

PEMBROKESHIRE CLIMATE ADAPTATION STRATEGY

July 2022



Pembrokeshire Public Services Board
Bwrdd Gwasanaethau Cyhoeddus Sir Benfro



NETHERWOOD
SUSTAINABLE FUTURES
Sustainability Governance Policy Practice



UK Government
Llywodraeth y DU

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1. Introduction

1.1 This document is a County-wide Pembrokeshire Climate Adaptation Strategy to be delivered between 2022 and 2027 by the Pembrokeshire Public Services Board (PSB)¹ and its constituent partners alongside other public bodies, community groups and businesses across the County. It provides a strategic approach to increase the resilience of Pembrokeshire to the effects of climate change and to prepare for specific climate risks. This Strategy provides some of the building blocks for Pembrokeshire preparing for a changed climate in coming decades.

1.2 The Strategy has been developed in 2022 involving key agencies, public sector bodies businesses and local community organisations². The process has been co-ordinated by Pembrokeshire Coastal Forum (PCF) and Netherwood Sustainable Futures (NSF)³, with the support of the Pembrokeshire Public Services Board and Pembrokeshire County Council. The project is funded by the UK Government through the UK Community Renewal Fund⁴.

1.3 The UK and Wales Climate Change Risk Assessments⁵ suggest that by mid-century (2040-2060) we can expect the following changes to our climate, seasonality, and weather patterns:

- warmer and wetter winters
- hotter and drier summers
- high variability of extreme weather
- increase our exposure to weather-related hazards
- increased frequency and intensity of wildfire.
- increases in average and extreme temperatures, in winter and summer
- changes to rainfall patterns
- flooding and water scarcity
- increased coastal flooding and erosion
- sea level rise, sea temperature rise and ocean acidification

Key messages from this work are that some climate change is already inevitable (due to past emissions) and that while we can reduce future severity of change by reducing carbon emissions into the atmosphere through decarbonisation, we also need to prepare for a wide range of risks resulting from a changed climate also known as climate adaptation.

1.4 The third UK Climate Risk Independent Assessment (CCRA3) outlines the way in which these changes will impact on the UK and Wales' environment, infrastructure, communities and economy through a detailed analysis of 61 risks. This Strategy builds on the analysis for the UK and Wales to examine climate risks at a Pembrokeshire scale and identifies specific actions to increase stakeholders and communities' readiness for change.

1.5 The process of identifying the priorities and actions involved the following: engaging 184 individual contacts across Pembrokeshire; 32 organisations contributing to five themed workshops and four detailed surgeries with local experts drawn from these organisations; targeted outreach to engage 12 organisations on the draft actions.

¹ <https://www.pembrokeshire.gov.uk/public-services-board>

² See Appendix A for a full list of partners who have actively participated in workshops, surgeries, outreach work and provided their input to the draft Strategy.

³ See Appendix C for information on PCF and NSF

⁴ The UK Community Renewal Fund is a UK Government programme for 2021/22. This aims to support people and communities most in need across the UK to pilot programmes and new approaches to prepare for the UK Shared Prosperity Fund. It invests in skills, community and place, local business, and supporting people into employment. For more information visit <https://www.gov.uk/government/publications/uk-community-renewal-fund-prospectus>

⁵ UK CCRA3 <https://www.ukclimaterisk.org/> Wales CCRA3 <https://www.ukclimaterisk.org/independent-assessment-ccra3/national-summaries/>

1.6 The 61 risks have been examined in detail throughout this project, resulting in identifying:

- **39 priorities** which all organisations and communities need to consider in planning forward for a changed climate in Pembrokeshire, in addition to current and planned activity (see Section 3)
- **24 specific actions** which will help to build resilience to climate risks over the next five years; to be actioned and delivered by public bodies and third and private sector partners in Pembrokeshire, coordinated by the PSB: in addition to current and planned activity (see Section 4)

1.7 It is important that these actions are delivered over the next five years.

To support delivery of actions, it is recommended that:

- it will be the PSB's responsibility to implement the Strategy by 2027, with progress being scrutinised via a "Red, Amber, Green" (RAG) system and reported to the Pembrokeshire County Council Policy and Pre-decision Committee.
- implementation will require senior level advocacy from PSB partners to re-assign and co-ordinate existing resources and to lead on applying for additional funding to support the implementation of this Strategy.
- the actions should be integrated into the business planning of PSB partners and other organisations, to progress during the 2022/23 business planning cycle and beyond.
- the PSB should produce a delivery plan for these actions in September 2022 to facilitate the above.

1.8 It is important to note, even at this early stage, that the PSB is at the vanguard of Climate Adaptation Strategy development in Wales as a result of this work. This is what well-reasoned, evidenced, co-produced climate adaptation looks like at a local level⁶.

1.9 It is important to note that this is core work for public bodies, and the Strategy is necessarily detailed to support climate adaptation action and implementation, rather than a list of 'should do and could do'. It provides detail of what needs to be done over the next five years to build climate resilience into Pembrokeshire's environment, economy, communities and infrastructure.

⁶ Climate Risk and Adaptation in Wales Leadership for Future Generations? Dr. Alan Netherwood & Professor Andrew Flynn Chapter 14 in Rethinking Leadership for a Green World. Editor Andrew Taylor; Routledge Publishing (2021)

2. Developing the Strategy

2.1 The climate adaptation content and facilitation of the above activity was led by Netherwood Sustainable Futures, including drafting this Strategy. Pembrokeshire Coastal Forum has led on coordination, networking, facilitating partner input and providing an online platform for the above work.

