly Key Settlement area:

- Village Farm Industrial Estate. The topography of the Village Farm Industrial Estate and the multiple small drainages and culverts are conducive to surface water flooding, with the risk greatest towards the centre of the site.
- B4281, Collwyn Road to Pyle Station. The surface water flood map indicates a potentially significant overland flow route along the B4281, down Collwyn Road and toward Pyle Station where if flows into the Afon Fach.



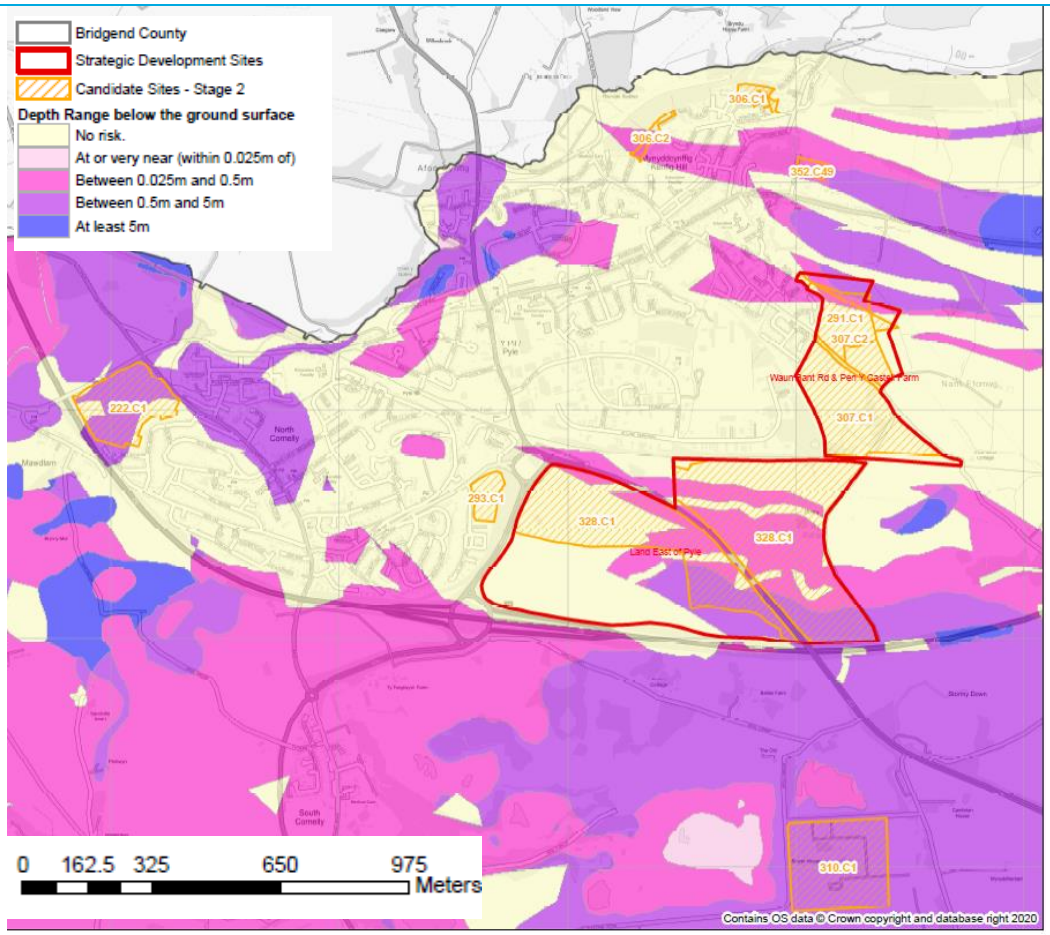
Pyle, Kenfig and North Cornelly Flood Risk from Surface Water

Strategic sites

Both strategic sites include headwater tributaries of the Afon Fach with which localised areas of surface water flood risk are associated. Whilst it is expected that these limited areas of surface water flood risk can be managed through the use of SuDS techniques and good design, developers should be encouraged to seek additional opportunities to contribute to a reduction in downstream flood risk on the Afon Fach given the significant flood risk issues at Village Farm Industrial Estate.

Risk of flooding from Groundwater

The majority of Pyle, Kenfig and North Cornelly are not at risk of groundwater emergence. Areas at higher risk of groundwater emergence (0.025m-0.5m) are dispersed around the area.



Pyle, Kenfig and North Cornelly Groundwater

Strategic sites

There are two strategic sites located within the Pyle, Kenfig and North Cornelly Key Settlement. Parts of the Land East of Pyle strategic site have groundwater at depths of between 0.025m and 0.5m from the ground surface and between 0.5 and 5m below the ground surface. The risk of groundwater flooding should be considered in any development proposals and may dictate the depth of SuDS assets across the proposed development site.

Other sources of flood risk

Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site specific basis.

Artificial: No artificial sources of flood risk have been identified for this area.

Flood Consequence Assessment Guidance

- Village Farm Industrial Estate: It may be appropriate to apply greater latitude to the indictive guidance of A1.14 and A1.15 as it applied to this site, provided that development does not increase the vulnerability of development and will contribute to an overall improvement in flood resilience within the Estate.
- The strategic development sites should seek additional opportunities to contribute to a reduction in downstream flood risk on the Afon Fach given the significant flood risk issues at Village Farm Industrial Estate. At a minimum it is essential that downstream peak flows are not increased by development.

7.6 Porthcawl

Settlement:	PORTHCAWL/NEWTON		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Porthcawl Regeneration Site	19.3%	0.2%	Amber

