

Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Perth, February 2023









Creating Water Resilient Places





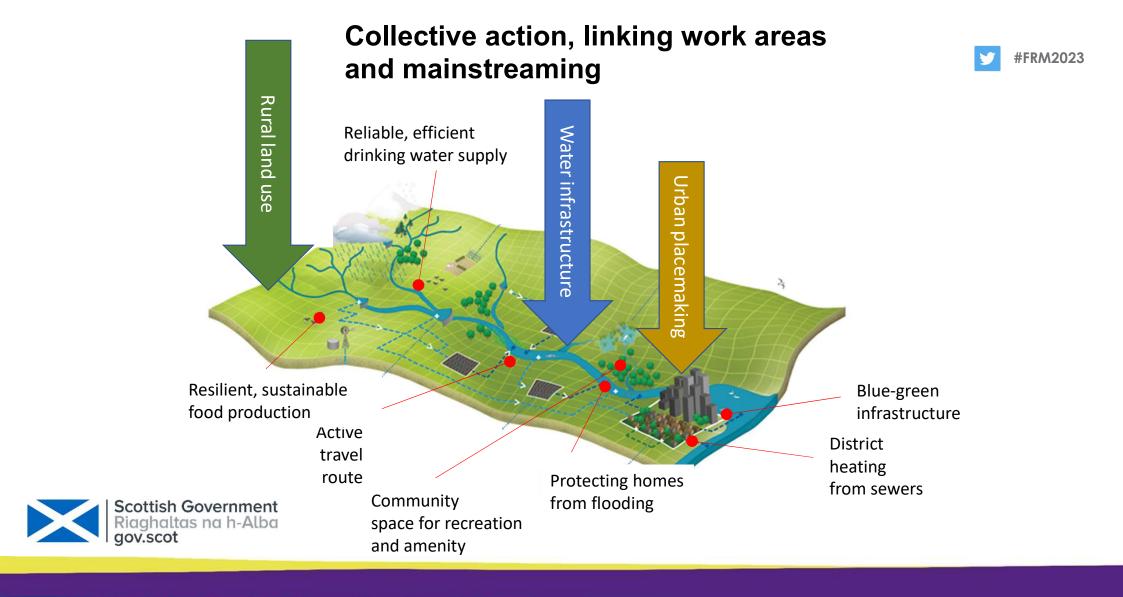
Scotland's Flood Risk Management Conference 2023

Session 1: Challenges and progress toward a Water Resilient Scotland

Chair: Kevin Quinlan, Scottish Government







Developing the strategy



We want your views and input...

Tell us what you think - share your ideas on **how** we should be dealing with the big issues, developing the strategy and delivering the actions.

- Slido #FRM2023-strategy what are the most important questions the strategy must address?
- Postbox in foyer
- **Email** flooding_mailbox@gov.scot
- Themed workshops

Tell us how you would like to be involved.







#FRM2023

Water and flood management is part of our climate resilience and placemaking - an essential part of urban design and land management

Our activities and land-use are co-designed and co-delivered and optimised for climate resilience and multiple benefits

Everyone benefits and everyone has a contribution to make

We have increased our access to funding opportunities

We have increased our delivery opportunities

We benefit from increased flood resilience at all scales

We have thriving sustainable communities that are designed for our future climate

...reduce/eliminate additions to flood exposure?

How can we...

...improve funding allocation?

...assist communities to adapt through managed retreat?

...improve delivery of specific flood actions including flood protection schemes?

...deliver a broader range of flood management actions?

...improve Scotland's flooding programme management?

...involve communities in flood resilience planning – part of their climate adaptation planning? ...we engage a broader range of delivery partners?

...improve the national knowledge base to benefit local delivery functions?

...increase the use of nature based solutions, and other interventions? ...make flood resilience an inherent consideration in the design of our places?

...establish flood resilience as a core part of our climate resilience journey? ...link flooding and coastal change adaptation planning actions?



A new Flood Resilience Strategy for Scotland

#FRM2023

The Scottish Government Programme for Government made a commitment to consult on a new flooding strategy.

The strategy will set out how we will aim to deliver a more diverse range of flood actions faster to reach a sustainable level of flood resilience.

We recognise the wealth of knowledge, skills, and most importantly ideas, within the flood risk management community and so would like to work closely with you to set out how we collectively plan to tackle those shared challenges in the new Flood Resilience Strategy for Scotland.

We have made a starter list of questions that we think need addressed – these will help us develop themes for the strategy and we want to hear from you:







Join at slido.com #FRM2023-Strategy

(i) Start presenting to display the joining instructions on this slide.



How can we reduce/eliminate additions to flood exposure?



How can we better support the delivery of specific flood actions including flood protection schemes?



How can we Improve Scotland's flooding programme management?



How can we Improve funding allocation?



How can we Improve support from a broader range of partners for the delivery of flood actions?



How can we deliver a broader range of flood management actions?



How can we Improve the national knowledge base to benefit local delivery functions?



How can we increase the use of nature based solutions, or any other possible forms of intervention?



How can we establish flood resilience as a core part of our climate resilience journey?



How can we ensure flood resilience is an inherent consideration in the design of our places?



How can we involve communities in flood resilience planning – as part of their climate adaptation planning?



How can we link flooding and coastal change adaptation planning actions?



How can we assist communities to adapt through managed retreat?



What questions have we missed?

A new Flood Resilience Strategy for Scotland



If you would like to be involved in the consultation workshops or in helping to develop or deliver the strategy please contact the flooding team at Scottish Government on:

flooding_mailbox@gov.scot







Scotland's Flood Risk Management Conference 2023

Session 1: Challenges and progress toward a Water Resilient Scotland –
Panel discussion

Chair: Kevin Quinlan, Scottish Government

Vincent Fitzsimons, SEPA

Karen Dee, Scottish Water

Carol Raeburn, Scottish Flood Forum

James McLeod, Dumfries & Galloway

David Faichney, Scottish Government







Audience Q&A

Coming up next...

Session 2:

Policy & Placemaking





Day 1 Morning Plenary

Wed 22/02/23

1115-1230

Session 2. Policy and place-making

Gannochy Auditorium & online stream

Welcome from the chair: Peter Robinson (AECOM)

- An introduction to the Hydro Nation on flooding and place and planned place-based initiatives
 Deryck Irving (Hydro Nation)
- South Lanarkshire East Kilbride Surface Water Management Plan: Capturing multiple benefits
 Rhona Taggart, Zorica Todorovic and Fraser May (Atkins)
- Granton Waterfront: Development Framework for an ambitious place-based, inclusive approach to regeneration Dylan Huws (AECOM), Jude Barber (Collective Architecture)
- Sidmouth Amphitheatre: Dual-use blue green infrastructure Paul Hargreaves (Jacobs)
- Q and A via Slido #FRM2023-S2





Creating Water Resilient Places



Scotland's Flood Risk Management Conference 2023

Session 2: Policy & Placemaking

Chair: Peter Robinson, AECOM







An introduction to the Hydro Nation Chair: Place-based Innovation

Deryck Irving

Senior Innovation Fellow, Hydro Nation Chair University of Stirling

The Hydro Nation Chair Research and Innovation Programme Team

CHAIR

RESAERCH

PROF ANDREW TYLER STIRLING WARNE



PROG MANAGER

DR FIONA MILLAR STIRLING STIRLING



INNOVATION

GEORGE PONTON





PROF GABRIELA MEDERO Infrastructure Emissions





PROF ASHLEIGH FLETCHER **Process Emissions**





DERYCK IRVING Place





DR AMY PICKARD **Nature Based Solutions**



UK Centre for Ecology & Hydrology



DR ANIA ESCUDERO Circular Economy





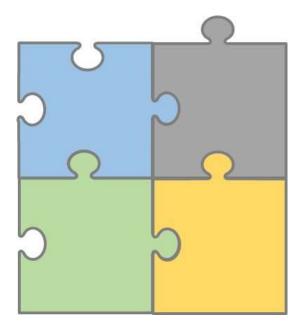
DAVID MILLAR Technology





Hydro Nation Chair: my role

- Supporting innovative place solutions
 - planning
 - decision-making
 - finance
 - technology
 - delivery
- Exploring place constraints and opportunities for other programme outputs
- Providing place expertise for Scottish Water initiatives
- Providing place expertise for wider initiatives with relevance to the water sector



Why is place important for water sector innovation?

focus for delivering across multiple priorities for Scotland's water

embedding water in placemaking and placemending

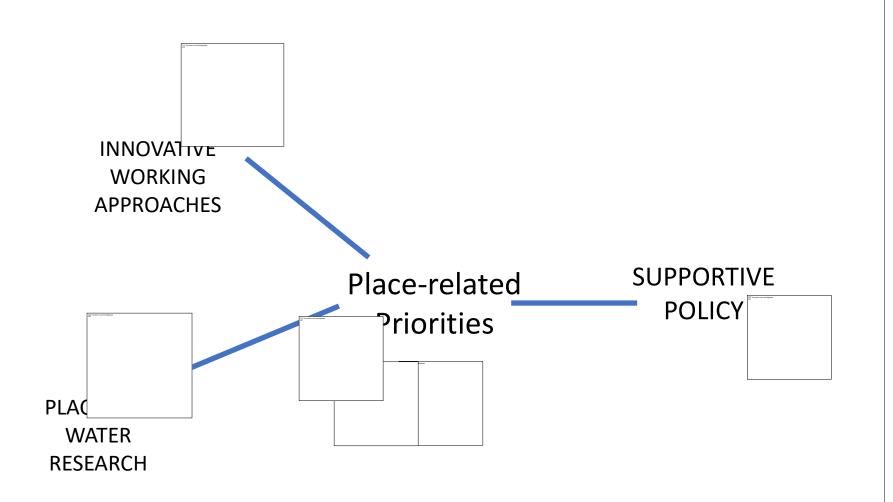
Place

opportunity to work collaboratively to develop multifunctional solutions

cultivating water stewardship and leadership

ensuring the water sector is ready and able to engage appropriately with place





Working Approaches: Place Use Cases



Working Approaches 2: UKWP Resilient Places workstream



PHASE 1
EXPLORING
'RESILIENT PLACE'
FROM A WATER
SECTOR PERSPECTIVE



PHASE 2
WORKING WITH KEY
SECTORS TO EXPLORE
AND DEVELOP
SYNERGIES AND
COLLABORATION



PHASE 3
CO-DEVELOPMENT OF
A DIGITAL RESOURCE
AND POLICY
RESOURCES
[THOUGHT LEADERSHIP]



PHASE 4
(FUTURE AIM)
RETROFIT AND
EXISTING PLACES

Place and Water Research

- Reconciling Floods and Droughts Crucible
 - Accessible tools and resources
 - Value of water
 - Community water resilience
- Water metrics to drive investment in nature-based solutions
 - Quantity | Flows | Quality
- Hydro Social Observatory
 - Community | Wellbeing | Economy | Equalities ...

Thank you for listening

deryck.irving@stir.ac.uk
www.hydronationchair.scot



Scotland's Flood Risk Management Conference 2023

Session 2: Policy & Placemaking

Rhona Taggart, Zorica Todorovic and Fraser May, Atkins







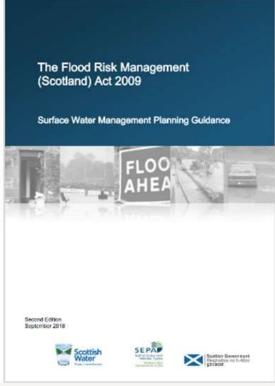


East Kilbride Surface Water Management Plan

Capturing Multiple Benefits

Surface Water Management





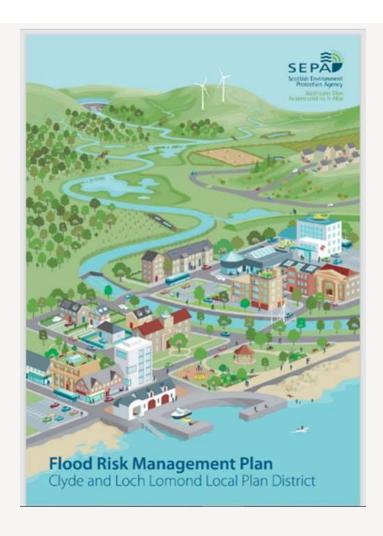






Surface Water Flooding: East Kilbride







East Kilbride Hotspots

- › Over 20 Hotspot Locations Identified
- > Review of SEPA Flood Maps
- > Review of Scottish Water Integrated
- Catchment Study
- > Root Cause Analysis
- Site Visit
- > Consultation with South Lanarkshire
- > Filter





PA 11 - Sweet Thorn Drive





MBV Model	Flooding	SEPA Records	Scottish Water
Confidence	prediction		Register
High	1yr 9m³	None	3 x1 in 10 INT







East Kilbride Hotspots

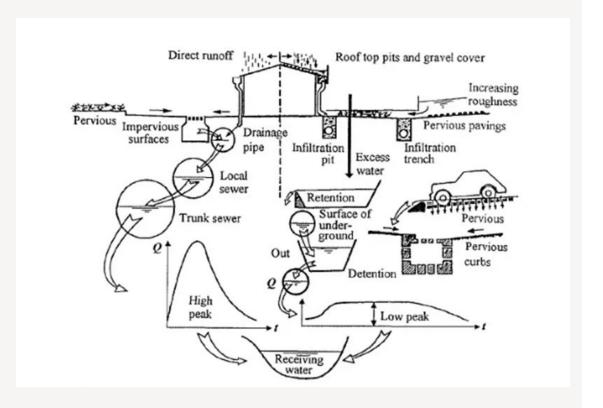




Types of Options Assessed

Long List of Potential Options

- Non-structural measures
 - Maintenance, Awareness
- Structural measures
 - > Property Level Protection (PLP)
 - De-culverting and realigning of existing watercourses to increase capacity
 - > Removal of cross-connections
 - 'Grey' solutions (tanks, detention, oversized pipes)
 - Nature based 'Green' solutions in a form of sustainable drainage systems – SuDS











A GIS tool enabling rapid desktop assessment of opportunities for installation of a vide range of SuDS features



- > 15 Types of SuDS Features Assessed
- > Stormwater Management Benefits
- High Level Costing
- Carbon Calculation
- Natural Capital and Social Benefits



- Common Platform for
 - Strategic Planning
 - **Bringing Partners Together**
 - Unlocking Multiple Funding































Input Data



Inputs

MasterMap

LiDAR

BGS Infiltration Maps

Detailed River Network

Flood Zones

Listed Buildings

Drainage Network

Source Protection Zones

Priority habitat

Development zones

Anything else available in GIS?

Parameters

Distances

Sizes

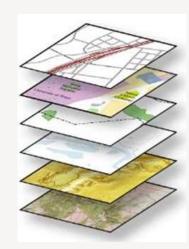
Rainfall

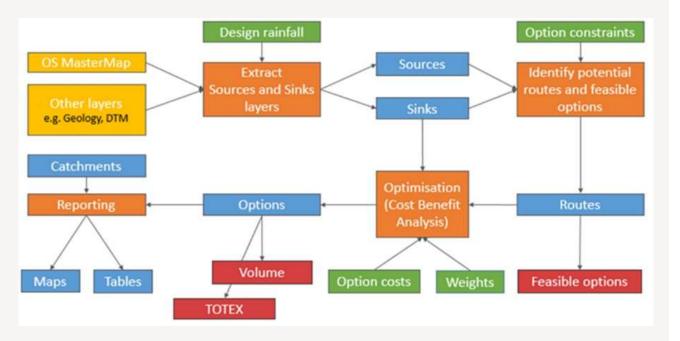
Ground slope

CAPEX

OPEX

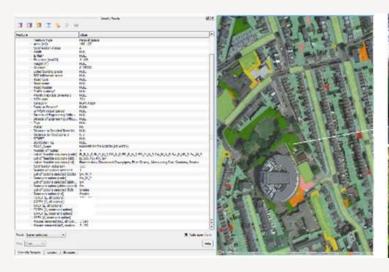
Multiple Benefits







Types of Outputs







SuDS type	Number of instances	Area covered (km²)	Volume captured (m³)	Installatio n cost (£mill)	Maintenance cost (£mill)	Total cost (£mill)
Attenuating Rain Gardens	1449	0.49	24520	10.9	3.7	14.6
Attenuation Pond	211	0.03	1256	0.1	0.8	0.8
Bioretention	6104	0.07	3636	26.1	4.7	30.9
Direct to Watercourse	0	0	0	0	0	0
Disconnect Downpipes	3226	1.22	61109	18.3	10.7	29.0
Filter Drains	4164	0.53	26303	13.2	6.1	19.3
Gravel Paving Green Roof Permeable Block Paving Rain Garden Box Rain Gardens (Surface)	2	0	0	0.0	0.0	0.0
	226	0.02	1012	2.0	1.1	3.1
	1736	1	49831	114.6	8.3	122.9
	174	0.02	1180	2.1	0.2	2.3
	58900	1.8	89944	62.6	52.0	114.6
Soakaway	1315	0.18	9133	4.6	0.8	5.3
Swales	5680	1.79	89416	2.7	5.8	8.5
Tree pit	141	0	212	0.4	0.1	0.4
Water Butts	295	0	22	0.0	0.1	0.1
Wetland	0	0	0	0.0	0.0	0.0

Implementation Scenarios	Volume Captured (m3)	TOTEX (£)	Sum of Multiple Benefits (£)
Commercial Sites	236	278,000	20,271
Educational Facilities	943	823,000	121,567
Industrial & Business Parks	824	1,396,000	239,832
Wide Highway Pavements	851	5,811647	75,193
Roads	1,173	1,771,544	183,420
Grand Total	4,027	10,080,191	640,284





m Traffic Calving

- Purpided Curbon 25,000 Sequentered Carbon

20,000 minnoded Carbon

15,000 Milliding Temperature

-Air Quality

5,000 —yokama Addressed [m3] -torex (x store)

Multiple Benefits



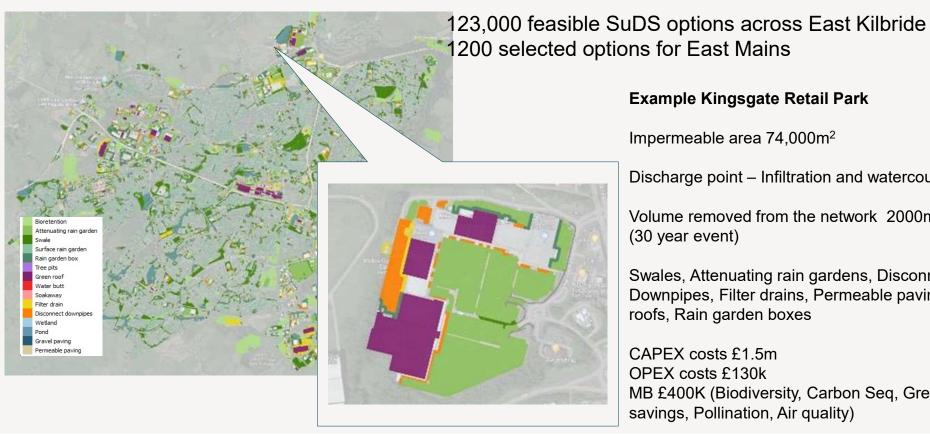


Benefit category	What it covers	Quantified	Monetised
Air quality	Impact on health from improved air quality (NO2, SO2, PM10, O3)		
Biodiversity and ecology	Enhancements to habitats and plants. this is mainly linked to implementing ponds and wetlands	\square	☑
Building temperature (green roof energy)	Energy saved from avoided heating (kWh) and cooling in the summer, linked to implementation of green roofs	✓	☑
Carbon avoided	Avoided operational carbon from treatment	\checkmark	abla
Carbon sequestered	Sequestration (planting)	\checkmark	abla
Carbon embodied	This is calculated using the Atkins internal carbon calculator, Carbon Knowledge Base for a typical size/area for each option based on a bill of quantities for each of the opportunity types. The embodied carbon calculations also include the transport of the material	✓	-
Climate change levy	Climate change levy avoided due to avoided treatment	-	abla
Treatment energy	Avoided energy costs from treatment	\checkmark	abla
Education	Enhanced educational opportunities by increasing the number of educational visits to SuDS		✓
Flood risk	Volume of water addressed by SuDS		-
Groundwater	Increases in groundwater recharge due to increases in infiltration from SuDS	\square	\square
Health	Benefits of increased numbers of visitors to SuDS sites	\checkmark	
Amenity (Greening streets)	Value of green streets to the residents	-	
Amenity (improved parks)	Property value increases due to improvements in nearby parks	-	abla