2.2 The schedule of workshops is shown in Diagram 1. Separate individual reports on the workshops provide the rationale for the priorities and actions included in this Strategy and are available on PCF’s website. These should be treated as the business case for the actions contained in this Strategy.

The five workshops were scheduled as follows:

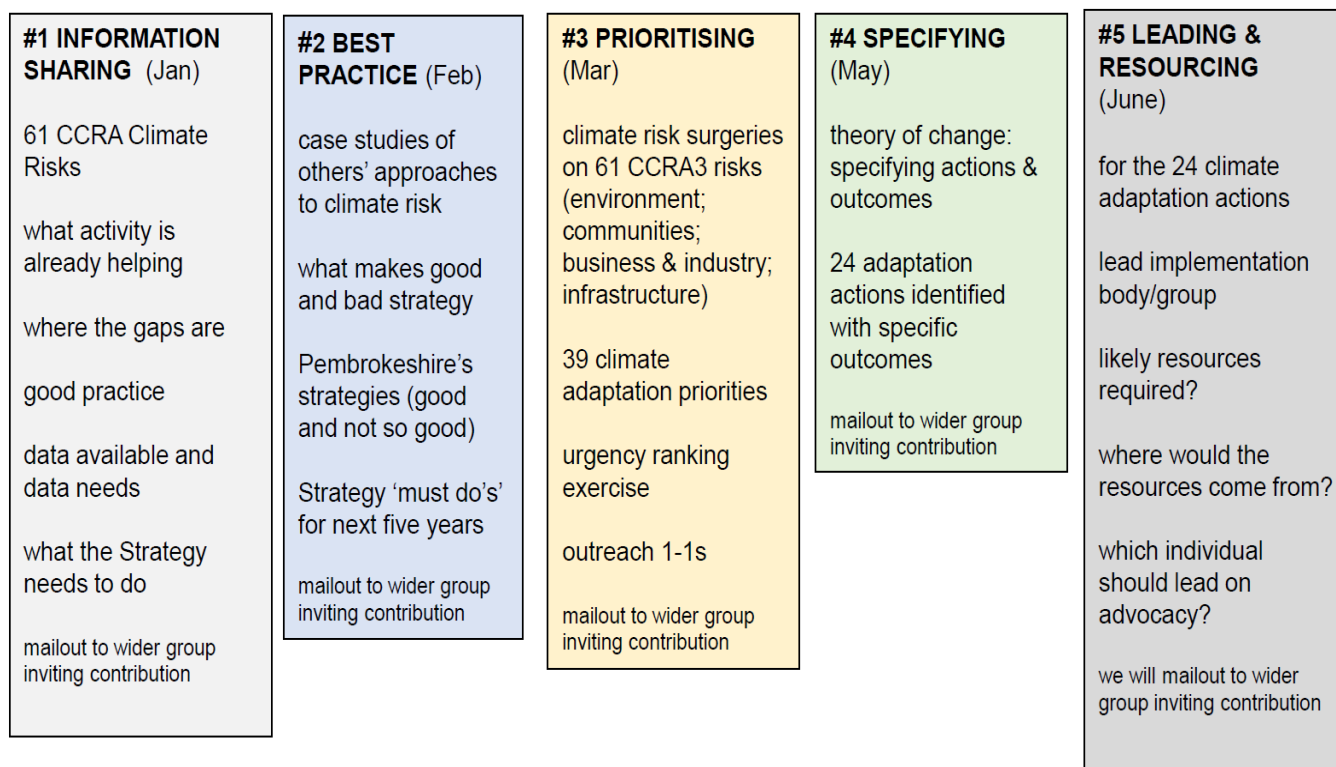
- Workshop #1 – Information Sharing
- Workshop #2 – Exploring Best Practice
- Workshop #3 – Prioritising Climate Adaptation
- Workshop #4 – Specifying Climate Adaptation
- Workshop #5 – Leading & Resourcing Climate Adaptation

Diagram 1: Climate Adaptation Workshops Schedule



2.3 Each workshop built the capacity of partners to understand climate risks, consider climate adaptation and identify specific actions to implement in Pembrokeshire to develop climate resilience. Outcomes for each action were also identified. The details of what was covered in each workshop is provided in Diagram 2.

Diagram 2: Climate Adaptation Workshops Content



2.4 HM Treasury Guidance⁷ on Strategy, programmes and projects was used to enable partners to understand the difference between a Strategy, programme, project and action. Diagram 3 explains the relationship between these different levels of activity and how this hierarchy was interpreted for climate adaptation in Pembrokeshire.

2.5 The draft Strategy was circulated to 184 contacts during June and July, including PSB members all Pembrokeshire Councils and the wider community. Responses were noted and amendments made where appropriate⁸. The first draft of the Strategy was reported by PCF and NSF to the Pembrokeshire Public Services Board (PSB) Climate Change Group and full PSB on 19th July 2022. PCF also presented the Strategy to the PSB Climate Change and Environmental Risk Assessment Group (CCERA) in a meeting on the 21st of July 2022.

⁷https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/749085/Programme_Business_Case_2018.pdf

⁸ Responses were predominantly on relevance of the agenda to respondees' work rather than Strategy content.

Diagram 3: Climate Adaptation: Strategy; programme; project; action hierarchy



3. Pembrokeshire's Priorities for Climate Adaptation

3.1 The process described above enabled partners to identify **39 climate adaptation priorities** for Pembrokeshire. These priorities shown on the next four pages illustrate that the impact of climate change on the County will involve multiple issues affecting infrastructure, communities, natural environment, agriculture and in business and industry. These impacts will be felt differently in different places and contexts across Pembrokeshire.