Settlement / Strategic site description

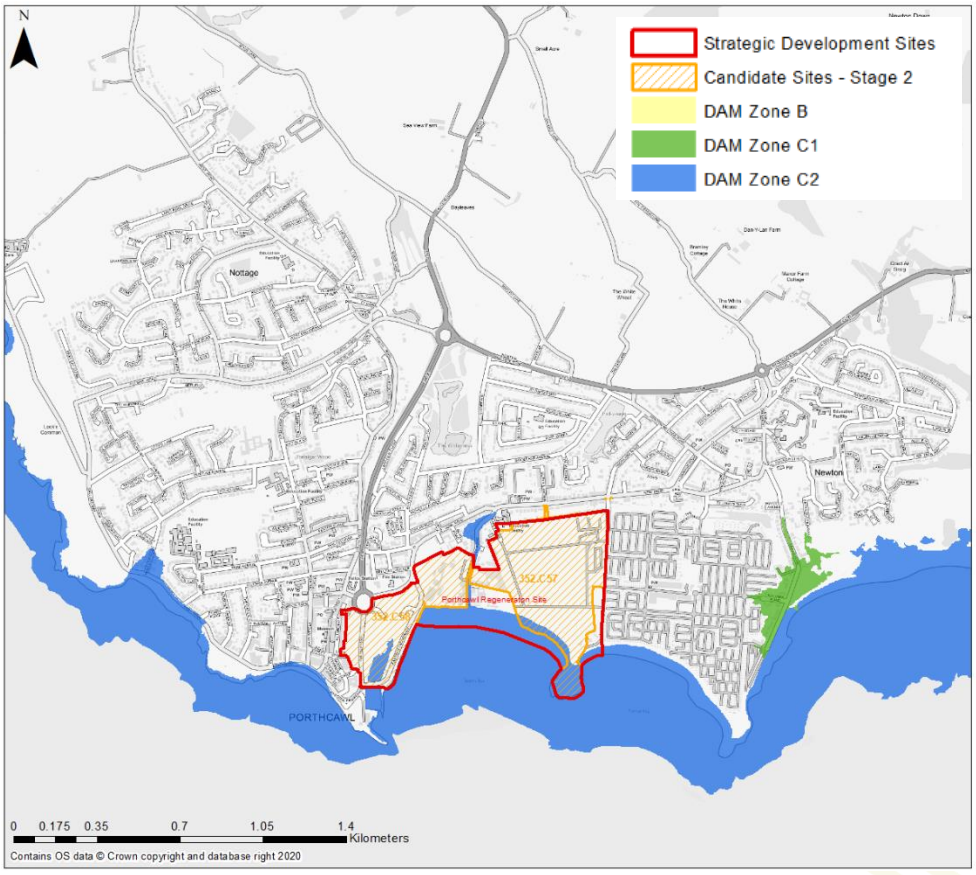
Porthcawl (including Newton) is a coastal community and an area of high scenic beauty and biodiversity, enhanced by its coastal location, characterful town centre and seafront. It offers accessible sandy beaches and surf for active pursuits and a base for touring South Wales.

Porthcawl is a coastal community in the west of Bridgend. It plays a strategic role within the County Borough as a focus point for services, transport and community activity. It also plays an important role as a leisure and tourism destination. The LDP and the Regeneration-Led Spatial Strategy for Bridgend aims for Porthcawl to redefine itself as a premier tourist destination. The town centre is seen as an integral element in the retail sector, providing an important focus for retailing and services for residents.

Fluvial and Tidal Flood Risk

Overview

The primary risk of flooding to Porthcawl is tidal, although only limited areas of Porthcawl lie within DAM Zone C2 and C1, with the majority of the key settlement located within DAM Zone A. Areas in Zone C2 include, West Drive and the Esplanade, Salt Lake car park and Mackworth Road. Formal flood defences at Beach Road, Newton result in the only area of Zone C1. Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including acceptability Criteria.



Porthcawl DAM Map

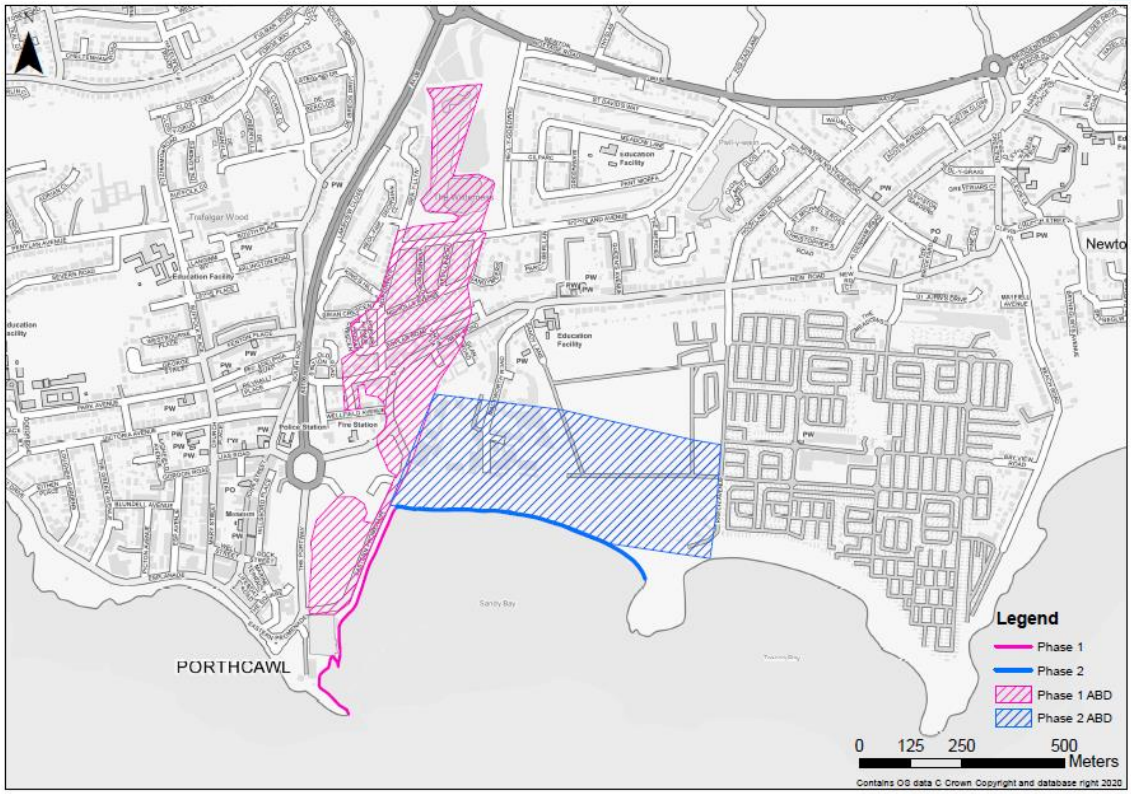
The DAM does not include any allowance for climate change and in a coastal context increasing sea levels have the potential to significantly increase tidal flood risk. Consequently, coastal development should be mindful that a DAM Zone A classification does not always mean that there will be no flood risk over the lifetime of development. BCBC have completed detailed tidal modelling of Sandy Bay to understand the future potential for tidal flooding. The results of this modelling show that left unchecked climate change will significantly increase flood risk at Salt Lake car park and cause a broad swath of Porthcawl to flood from the northeast corner of Sandy Bay to The Wilderness. The predicted flood extent and depths through Porthcawl can be seen in Appendix A.