SuDS Studio East Kilbride Results



Example Kingsgate Retail Park

Impermeable area 74,000m²

Discharge point – Infiltration and watercourse

Volume removed from the network 2000m³ (30 year event)

Swales, Attenuating rain gardens, Disconnected Downpipes, Filter drains, Permeable paving, Green roofs, Rain garden boxes

CAPEX costs £1.5m OPEX costs £130k MB £400K (Biodiversity, Carbon Seq, Green roof energy savings, Pollination, Air quality)



Prioritisation Criteria

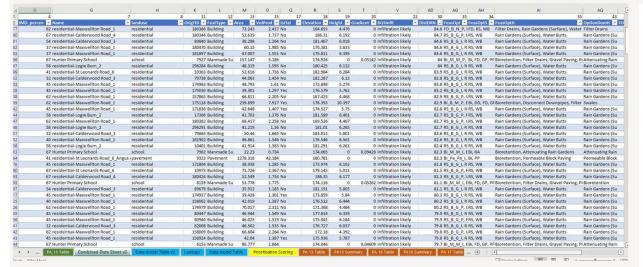
Critical success factors selected:

- Strategic fit
- Value for money
- Ownership
- Proximity to flooding
- Delivery risks and opportunities
- Multiple benefits
 - a. Carbon
 - b. Air quality
 - c. Biodiversity
 - d. Building temperature
 - e. Health
 - f. Traffic calming
 - g. Educational





East Mains Example



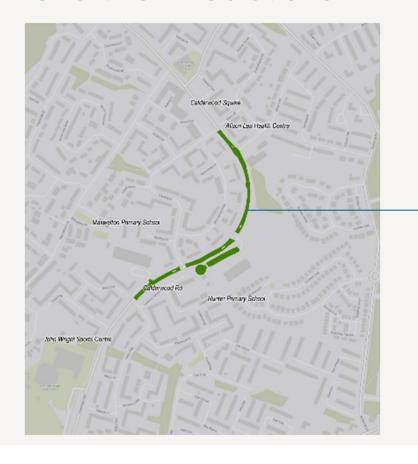
Prioritisation

				Road	SuDS Studio Outputs			
	Location	SuDS Studio Identified solution	Public or Private	surfacing planned	Volume attenuated (m³)	Volume removed (m³)	Value for Money (£/m³)	High-level cost (E)
Short Term	Buchandyke Road	Remove cross- connection	Public	N/A	N/A	N/A	N/A	19,714
	Calderwood Road roadway and adjacent green spaces of the slope	Swales	Public	Yes	0	197	227	44,761
S	Hunter Primary School – lower car park	Bioretention and swales	Public	Yes	53	D	950	51,036
	Subtotal			53	197	383	115,511	
_	Calderwood Square car park	Altenuating raingardens	Public	No	D	50	413	24,770
Term	Alison Lea medical centre car park	Bioretention, filter drains and swales	Public	No	0	38	1,621	61,267
Medium Term	John Wright Centre roof and car park	Disconnect downpipes and swales	Public	No	0	351	367	128,802
	Subtotal				0	448	479	214,839
Long Term	Maxwelton Primary School roof, hardstanding and car park areas	Attenuating raingardons, disconnect downpipes and swates	Public	No	3	306	303	94,482
	Hunter Primary School roof, hardstanding and car park areas	Attenuating raingardens, disconnect downpipes and swates	Public	No	5	164	591	99,955
	Moncreiff Parish Church roof and car park	Attenuating raingardens, disconnect downpipes and swales	Private	No	D	62	612	38,159
	Subtotal				8	543	428	232,596
TO	TOTAL				61	1,181	407	562.945





Short Term Solutions













Medium Term Solutions











Long Term Solutions



A visualisation of our proposals

Photograph following completion

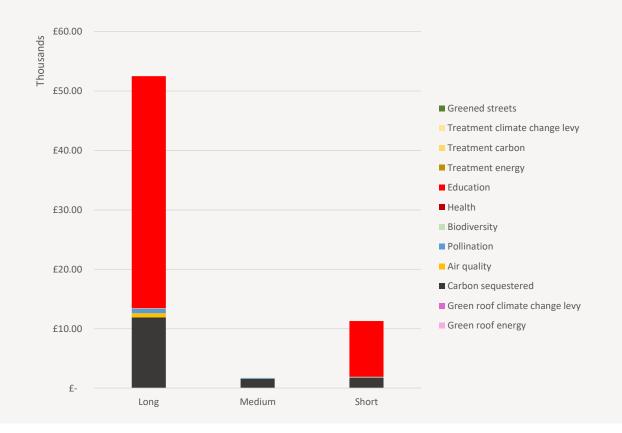




Impact on Flooding East Mains



East Mains Multiple Benefits

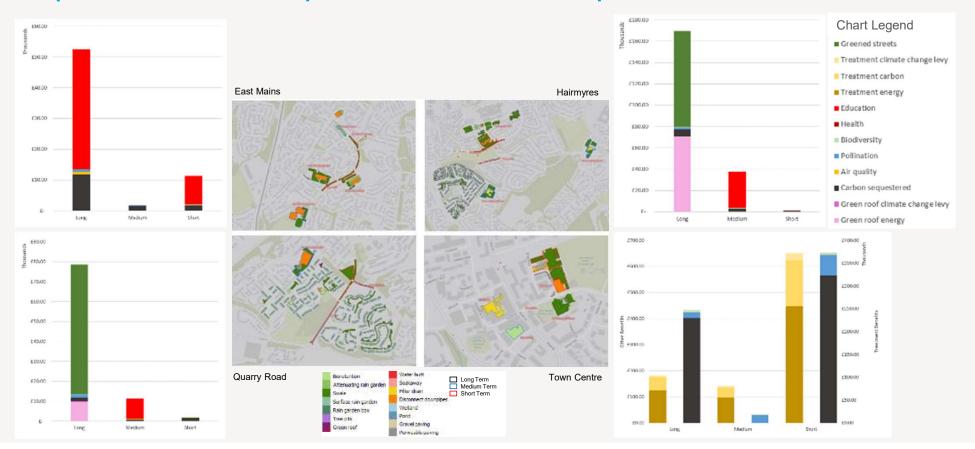








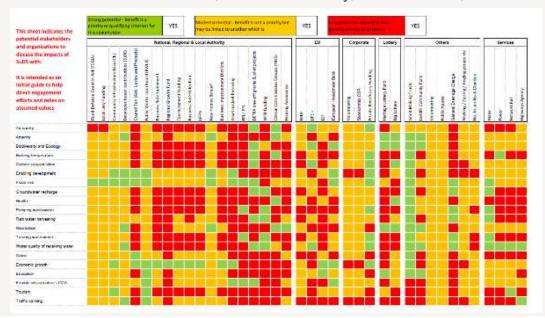
Multiple Benefits Comparison Across Hotspots





Future Use of Data

- Identify beneficiaries
- > Identify redevelopment work to unlock match funding
- > Housing estates refurbishing
- > Potential links with BNG, Green Recovery, Active Travel, etc









Scotland's Flood Risk Management Conference 2023

Session 2: Policy & Placemaking

Dylan Huws, AECOM and Jude Barber, Collective Architecture





GRANTON WATERFRONT

Dylan Huws, AECOM Jude Barber, Collective Architecture



EVOLUTION









COLLECTIVE ARCHITECTURE





Studio for New Realities





OPPORTUNITY









Studio for New Realities





APPROACH

- Link Design Framework with a number of key strategies
- Provide a robust and flexible plan that can be delivered
- Develop future vision for the area rooted in its place, people and history
- Do things differently –not just another 'masterplan'
- Consulting, listening and responding
- Working with existing site constraints and infrastructure
- Applying 21st Century approach to climate change and urban design
- Low carbon, 'green' approach
- o Partnership working
- Detailed plans and set of clear principles
- Building on existing assets and linking with existing neighbourhoods
- Phased and flexible approach to allow incremental change



THE GRANTON **PRINCIPLES**

COASTAL

Celebrating the Firth of Forth's unique and biodiverse shoreline. Enhancing and expanding spaces for open access to natural and urban coastal activities.



URBAN

A vibrant urban environment, with space for living in dense, 21st Century urban housing with ready access to an intelligent mix of dynamic civic and cultural destinations.



ROOTED

Reinvigorating existing heritage assets and working in partnership with local community organisations to further strengthen and grow Granton's identity, physical environment and character.



COLLECTIVE ARCHITECTURE

AECOM



RE-CONNECTED

Linking new and existing neighbourhoods not only with each other but with surrounding areas, Granton Harbour and the City - both physically and socially.



RESPONSIBLE

Developing a self-sustaining neighbourhood within the wider City of Edinburgh with a circular economy addressing work, enterprise, learning, health, energy and social mobility.



ROBUST + INNOVATIVE

Creating a robust framework, with space for future flexibility to create fresh and diverse opportunities for health, energy, production, work, and learning that stand the test of time.



Inhabiting pleasant streets and open spaces that improve health and well-being for all in the community.

LIVING SUSTAINABLY

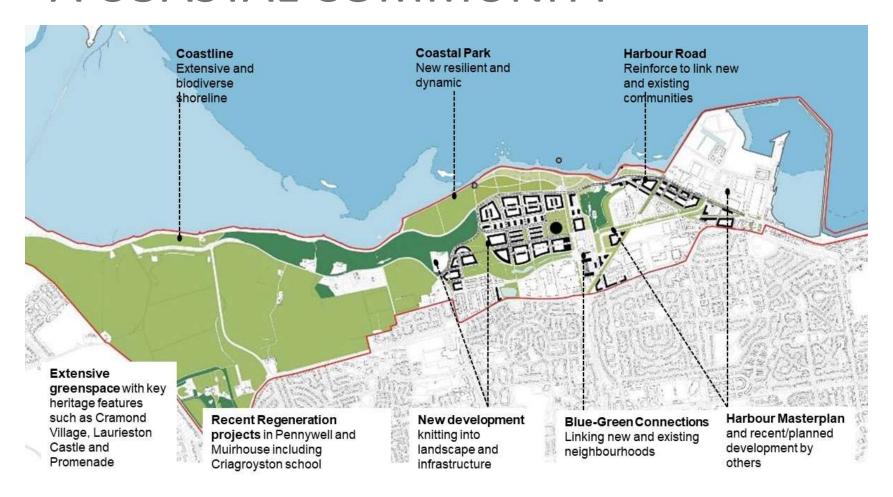


for New

ARUP



A COASTAL COMMUNITY





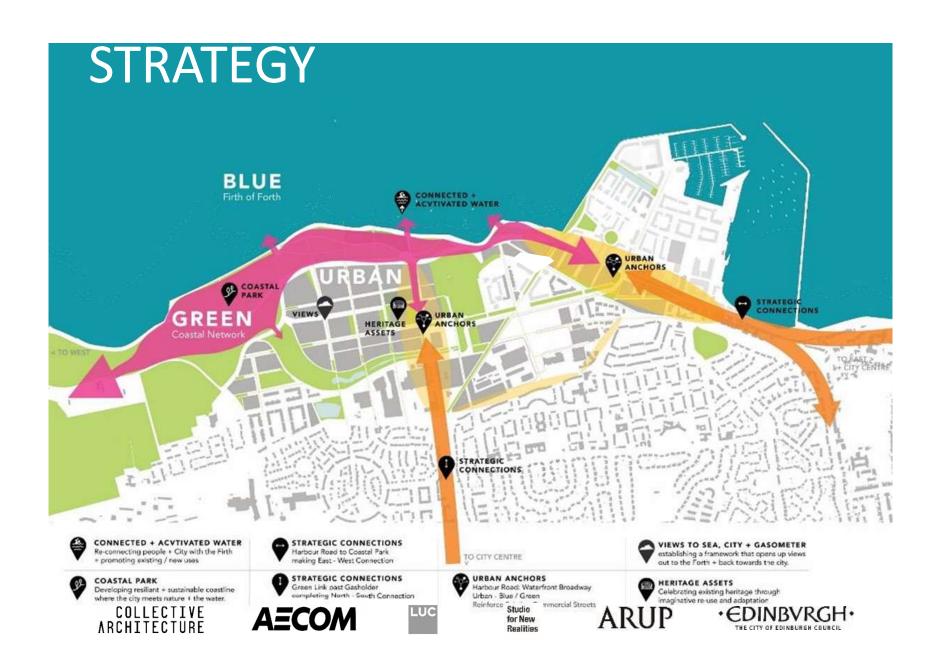




Studio for New Realities

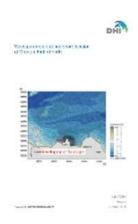






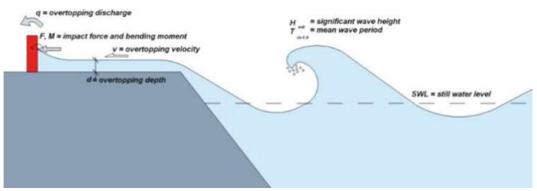
FLOOD RISK





Predicted 1:200 year flood extent from still water level and wave carry over

Wave Overtopping Mechanism







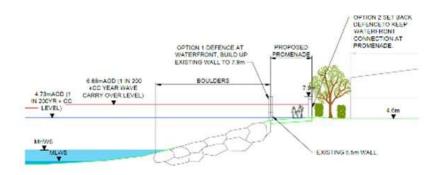




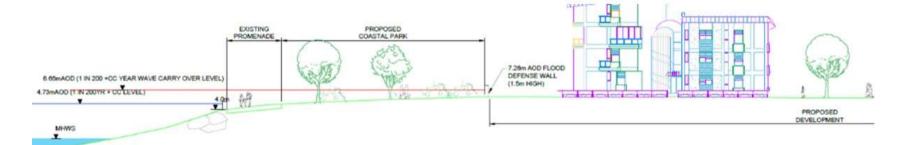




TIDAL FLOODING MITIGATION



Potential Section of defence through existing costal walkway



Setback defence option with compromise between Coastal Park and Development













CASE STUDIES

Millennium Park, Carmarthenshire, Wales



Hunters Point, New York - wetlands rimmed by a sloping rock

















DEVELOPING A COASTAL PARK

Initial Landscape Concept for Coastal Park





Potential Coastal Park Layout using soft or hard terracing to gradually build to defence level along West Shore Road













COASTAL PARK

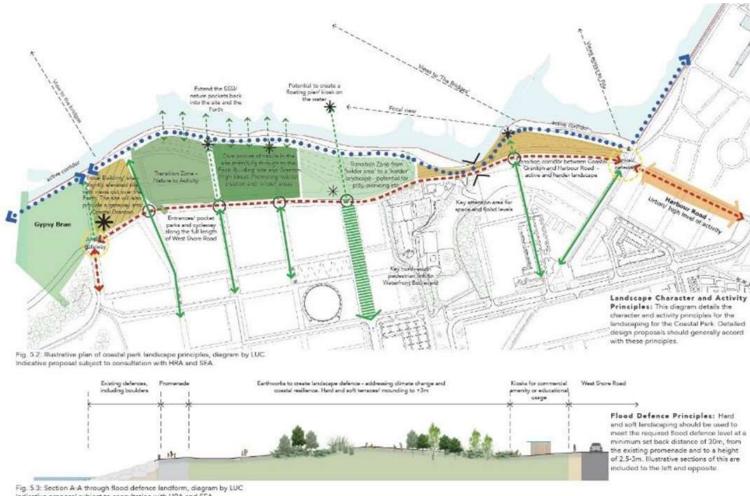


Fig. 5.3: Section A-A through flood defence landform, diagram by LUC indicative proposal subject to consultation with HRA and SEA.





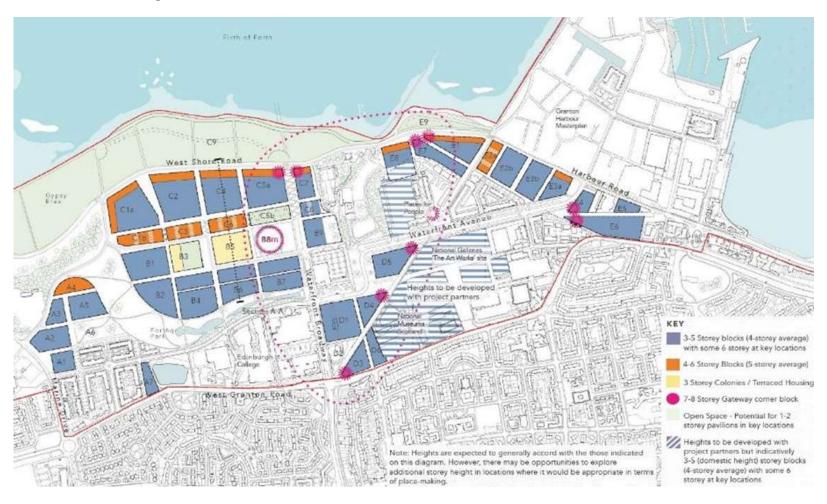


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PARK / URBAN DENSITY









Studio for New Realities





BLUE-GREEN INFRASTRUCTURE









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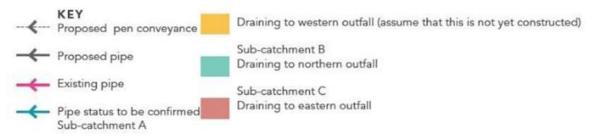




CATCHMENTS



Fig. 3.17: Catchment areas, outfalls and conveyance routes







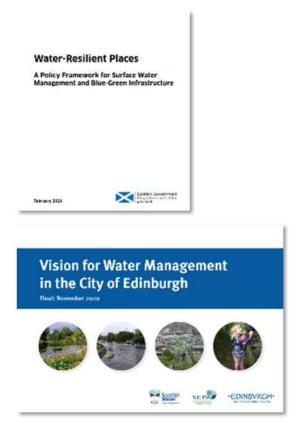








Water Management and Resilient Places



- New guidance has been launched by both SG and CEC looking at water resilience places and a long term sustainable approach to river coastal and storm water management.
- Key themes that have emerged are
 - Placemaking
 - Positive flooding and drainage actions to minimise harm
 - Coordination across organisations and implementing the best integrated solutions
 - Transition to blue green cities