3.2 The 39 priorities represent strategic challenges to Pembrokeshire's environment, economy and communities in coming decades from climate change - and have been informed by discussions with local experts on what risks may need to be managed and where in Pembrokeshire they may impact. They are 'what matters' in relation to climate adaptation and are split into four key areas:

- Infrastructure
- Natural Environment & Agriculture
- Communities
- Business & Industry

3.3 These 39 priorities stand alone as a 'checklist' of issues that ought to be considered as a normal part of decision making and forward planning across Pembrokeshire.

It is recommended that:

- these priorities should be used to inform all forward plans and strategies to be developed affecting Pembrokeshire, including the PSB's Well-being Plan⁹, work on the Local Development Plan¹⁰ and the work of the Coordinating Joint Committee on the Strategic Development Plan and sectoral planning, for example the Pembrokeshire Destination Management Plan¹¹ and the Recovery and Regeneration Strategy¹².
- organisations and communities should be encouraged to consider these priorities as critical issues for examining local climate risk in forward planning, for example in relation to asset and service planning, place planning and site management.
- further information will need to be gathered in many of these areas to understand the scale of risk, and adaptation need in greater detail – many of the actions in Section 4 of this Strategy seek to build greater understanding around some of these priorities.

3.4 Please note that these priorities are separate from the 24 actions in Section 4 of this Strategy which will help, in part, to address them.

3.5 It is important to note that all 39 priorities are critical for Pembrokeshire's partnerships, organisations, communities and groups to address to build climate resilience over coming decades.

⁹ <https://www.pembrokeshire.gov.uk/public-services-board/well-being-plan>

¹⁰ <https://www.pembrokeshire.gov.uk/local-development-plan>

¹¹ <https://www.visitpembrokeshire.com/wp-content/uploads/Pembrokeshire-Destination-Management-Plan-2020-2025-English.pdf>

¹² <https://www.pembrokeshire.gov.uk/regeneration-project-plans>

3.5 Infrastructure Climate Adaptation Priorities

I1 Cascading Infrastructural

Risks understanding levels of risks where infrastructural risks interact e.g., combined infrastructure failure: oil infrastructure; gas infrastructure; landfill and contaminated land; ICT; transport network; energy and water supply; sewerage. e.g., Haverfordwest or Milford Haven Port

I2 Infrastructural Investment

factoring in climate risks (flood, heat severe weather) and cascading risks into maintaining existing infrastructural assets and investment in new infrastructure. e.g., Milford Haven Quay & Lock; Pembroke Port Redevelopment)

I3 Land Stability planning for slope stability on embankments of transport routes and rivers and beach cliffs e.g., Amroth, Wiseman’s Bridge; and subsidence from old coal field mine working, limestone sink holes on roads and buildings.

I4 Highways Infrastructure

planning for risks to roads, embankments, trees (slopes, windfall) bridges -erosion, scour), including slope stability on transport network e.g., Haverfordwest and Pembroke; Newgale, Abereiddi – Resilient Roads Study

I5 Rail infrastructure planning for risks to rail embankments, trees (slopes, windfall), bridges -erosion, scour; track maintenance e.g., access to Tenby and Goodwick Port; (also dependent on Carmarthen routes)

I6 Waste infrastructure &

Contaminated Land planning for future risks to current and historical landfill (erosion and leaching) and contaminated

I7 Pipelines and Cable Networks

planning forward for risks to networks of pipelines and cables across Pembrokeshire; both subterranean and underwater e.g., ports pipelines; landfall for offshore pipelines; underwater cabling; gas.

I8 Water infrastructure

climate risks to waste water treatment works, sewage systems; sewage outlets e.g., Fishguard Lower Town; planning forward for increased water demand from agriculture and business around supply ring.

I9 Energy Infrastructure

planning forward: for resilient existing and future energy infrastructure: offshore, land-based renewables, grid enhancement; power lines and subterranean; ensuring new energy generation does not lock in climate risks (e.g., water and hydrogen)

I10 Port Infrastructure

planning for multiple risks to Milford Haven and Fishguard and smaller ports/harbours around the coast given sea level rise; coastal erosion; frequent severe weather impacts.

I11 ICT Infrastructure

addressing vulnerabilities in ICT networks both on and off site which may affect critical infrastructure, systems across the County.

I12 Minerals

managing climate risks related to mining legacy; supply and demand for crushed limestone; shales; sand and gravel

3.6 Natural Environment & Agriculture Climate Adaptation Priorities

N1 Transitional change across

habitats planning forward to manage risks that transition across terrestrial, coastal, and marine habitats as a result of climate change e.g., soil loss, sedimentation, effects of nutrient loading, invasive non-native species (INNS).

N2 Designated Sites establishing approaches that enable change; connectivity; species mobility in management planning at National Park landscape, Special Areas of Conservation (SACs) and individual site scales. 77 Special Sites of Scientific Interest (SSSIs), four Special Protection Areas (SPAs) etc. Managing condition through climate change.

N3 Soil health planning forward through climate change to maintain organic matter, minimise mineralisation; run-off; loss to the sea; nutrient loading; maximising biodiversity to support agricultural production.

N4 Land use management

establishing approaches to land use which combine carbon sequestration and storage, soil health, water quality, biodiversity, flood risk management alongside food production with landowners and farm businesses.

N5 Marine working with marine stakeholders to understand and monitor change underway, risks (e.g., INNS, siltation) and opportunities (fisheries and blue carbon); integrate into forward planning for sustainable approaches to managing the Marine SAC.