As a result of the future tidal flood risk in Porthcawl BCBC have developed plans for the Porthcawl Flood Defence scheme. The scheme has been developed to be delivered in two phases. Phase 1 (Eastern Promenade) will protect the Salt Lake area and existing development to the north. This phase of the scheme will consist of the following measures:

- Repair and maintenance to the Western Breakwater to safeguard the structural integrity of the structure.
- Strengthen and raise the existing parapet wall to reduce the risk of wave overtopping along Eastern Promenade.
- Minor management measures to preserve the Sandy Bay relict dunes.
- Installation of rock armour to protect the neck of Rhych Point.

Phase 2 (Coney Beach) will consist of flood and coastal erosion measures along the Coney Brach frontage to safeguard and enhance the existing flood protection to the frontage provided by the existing ad-hoc revetment.

The areas expected to benefit from the two phases of the Porthcawl Flood Defence scheme are shown in the figure below. The expectation is that both phases will protect these areas for the next 100 years to a minimum of a 0.5% AEP standard of protection.



Proposed areas benefitting from defences following coastal works

BCBC has secured funding and all necessary permissions for Phase 1 of the Porthcawl Flood Defences Scheme and work is due to start imminently. Upon completion of Phase 1 flood

defence works, the DAM classification which covers a small portion of the site, should change from C2 to C1. A risk of flooding may remain in the 0.1% AEP but this will be significantly reduced by the flood defences and should be manageable through good design. Consequently, within the area benefiting from Phase 1 of the Porthcawl Flood Defences Scheme all forms of development should be appropriate.

Phase 2 of the Porthcawl Flood Defences Scheme is yet to receive funding and approval. However, as most of the area in located in DAM Zone A and future flood risk is predicted to be limited in extent and modest in depths, all forms of development are appropriate subject to a detailed and satisfactory Flood Consequence Assessment.

As tidal flood risk and the impacts of climate change can be complex, it is advised that a Flood Consequence Assessment should accompany any plans to develop within the Phase 1 and 2 areas irrespective of its location in Zone A of the DAM. The LLFA may also wish to request a Flood Consequence Assessment for other sites in close proximity to the coastal frontage.

Strategic sites

The Porthcawl Regeneration site is an extensive brownfield site extending from Trecco Bay caravan site and Rhych Point in the east to the existing harbour and town centre to the west, taking in the former Council owned Sandy Bay caravan site and Salt Lake car park.

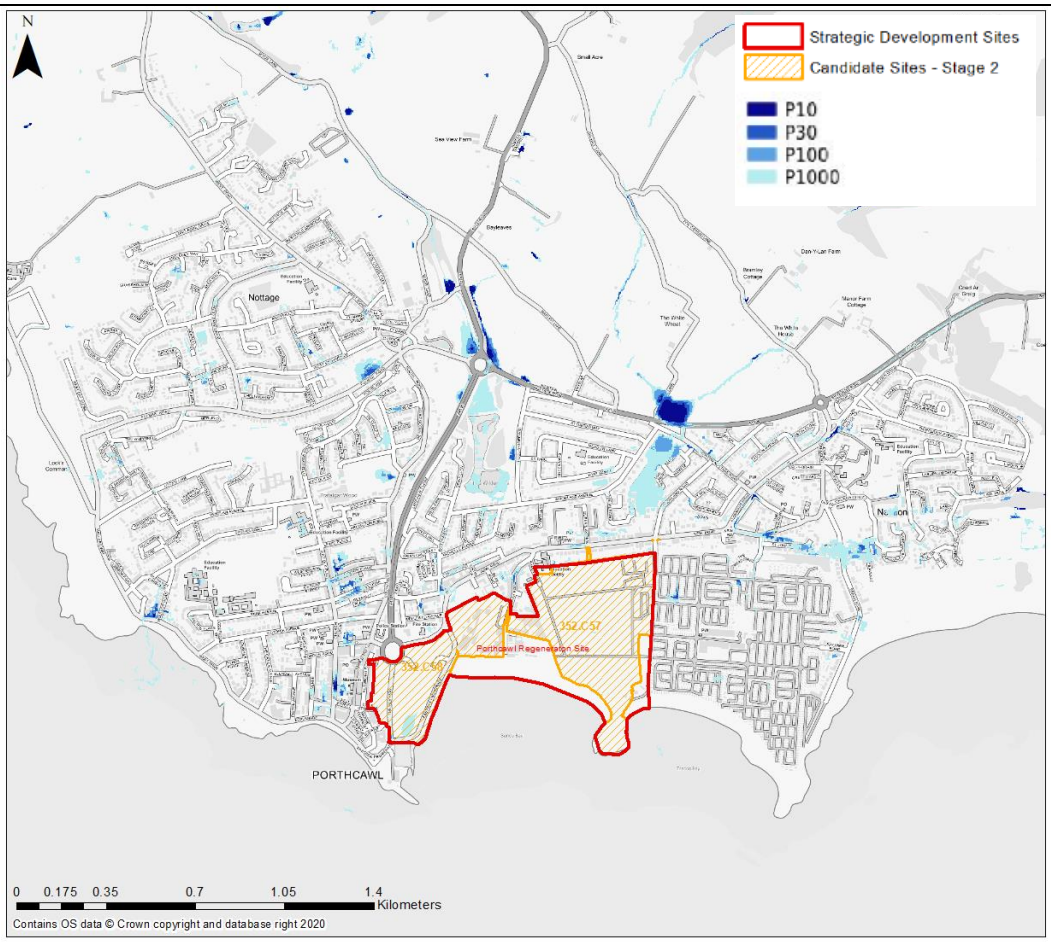
The current strategic development site boundary includes significant areas of the coastal foreshore and are therefore located in DAM Zone C2. However, these areas are not proposed for built development and therefore the percentage coverage of C2 is somewhat misleading, with most development areas located in Zone A of the DAM.

The costal setting of this site makes it particularly important to consider the impacts of climate change on tidal flood risk. Some areas of the strategic site currently located in DAM Zone A are predicted to be at future flood risk without improvements being made to the coastal flood defences. However, with implementation of the Porthcawl Flood Defences Scheme it is likely that the Porthcawl Regeneration site can be developed in full compliance with the requirements of TAN15. Nevertheless, all development in the area should be accompanied by a Flood Consequence Assessment.

Risk of Flooding from Surface Water

FRAW data indicates that the Porthcawl area is generally not susceptible to surface water flooding. Notable areas of surface water flood risk include:

- An area of ponding on agricultural land north of Nottage Road at its junction with Zig Zag lane. From this point surface water continues to flow in a southerly direction towards residential areas south of the Nottage Road, towards the north of Porthcawl.
- Ponding to the north of Nottage Road at its junction with the A4229, where an unnamed watercourse is culverted beneath the highway junction.
- Ponding where the watercourse flows south into the Wilderness Lake. The Bridgend PFRA identifies two incidents of surface water flooding in this area in October 1998 and December 2000.
- There are two records for historic flooding on Marlpit Lane (October 1998 & December 2000), although the surface water flood map shows no areas of susceptibility on Marlpit Lane.
- A small preferential flow path can be seen along St John's Drive and Mayfield Avenue in an East West direction, towards the eastern extent of Porthcawl, affecting several residential properties. The Bridgend PFRA identifies one incident of surface water flooding in this location in October 1998.