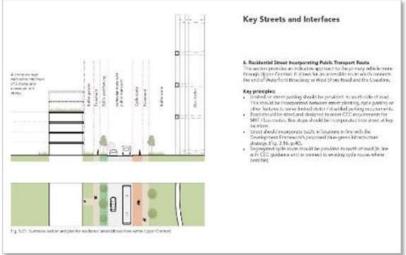






DESIGN GUIDELINES









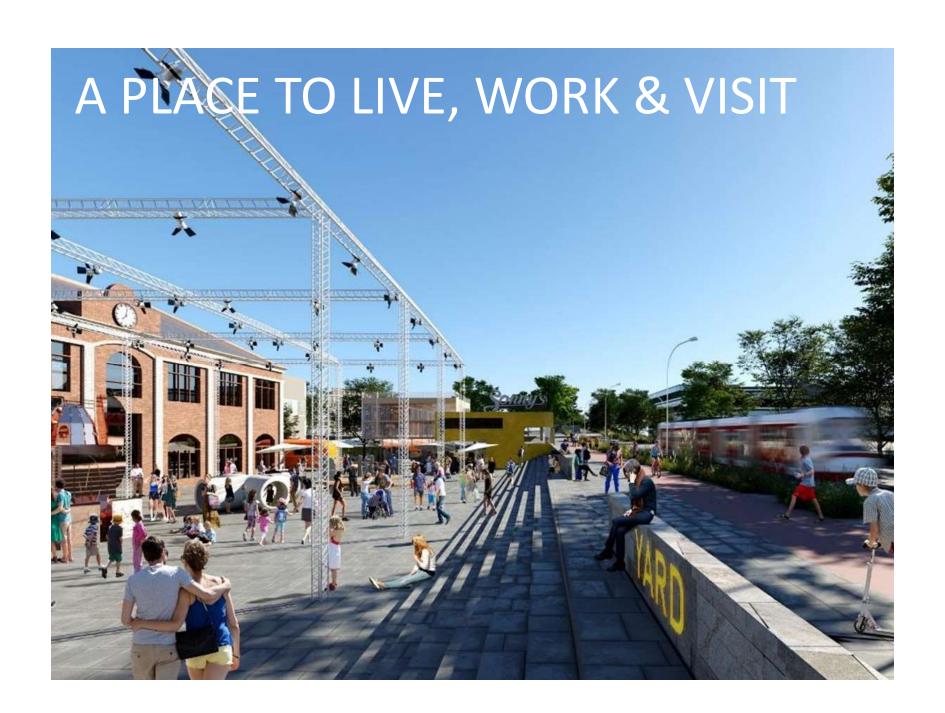


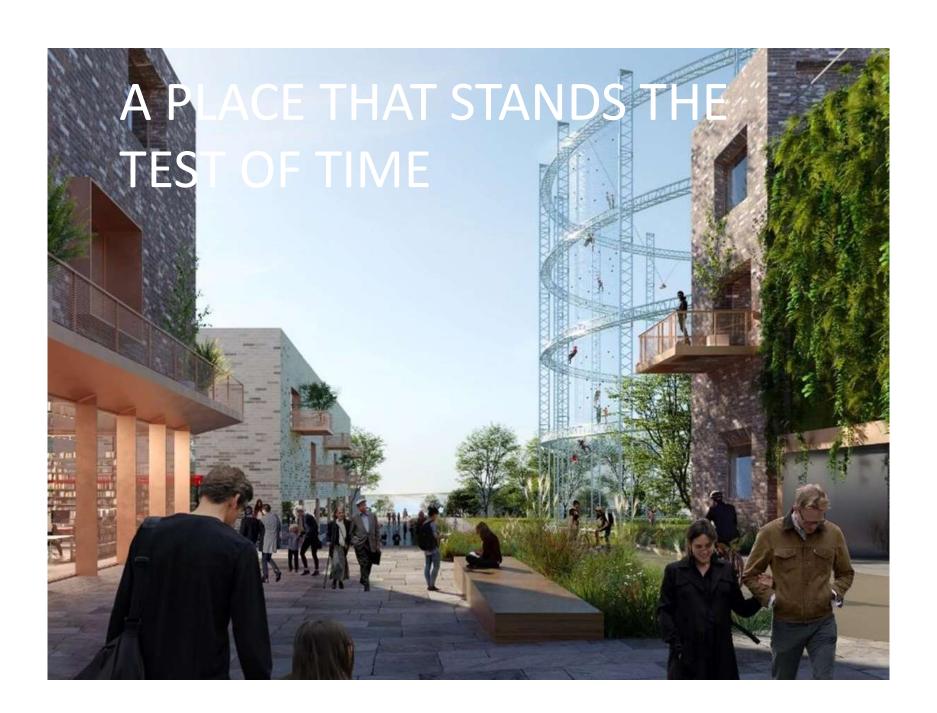












A vibrant and sustainable coastline





COLLECTIVE ARCHITECTURE





Studio for New Realities



EDINBVRGH



Scotland's Flood Risk Management Conference 2023

Session 2: Policy & Placemaking

Paul Hargreaves, Jacobs





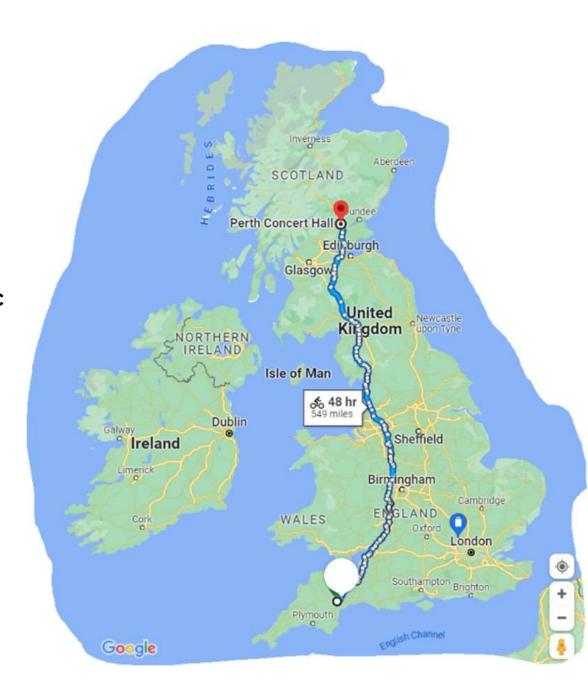




Where is Sidmouth?

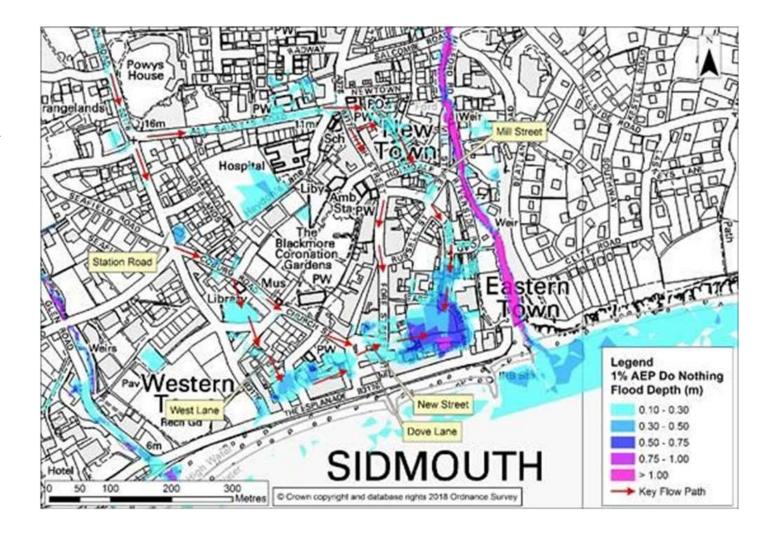
- Sidmouth is situated on the south coast of Devon in the south west of England
- Fab beaches and great ice-cream!
- Home to an international folk music festival





A town with a history of flooding

- Suffers from coastal, fluvial and surface water flooding
- >150 properties at risk from Surface Water flooding



Jacobs

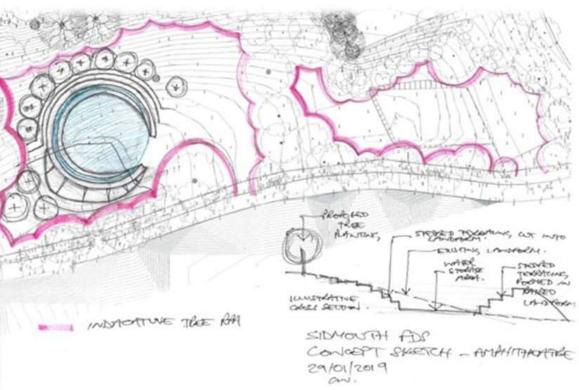
Challenging today. Reinventing tomorrow.



The concept...

Hand sketches initially inspired by National Trust property in Esher west London

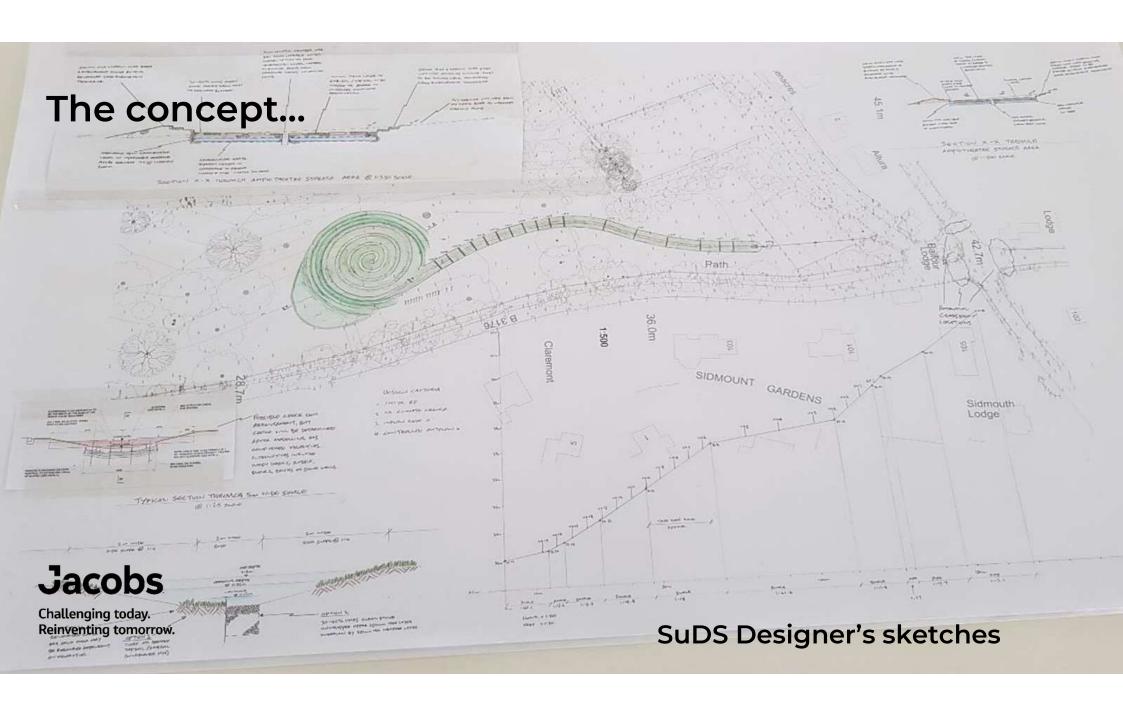




Landscape Architect's sketch



Challenging today. Reinventing tomorrow.











Key features of the proposal include:

- Wildflower grass turf to swale sides
- 2. Proposed semi-mature tree planting
- 3. Existing gates refurbished
- Estate style railing to headwall and retaining wall
- 5. Cellular grid grass reinforcement to allow vehicle overrun
- Interpretation board 6.
- 7. Stone clad headwall and retaining wall
- 8. Pebble finished spiral filter drain
- 9. Grass stepped amphitheatre
- Locally sourced limestone paving
- Bespoke central chamber cover 11.
- 12. Bespoke steps with etched artwork
- 13. New pedestrian access from car park
- Cross drains to capture surface water

- Improved the drainage of an existing parkland area, making it more accessible to the community
- ♦ 2,500m² of wildflower meadows seeded





- Improvement to the parks habitat and biodiversity
- Species were also selected which were in national decline





Improvement to biodiversity by the laying of wildflower turf to swale sides





Jacobs
Challenging today.
Reinventing tomorrow.

- Water quality improvements due to multi stage filtration
- Slowing the flow
- Aquifer recharge through infiltration tank









- Public information board providing engagement for children as well as adults
- Provision of a community performance space







Lessons learnt?

 Wildflowers are amazing, but they need the right conditions to succeed





Lessons learnt?

- Earthworks after mid October are not a good idea!
- Storage of moisture sensitive materials away from a low point is a great idea...





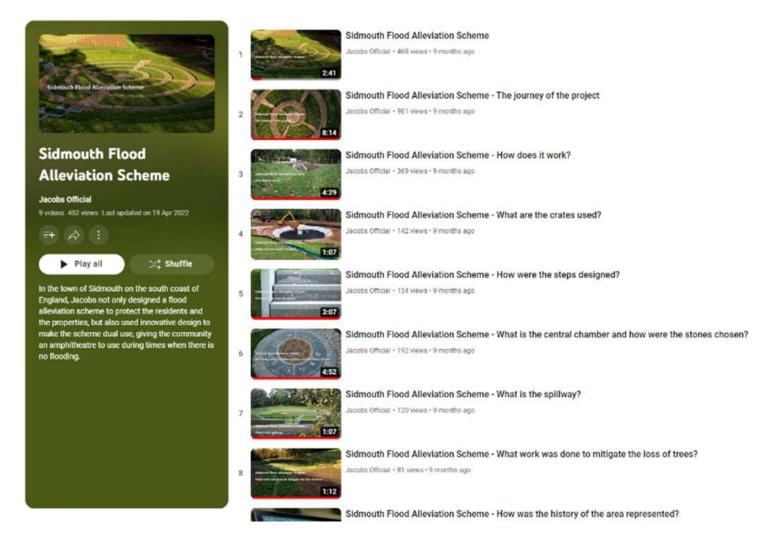
Lessons learnt?

- High quality finishes are important to get public buyin
- If designing for dual / multiuse make sure those interested in the secondary use are clear on what is and isn't included





Want to find out more?





Check out Jacobs' YouTube Channel

Type in the search function 'Jacobs official',

Then click on 'Playlists' and select Sidmouth



Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 2: Policy & Placemaking



Join at slido.com #FRM2023-S2





slido





Session 2: Policy & Placemaking Audience Q&A





Coming up next...

Lunch break & networking!

Our next session starts at 13:30





Day 1 Afternoon Plenary

Wed 22/02/23

1330-1500

Session 3. Science and delivery updates

Gannochy Auditorium & online stream

Welcome from the chair: Dawn Lochhead (Scottish Water)

- Coastal change science update from Dynamic Coast Dr Alistair Rennie (NatureScot)
- Coastal change funding update Tracy McKen (Scottish Government)
- Introduction to the Coastal Change Adaptation Planning Guidance Dr Steve McFarland (SEPA)
- Q and A via Slido #FRM2023-S3
- The Natural Flood Management Network Scotland Dr Mark Wilkinson (The James Hutton Institute)
- Environment Agency Flood Hydrology Improvements Programme
 Dr Sara Alexander (The Environment Agency)
- Q and A via Slido #FRM2023-S3





Creating Water Resilient Places



Scotland's Flood Risk Management Conference 2023

Session 3: Innovation & Delivery

Chair: Susan Veitch, Scottish Water





Dynamic Coast

Coastal change science update

Wednesday 22nd February 2023

DynamicCoast.com
Alistair.Rennie@nature.scot
DynamicCoast@nature.scot
@DynamicCoasts









Introduction



The Scottish Government's Dynamic Coast project was funded by CREW, NatureScot and St Andrews Links Trust, with the research conducted by the University of Glasgow.

Dynamic Coast aims to:

- Improve the evidence on coastal change in Scotland;
- Improve awareness of the impacts of coastal change in Scotland;
- Support decision-makers to ensure Scotland's coast and assets can flexibly adapt to our future climate.





























What is the 'problem'?



Coastal erosion and erosion enhanced flooding are identified as: **cross cutting risks** for Scotland.

RISKS & OPPORTUNITIES	N6. Agricultural and forestry productivity	Extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind)	
RISKS & OPPORTUNITIES	N17. Coastal species and habitats	Coastal flooding, erosion, and climate factors	
RISKS	13. Infrastructure services	Coastal flooding and erosion	
RISKS	Flooding and erosion 14. Bridges and pipelines		

CCC state, in Scotland:

- Progress delivering adaptation has stalled,
- Monitoring & evaluation of adaptation is urgently needed,
- There are opportunities to raise our adaptation response...



What is the context?



Pre 2015 Poor awareness

DC1 starts

2017 DC1 published

2018 DC2 starts

2021 DC2 published

2050 + 0.44m sea level

2100 + 1.16m sea level

(IPCC RCP 8.5 95%)



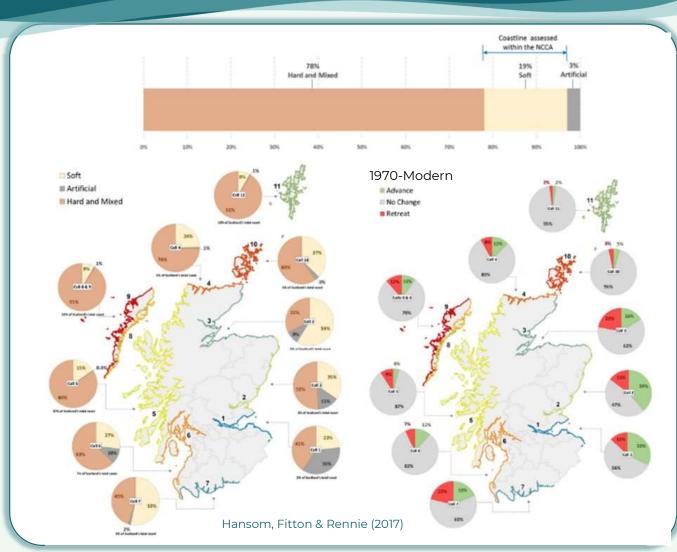
- Prior to 2015, Scotland's coastal erosion problem was devolved to local authorities & landowners, relying on inaccurate legacy data, with limited national awareness of future implications.
- Over the last 7 years Dynamic Coast has driven huge improvements in Science and Governance... 'Laggards to leaders.'
- Like many countries, our risk appraisal shows that past approaches aren't enough: 'In a changing world, business as usual will fail'
- Dynamic Coast is a game-changer, delivering a stepchange in awareness but improvements, delivery and action are now required to realise the benefits.

Earlier phase of work (2015-17)



Dynamic Coast's 1st phase of work identified Scotland's coastal types, then mapped changes between 1890s, 1970s & modern maps on the 'soft' erodible coast.

- 19% of Scotland's coast is erodible*
- 3% of Scotland's coast is artificial
- Recent extent of erosion is above historic baseline levels.
- £350m is at risk if erosion continues

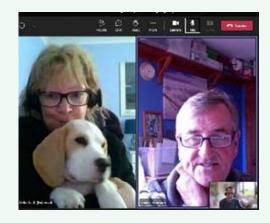


What has happened since FRM2021?



In 2018 the second phase of research into Scotland's erodible coast was commissioned.

'DC2' was launched in August 2021.