N6 Coastal planning forward for sea level rise and coastal erosion and its impact on the management of saltmarsh, sand dunes and inter-tidal habitats species given the Shoreline Management Plan (SMPs)* recommended approaches (Hold The Line (HTL), Managed Realignment (MR) or No Active Intervention (NAI))

N7 Freshwater managing multiple impacts of flooding, increased temperatures, lower flows, bank erosion and associated decreases in water quality exacerbated by climate change. e.g., Eastern and Western Cleddau. Potential impacts on lagoons (Pickleridge) and Bosherton Lily Ponds.

N8 Forest and woodlands planning forward to manage forest, woodlands, and hedgerows through change to water, soils, temperature; diseases; INNS; severe weather (drought and storms) and for connectivity; biodiversity; landscape and forestry needs.

N9 Grasslands planning forward to manage upland and lowland grasslands to combine carbon sequestration and storage, water quality, biodiversity and flood risk management alongside agricultural use and to maintain landscapes.

N10 Landscape addressing climate risk management in Pembrokeshire National Park, 28 landscape character areas and seven landscapes of outstanding / special historic interest - establishing approaches that enable change or maintaining features that led to designation.

* <https://naturalresources.wales/flooding/managing-flood-risk/shoreline-management-plans/?lang=en>

3.7 Communities Climate Adaptation Priorities

C1 Coastal communities

engagement with communities at risk (HTL, MR, NAI); evidence; options; business case; finance; and adaptation schemes.

C2 Flooding communities

engagement with communities at risk; evidence; options; business case; finance; and adaptation schemes.

C3 Public Asset Management

factoring in climate risks (e.g., flood, heat severe weather) and cascading risks into:

- existing buildings
- land
- new infrastructure (public, private, health, agriculture, education) through asset management planning

C4 Mental health planning forward for mental health risks from more frequent severe weather impacts; flood; heat; 'overwhelm'

C5 Wildfire planning forward for increased frequency of moor, grass, woodland fires, and impact on air quality e.g., a Preseli Hills project plus a future focus

C6 Water quality addressing *social consequences* of climate change on deteriorating water quality: nutrient loading; blue pharmaceuticals; sewerage; food production; soil health.

C7 Public services planning forward for individual public services and how they will need to adapt e.g., social model of care; schools services; regeneration in Pembrokeshire County Council and Hywel Dda Health Board.

C8 Heritage and Culture planning forward for changes in historic landscapes that communities live in, and assets valued by communities and visitors, such as historic built assets.

C9 Disease and health risks addressing changes in vector-borne zoonotic disease, bioaccumulation through health services.

C10 Cascading community risks understanding levels of risks to communities where risks interact in specific places due to landscape, network, infrastructural, social or economic vulnerabilities.

3.8 Business & Industry Climate Adaptation Priorities

B1 Business communities

engagement with business communities at risk from coastal erosion; fluvial, surface and tidal flooding; evidence; options; business case; finance; adaptation schemes; smaller scale projects and nature-based solutions to alleviate risk.

B2 Business and Industrial

Assets factoring in climate risks (flood, heat, severe weather) and cascading risks into existing and new buildings; land and investment in new infrastructure; industrial estates. (Milford Haven Quay & Lock; Pembroke Port Redevelopment)

B3 Business water-use planning forward *with businesses* for a changed climate; industrial processes; farm storage; private abstraction; agricultural use; energy transition (hydrogen); increased tourism uses at times of low supply.

B4 Tourism Economy planning forward for climate risks to tourism infrastructure (coastal path); heritage assets; heritage landscape; beaches; slopes; woodland; cliffs (Wisemans); outdoor recreation; caravan sites.

B5 Agricultural businesses

planning for future business in a changed climate; water use; soil health; crop productivity; livestock productivity; seasonal access; nutrient trading payments for ecosystems services; focus on profit margin alongside productivity.

B6 Cascading risks for

businesses: planning for multiple risks to businesses and locations where risks interact and cascade, such as:

- *off-site* transport networks, supply chains) energy infrastructure; grid resilience and capacity, IT infrastructure as well as *on site* risks to assets and business continuity
- and *strategic* risks for businesses (markets), such as:
 - Pembrokeshire being at the end of the logistics chain
 - onward links to the UK mainland and beyond
 - connections with the Republic of Ireland

B7 Finance financial implications of climate risk to local and regional economy and businesses; insurance; repeated clean up; investment in infrastructure; relocation; land value; housing market; supply and distribution costs.

4. Pembrokeshire Climate Adaptation Actions 2022-27

- 4.1 The process enabled partners to identify **24 specific climate adaptation actions** to build resilience to climate change in Pembrokeshire between 2022 and 2027. This five-year Strategy is the start of the process for continual climate adaptation between now, mid-century and beyond.
- 4.2 These actions are putting building blocks in place for stakeholders and communities to adapt to climate change in the right way and in the right place across the County and plan well for the future.
- 4.3 These are the *specific* activities which can be implemented by the PSB and individual partners to build climate resilience across the county. They use a theory of change based on:
- climate adaptation **action** – what will be done?
 - climate adaptation **output** – what will be delivered?
 - climate adaptation **outcome** – how will the action help to address climate risks?
- 4.4 It is recommended that the PSB provide strategic leadership and coordination for the delivery of these actions across Pembrokeshire. The PSB should act as the fulcrum for partners' and county-wide activity on this issue. While this process has been able to identify responsibilities and who should be part of collaboration on each action (see 4.13) it will be challenging for the PSB to set up a delivery system to ensure things get done.
- 4.5 It is suggested that **these actions represent core work for public bodies in Pembrokeshire**, and the actions are relevant to the services that these bodies provide, including strategic planning, place planning and working on behalf of future generations. To that end, it is recommended that PSB partners re-organise their existing resources to deliver these actions and:
- allow staff time to work on actions in business plans
 - audit budgets – identify where existing funding could deliver, where resources could be pooled and what resources are required for each action
 - coordinate evidence gathering and commission new evidence
 - develop business cases for deliverables (e.g., information hub)
 - secure funding from grant applications for additional resources
 - engage key organisations in actions e.g., Dwr Cymru
 - advocate, join up, coordinate, monitor, report on progress on 24 actions 2022-2027
- 4.6 It is recommended that a delivery plan is developed by the PSB in September 2022 to inform business planning of partners for the 2022/23 financial year. It is recommended that the PSB adopt a “Red, Amber, Green” (RAG) approach to monitoring progress on these actions on a quarterly basis. This delivery plan will put the Pembrokeshire PSB into a good position to bid for **additional resources to deliver action**.
- 4.7 It is suggested that progress in delivery of these actions and this Strategy should be reported by the Chair of the Pembrokeshire PSB to the Pembrokeshire County Council Policy and Pre-decision Committee.