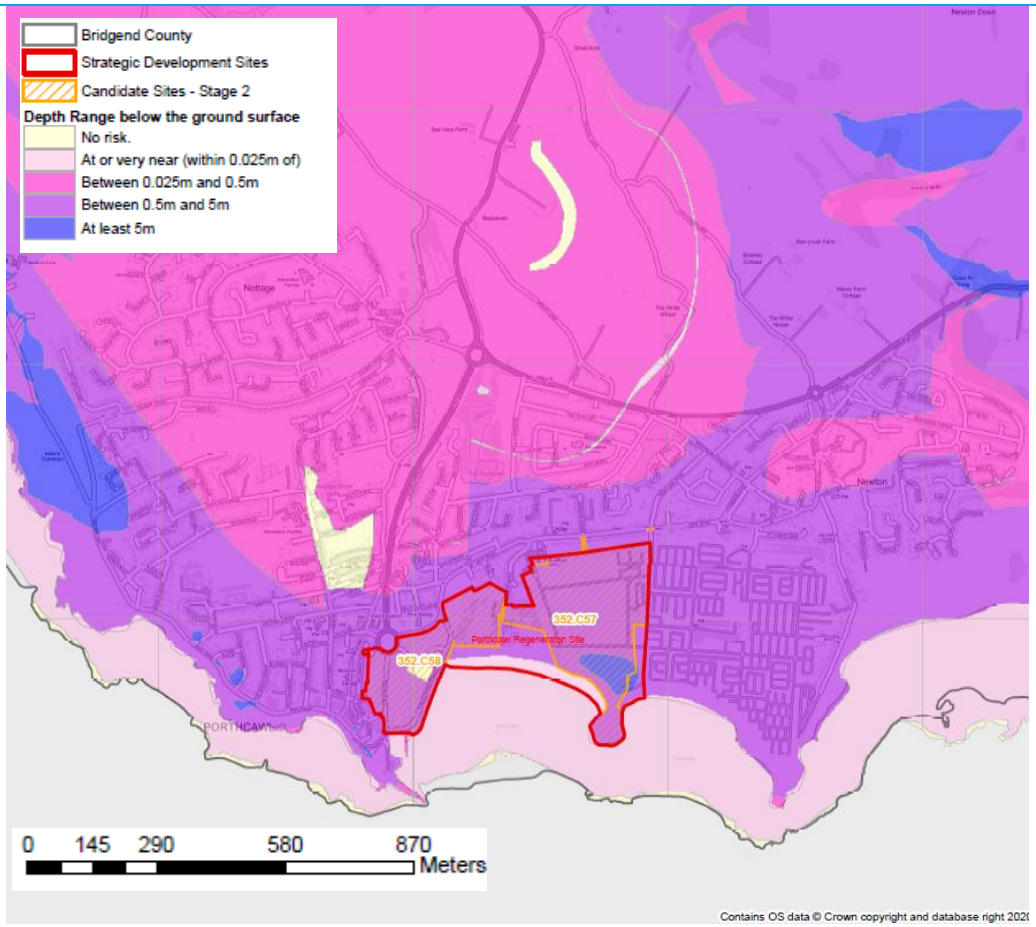
Porthcawl Flood Risk from Surface Water

Strategic Sites:

The site has a single small area at the southern extent of Salt Lake car park with a risk of surface water flooding. This small area is to be expected given the topography of the site. However, it is anticipated that surface water on this site should be relatively easily managed through the use of SuDS techniques and good design.

Risk of flooding from Groundwater

Groundwater levels below Porthcawl are predominantly between 0.5 and 5m below the surface. Groundwater levels in areas to the north and east of Porthcawl are significantly higher, between 0.025m and 0.5m below the surface.



Porthcawl Groundwater

Strategic Sites:

Groundwater across the strategic development site is between 0.5m and 5m of the ground surface.

Other sources of flood risk
Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site specific basis. **Artificial:** No artificial sources of flood risk have been identified for this area.
Flood Consequence Assessment Guidance
As tidal flood risk and the impacts of climate change can be complex, it is advised that a Flood Consequence Assessment should accompany any plans to develop within the Phase 1 and 2 areas irrespective of its location in Zone A of the DAM. The LLFA may also wish to request a Flood Consequence Assessment for other sites in close proximity to the coastal frontage. Flood Consequence Assessment should consider both the risks of still water flooding and wave overtopping. They may also need to consider the residual risk of flood defence failure.

7.7 Waterton

Settlement:	WATERTON		
Strategic Site RAG scores			
	% Zone C	**% surface water**	**RAG**
Parc Afon Ewenni	8.4%	2.0%	Amber