All of the results available via www.DynamicCoast.com









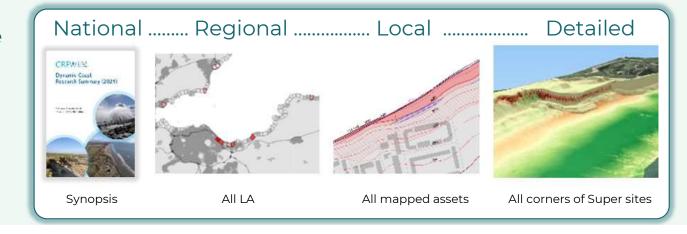
DC2 – Methods



DC2 builds on the initial research (2017). Climate change needed to be accounted for, but DC2 explored a range of themes:

- WS1: Coastal erosion enhanced flooding
- WS2a: Coastal change under high, med, low emissions
- WS2b: National Coastal Erosion Risk Assessment
- WS3: Vegetation Edge monitoring
- WS4: 6 x Super Site Case Studies
- WS5: Sector Summaries
- WS6: Coastal Erosion Disadvantage
 - (social vulnerability)
- WS7: Novel coastal monitoring





WS1 – Coastal erosion linked flooding

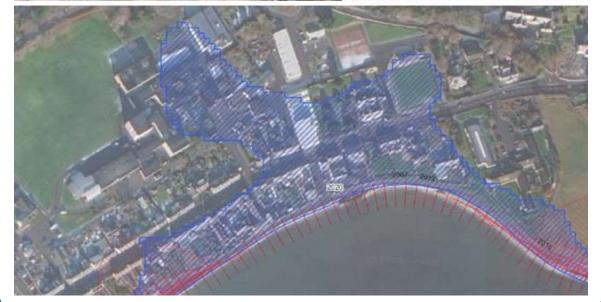


Where might coastal erosion enhance coastal flooding?

Basic proximity analysis between areas of inland flooding (SEPA flood polygons including climate change) & anticipated position of Mean High Water Springs.





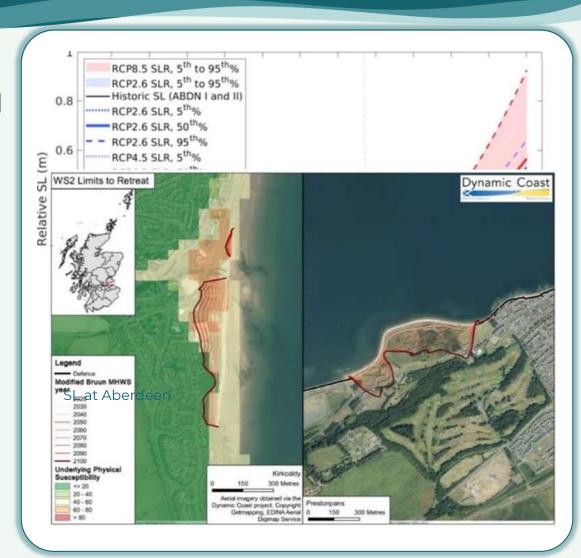


WS2 – Coastal erosion & sea level rise



How are recent rates of coastal change likely to be influenced by future sea level rise:

- Identify recent change using 6,000km of new tidelines (with >5yr gap)
- Use modified Bruun Rule (accounting for shore face slope, rock head/defences & sea level)
- Decadal position of MHWS across soft wave-dominated shores & defended shores with fronting beach. Excludes salt marsh.
- Run for High, Medium and Low Emissions Scenarios (RCPs 8.5, 4.5, 2.6)



WS2RA – Risk Assessment



What assets are at risk from anticipated coastal change under a precautionary baseline (where natural and artificial defences are not maintained)?

 Run for High, Medium and Low Emissions Scenarios (RCPs 8.5, 4.5, 2.6)



WS3 – Vegetation Edge



Legend Veg edge (pictures)

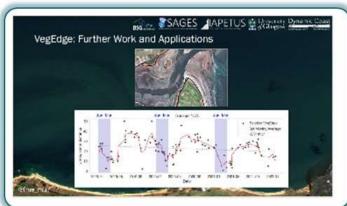
- 2019

--- 2015

Veg edge (all sources)

What other shoreline features can we use to improve our understanding?

- ✓ MHWS
- Vegetation Edge
- MLWS





Automatic veg edge detection on satellite & aerial imagery

Veg edge at St Cyrus (Montrose) mapped with GPS device



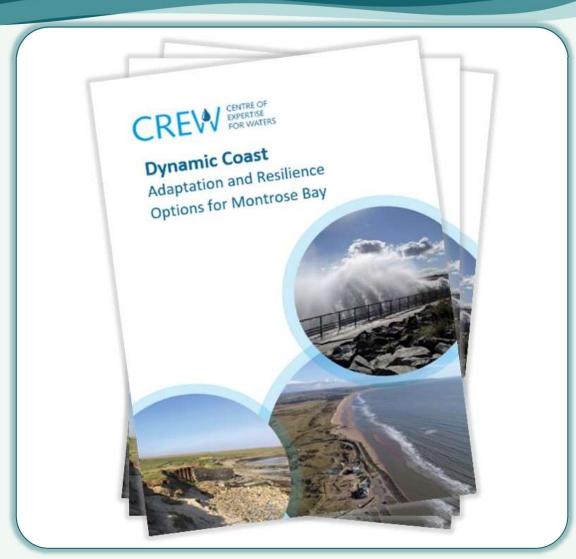
Dynamic Coast: Scotland's NCCA

WS4 – Super site case studies



Six case studies show how coastal change has occurred, how it may affect coastal assets and what resilience and adaptation options are available.

- Bay of Skaill
- Dumbarton
- Golspie Links
- Montrose Links
- St Andrews
- Tiree



WS5 – Sector summaries



Distil national statistics into sector summaries to help managers appreciate the scale of the challenge.

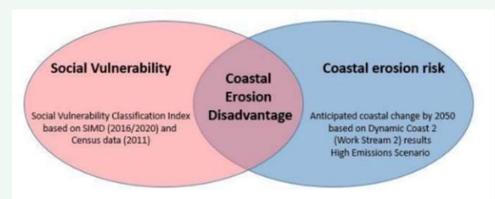
- Built environment
- Cultural environment
- Golf
- Natural heritage
- Transport
- Water

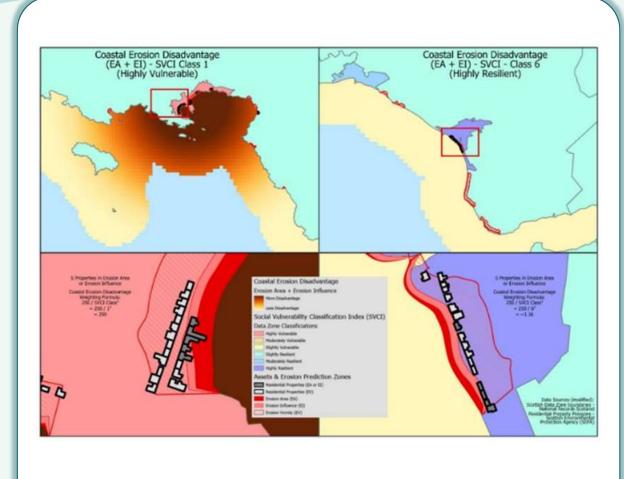


WS6 – Coastal erosion disadvantage



Using Scottish Index of Multiple Deprivation and Census Data, which communities are more / less socially vulnerable to coastal erosion in Scotland?





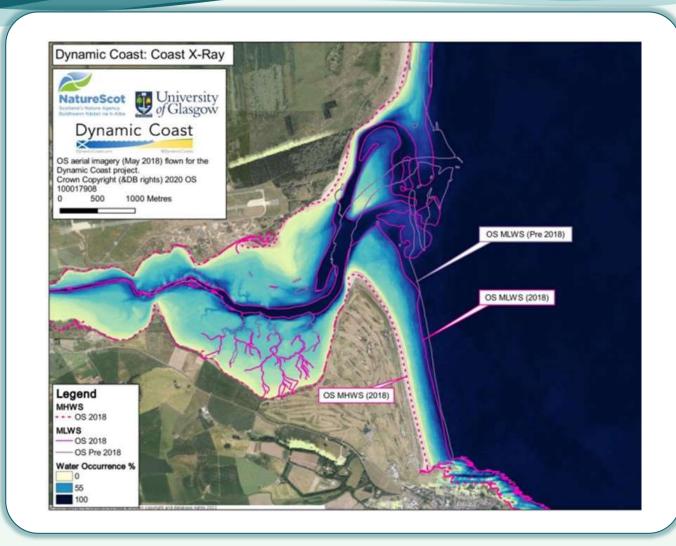
WS7 – Coast X-Ray



Can novel Earth Observation techniques improve our evidence base?

Updated with analysis from Sep' 2016 to Sep' 2021







1. Around **£ 20B of assets** lie within 50 m of our coast. (incl. road, rail & residential property)

Of this, **£ 5B** of assets are protected by artificial defences, whilst **£ 14.5B** are protected by natural defences.

We must appreciate the value of our natural coastal defences.







Natural defences at Nairn (Highland)



2. 46% of soft open coast is erosional. Rate and extent of erosion increases under all emission scenarios. With erosion affecting 84% of our soft open coast under HES.

Under a cautious risk assessment and a High Emissions future, an estimated £ 1.2B of assets may be at risk of erosion by 2050.

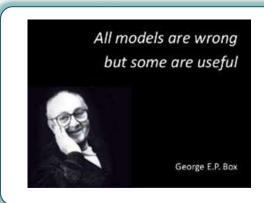
Under a comparable **Low Emissions future around £ 814M** of assets may be at risk by 2050.

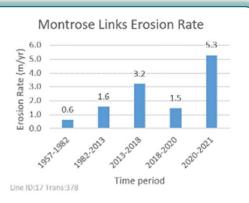
Thus a low emissions future provides £ 395M avoided damage costs.





- 3. Impacts are expected to occur initially through increased erosion and erosion enhanced flood impact, followed by storm damage & landslides.
- 4. Modelling suggests that the decade 2020s is when erosion first influences most shores. It is also the decade where inland low-lying coastal flood risk areas are most at risk from erosion-enhanced flooding.





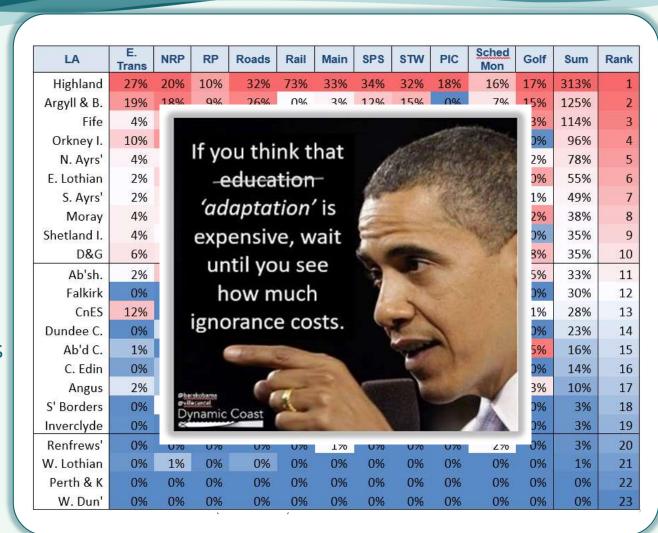




5. Local variations and complexities exist, however most assets at risk are clustered in a few local authority areas (incl. Argyll & Bute, Dumfries & Galloway, Highland and Orkney).

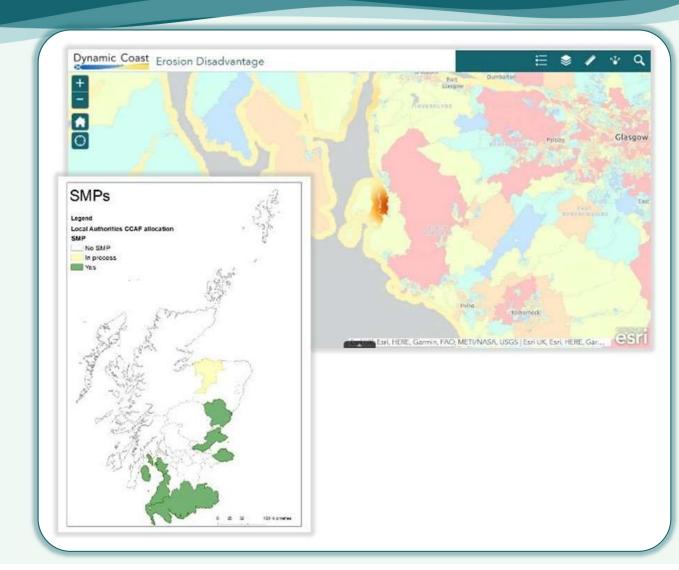
Super sites show us that we can use targeted assessments to identify short-term resilience measures which buy time for longer term adaptation strategies to be developed.

Times are hard now, so we must spend our time & £ more wisely!





- 6. Social vulnerability to coastal erosion is uneven. Dynamic Coast's initial assessment paves the way for more detailed study by local authorities to consider Just Transition implications.
- 7. Coastal management approaches have been slow to change. The existing Shoreline Management Plans have relied heavily on artificial defences to hold the shoreline.





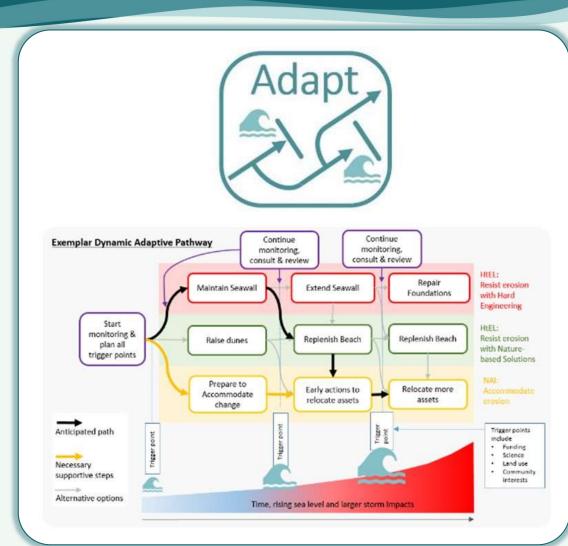
8. The pace and extent of future direct and consequential change at the coast suggests a **new approach is needed to deliver an inherently resilient coast and a better adapted society**.

We recommend Dynamic Adaptive Pathways within Coastal Change Adaptation Plans.

We must become 'sea level wise'

Sea level wise:

- What sea level, coastal erosion & flood frequency should we expect?
- · What things that we care about are at risk?
- How can we better manage these risks?
- Short-term NBS resilience / long-term adapt
- How can we flexibly respond?



Implications & Recommendations





Headlines Implications:

- £15bn assets within 50m of soft coast.
- High Emissions *: £1.2bn assets at risk by 2050
- Low Emissions *: £0.8bn assets at risk by 2050
 - Avoided cost £400m
- Both adaptation AND mitigation essential
- Erosion enhanced flooding expected to worsen most this decade
- In a changing world, Business As Usual will fail, so we must become 'sea level wise'
- Coastal Change Adaptation Plans should be undertaken & updated with ongoing monitoring

Advice for SG & Local Authorities:

- 1. Recognise the scale of change anticipated at the coast. Via planning system (adequate accommodation space & move assets out of harms way) & support wider adaptation work). Visibility;
- 2. Support the development of Coastal Change Adaptation Plans all erodible shores with assets at risk would you gain from Knowledge Exchange Partnerships?
- 3. Deliver better short-term resilience measures and deliver funded long-term adaptation plans and actions (investing in natural coastal defences is an essential element in resilience and adaptation strategies), help ID opportunities;
- 4. Improve the quality, extent and frequency of coastal monitoring data.

 What monitoring do you need to inform trigger points and adapt?

^{*} Precautionary baseline, incl. do nothing management strategy, ie do not maintain natural / artificial defences.









Prof Jim Hansom

Dr Martin Hurst
Freya Muir

Prof Larissa Naylor

Dr Ria Dunkley

Dr James Fitton
Craig McDonnell



Thanks to the DC2 Team!

DynamicCoast.com



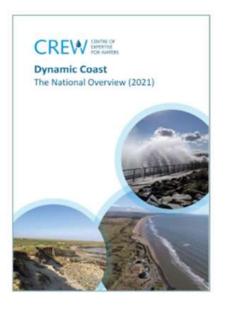
Dr Ali Rennie Debi Garft





















Our funders:









Our partners:





















DynamicCoast.com DynamicCoast@nature.scot @DynamicCoasts

DC research team:

Prof Jim Hansom

Martin Hurst Freya Muir

Prof Larissa Naylor

Ria Dunkley

James Fitton Craig McDonnell



DC team

Debi Garft (retired)

The state of the state of

Tracy McKen

Dr Alistair Rennie

Sophie Beier

Dr Steve McFarland

Dr Mairi Davies

Walter Scott

Sandy Reid

Anna Beswick

Duncan Moss

Magda Low John Adams

Nicholas Williamson (Fife Council)

(SG/NatureScot)

(CREW) (SEPA)

(Historic Envi. Scotland)

(Angus Council)

(St Andrews Links Trust)

(Adaptation Scotland)

(Ordnance Survey)

(Ordnance Survey)

(Montrose)



Scotland's Flood Risk Management Conference 2023

Session 3: Innovation & Delivery

Tracy McKen, Scottish Government





Tracy McKen

Senior Policy Advisor
Water Environment and Resilience Team

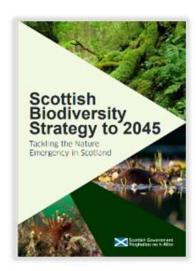




Coastal Adaptation and Wider Policies

- Scottish Climate Change Adaptation Program
- National Planning Framework 4
- Biodiversity Strategy
- Placemaking









 Dynamic Coast (DC2) has identified the risks

 August 2021 – Funding for CCAP announced

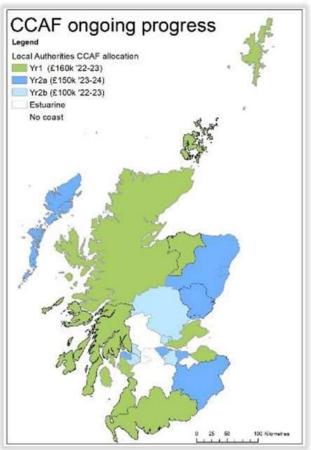
 £11.7m over four financial years





Capital Funding Breakdown per year

- 2022-23 £1.6 million
 - Moray CCAP '22-23
 - Orkney LiDAR '23-24
 - Angus & Montrose resilience measures
 - S. Borders SMP opportunities
 - D&G SMP opportunities
 - S. Ayrshire (mini CCAP opportunities)
 - Argyll & Bute (CCAP opportunities)
- 2023-24 £2.6 million
- 2024-25 £2.7 million
- 2025-26 £5.0 million

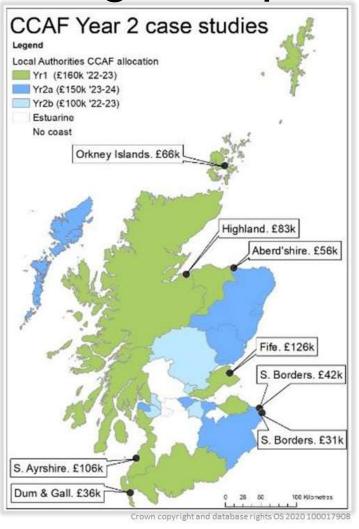


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Community Consultations & Discussions in Orkney





Monitoring & valuing Nature-based approaches at Nairn



Case Study Funding for 2023-24

Case study area	Council	Brief outline	Amount
Ballantrae	South Ayrshire	Shingle shore resilience options	£ 106k
Orkney Islands	Orkney Islands	Community engagement	£ 66k
Nairn	Highland	Monitoring & enhancements for sand beach resilience	£ 83k
Sandend	Aberdeenshire	Options appraisal for dune system	£ 56k
Sandhead	Dumfries and Galloway	Nature-based resilience for at risk road	£ 36k
Scottish Borders	Scottish Borders	Coastal path	£ 31k
Scottish Borders	Scottish Borders	Shoreline Management Plan support	£ 41k
St Andrews	Fife	Sand beach and dunes	£ 126k



Case Studies for Future Years

- Projects that allow all Local Authorities to learn & act.
- Monitoring, resilience, trigger points, community involvement...
- Broader benefits of joint funding (Nature Recovery Fund etc.)
- Possible Gaps in knowledge
 - Salt Marsh
 - Urban Shores
 - End of Life of Existing Structures

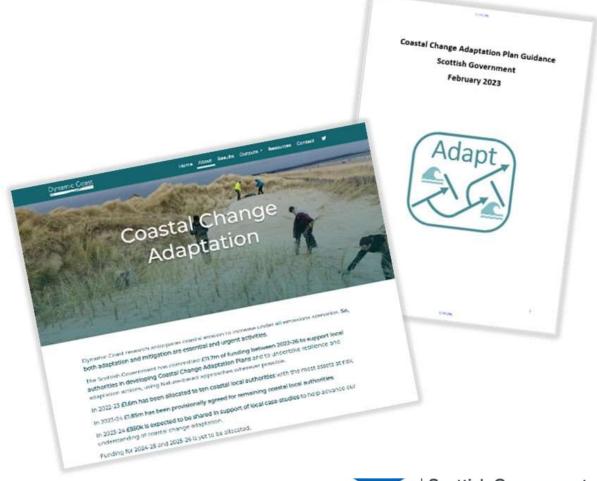




What next?