4.9 Infrastructural Climate Adaptation Actions

INFRASTRUCTURE CLIMATE ADAPTATION	Climate Adaptation Action - <i>what will be done</i>	Climate Adaptation Outputs - <i>what specifically will be delivered</i>	Climate Adaptation Outcomes - <i>how the activity will reduce climate risks</i>
IF1 - Roads & Highways Network	Map and identify risks and the most vulnerable road and highways assets from multiple and cascading risks from climate change	Data, mapping and analysis report on drainage capacity of highways network under a changed climate; resilience of scour-vulnerable structures (bridges, retaining walls); road structure stability; diversion route resilience. Update on Highways Specifications for surface dressing and foundations to account for climate extremes. Outreach to stakeholders.	<ul style="list-style-type: none"> • Stakeholder organisations and communities can understand the nature, location and scale of risk, providing understanding of relocation, re-alignment, protection, maintenance and long-term management • information can be used to: guide relevant bodies where to invest/seek funding as a priority; target direct investment to locations most in need of adaptation, including upgrades, updated specifications; to budget to address risks at particular locations • ensure new assets are future proofed through early consideration of climate risk • inform both strategic and emergency planning for cascading risks in particular locations
IF2- Energy Network	PSB engage with energy companies to understand their forward planning for management of the most vulnerable assets. Work with them to map and identify risks and the most vulnerable assets;	Data, mapping and analysis report on vulnerability of substations; overhead cables; thermal resilience of electricity network and need for re-conducting. Guidance to ensure all new infrastructure considers climate risk to energy networks from the outset. Outreach to stakeholders. PSB and Coordinating Joint Committee to understand forward planning for vulnerabilities. Stakeholder seminar with utilities companies	As above

<p>IF3 - Land Stability</p>	<p>1. Map and identify risks and the most vulnerable land assets; advise stakeholders; and consider in forward plans. 2. Study of the future resilience of the Pembrokeshire coastal path to climate change</p>	<p>Data, mapping and analysis report on land stability on assets including tourism assets; roads; residential areas; business sites; waste and contaminated land sites; Outreach to stakeholders. Analysis report future resilience of the Pembrokeshire coastal path to climate change and management options</p>	<p>As above</p>
<p>IF4 - Port & Harbours</p>	<p>Map and identify risks and the most vulnerable Port & Harbour assets</p>	<p>Data, mapping and analysis report on: climate impacts to key ports and harbours at risk including cascading risks to leisure amenity, fishing industry/food, flooding of local properties and businesses; Guidance on how port upgrades need to take account of climate impacts and plan accordingly Outreach to stakeholders.</p>	<p>As above</p>

Infrastructural Climate Adaptation Actions are continued on the next two pages.

IF2, IF3 and IF4 share common Climate Adaptation Outcomes with IF1 for mapping and analysis of infrastructural climate risks¹³

Section 4.13 lists key delivery organisations against each action.

¹³ Common climate adaptation outcomes for Infrastructure

- stakeholder organisations and communities can understand the nature, location and scale of risk, providing understanding of relocation, re-alignment, protection, maintenance and long-term management
- information can be used to: guide relevant bodies where to invest/seek funding as a priority; target direct investment to locations most in need of adaptation, including upgrades, updated specifications; to budget to address risks at particular locations
- ensure new assets are future proofed through early consideration of climate risk
- inform both strategic and emergency planning for cascading risks in particular locations

Infrastructural Climate Adaptation Actions (continued)

INFRASTRUCTURE CLIMATE ADAPTATION	Climate Adaptation Action - what will be done	Climate Adaptation Outputs - what specifically will be delivered	Climate Adaptation Outcomes - how the activity will reduce climate risks
IF5- Water & Sewerage (also see BI5)	PSB to engage with Dwr Cymru to understand their forward planning for management of their most vulnerable assets.	<p>Data, mapping and analysis report on sewage infrastructure assets (eSTW/pumping stations on flood plains); foul and surface water drainage systems; impacts of more frequent and severe weather events on water supply networks are critical - and this should include groundwater aquifers as well as rivers, streams, reservoirs and lakes.</p> <p>Stakeholder seminar with utilities companies, NRW, PSB and Coordinating Joint Committee to understand forward planning for vulnerabilities.</p> <p>Analysis Report on future water needs in and around Milford Haven especially related to large scale hydrogen production (see also BI5)</p>	<ul style="list-style-type: none"> • Stakeholder organisations and communities can understand the nature, location and scale of risk, providing understanding of relocation, re-alignment, protection, maintenance and long-term management • information can be used to: guide relevant bodies where to invest/seek funding as a priority; target direct investment to locations most in need of adaptation, including upgrades, updated specifications; to budget to address risks at locations • ensure new assets are future proofed through early consideration of climate risk • inform both strategic and emergency planning for cascading risks in particular locations
IF6 - Pipelines & Cables Network	Map and identify risks and the most vulnerable Pipeline & Cable Assets	<p>Data, mapping and analysis report on climate vulnerability of pipes and cables across Pembrokeshire including land based and subterranean networks; underwater and shoreline networks around Milford Haven.</p> <p>Arrange stakeholder seminar with utilities companies, energy companies, PSB and Coordinating Joint Committee to understand forward planning for vulnerabilities; identify further actions to understand vulnerabilities.</p> <p>Outreach to stakeholders.</p>	As above