Settlement / Strategic site description

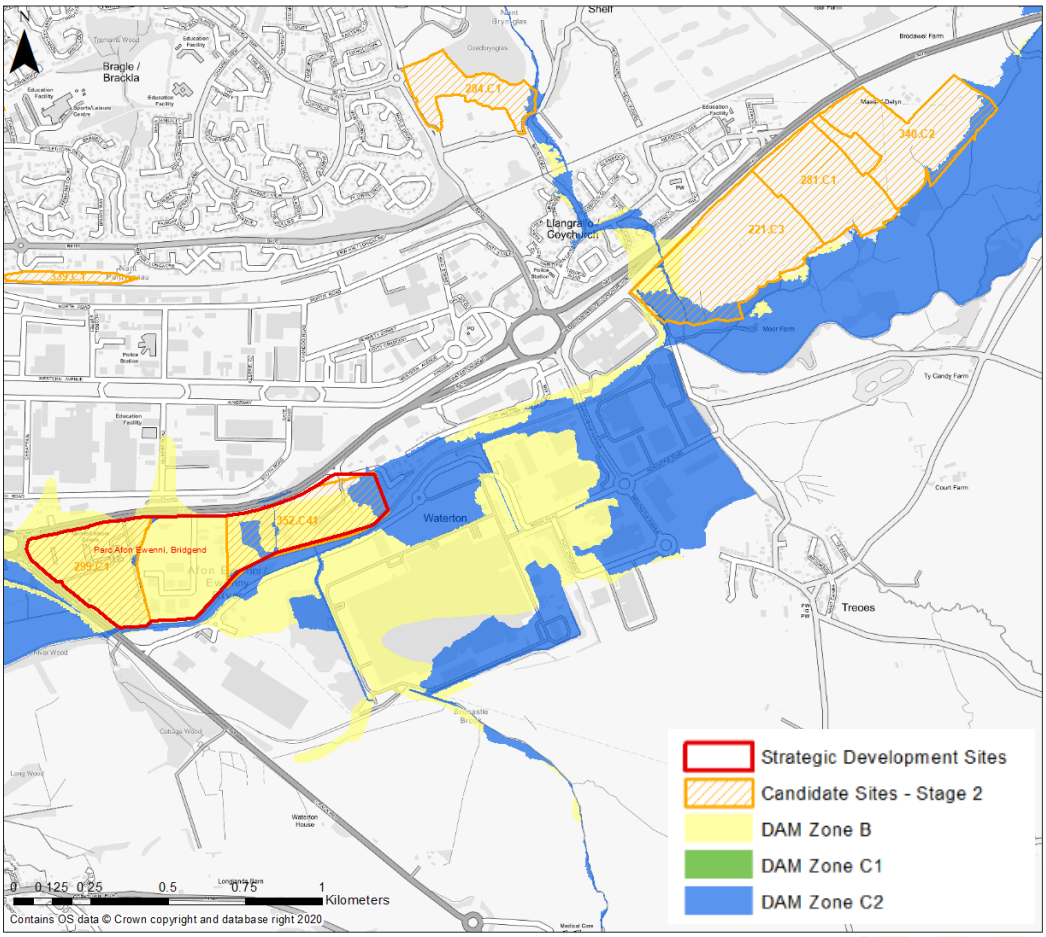
Waterton is located towards the southern extent of Bridgend Town, close to the boundary with the Vale of Glamorgan. The River Ewenny flows through in south-westerly direction and is joined by a number of minor tributaries in the Waterton area.

Whilst Waterton is not officially classified as a Key Settlement within the existing LDP, it is identified as a significant industrial and employment area within the county borough and contains a large strategic site which is deemed important for meeting the aims and objectives within the LDP.

Fluvial and Tidal Flood Risk

Overview

Waterton is not at tidal flood risk. The fluvial flood risk comes from the River Ewenny and there are no formal food defences within the area. Therefore, there are no areas of Zone C1 within the DAM. NRW historic flood outlines indicate that the Bryn Road area of Pencoed flooded in the 1998 flood event.



Waterton DAM Map

Upstream of the Waterton Estate the River Ewenny is meandering, braided, with an extensive and natural floodplain. As the river travels through the Waterton Estate it has

been heavily modified to reduce the risk of flooding by widening and straightening the channel. Although the increased capacity of the River Ewenny through the Waterton Estate reduces the risk of flooding it does not eliminate it and there are significant areas of the Estate within DAM Zone C2. Only less vulnerable development is suitable in areas of Zone C2, subject to the application of the Justification Test, including Acceptability Criteria.

The DAM through Waterton is largely based on outdated generalised flood modelling and therefore there is considerable uncertainty with the DAM Zones for the area. The FRAW fluvial flood mapping has been reviewed and this suggests that there is potential for the current DAM to be underestimating flood risk in the area. Flood Maps associated with Waterton are contained in Appendix A.

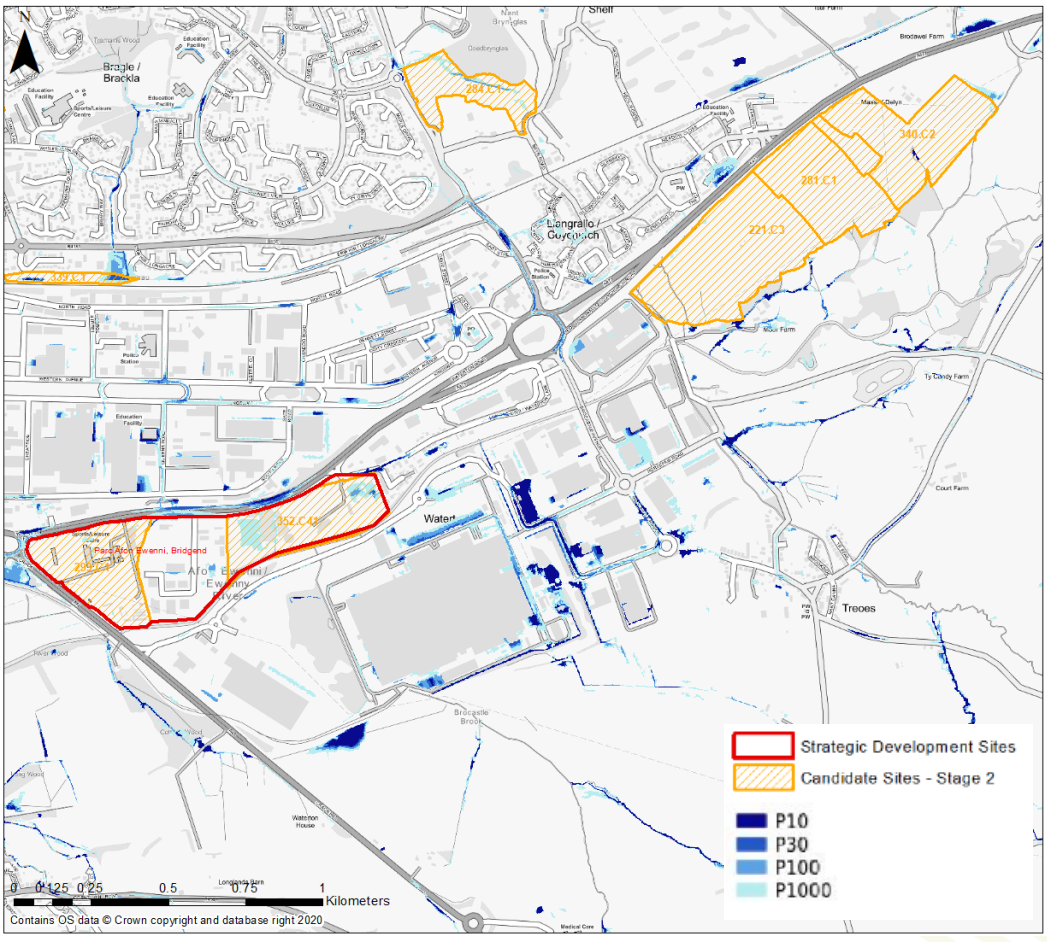
Strategic sites

Parc Afon Ewenni is a strategic development site within the Waterton area. With 8.4% of the site located in DAM Zone C2 the site is assessed to have RAG status 'Amber', being just over the 5% threshold. NRW flood zone mapping suggest that the Parc Afon Ewenni site is largely free of flood risk, with most areas of Zone C2 only flooding in the 0.1% AEP event (Flood Zone 2).