 Agree funding distribution for 2024-25 and 2025-26

- Knowledge Exchange
- CCAP Guidance
 - www.DynamicCoast.com/cca
 - Implementation and Updating







Scotland's Flood Risk Management Conference 2023

Session 3: Innovation & Delivery

Dr Steve McFarland, SEPA





Coastal Change Adaptation Plan Guidance





Steering Group:

Scottish Government
Dynamic Coast
Adaptation Scotland
Edinburgh City Council
Orkney Islands Council
Dumfries and Galloway
Council
Scottish Environment
Protection Agency

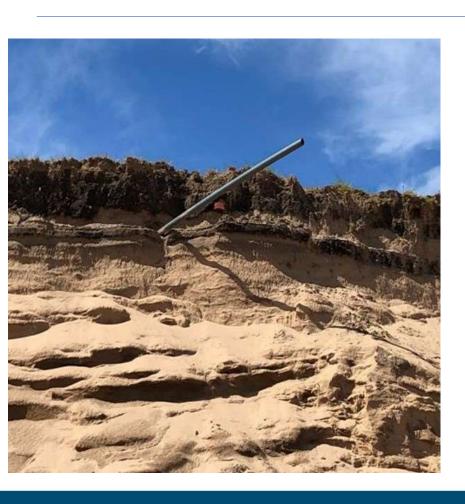
Advice from many others greatly appreciated

Special thanks to Verity Flett@sepa

steve.mcfarland@sepa.org.uk

Interim Coastal Change Adaptation Plan Guidance





What is the guidance for?

- 1. Much of Scotland's soft coast is eroding and low-lying areas are vulnerable to flooding from the sea.
- 2. Artificial coasts are hard to maintain due to the adverse impact of structures on coastal processes.
- 3. Climate change, leading to accelerating sea level rise, causes faster and more widespread erosion, a disproportionate increase in coastal flood risk and challenges the viability of many coastal structures.
- 4. We <u>all</u> have a statutory function to plan for future climate change at the coast and to support long term adaptation and resilience of our coastal communities to that change. This guidance supports that statutory function.
- 5. Coastal Change Adaptation Plans will inform decision making in Local Development and Flood Risk Management Plans.

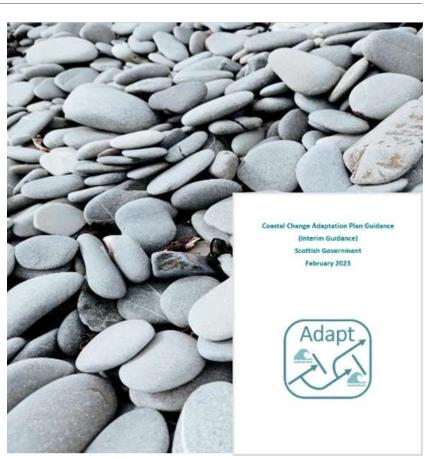
Interim Coastal Change Adaptation Plan Guidance



How was the guidance produced?

- 1. SEPA coordinated the preparation of the **Interim** Coastal Change Adaptation Plan guidance.
- 2. Review of best practice across the UK and beyond where shoreline management and coastal adaptation planning has been taken forward (including advice from expert practitioners)
- 3. Consideration of Scottish policy context particularly in relation to spatial planning and climate change adaptation
- 4. Approach agreed with steering group.
- 5. Multiple revisions of draft guidance to take account of input received.
- Finalisation of guidance by Scottish Government.

You can find the guidance at www.bynamicCoast.com/cca





How is the Guidance Structured?

PART 1. Modified version of the DEFRA guidance for Shoreline Management Plans in England and Wales 2006 (as updated by Environment Agency Supplementary Guidance 2020). Provides a robust process for identifying policy direction for coastal management that takes account of larger scale pressures on, and aspirations for, coastal areas.

PART 2. Adopt a Dynamic Adaptive Pathways approach which allows for community co-design of solutions and identification of flexible responses to an uncertain future. It encourages and facilitates taking early adaptive actions by identifying trigger points for a change in approach and the steps need to be taken in advance to prepare for that change.



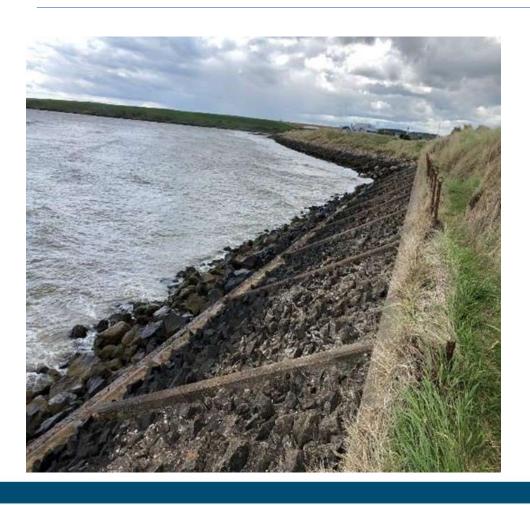


Key Points: Part 1, the modified SMP approach

- A broad assessment of the risks of coastal erosion and flooding over next 100 years or so and identification of policies to manage or reduce these risks to people and the developed, historic and natural environment.
- 2. Broadly uses the same work steps and similar policy names and descriptions (as updated in the EA SMP Supplementary Guidance 2000) but with a desire to move towards more spatial planning terminology for policy names in the future.
- 3. Removes the 3 epochs / arbitrary timeframes for which policies are traditionally set replacing them with a "where we are now" and "a where we need to get to" approach.







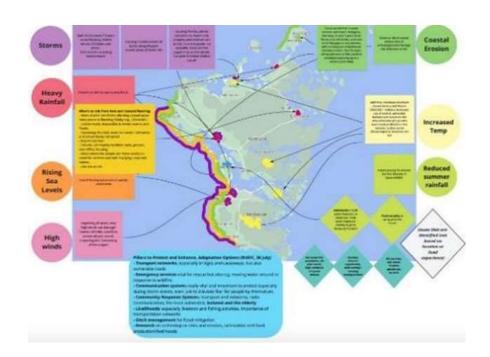
Key Points: Part 2, Adaptation Planning

- 1. Recommends to adopt a Dynamic Adaptive
 Pathways approach to assess a range of ways to get
 from the "where we are now" to the "where we need
 to get to" high level policies agreed in Part 1.
- 2. Identify trigger points where a change from one management approach to another is required
- 3. Set in motion, at an early stage, the forward planning need to facilitate a change in management approach (**before** a trigger is reached).
- 4. Accommodate uncertainty, such as the amount of time that passes until a trigger is reached.
- 5. Must consider extreme scenarios (plausible but unlikely to happen with current understanding).



Community Engagement

- 1. Essential to **fully engage** with local communities to share understanding and co-develop dynamic adaptive pathway solutions.
- Communities have different experiences and different challenges (not just related to coastal change). A placemaking approach can help to solve problems collectively and deliver multiple benefits.
- Great examples of engagement are the North Uist pilot engagement / participatory mapping project and the Outer Hebrides Climate Storyline Project which explore climate risks by connecting climate science and local lived experience.
- 4. Good community engagement is essential to delivering adaptation at the coast and its important to **start early.**





Working with natural defences?

- 1. The guidance emphasises the benefits of working with natural features that provide protection to coastal communities and assets, (£14.5bn of coastal assets protected by nature versus £5 billion by artificial defences*).
- 2. Preserving, enhancing and restoring these natural coastal features adds natural resilience to coastlines against flooding and erosion as well as providing additional services and benefits such as carbon capture, promoting biodiversity and wellbeing and in supporting local tourism.
- 3. Natural features need space to respond to coastal change and sea level rise and there is an important role for spatial and adaptation plans to help create and preserve space for the coast, and affected assets, to respond in the future.





What's next?

- We want people to work with the interim guidance and feedback on experience so the guidance can be improved.
- Existing Shoreline Management Plans can be reviewed and used as a basis for Coastal Change Adaptation Plans but noting the need to bring Plans up to date and the inclusion of Scotland specific requirements.
- Make use of the Coastal Change Adaptation
 Fund to take forward demonstration projects of
 adaptation planning and delivery of adaptation
 on the ground.
- Further dissemination events will be held and resources developed to support local authorities taking forward their Coastal Change Adaptation Plans.





Thank you for listening ⁽²⁾





Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 3: Innovation & Delivery



Join at slido.com #FRM2023-S2





slido





Session 3: Innovation & Delivery – audience Q&A







Scotland's Flood Risk Management Conference 2023

Session 3: Innovation & Delivery

Dr Mark Wilkinson, The James Hutton Institute







The Natural Flood Management Network Scotland: *Update*

www.nfm.scot

Mark Wilkinson, James Hutton Institute (presenting) and Heather Forbes, SEPA



 "Natural Flood Management Network Scotland – sharing best practice and knowledge amongst people working with NFM in Scotland – from the headwaters to the coasts"

Introduction





Web platform launched in 2018

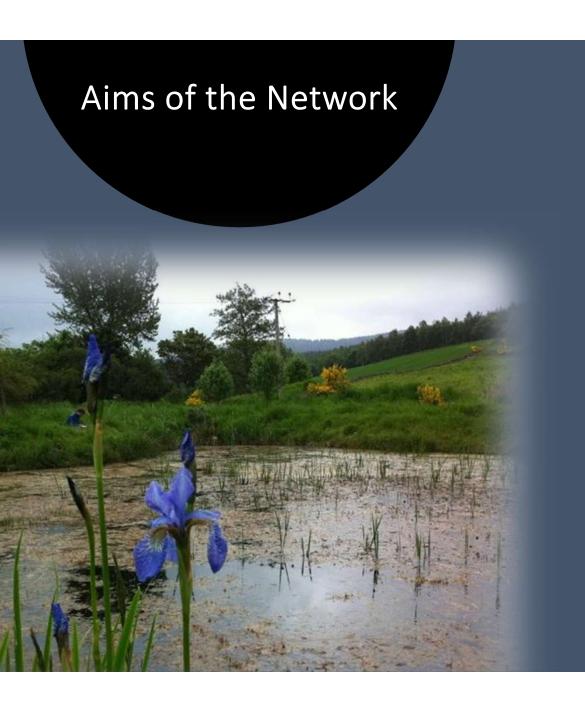
Its aim was to be a dedicated resource on NFM that supports those tasked with delivering this approach to sustainable flood risk management in Scotland.

Funding and management

Funded by the Scottish Government RESAS programme and managed by James Hutton Institute as part of the AiM NBS 5-year project. Steering group: SEPA & Scottish Government

Growing every year

Over 350 registered members and growing. Many international visitors to the website.



• It will help to:

- Provide news updates
- Connect projects
- Collate information
- Link to other resources
- What the network doesn't do (e.g.,)
- Develop independent material
- Answer specific external content
- Give advice (like a society/centre)

Content

- A practical and accessible website which allows users to upload content
- "The latest news and events"
- "Bringing together Scottish NFM case studies"
- "A twice-yearly e-bulletin with NFM highlights"

News and events in chronological order with topic 'tags'

Currently contains 15 Scottish case studies

Sign up to this during registration

22 February, 2023 - 10:00 to 23 February, 2023 - 16:00

Register now for Scotland's Flood Risk Management Conference 2023

Sniffer will be hosting the Scottish Flood Risk Management Conference.
The 2-day hybrid conference will be held in person on 22 – 23 February
2023 at Perth Concert Hall. Those unable to travel will be able to view





E-bulletin number 8

Feb 2023

News

The first ever UK practice guide has been produced on designing and managing forests and woodlands to reduce flood risk. Produced by Forest Research, the new Practice Guide provides advice to landowners, forest and woodland managers, planners, practitioners and flooding authorities, on how forests and woodlands can make a positive contribution to natural flood



O Event

Woodland

> Land and runoff management

River and floodplain management

Coastal and estuary

Multiple benefits

Stakeholder engagement

Science and Research

Funding

Reasons why you might want to join

•1

 Be part of the NFM community in Scotland and contribute your own experiences •2

 Keep up to date with NFM related news and events •3

Have the option to receive news updates

•4

 Search for information and examples in case studies and topic areas •5

• Its free to join





The network needs you

<u>www.nfm.scot</u> is user driven so please do sign up or log in and add your news, events and case studies

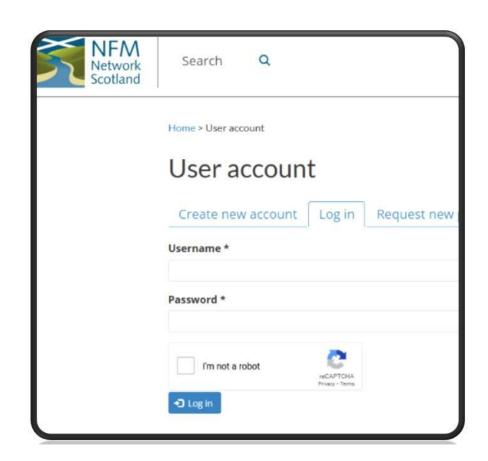


How to add content - www.nfm.scot

Step 1

LOG IN OR REGISTER

• First you will need an account. It takes a couple of minutes to sign up.

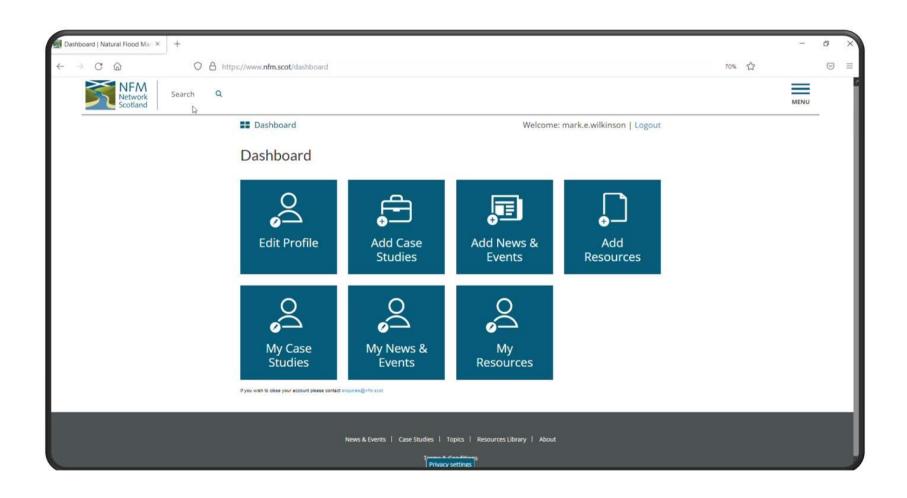


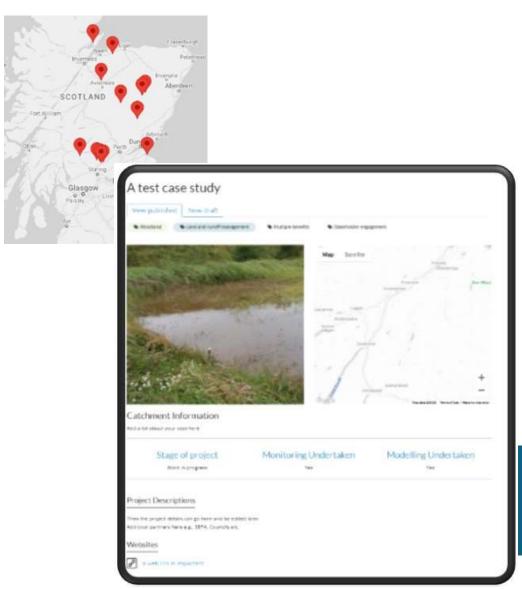


•Step 2 THE DASHBOARD

• Here you can add new content or edit existing content.

•Step 3 ADD CONTENT





Final Step

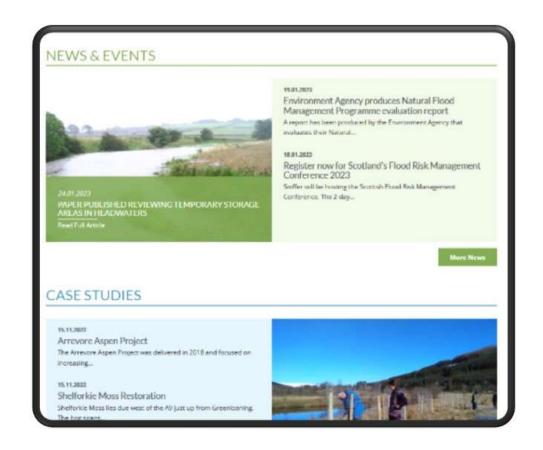
MODERATION, POSTING AND EDITING

- Content is moderated before going live
- You can edit your content at any time



My Case Studies

Title	Post date
A test case study	08 Feb 2023



PLEASE VISIT

https://www.nfm.scot/

PLEASE JOIN

• It takes 2 minutes to join

PLEASE CONTRIBUTE

Let's share knowledge & best practice on NFM



The NFM Network Scotland is supported by the Rural and Environment Science and Analytical Services Division of the Scottish Government through the 'Achieving Multi-Purpose Nature-Based Solutions' project





Scotland's Flood Risk Management Conference 2023

Session 3: Innovation & Delivery

Dr Sara Alexander, The Environment Agency







Environment Agency

Flood Hydrology Improvements Programme

Sara Alexander



Flood Hydrology Roadmap

A community led

25 – year vision for flood hydrology across the UK

Ways of working,

Data,

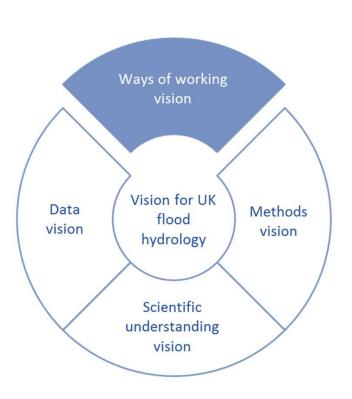
Methods,

Scientific understanding

Log £100 million of investment over 25-years, delivered through 31 actions



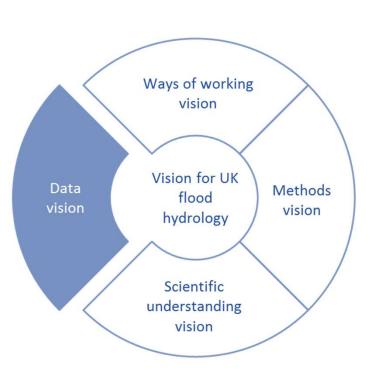
Flood Hydrology Roadmap: Ways of Working



- A representative and unifying UK group as a lead voice for flood hydrology
- The flood hydrology community work together
- We engage across the UK and internationally



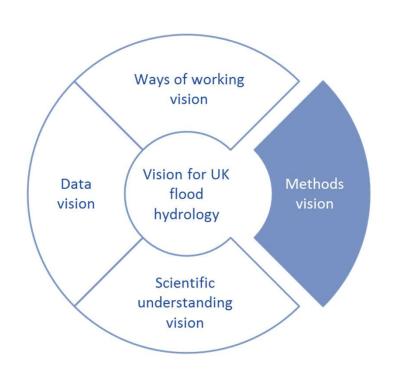
Flood Hydrology Roadmap: Data



- We can monitor the UK hydrological environment; particularly extremes
- Data are communicated and shared openly
- Data is freely available
- Data are of sufficient quantity and quality

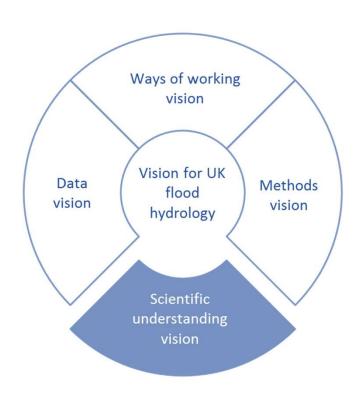


Flood Hydrology Roadmap: Methods



- Flood hydrology methods deal with all sources of flood risk
- Methods are open-source, effective and regularly updated
- Methods allow use of available information and employ best available tools
- Impacts of future change and the calculation of uncertainty are included

Flood Hydrology Roadmap: Scientific Understanding



- We continually improve our understanding of the processes governing all areas of flooding risk
- This science and knowledge is transferred into practical improvements





Track delivery of actions and outcomes

Scientific and Technical Advisory Group

~15 members with some fixed representation from regulators

BHS

Link to hydrology community

Project Governance

projects delivering Roadmap actions and outcomes **UK Hydrology Community**



EA Flood Hydrology Improvements Programme

Vision

Environment Agency, and wider UK hydrology community, are better equipped to create a society with improved hydrological information and understanding to manage flood hazard in a changing world

Ways of Working,

Data,

Methods

Actions

£7 million of investment over 6-years,

delivered through 20 projects





FHIP Ways of Working Theme

- Determining the value of hydrology
- Innovation and closer ties nationally and with academia



UK Hydrology Skills and Satisfaction Survey 2023

Environment Agency and the UK Flood Hydrology Roadmap Board

Help us capture a picture of the UK hydrology community in 2023.