<p>IF7 - Information technology</p>	<p>Map and identify risks and the most vulnerable IT assets;</p>	<p>Data, mapping and analysis report on the most vulnerable information technology assets – in relation to cascading risks to communities, including UPS/back-up generator energy supply. Guidance to ensure all new IT infrastructure considers climate risk at the outset; Outreach to stakeholders.</p>	<p>As above</p>
<p>IF8 - Rail Network</p>	<p>Engage with Network Rail and rail operators to understand their forward planning for management of their most vulnerable assets.</p>	<p>Arrange stakeholder seminar with PSB, Rail Operators, Network Rail and Coordinating Joint Committee to understand forward planning for vulnerabilities. Identify further actions to understand vulnerabilities; Outreach to stakeholders.</p>	<ul style="list-style-type: none"> • Stakeholder organisations and communities can understand the nature, location and scale of risk, providing understanding of relocation, re-alignment, protection, maintenance and long-term management • Information can be used to: guide relevant bodies where to invest/seek funding as a priority; target direct investment to locations most in need of adaptation, including upgrades, updated specifications; to budget to address risks at locations • ensure new assets are future proofed through early consideration of climate risk • inform both strategic and emergency planning for cascading risks in particular locations
<p>I8 - Climate Adaptation Evidence Hub</p>	<p>Development of a shared information “Hub” to a) centralise all climate risk data, maps on energy, water, flooding, IT, ports, highways, rail, land use etc to provide one accessible platform; and b) to commission research to inform the “Hub”</p>	<p>a database of evidence sources; a GIS mapping function; commissioned reports to fill evidence gaps (see below); funding bids to support evidence gathering; stakeholder seminars to gather evidence.</p>	<p>Multiple risks can be considered on a location-by-location basis across Pembrokeshire; to inform stakeholders’ thinking on combinations of climate risks on a place-by-place basis, and the impact of cascading risks on communities.</p>

Section 4.13 lists key delivery organisations against each action.

4.10 Natural Environment and Agriculture Climate Adaptation Actions

NATURE & AGRICULTURE	Climate Adaptation Action - <i>the activity to be undertaken</i>	Climate Adaptation Outputs - <i>what specifically will be delivered</i>	Climate Adaptation Outcomes - <i>how the activity will reduce climate risks</i>
NA1 - Designated Sites and Landscapes	Appraise designated sites and landscapes for climate vulnerability including SSSIs, LNRs, SACs and SNCI and MPA across Pembrokeshire's land, coast and seas	Appraisal report; maps; guidance material for stakeholders to inform their forward planning; training/outreach with nature recovery partners	Stakeholders' management and investment planned and delivered to support nature recovery in a changing climate; including connectivity for biodiversity.
NA2 - Landscapes	Map and identify climate risks to landscapes across Pembrokeshire	Maps and guidance material for stakeholders to inform their forward planning; training/outreach with support from nature recovery partners.	Stakeholders provided with data to target interventions (and funding) to implement sustainable land management to achieve flood risk management, nature recovery and carbon sequestration alongside other land management practices.
NA3 - Soil Resources	Map and identify climate risks to soils across Pembrokeshire	Maps & guidance material for stakeholders to inform their forward planning; training/outreach with nature recovery partners	Stakeholders provided with data to target interventions (and funding) to manage soil resources, with landowners, farmers and public bodies in a changing climate and information to improve knowledge and awareness of soil health and regenerative practices.
NA4 - Saltmarsh & Seagrass	Identify options for establishing seagrass and saltmarsh restoration on Pembrokeshire coasts	Options report; maps; guidance material for stakeholders to inform their forward planning	Management and investment in seagrass and saltmarsh targeted to support management of coastal erosion and flooding in a changed climate.
NA5 - Coastal Land Management	Review of coastal land management plans (strategic plans, asset plans, maintenance plans, business plans) related to climate risks	'How to review' guide for Pembrokeshire partners: public, third, private sector landowners, farmers and tourist businesses; training/outreach with nature recovery partners	Partners and businesses can plan forward, factoring in climate risks to land management practices and investment, to build resilience to a changed climate.

Section 4.13 lists key delivery organisations against each action.