If the current flood zones are correct, most areas of the site are likely to be suitable for development, with Highly Vulnerable Development excluded for those areas of Zone C2. However, with uncertainty in the accuracy of the DAM it is recommended that any development of this strategic site is supported by a detailed site-specific flood modelling and corresponding Flood Consequence Assessment.

Risk of Flooding from Surface Water

The FRAW data indicates that there is little surface water flood risk across the Waterton area. Some areas of ponding are identified within Waterton Industrial Estate, primarily south of the River Ewenny and in areas of localised depressions.



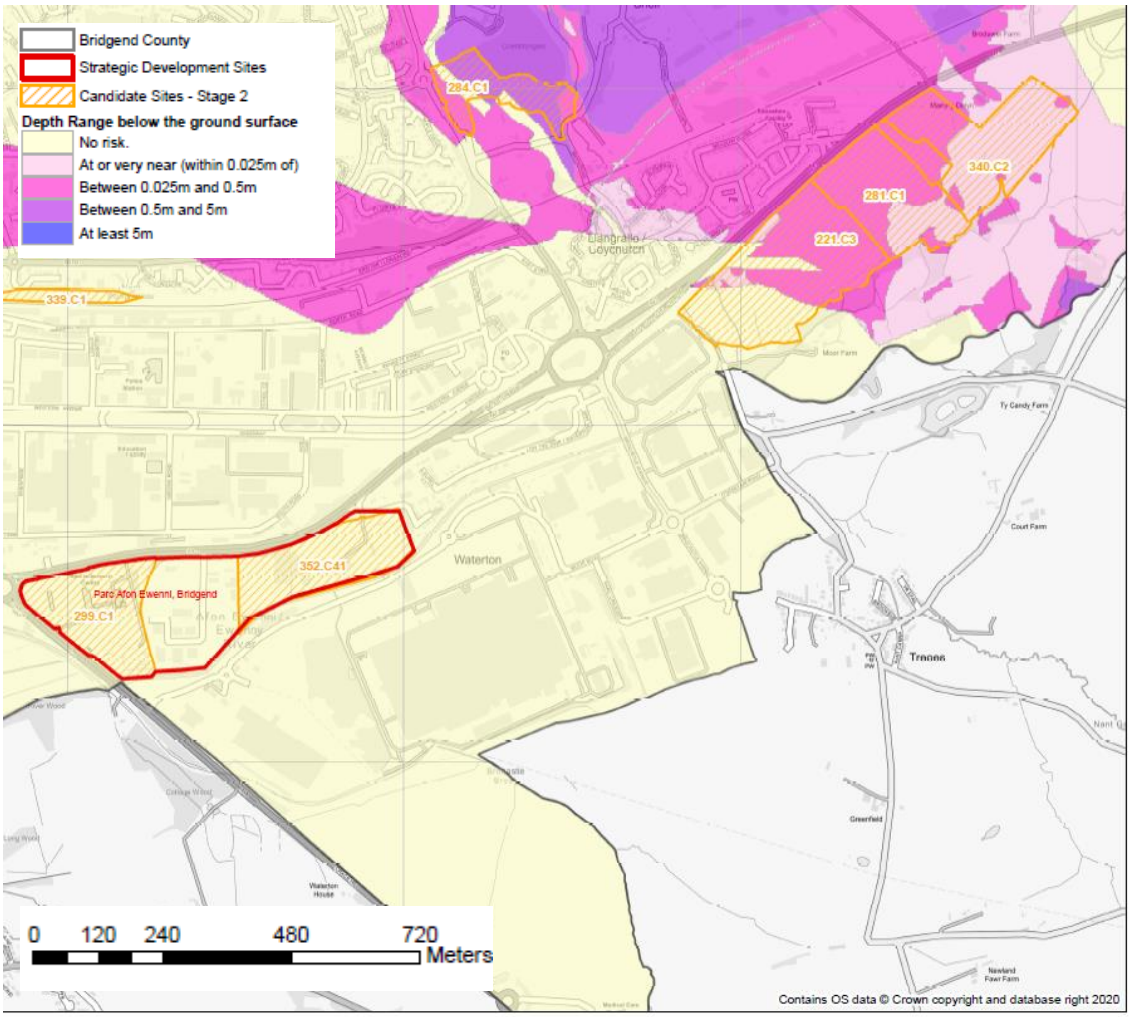
Waterton Flood Risk from Surface Water

Strategic Sites:

Parc Afon Ewenni is a strategic site located within the Key Settlement of Waterton. Several small areas of the site are at high risk of surface water flooding due to localised topographic ponding. It is expected that this modest risk of surface water flooding can be managed through the use of SuDS techniques and good design.

Risk of flooding from Groundwater

There is generally no risk of groundwater emergence across the Waterton area. The north-eastern area of the this key settlement is shown to have a range of groundwater depths.



Waterton Groundwater

Strategic Sites:

Parc Afon Ewenni is a strategic site located within the Key Settlement of Waterton. The area is not at risk of groundwater flooding and groundwater is therefore unlikely to have an impact upon development. .

Other sources of flood risk

Sewer: No significant reports of sewer flooding recorded. DCWW to be consulted on a site specific basis.

Artificial: No artificial sources of flood risk have been identified for this area.

Flood Consequence Assessment Guidance

- Flood consequence assessments in Waterton should be supported by detailed flood

modelling, the scope of which is recommended to be agreed with NRW in advance.

8 Assessment of Candidate Sites

The flood risk associated with each candidate site has been assessed in line with a RAG system. The full results of this assessment are contained in Appendix B.

The RAG assessment provides information for screening purposes only. Where a flood risk potential is identified, it will be for the promoter a candidate site to undertake a site-specific flood consequence assessment to demonstrate that the flood risks can be managed in line with the requirements of TAN15.

The DAM map has been used within this assessment to identify fluvial and tidal flood risk to a site. Any site within Zone C1 is deemed to have a lower risk of flooding when compared to sites in Zone C2 as a result of the presence of defences protecting the site. FRAW data has been used to assess surface water flood risk to the site as the most up-to-date data available at the time of assessment.

The resulting RAG scores and classification are used to indicate the following:

- Red: Site is unlikely to pass the Justification Test
- Amber: It may be possible to develop the site in line with the requirements of TAN15 subject a detailed site-specific Flood Consequence Assessment and satisfaction of the Justification Tests.
- Green: The site is at low risk of flooding and a site-specific Flood Consequence Assessment is unlikely to be required.