If you use hydrology
— whether or not you call yourself a hydrologist—
- whether or not you do hydrology yourself or commission others—
we would like you to spend ~15 mins filling out the survey.

Open Feb 6th until Feb 26th 2023







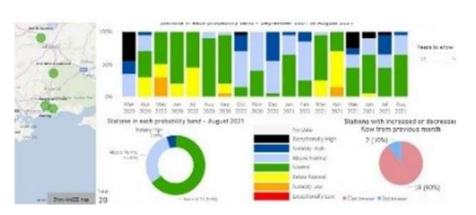


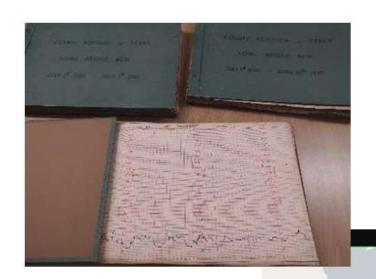




FHIP Data Theme

- Open Data
- Data Rescue
- Data Quality Dashboard
- Quantifying & Communicating Hydrometric Data Uncertainty
- Reconciling peak flows and ratings







Be der eight for the first for

Sara. Alexander@environment-agency.gov.uk

FHIP Methods Theme

- Decision-Making Approaches in Operational Flood Hydrology
- *Benchmarking Tests in Operational Flood Hydrology
- Understanding Hydrological Uncertainties (report freely available)
- *Catchment-Based Methods





^{*}will be delivered in partnership with the Devolved Nations



- Flood hydrology roadmap GOV.UK (www.gov.uk)
- EA FHIP
 - Webpage: Flood Hydrology Improvements
 Programme | Engage Environment Agency
 (engagementhq.com)
 - Project list
 - General email: FHIP@environment.agency.gov.uk
 - Featured in BHS Circulation 155: <u>Publications</u> (hydrology.org.uk)
- SNIFFER FRM Marketplace



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Open Feb 6th until Feb 26th 2023

https://www.smartsurvey.co.uk/s/ukhydrologyskillssatisfaction2023/















Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 3: Innovation & Delivery



Join at slido.com #FRM2023-S2





slido





Session 3: Innovation & Delivery – audience Q&A







Coming up next...

Networking break, followed by Parallel Sessions at 15:20

Session 4a: Coastal Change. Location: Auditorium

Session 4b: Surface Water Management. Location: Norrie Miller





Day 1 Afternoon Parallel Sessions Wed 22/02/23

1520-1630 Session 4a. Coastal change parallel plenary

Gannochy Auditorium & online stream

Welcome from the chair: Susan Veitch (The Highland Council)

- Developing a Coastal Change Adaptation Plan for Moray
 Dr Jenny Shadrick (JBA Consulting) and Will Burnish (Moray Council)
- How can we monitor coastal change to support adaptation?
 Doug Pender (JBA Consulting)
- Ten in 10: Getting started with Adaptation Pathways learning from the Clyde and other places Steven Trewhella (Rivelin Bridge)
- Opening the Door for Discussion involving communities in long term Coastal Management Alix Scullion (Royal HaskoningDHV)
- Q and A via Slido #FRM2023-S4a





Creating Water Resilient Places



Scotland's Flood Risk Management Conference 2023

Session 4a: Coastal Change

Chair: Will Burnish, Moray Council







Developing a Coastal Change Adaptation Plan for Moray

Will Burnish, Jenny Shadrick and Doug Pender

Sniffer FRM Conference February 2023

JB

Why did we need a Coastal Adaptation Plan?

- Varity of Assets
- Vulnerability to climate change
- Management of Development
- Support NPF4
- Community Resilience
- Future Plan
- Risk Management





Defining our Requirement:







- Ability to adapt to policy change
- High level setting plan
- Local plans
- Pathway approach
- No end goal
- Its not just property
- Triggers and actions

Coastal Adaptation Plan - Approach



Four pillars of adaptation

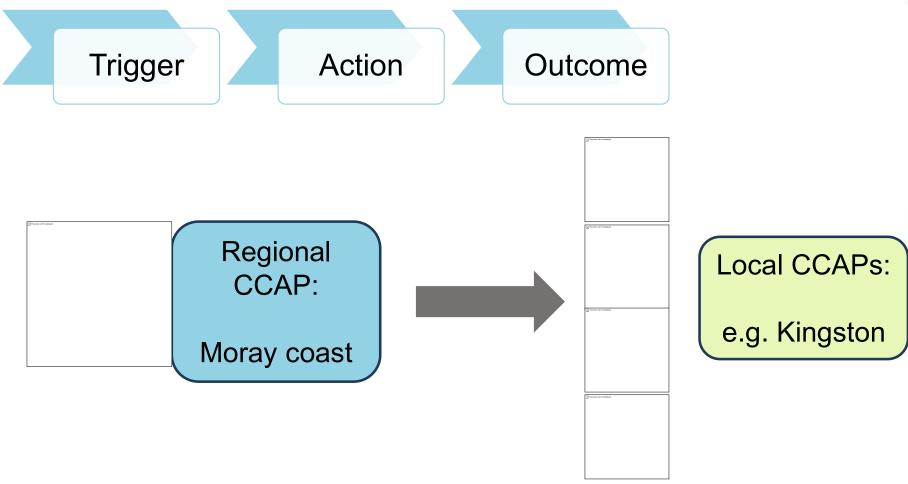


Coastal Adaptation Plan:

- Align with existing policy
- Understandable
- Flexible
- Achievable

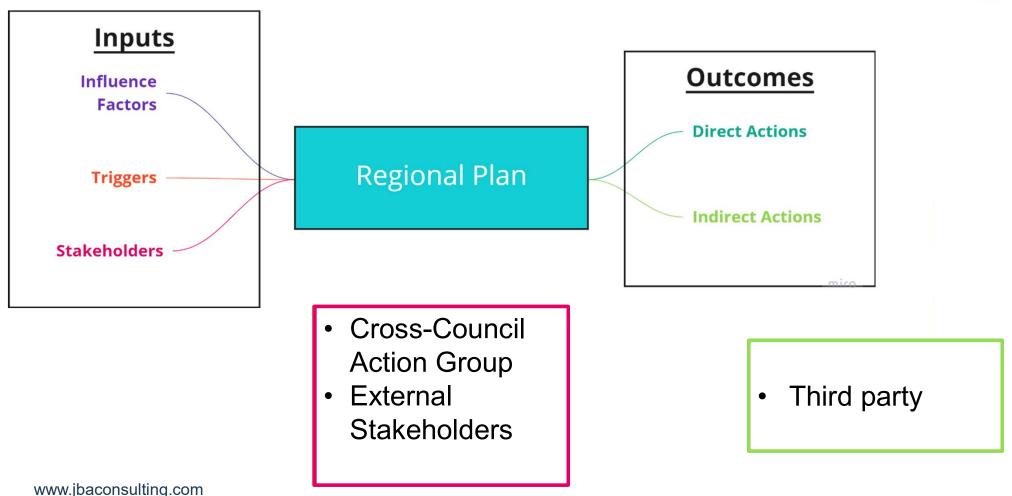
Coastal Adaptation Plan – Approach





Coastal Adaptation Plan – Regional Plan









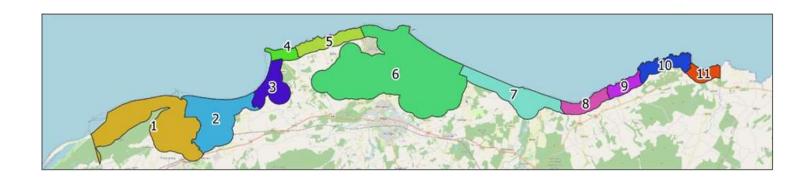
Regional Plan



Coast subdivisions

Coast subdivided into Coastal Change Management Areas

- SEPA flood maps
- Council district boundaries
- Sediment cells



Coastal Adaptation Plan – Local Plan prioritisation



Regional Plan



Coast subdivisions



Local Plan prioritisation



Local Plans

- Risk
- Management
- Demographic
- Economic

ССМА	Unit Area (km²)	Risk	Management	Demographic	Economic	Overall
Buckie	3.69	7	1	1	1	1
Lossiemouth	70.02	2	1	5	7	2
Portgordon	4.95	5	1	2	2	3
Cullen	3.61	3	5	5	5	4
Kingston	14.62	4	1	8	7	5
Culbin	32.08	5	6	4	10	6
Findhorn	19.26	1	6	8	7	7
Burghead	2.6	8	6	5	5	8
Portknockie	6.13	8	6	3	3	9
Hopeman	6.65	8	6	11	3	10
Roseisle	8.28	11	6	10	11	11

Highest priority CCMAs:

Local Plans

Coastal Adaptation Plan – Local Plan



Local Plan



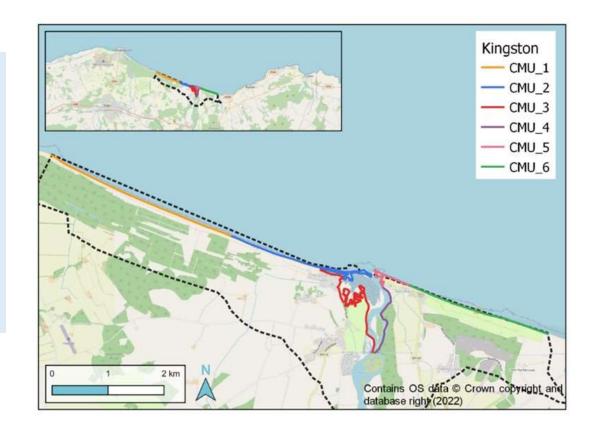
CMU classification

Coastal Management Units

Coastline subdivided and categorised:

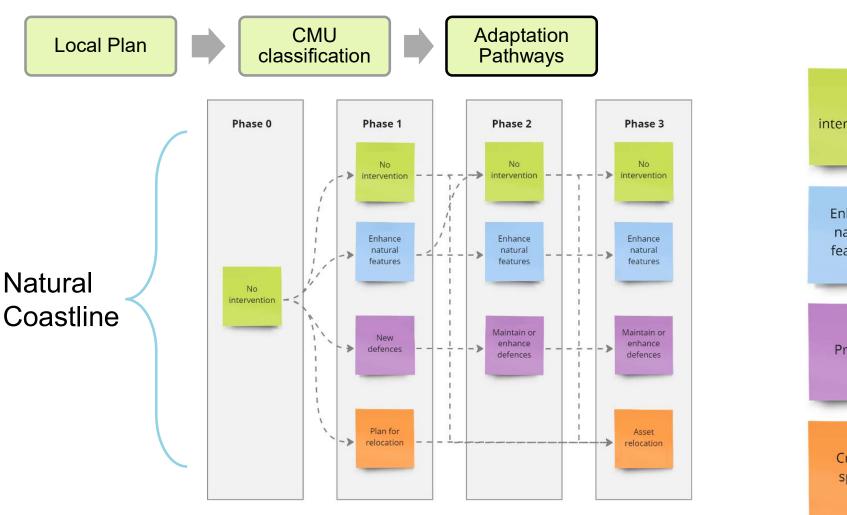
1. Coastal Type

2. Risk



Coastal Adaptation Plan – Local Adaptation Pathways





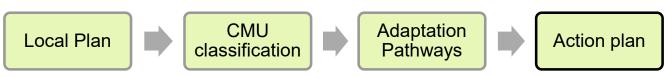
No intervention

Enhance natural features

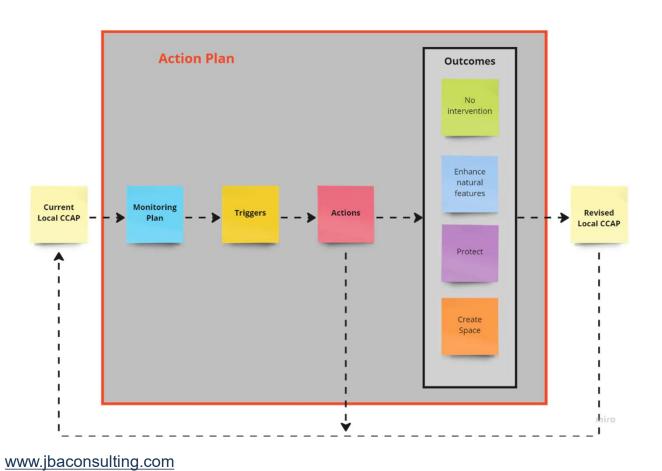
Protect

Create space

Coastal Adaptation Plan – Local Action Plan







Monitoring:

Triggers:

Actions:

Outcomes:

- No intervention
- Enhance natural features
- Protect
- Create space

Coastal Adaptation Plan – Supporting Steps





Supporting Step examples:

- Develop modelling framework
- 2. Establish coordinated and consistent beach monitoring
- 3. Adaptation workshop with local community
- 4. Identify landownership and safeguarding



Looking to the future with our plan



- Routine monitoring
- Tie in to wider adaption planning
- Inclusion in to wider polices and drives
- Update in line with FRM act iCommunity buy in
- Seek Action funding





Scotland's Flood Risk Management Conference 2023

Session 4a: Coastal Change

Doug Pender, JBA Consulting







How can we monitor coastal change to support adaptation?

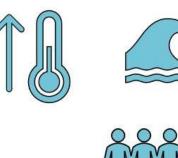
Doug Pender

Sniffer FRM Conference February 2023



Overview

- Some upfront questions:
 - 1. What do we mean by monitoring for adaptation?
 - 2. What are the coastal indicators we need to monitor?
 - 3. What technology is available to support this?
 - Citizen Science, Satellites, Drones, Others......
 - 4. How do these fit within a tiered monitoring programme?
 - Risk, spatial scale, frequency, accuracy.......



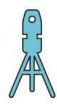






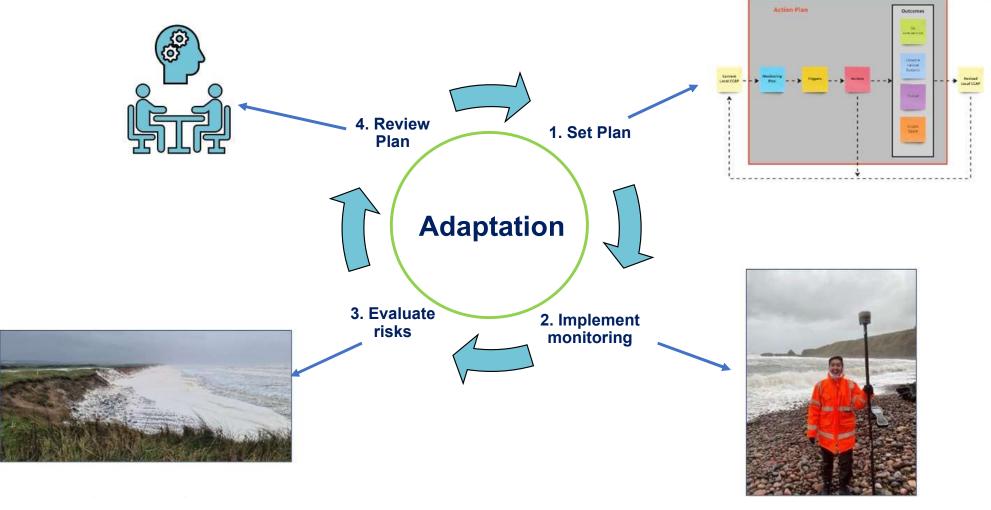








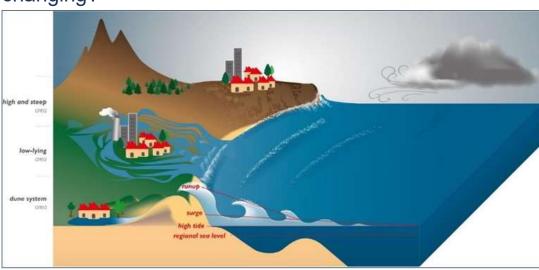
Monitoring for adaptation



JBA consulting

Coastal indicators

- What do we need to understand?
 - When changes force a management decision?
 - When changes result in increased risk?
 - · How are options performing
 - How is the overall resilience of the coastal system changing?
- How do we schematise our coasts?

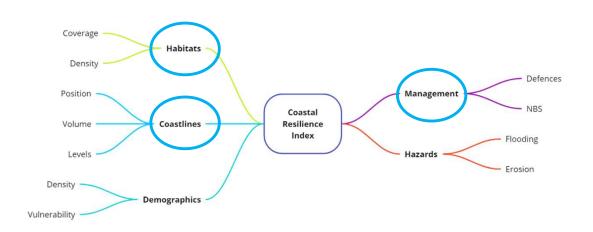


Almar, R., Ranasinghe, R., Bergsma, E.W.J. et al. A global analysis of extreme coastal water levels with implications for potential coastal overtopping. Nat Commun 12, 3775 (2021). https://doi.org/10.1038/s41467-021-24008-9



Coastal indicators

- We can set some sort of "Resilience Index".
- Consists of indicators required to support an Adaptation Plan.



Habitats and Vegetation

- Coverage
- Type Density

Coastlines

- Position
- Geometry

Management

• NBS – How are the performing?