4.11 Communities Climate Adaptation Actions

COMMUNITIES	Climate Adaptation Action - <i>the activity to be undertaken</i>	Climate Adaptation Outputs - <i>what specifically will be delivered</i>	Climate Adaptation Outcomes - <i>how the activity will reduce climate risks</i>
CM1 - Climate risk and Communities protocol	Develop protocol for engaging with communities at risk from climate impacts with information targeted at multiple audiences: communities; institutions; local members. Training for members and officers on working with at risk communities	Protocol document and guidance material for stakeholders; training sessions for officers, members and partners	Stakeholders will be able to work effectively and sensitively with “at risk” communities to consider future climate adaptation options.
CM2 - Community climate adaptation groups	Formation of community climate adaptation groups in at risk communities: co-production of adaptation plans specific to the location	Formation of climate adaptation groups in “at risk” communities; bespoke community climate adaptation plans ; establishment and support of network of groups across Pembrokeshire	People embedded within the community are supported to work with stakeholder organisations (including the third sector) to co-produce adaptation plans for a changed climate, before a "crisis" point is reached.
CM3 - Climate risk to Health and Social Services	Produce a policy document and guidance for health and social services providers on climate risks as part of the ‘One Health’ agenda.	Policy document and guidance material for stakeholders; training sessions for health and social services partners	Health partners have a greater understanding of spatial and demographic distribution of climate risks to health, including access to health services; mental health impacts; vulnerability of health assets; and new health risks to inform forward planning.
CM4 - Wildfires in a changed climate	Research on future spatial distribution of wildfires under a changed climate and implications for wildfire management.	Research report and recommendations for adapting approaches to wildfire management in coming decades; training sessions for wildfire management partners	Partners will be able to understand risks in relation increased frequency and severity of wildfires as the climate changes. including the impact on air quality and health; the roles of soils and vegetation and land management; and identify appropriate management measures in the landscape and plan forward for wildfire management.
CM5 - Heritage Assets in a changed climate	Risk assessment of the potential impacts of climate change on historic buildings and structures and archaeological sites.	Research report and recommendations for adapting approaches to heritage asset management in coming decades; training sessions for heritage asset management partners	Heritage organisations and partners will be able to review assets with a view to cost benefit analysis of protection and adaptation or allowing loss (as appropriate).

Section 4.13 lists key delivery organisations against each action.

4.12 Business & Industry Climate Adaptation Actions

BUSINESS AND INDUSTRY	Climate Adaptation Action - <i>the activity to be undertaken</i>	Climate Adaptation Outputs - <i>what specifically will be delivered</i>	Climate Adaptation Outcomes - <i>how the activity will reduce climate risks</i>
BI1 - Tourism Business Climate Risk Support	Integrate climate risk management into existing business support services to tourism industry to make business aware of risks; support and solutions.	Guidance material for stakeholders to undertake climate risk assessments; training sessions for businesses on support and solutions	Businesses across all sectors of the tourism economy understand climate risks are supported to assess likely impact; build in contingencies and resilience in forward planning e.g., access for visitors; caravan parks and campsites; tourism businesses outside mains settlements in rural locations; impacts of climate change on the Pembrokeshire tourism 'offer'.
BI2 - Agri-Business Climate Risk Support	Integrate climate risk management into existing business support services for agri-business to make business aware of risks; support and solutions:	Guidance material for stakeholders to undertake climate risk assessments; training sessions for businesses on support and solutions	Agri -businesses understand climate risks; are supported to assess likely impact; build in contingencies and resilience in forward planning, including crop viability; water resource management; crop and livestock productivity and soil health; supply chains and transport logistics.
BI3 - Fishing Climate Risk Support	Research report on climate impacts on the fishing industry; and delivery of support to make fisheries business aware of risks; and solutions.	Research report and recommendations: training sessions for fishing industry partners (and potential guidance and training as above)	Stakeholders can assess likely impact on the fishing industry in Pembrokeshire; build in contingencies and resilience in forward planning including catch/yield; business logistics and supporting infrastructure (aquaculture, quayside improvements)
BI4 - Business & Industrial Assets	Map nature and location of climate risks to business and industrial assets in Pembrokeshire	Maps and guidance material for stakeholders to inform their forward planning; training/outreach with business and industry partners to support this.	Business and industry can understand asset-based climate risks to build in contingencies and resilience in forward planning; smaller industrial estates; industrial activities in rural locations; offshore assets; new marine technology and infrastructure; landfall sites for pipelines and cables; abstraction of water; discharge consents; rainwater harvesting; the role of green infrastructure.

<p>BI5 - Water Resources & future economy (also see IF5)</p>	<p>Engage with Dwr Cymru¹⁴ to combine data from climate risks mapping (see other sections) to understand water resource use for business and industry under a changed climate.</p>	<p>Stakeholder seminar with utilities companies, NRW, PSB and Coordinating Joint Committee to understand forward planning for vulnerabilities. (See I5)</p>	<p>Business and Industry partners will understand future scenarios for water resources in a changed climate factoring in new technologies with intense water use e.g., desalination; hydrogen production; abstraction for rural businesses; on-site storage of water; anticipatory investment required to support economic growth; impacts on water quality and phosphate and nitrate pollution.</p>
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Section 4.13 lists key delivery organisations against each action.

¹⁴Dwr Cymru were only able to provide information in July 2022 on their Water Resource Management Plan, Drainage and Waste Water Management Plan, five year periodic review and Assets Appraisal. These activities will need to inform actions IF5 and BI5

4.13 Delivering the Climate Adaptation Actions 2022-27

The following table is derived from Workshop #5 and from responses to the first draft of this Strategy. The table shows who partners see as the key lead organisations for each action. It is recommended that the PSB use this to determine on who works on what aspect of the delivery plan in Autumn 2022 and to drive and scrutinise delivery over the next five years.