Table 8-1 provides information on the proposed Candidate Sites that have been assessed as 'Red' and 'Amber'. The table provides detail on the screening assessment and the need for further detailed assessment. The full Candidate Site Assessment is contained in Appendix B.

Table 8-1 Candidate Site Assessment

Site Reference	Candidate Site Name	Maximum Percentage of Flood Risk Area	Primary Source of Flooding	RAG Assessment	Comments
352.C31	**Ty'r Ardd**	97.2	Fluvial	Amber	This brownfield site is located within DAM Zone C1, indicating a risk of fluvial flooding and an area of the floodplain served by significant flood defence infrastructure. The site is covered by the Bridgend flood model. In the defended scenario, this site is predicted to be flood free during the 1% AEP event plus climate change and is therefore likely to satisfy the requirements of A1.14 of TAN15. Additionally, the site is predicted to flood to depths of approximately 300mm during the 0.1% AEP event, and would therefore comply with A1.15 of TAN15. As a result, there appears to be good potential for this site to satisfy the requirements of TAN15 for all forms of development.
352.C15	**Former Copper Standard Site**	40.7	Fluvial	Amber	Approximately 40% of the site is located in Zone C2. Very little of the site is predicted to flood which is likely to greatly inhibit the sites potential for Highly Vulnerable Development (i.e. residential). However, the flood risk is largely confined to the 0.1% AEP and is predicted to be shallow (>300mm) across most of the site. Consequently, it is likely that the requirements of A1.14 and A1.15 of TAN15 will be satisfied relatively easily. Flood risk on the site is likely to be manageable in line with TAN15. But careful layout design will be required to avoid Highly Vulnerable Development in Zone C2.
352.C41	**Parc Afon Ewenni**	23.8	Fluvial	Amber	The DAM indicates that this site is partially located within DAM Zone C2, although the majority of the site is located in Zone A. FRAW fluvial flood risk mapping indicates that the current DAM may be underestimating the flood risk, but NRW hold no detailed flood models for the area. As a result, detailed flood modelling will be required to support the production of a Flood Consequence Assessment and this may find that the site is not be suitable for Highly Vulnerable Development.

339.C1	**Tremains Halt (Land at)**	17.3	Surface Water	Amber	A large area of this site is susceptible to surface water flooding. This is likely as a result of a constriction of the Nant Pontysanau as it is culverted beneath the railway line. Development is likely to be acceptable with the carefully considered management of this surface water flood risk. A detailed Flood Consequence Assessment should accompany any plans to develop this site irrespective of its location in Zone A of the DAM.
352.C19	**Coegnant**	16.4	Surface Water	Amber	A significant surface water flow path is identified across the southern extent of the site. Current surface water outlines across the site correspond with the existing BMX track layout. Development is likely to be acceptable with the carefully considered management of this surface water flood risk. A detailed Flood Consequence Assessment should accompany any plans to develop this site irrespective of its location in Zone A of the DAM.
219.C1	**Pencoed Campus**	16.0	Fluvial	Amber	16% of the wider Pencoed Campus site is located within DAM Zone C2. This flooding is entirely contained to the west of the A473 and many areas are only affected in the 0.1% AEP event and even then, only to shallow depths. The DAM does not reflect the latest NRW detailed flood modelling for Pencoed, which shows a notably lower risk of flooding in this area. Supported by further detailed assessment, the vast majority of the site is likely to comply with the requirements of TAN15. NRW should be consulted to agree the detailed flood modelling for the area and flood map update may be justified. NB: this assessment applies to the larger Pencoed Campus site, Ref 219.C1. The smaller Pencoed Campus site, Ref 219.C2 is classified as 'Green' within this assessment.
352.C11	**Blaencaerau Junior School**	13.1	Surface Water	Amber	The site is entirely located in DAM Zone A but has been classified as an amber site due to the risk of surface water flooding. Surface water flood risk to this site is as a result of overland surface water flows from higher ground at the head of the valley flowing towards Blaencaerau Road and the River Llynfi. There is no known history of flooding to this brownfield site. Development is likely to be acceptable with the carefully considered management of this surface water flood risk. A Flood

					Consequence Assessment should accompany any plans to develop this site irrespective of its location in Zone A of the DAM.
352.C57	**Sandy Bay (Phase 2)**	10.2	Tidal	Amber	This site has been classified as amber as the proposed site boundary encompasses areas of the tidal foreshore which presumably will not see built development. All areas of the site set back from the coastline are located in DAM Zone A and therefore development would not normally trigger a requirement for a Flood Consequence Assessment. Climate change driven sea level rise and coastal erosion have the potential to increase flood risk in the area in future. However, BCBC flood modelling undertaken to support the Porthcawl Flood Defence Scheme has not identified a significant future increase in flood risk to the Sandy Bay site. The area will benefit from several elements of the fully funded Porthcawl Flood Defence scheme (Phase 1), including measures to safeguard the dunes and Rhych Point. Phase 2 of the Porthcawl Flood Defence scheme has not yet been finalised or gained funding to proceed, but this phase will further secure the Sandy Bay frontage. As tidal flood risk and the impacts of climate change can be complex, a detailed Flood Consequence Assessment should accompany any plans to develop this site irrespective of its location in Zone A of the DAM.
340.C2	**Maes-Y-Delyn Farm**	9.6	Fluvial	Amber	The site is partially (9.6%) located within DAM Zone C2. However, provided that built development is directed away from this area, which fringes the southeast boundary of the site, it should be possible to satisfy the requirements of TAN15.
221.C3	**Coychurch (Land South of)**	8.3	Fluvial	Amber	8.3% of the site is located within DAM Zone C2. However, provided that built development is directed away from this area, which affects the southern boundary of the site, it should be possible to satisfy the requirements of TAN15.
352.C58	**Salt Lake Car Park / Dock Street (Phase 1)**	7.8	Tidal	Amber	A small (7.8%) proportion of the site is located in DAM Zone C2. The flood risk is predominately tidal flooding, which is predicted to increase due to the effects of climate change. Without intervention the flood risk across the site will increase over time.