Technology – Citizen Science

JBA consulting

- Shoreline and coastal features can be tracked from images
- Global CoastSnap project started in Australia
- · Four site currently in northeast Scotland



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JBA consulting

Technology – Citizen Science

- We can understand behaviour and develop conceptual models for change
- We can monitor the position of features in respect to Trigger levels.
- We can quantity change of features for Risk Assessments.



John Adams 13-Oct-20 10:15





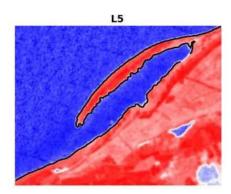
JBA consulting

Technology – Satellite Imagery

- Publicly available satellite imagery can help understand coastal change.
- High temporal frequency.
- Lost cost. Potentially low accuracy. Commercial options.
- We can monitor the position of features in respect to Trigger levels.
- We can quantity change of features for Risk Assessments.
- All at very large spatial scales and <u>backdated</u> to provide an evidence base.









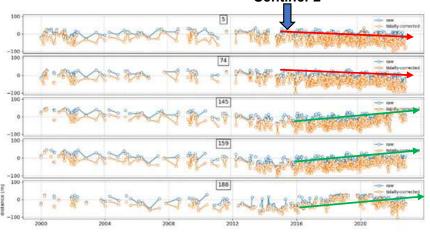
Technology – Satellite Imagery













Technology – Drones and UAVs



- Drones and UAVs can be very effective in monitoring programmes.
- Coastal features AND defence condition.
- Relatively inexpensive.
- Range of accuracy depending on cost.



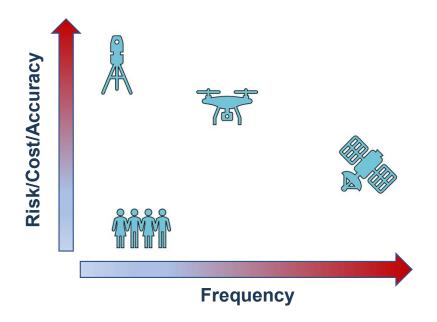




A tiered monitoring programme?

Regional

- Large spatial scale
- Identify issues and prioritise
- Strategic evaluation
- Low frequency
- Low cost



Local

- · Smaller spatial scale
- Specific Triggers
- Support Risk Assessments
- Risk controls

Frequency

Spend

Accuracy

All technology has a place but data must be collected and integrated in the correct way.



Scotland's Flood Risk Management Conference 2023

Session 4a: Coastal Change

Steven Trewhella, Rivelin Bridge



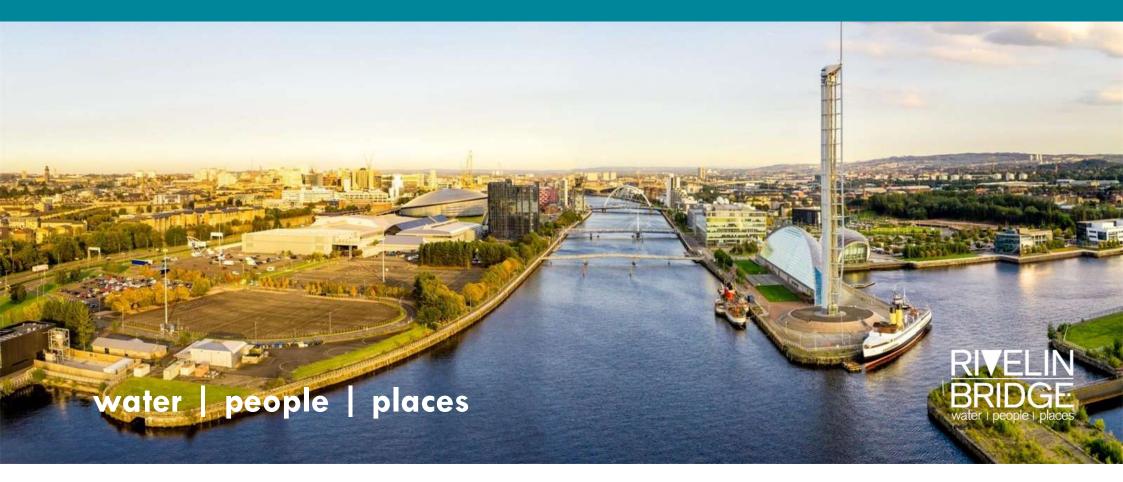


Sniffer Flood Risk Management 2023 #FRM2023 #SnifferConference

Ten in 10: Getting started with Adaptation Pathways "Learning from the Clyde and other places"

22 February 2023, Steven Trewhella





Sniffer Flood Risk Management 2023 #FRM2023 #SnifferConference

Background and inspiration





Tidal flooding on the Clyde options analysis and scoping

DOI: http://dx.doi.org/10.7488/era/2176

International practice on assessing investment needs and securing investment to adapt to climate change DOI: http://dx.doi.org/10.7488/era/819

Managed adaptive approaches to flood risk management planning

DOI: http://dx.doi.org/10.7488/era/2407

Thanks to Anne Marte Bergseng (CXC) and David Harley (SEPA/ Clyde Mission)

Other projects and investments

Developing future flood risk investments for the fens and coastal lowlands: Fens2100+ (Environment Agency)



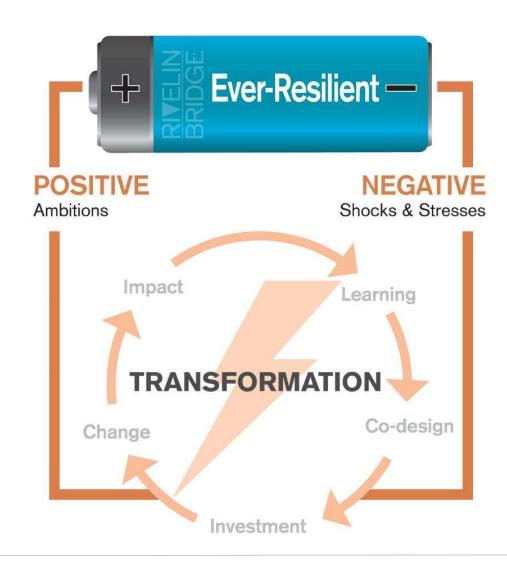
Resilient Coasts
(Coastal Partnership East)



Evaluation of adaptation pathways programme (Defra and Environment Agency)

Measuring resilience (Environment Agency)

Business case guidance (Resilience innovation programme - Environment Agency)





Outer Hebrides



Multi-stakeholder orientated

Rothes, Moray

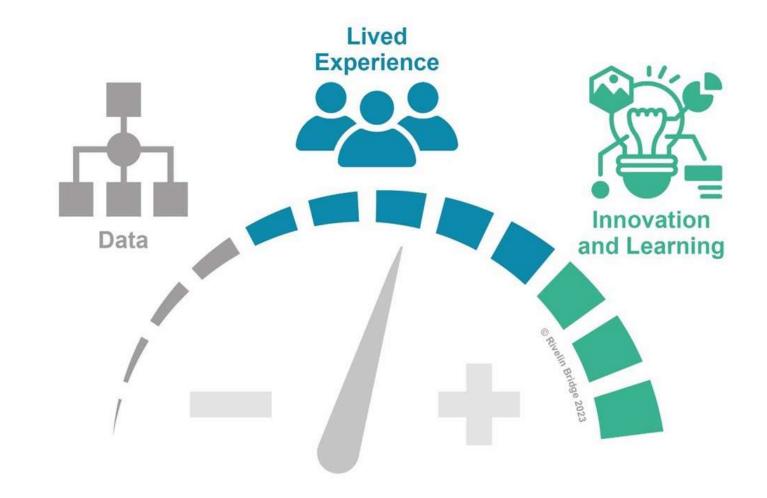


Performance threshold orientated

Clyde

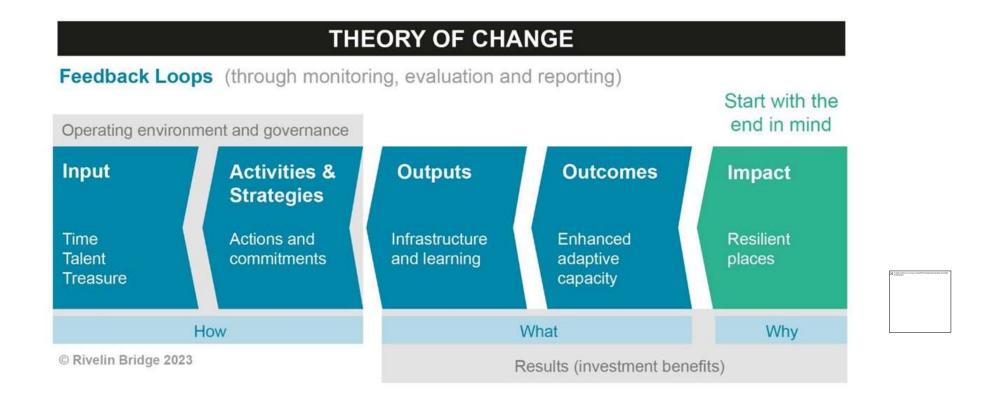


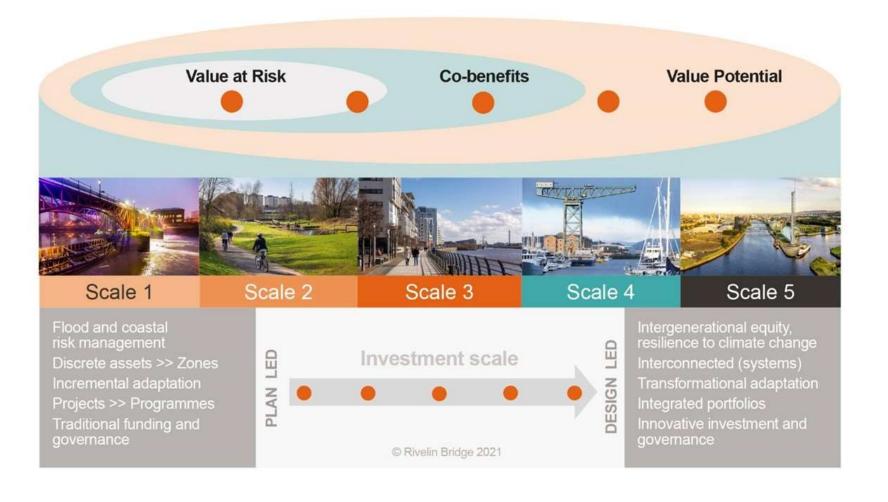
Transformation orientated

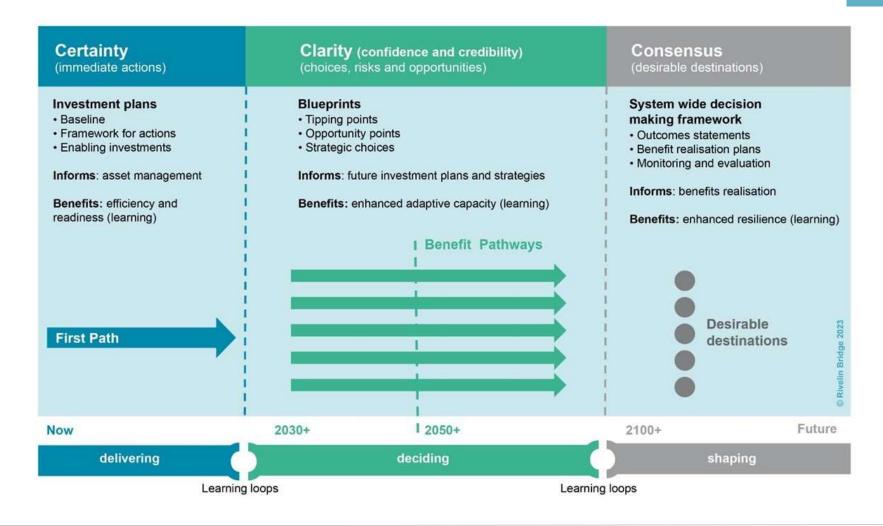




Source: Design Council, 2021 "Beyond Net Zero - A systemic design approach"





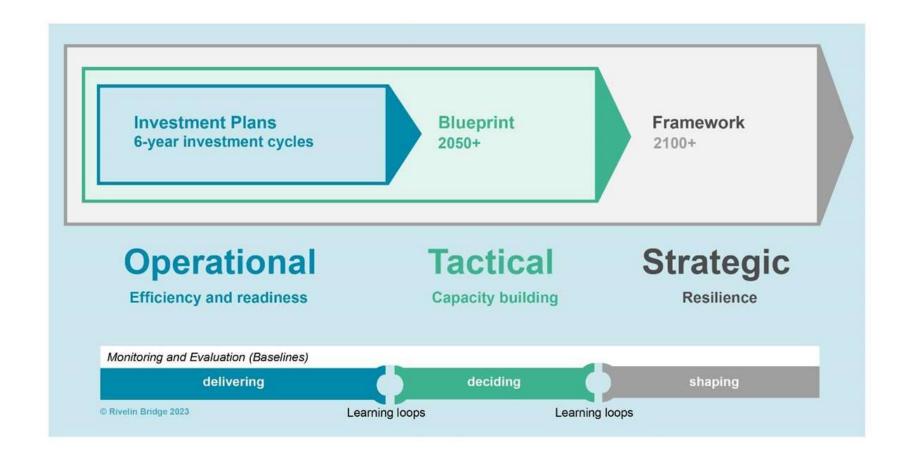


System-wide adaptation opportunities and measures for the Tidal River Clyde

	Anticipate	Resist and Absorb	Respond and Recover	Adapt and Transform
Soft Measures	Clear place-based ambitions Governance and collaboration System-wide Knowledge sharing Resilience indicators and monitoring Research and development	System-wide Policy Units / zones Design and appraisal guidance Design standards	Communication plans Flood warning systems Emergency plans including evacuation and signage Continuity planning Insurance	System-wide adaptation framework Education and awareness Legal framework Funding and finance Knowledge of costs and benefits
Green Measures	Policy Land-water zoning Buffer-zones for roll-back Design guidance and standards Pilots and trials	New tidal wetlands Urban waterfront parks Sustainable Urban Drainage Landscaping Artificial reefs	Communication plans Neighbourhood recovery plans Build-back green Asset decommissioning	Land-use change Asset relocation Blue-Green corridor
Grey Measures	Relocation of critical infrastructure Relocation of community infrastructure and property Design guidance and standards Asset management and retrofit	Flood walls and Embankments Quay wall and land raising Underground flood storage Elevation of buildings, infrastructure and utilities Floating and amphibious structures	Incident plans Temporary defences Property flood resilience Pumping stations Build back better	Tidal barrier and barrage systems Terraced waterfront development and quay wall replacement/repair Terraced to the control of the control o

- Building coping and adaptive capacity
- Resilience portfolio: Anticipate >
 Resist > Respond > Adapt
- Grey, green and soft infrastructure portfolio



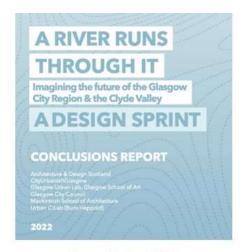








Source 2 - May 2022



Source 3 - Sept 2022

delivering deciding shaping

Source https://www.glasgow.gov.uk/CHttpHandler.ashx?id=58878&p=0

2. Source https://www.climatexchange.org.uk/research/projects/fidal-flooding-on-the-clyde-options-analysis-and-scoping-of-adaptation-pathways/

3. Source: https://www.burohappoid.com/thought-leadership/a-river-runs-through.

Ten in 10: getting started



Framing is everything



1. Resilience

Monitoring and evaluation

Informs (resilient) Choices and supports future learning (and monitoring and evaluation).

Drives (integrated) investment through agreed ways of working and decision making.

Delivers (place-based) impact by creating a tactical handshake between ambitions, investment and action.

Sniffer Flood Risk Management 2023 #FRM2023 #SnifferConference

Contact details

Steven Trewhella CEng FICE CMgr FCMI

Tel. 0755-791-4100 Email. <u>steven.trewhella@rivelinbridge.com</u>

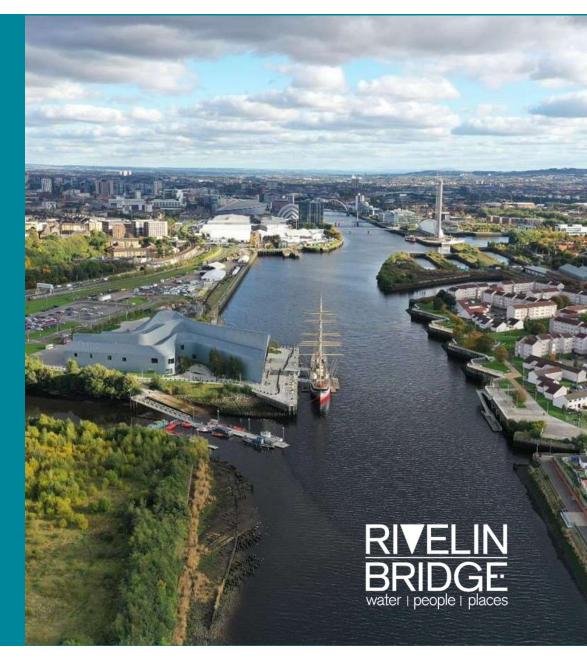
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Scotland's Flood Risk Management Conference 2023

Session 4a: Coastal Change

Alix Scullion, Royal HaskoningDHV









Opening the Door for Discussion – Involving Communities in Long Term Coastal Management

Scotland's Flood Risk Management Conference 2023 - Water Resilient Places

Alix Scullion 22nd February 2023

Technical Advice Note 15: Development, flooding and coastal erosion

"Full consideration of flooding and coastal erosion must underpin the future planning for sustainable places"

"Public bodies are required to think about the long-term impact of their decisions, to work better with people, communities and each other, and to take action to prevent and mitigate persistent problems such as the impacts of climate change."