INFRASTRUCTURE	Lead organisation (s) for delivery plan and accountable for delivery
I1 - Roads & Highways Network	Pembs Council (Regeneration, Highways, LDP) Welsh Government (trunk roads)
I2- Energy Network	Pembs Council & PSB partners to engage Energy Network Providers
I3 - Land Stability	Pembs Council (Public Protection) & Pembs Coast National Park for Coastal Path study
I4 - Port & Harbours	Pembs Council, Milford Haven Port Authority, Saundersfoot Harbour, Harbour Associations
I5- Water & Sewerage	PSB Partnership arrange stakeholder seminar led by NRW
I6 - Pipelines & Cables Network	PSB Partnership arrange stakeholder seminar led by PCC and Milford Haven Energy Kingdom
I7 - Information technology	Pembs Council (Regeneration)
I8 - Rail Network	PSB Partnership arrange stakeholder seminar led by Pembs Council (Transport)
I9- Climate Adaptation Evidence Hub	PSB Climate Group
NATURE & AGRICULTURE	Lead organisation (s) for delivery plan and accountable for delivery
NA1 - Designated Sites and Landscapes	Natural Resources Wales & Pembs Environment Partnership
NA2 - Landscapes	Pembs Coast National Park
NA3 - Soil Resources	Natural Resources Wales , NFU, FUW, Pembs Coast National Park
NA4 - Saltmarsh & Seagrass	Pembs Coast National Park & Pembs Coastal Forum
NA5 - Coastal Land Management	Pembrokeshire County Council & Pembs Coast National Park
COMMUNITIES	Lead organisation (s) for delivery plan and accountable for delivery
CM1 -Climate risk and Communities protocol	PSB Climate Group (inc, PCC PAVS PLANED, PCNP, NRW, HDUHB) & One Voice Wales
CM2 -Community climate adaptation groups	Pembs Coastal Forum, PAVS, PLANED
CM3 -Climate risk to Health and Social Services	Hywel Dda University Health Board and Pembs Council & Public Health Wales
CM4- Wildfires in a changed climate	Mid Wales and West Fire Authority & Pembs Coast National Park & Wildfires Group
CM5- Heritage Assets in a changed climate	National Trust, CADW, Dyfed Archeological Trust, PLANED
BUSINESS AND INDUSTRY	Lead organisation (s) for delivery plan and accountable for delivery
BI 1 - Tourism Business Climate Risk Support	Visit Pembrokeshire, Pembs Coast National Park, Pembs Council (Regeneration)
BI 2 - Agri -Business Climate Risk Support	NRW, NFU, FUW, Pembs Coast National Park
BI 3 - Fishing Climate Risk Support	Pembs Marine SAC Partnership, Pembs Environment Partnership
BI 4 - Business & Industrial Assets	Pembs Council (Regeneration & LDP)
BI 5 -Water Resources & future economy.	PSB Climate Group & Dwr Cymru & Coordinating Joint Committee

Appendix A – Contributing Organisations

The following organisations contributed online and written input into the process:

Active Travel West Wales
Bluestone National Park Resort
Car y Môr
Cwm Arian
Dŵr Cymru
Farmers Union Wales
Friends of Pembrokeshire Coast National Park
Grŵp Resilience
Hywel Dda University Health Board
Keep Wales Tidy
Mid and West Wales Fire Authority
Milford Haven Port Authority
Milford Haven Energy Kingdom (Arup, West & Wales Utilities, Catapult, Riversimple)
National Trust
National Farmers Union
Natural Resources Wales
Netherwood Sustainable Futures
Newport Town Council
Pembrokeshire Association of Voluntary Services
Pembrokeshire College
Pembrokeshire Coast National Park Authority
Pembrokeshire Coastal Forum
Pembrokeshire County Council
PLANED
Royal National Lifeboat Institution (RNLI)
RWE
Transition Bro Gwaun
Visit Pembrokeshire
The Well-being Planner
Welsh Government
Western Power Distribution

Many of these organisations provided input from multiple staff to input into the different stages of the project, particularly Pembrokeshire County Council, Pembrokeshire Coast National Park Authority and Natural Resources Wales.

Appendix B – Workshop Summaries

The following workshop summaries are available on the PCF website:

<https://www.pembrokeshirecoastalforum.org.uk/climate-adaptation-strategy/>

- Workshop #1 – Information Sharing
- Workshop #2 – Exploring Best Practice
- Workshop #3 – Prioritising Climate Adaptation
- Workshop #4 – Specifying Climate Adaptation

The workshops provide detail on information, data, evidence, best practice, key local issues and the emerging actions within this Strategy. Please note that there is no report for Workshop #5 as the outputs from this workshop formed the Strategy document.

Appendix C – Pembrokeshire Coastal Forum & Netherwood Sustainable Futures

Pembrokeshire Coastal Forum (PCF) is a multi-award-winning coastal partnership that has been developing ground-breaking best practice in coastal management since 2000. PCF works across a broad spectrum of sustainability-related sectors including water quality & payment for ecosystems services; marine energy; sustainable recreation; conservation & restoration; climate change behaviour change and education and has delivered projects and work viewed as best practice nationally and beyond the UK including the Marine Code, Pembrokeshire Outdoor Charter Group, Wales Activity Mapping and Marine Energy Wales. PCF regularly undertakes consultancy work, often focused on stakeholder engagement. Examples range from annual Stakeholder Perception Studies (Port of Milford Haven) and stakeholder scoping and community engagement for WWF's Seagrass Ocean Rescue project. PCF has also run stakeholder engagement for Welsh Government to input into the Wales National Marine Plan.

Contact: pcf@pembrokeshirecoastalforum.org.uk

More information: <https://www.pembrokeshirecoastalforum.org.uk/>

Dr. Alan Netherwood of **Netherwood Sustainable Futures** has recently worked for the UK Climate Change Committee on the UK Climate Risk Assessment 3 (CCRA3). Alan is the author of the Climate Change Risk Assessment 3 for Wales; his current work on climate adaptation in local government in Wales focused climate leadership and land-based decarbonisation support for WLGA; Alan has undertaken climate risk work for local authorities, Ministry of Defence and Welsh Government amongst others. He is also leading a Cardiff University Climate Adaptation Pathways Project focusing on three deep dive climate risk studies in Wales during 2022. Alan is widely published on this issue, recently contributing a chapter to the book *Rethinking Leadership for a Green World* (Routledge 2021)

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