					BCBC has secured funding and all necessary permissions for Phase 1 of the Porthcawl Flood Defences Scheme and work is due to start imminently. Upon completion of Phase 1 flood defence works, the DAM classification which covers a small portion of the site, should change from C2 to C1 as the area will be protected against the 0.5% AEP tidal events for the next 100 years. A risk of flooding is likely to remain in the 0.1% AEP but this will be significantly reduced by the flood defences and should be manageable through good design. Consequently, Phase 1 of the Porthcawl Flood Defences Scheme is expected to enable all forms of development to take place across the site. As tidal flood risk and the impacts of climate change can be complex, a detailed Flood Consequence Assessment should accompany any plans to develop this site irrespective of DAM zoning.
221.C1	**Broadlands**	6.6	Surface Water	Amber	Surface water flood risk arises from a depression in local topography. Development is likely to be acceptable with the carefully considered and management of this surface water flood risk. A detailed Flood Consequence Assessment should accompany any plans to develop this site irrespective of its location in Zone A of the DAM.
307.C1	**Pen-Y-Castell Farm**	6.6	Surface Water	Amber	Surface water on this site flows towards Frog Pond Wood Nature Reserve located at the western boundary of the site. Surface water ponding occurs in localised depressions across the site. Development is likely to be acceptable subject to the careful consideration of the surface water flood risk and SuDS. NB: this assessment applies to site ref 307.C1. Pen y Castell Farm with site ref 307.C2 is located north of 307.C1and is classified as 'Green' within this assessment.
293.C2	**North East Brackla (Land at)**	5.6	Surface Water	Amber	Surface water ponding occurs in localised depressions across the site. Development is likely to be acceptable subject to the careful consideration of the surface water flood risk and SuDS.

9 Summary and Conclusions

9.1 Managing Flood Risk

Flooding can be managed in a number of ways, including;

- Avoidance - developing outside of the floodplain
- Mitigation - walls and embankments used to exclude water from a site, improved channel conveyance, pumping or flood storage areas used to attenuate/retain peak flows upstream, change in catchment land-use and management processes.
- Management – use of SuDS for managing surface water, flood resilient design, flood warning, evacuation and emergency planning, and flood awareness.

CFMPs provide a large-scale assessment of the risks associated with river flooding. They present a policy framework to address the risks to people and the developed, historic and natural environment in a sustainable manner. In doing so, a CFMP is a high-level document that forms an important part of the flood and coastal defence.

SMPs provide a large-scale assessment of the risks associated with sea flooding. SMPs provide the management plan and the policies required for it to be implemented. The policies adopted by BCBC are discussed in Chapter 3.

The impact of climate change on flooding from the sea is particularly important. The latest government guidance indicates exponential growth rates in sea level rise. This will have enormous implications on this type of flood risk in the future. It is important that the land use planning process is used to guide development away from these areas so that there may be less reliance on defences in the future.

The risk of flooding from surface water can be managed through the use of SuDS techniques and good design of developments. Schedule 3 of the Flood and Water Management Act 2010 and requires all new developments to implement SuDS techniques for managing surface water. As a result, it is expected that surface water shall be managed appropriately through the SuDS Approval Body (SAB) process of reviewing and approving all SuDS systems proposed on strategic and candidate sites across the local authority area.

The most suitable type of flood management at a site depends on site specific conditions, the receptor of flooding and the type of flooding.

9.2 Planning Guidance Summary

The SFCA provides information on all sources of flooding to provide decision support guidance when seeking an appropriate location for development. Known strategic and candidate sites have been assessed against known flood risk datasets to provide a preliminary assessment of flood risk with the aim of directing development away from high flood risk areas.

In accordance with the precautionary framework, development should be directed preferentially towards Flood Zone A, considering the impact of climate change for the lifetime of development, and areas with a low risk of flooding from other sources. Where this is not possible, a sequential approach directing development towards Zone B, then Zone C1 and C2 (considering climate change and other sources of flooding) should be adopted.

TAN15, PPW, the DAM Maps and the SFCA provide guidance to aid in the allocation of development within Bridgend County Borough Council area. The following generic steps should be undertaken when considering land-use allocation proposals;

- Seek to direct development away from high flood risk areas;
- Assess the suitability of development and planning requirement with reference to the information provided within this SFCA;
- Identify the source of information and the certainty of the level of flood risk;

- Consult with NRW or the LLFA;
- Determine, where necessary, the requirement for more detailed studies based on areas of high risk (where receptors must be located in higher probability flood zones) and where information is too uncertain for an effective land use planning decision to be made; and
- Undertake detailed flood consequence assessments as necessary.

9.3 Guidance for developers

The developer is responsible for demonstrating the development is consistent with the requirements of TAN15, PPW and those on flood risk in the LDP.

It is the responsibility of developers to consider flood risk issues at a site as early as possible and to consult with NRW and the LLFA prior to undertaking any FCA.

Developers are advised to make independent checks regarding flood risk before purchasing a site. The developer should apply the precautionary framework to determine the appropriate land uses across the site with respect to any flood risk within the site.

The scope of any FCA should be agreed with the Local Planning Authority and NRW. It may also be appropriate to consulting with others, including Sewerage Undertakers, Highways Authorities and Reservoir Undertakers.

This SFCA provides detail on the likelihood of proposed development in each key settlement to meet the criteria of A1.14 and A1.15 of TAN15. This can be used as the starting point to determine whether further detailed assessment of a proposed development site is required. FCAs should be proportional to the size and type of development and risk of flooding.

LDPs may provide specific guidance on, or criteria for, allocating development sites. Where sites have been allocated by the LPA, the SFCA may provide more detailed background information. A key requirement for FCAs is that they consider all sources of flooding and consider the consequence of flood risk at the development.

9.4 Conclusions

This SFCA provides a single repository planning tool relating to flood risk and development in Bridgend County Borough. Key flood risk stakeholders namely Natural Resources Wales, Welsh Water and Bridgend County Borough Council were consulted to collate all available and relevant flood risk information on all sources into one comprehensive assessment. Together with this report, this SFCA also provides a suite of flood risk maps (Appendix A) and a Development Site Assessment spreadsheet (Appendix B) illustrating the level of risk to the existing Local Development Plan sites identified by the Council, with subsequent recommendations.

The flood risk information, assessment, guidance and recommendations of the SFCA will provide strategic planners with the evidence base required to develop a spatial strategy for their new Local Development Plan and apply the justification and acceptability tests of TAN15 to help assess what type and scale of development should be located, where and demonstrate a risk based approach has been applied.

This SFCA should provide the necessary links between spatial development, wider flood risk management policies, local strategies / plans and on the ground works by combining all available flood risk information together into one single repository for both the Local Planning Authority and Lead Local Flood Authority. This is a strategic study, based on all detailed local information available at this time. Not all flood risks and combination of risks are accounted for, and there could be a further, more detailed assessment of specific areas or sites, within a Level 2 SFCA which could be carried out following on from the completion of this Level 1 assessment.

Appendices

A Flood Risk Maps

Appendices

B Candidate Site Assessment

Offices at

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