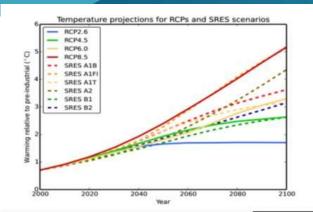
Pembrokeshire, SW Wales



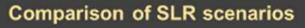
- A need for planning
- A need for engagement and adaptation

- Increased erosion and possible loss of beaches
- Increased risk of flooding
- Change to the way in which we live with and use the coast





1.8



years

2140

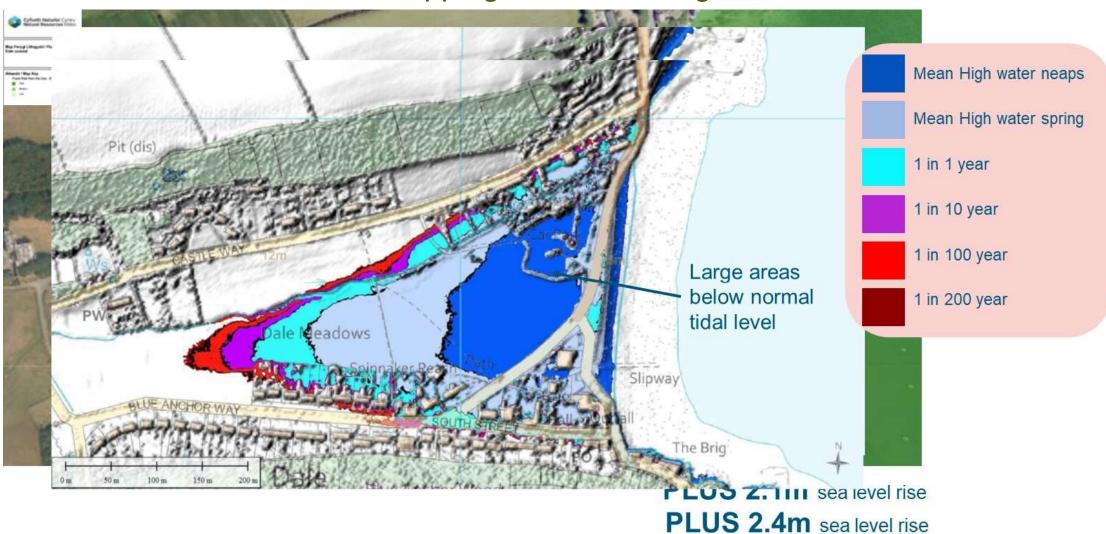
RCP 8.5 95% (north) - - WG H++

		16						,'		
Nimata abanga sasangia	Sea level rise values (m)									
Climate change scenario	Base year	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	
H++	2017	2045	2062	2075	2087	2096	2105	2114	2123	
RCP 8.5 (95%'ile)	2017	2052	2075	2093	2109	2124	2137	2149	2160	-
RCP 4.5 (95%'ile)	2017	2058	2090	2116	2140	2161	2181	2199	2216	
RCP 8.5 (50%'ile)	2017	2063	2094	2118	2140	2159	2176	2192	2207	
RCP 2.6 (95%'ile)	2017	2062	2103	2139	2172	2202				
		0								
		2000	200	20 '	2040	2060	2080	210	n 2	120

Lower Town, Pembrokeshire



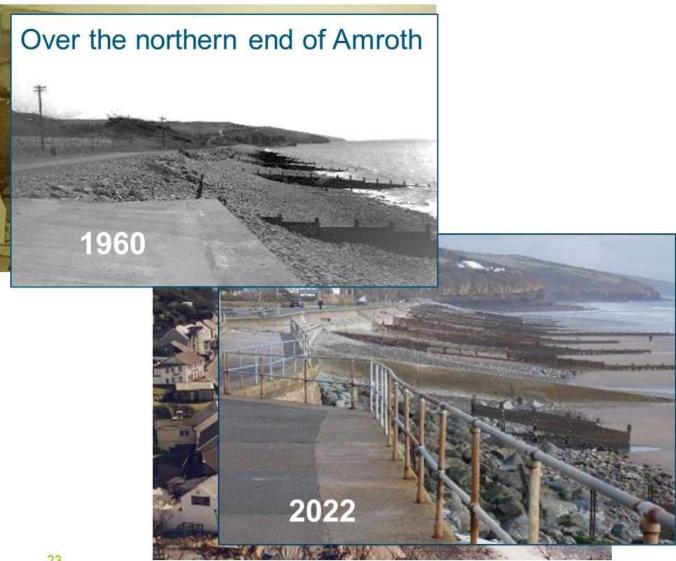
Dale: Current flood risk mapping shows existing risk



Coastal change

- With sea level rise the risk of waves overtopping will increase
- Construction of linear defence, with ongoing loss of beach levels and risk of failure
- 'Character' of beach will change





Amroth

- There has been a loss of a row of properties between the early 1900s and 1990s.
- Flood risk to Amroth North with
 1.5m SLR relatively local.
- The main issue is erosion over the next 10 years

Sustainable Coastal Communities



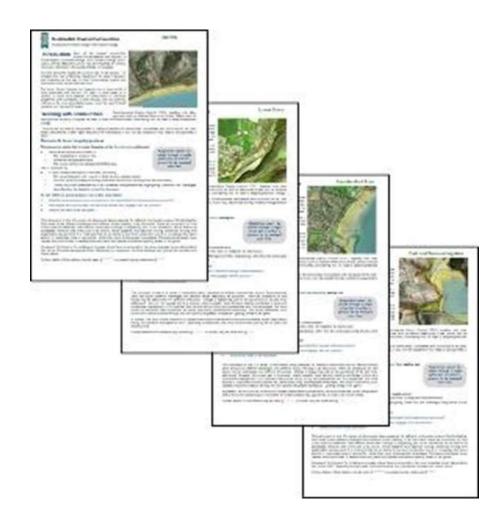
Aim to develop on this at a more local scale encouraging involvement from communities.

- Creating a better understanding of the challenges.
- Opening the door for discussion about tomorrow



- Taking people on a journey
- Empowering communities to become involved
- Framing the discussion in reality

Adaptation cannot be solved through a single action, but is rather a process to be managed over time



Going forward...

- 1. Developing this with selected communities
- 2. Initial contact (awareness)
- 3. Issue community sheets (inform)
- 4. Feedback and respond (engage)
- 5. Discuss and develop (involvement)



Developing a framework for thinking about the long-term impact of climate change on decisions, to work better with people, communities and each other.







Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 4a: Coastal Change



Join at slido.com #FRM2023-S4a





slido





Session 4a: Coastal Change – audience Q&A





Coming up next...

Networking drinks & canapé reception Followed by conference dinner at 19:30

We look forward to seeing everyone for tomorrows sessions, starting at 10:00





1520–1630 Session 4b. Enabling surface water management

Norie-Miller Studio (in person only, not available online)

Surface water is the highest source of flood risk in Scotland, yet there is no support network for stakeholders to raise and address concerns. A SWM working group is developing recommendations to address this gap. This workshop will identify collective priorities for the new SWM group.

Grant Vanson (Scottish Water), Richard Hamilton (SEPA) and Peter Dickson (Perth and Kinross Council)

Scotland's Flood Risk Management Conference 2023



Creating Water Resilient Places





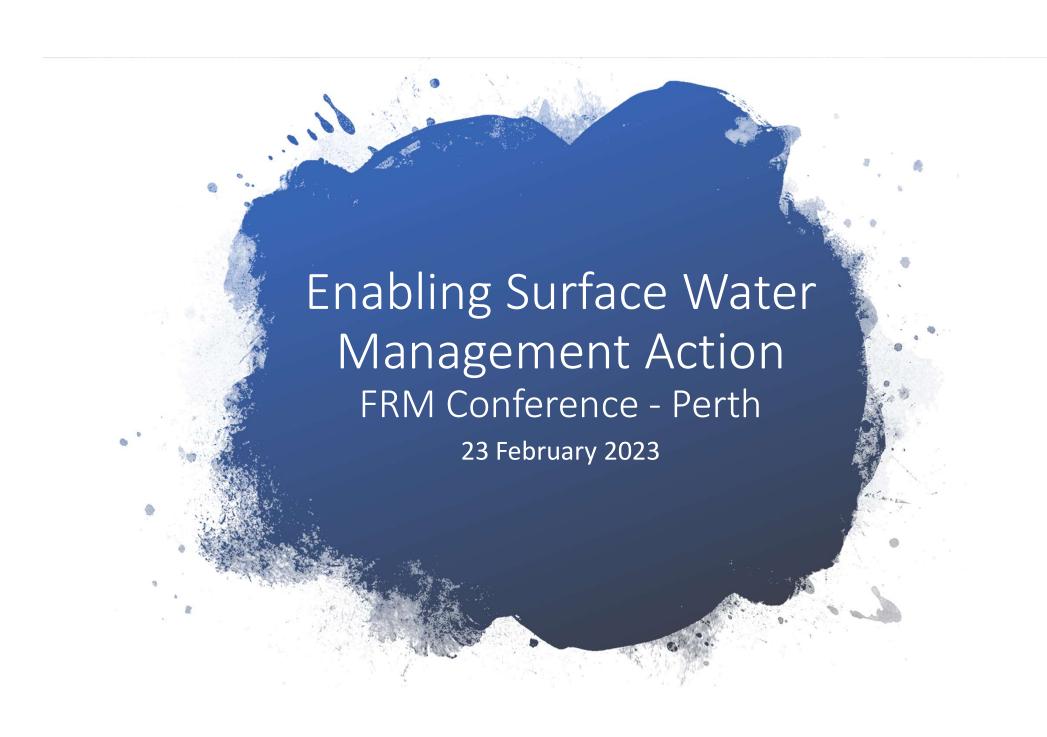
Scotland's Flood Risk Management Conference 2023

Session 4b: Enabling surface water management

Grant Vanson, Scottish Water, Richard Hamilton, SEPA and Peter Dickson, Perth and Kinross Council

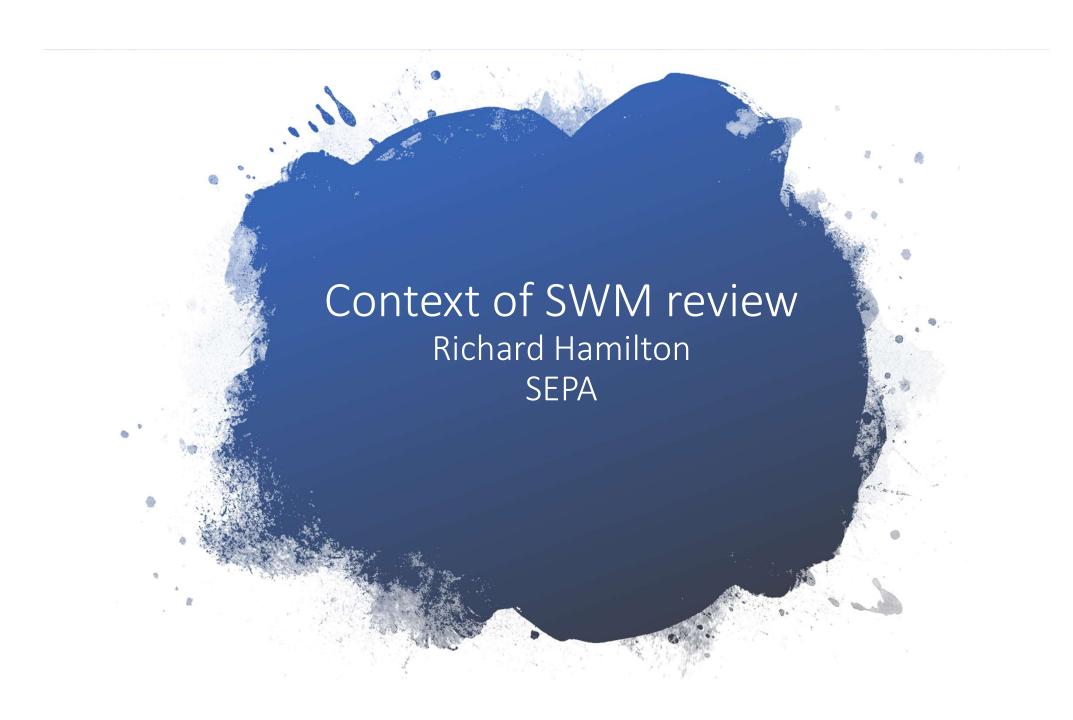






Workshop format

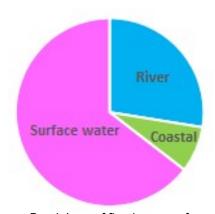
- Background and scene setting 5 mins
- SWM group work to date & key challenges 10 mins
- Breakout sessions: Requirements for enabling Surface Water Management action - 45 mins
- Initial summary of discussion
- Next steps



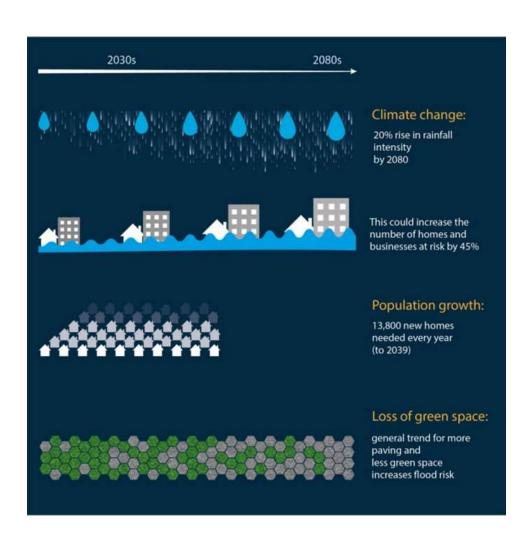
Surface water flood risk – SEPA NFRA2

Homes, Business and Services at Flood Risk – National Flood Risk Assessment 2018*								
Return Period/Probability	Surface Water	Coastal	River					
Medium Risk (1:200yr)	209,000	28,200	93,000					
Medium Risk (1:200yr) plus CC	274,000	57,500	143,00					

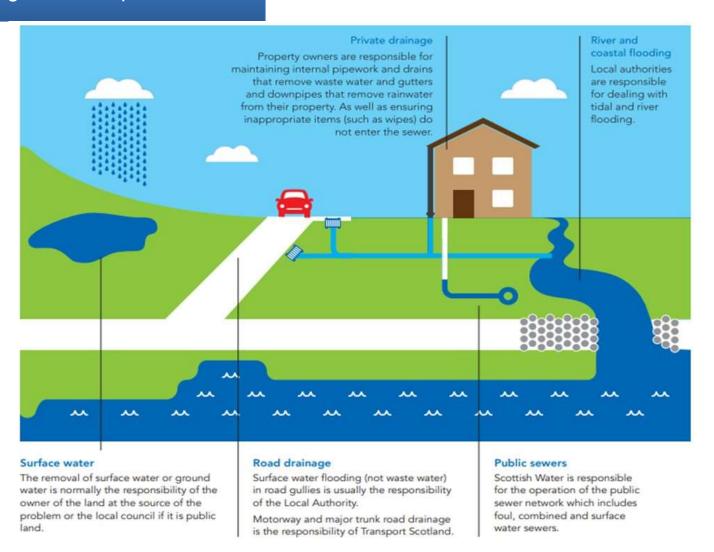
^{*}same property may be at risk from more than one source



Breakdown of flood sources for properties at flood risk in Scotland (NFRA2, 2018)



Complexities of drainage ownership



Changing Policy context

Flood Risk **National Planning** Water Resilient Framework 4 (inc. Places Management Planning – cycle 2 BGI, Infra First recommendations SW: Improving LA: Open Space LA: Biodiversity Plan (inc. Green Urban Water **Action Plan** Networks) Routemap Policy Climate SG: Flooding Development Adaptation Strategy (2023) (Scottish Government)



Purpose of Working Group

Issue: Long-standing need for a support network to progress numerous multi-agency concerns and queries relating to surface water management

<u>Aim:</u> To agree an approach to enable the resurrection of the required support network for Surface Water Management Planning through the SAIFF SWMP group

<u>How:</u> Develop a clear action plan and timescale for presenting recommendations to Scottish Government on the remit, membership and priorities of the SAIFF SWMP group

Who: Working group to develop recommendations and co-ordinate input and buy-in from stakeholders to enable progress on long-standing issues

Working Group activities to date

- Review of SAIFF SWMP remit, membership and activities from Cycle 1
- Agreed the approach to developing recommendations
- · Identified and consolidated ongoing challenges.
- Consult with range of stakeholders to widely inform recommendations on priority activities to inform group remit
- Document and present recommendations to Scottish Government

Identifying key challenges (2015 / 2018 / 2021)

Table 1. Summary of challenges for surface water management planning					1 Purpose						
SWMP stage	Key Challenges	Potential actions to address key challenges – to			allenges – to						
	200	be	agreed by SAIFF SWMP	•	200	1.1 The purpose	of this paper is to identify challenges for the sustair	nable management	t of surface		
Implementation	Complex roles and responsibilities		Recommend a review	of the leg	islative /		ng. Not all of these challenges are within the SAIFF S		100		
of measures	(affects agreeing who is		financial and institutio	tutional arrangements to		coordination	within the Scottish Government and relevant author	orities will be need	led.		
	responsible and where capital	ensure they support delivery of surface water management and drainage (and provide the autho		elivery of	sustainable						
	funding comes from and long					2 Background					
	term maintenance etc.)					3.1 Ministorial C	uidanaa an Sustainabla Flood Bisk Managament (20	111) anto que that la			
	FRM Act designation order stating			1500 500	2.1 Ministerial Guidance on Sustainable Flood Risk Management (2011) sets out that local authorities will lead on developing Surface Water Management Plans, supported by Scottish						
	relevant functions not yet in	S					PA with the aims of:	Pians, supported b	y scottisti		
		1000		ignation t	order or						
	place.	SAIFF Q&S group providing guidance how the FRMS and Q&S funding rounds.									
	Incentives and tools (financial /										
	regulatory) to enable			kS funding	g routes can	• Impleme	nting the most sustainable actions to manage surfa	ce water flood risk	to achieve		
	implementation of sustainable		be aligned.		.,	these ob	ectives				
	measures.	•	Does SAIFF SWMI	ategory	Issue	Consolidated Issues Challenges	Comments	Screening for working g Still relevant	SWM workstream?	Timescale	Priority
	 Funding of surface water 	some gr	some guidance or	idance or			Ongoing wider issue wider than just SWM. Can be overcome in local working	E	O TOTAL STATE OF THE STATE OF T	Timestore	THORY
	measures (are surface water		for SWMP measu		Data sharing	Large volumes of data and difficulty in managing / storing the Data sharing license and agreements required	IS. arrangements - data is being shared in Drainage Partnerships and for specific projects. Would suggest not in remit of SWM group. Sharing experience and	Yes	Unlikely	Long	
	measures likely to be lower		be aligned? E.g. c				guidance on how to use available data is more important			10 / 1	
	economic benefits than river and		measures are reg		Roles & Responsibilit	Lack of clarity and ownership. SWM not statutory duty for LA ties FRM Act designation order stating relevant functions not yet	Summary of issues previously provided by group. Potential for	Yes	Yes	Long	
	coastal?)		New developmen		Kores & Responsionin	place	recommendations to influence Climate Change Adaptation Bill	les	l les	Long	
	Alignment of different funding	0.000	clear for surface v				Delivery involves a lot of stakeholders with differing objectives				
	mechanisms		requirements		Multiple Benefits	How to design, plan and build multi functional assets that meet multiple objectives	and standards/specs. Some examples from SDP's can be shared but no consistency or visibility currently in what/how multiple	Yes	Yes	Short	
	Interaction with other planning	3000	How do we get he				benefits are assessed Lack of clear owners/decision makers within organisations that		\perp		
	processes (RBMP, LUP blue green	858	•		Co-ordination (internal & e	external) Co-ordination and senior level buy-in / guidance	can influence/support BGI. Some examples from SDP's can be	Yes	Maybe	Medium	
	, , ,		drainage and floo		Government Roadma	ap Government Strategy and roadmap for BGI	WRP recommendation for S.Gov to deliver. Could there be potential for group to review or influence this?	Yes	Unlikely	Short	
	networks) (at the implementation	10	new developmen	an	Integration with Development	nt NPF4 - Enactment of updated planning framework - consistency	depending on what is published, hopefully more focus on BGI,	V	W	Medium	
	stage)		benefits?		Planning policy	of application	betterment and surface water in general. However as already picked up, BGI policies differ nationally, maintenance issues etc.	Yes	Yes	Medium	
	Ensuring new development is not	•	Implementing pri			Existing legislation and policy conflicts and proposed chang	es.				
	at risk of surface water flooding		drainage on a city		Legislation and Poli		Summary of issues previously provided by group. Potential for recommendations to influence Climate Change Adaptation Bill	Yes	Unlikely	Long	
	and does not increase risk		these implementa			Todus det, sewer det, cory					
	elsewhere including ensuring		addressed.		Costing	Costing of SWM infrastructure not well understood - deliverand planning activities	Need to develop better evidence to challenge consultant/deliven cost estimates. GV has asked MGSDP to begin by sharing evidence		Yes	Short / medium	
	good surface water drainage and					CBA and multiple benefits don't make schemes viable. Action	from delivered schemes.				
	flooding infrastructure.				Appraisal - Benefits Asse	essment likely to be phased into a number of smaller schemes whi		Yes	Yes	Medium/Long	
	Implementation of the principles				Appraisal	doesn't access funding Detailed appraisal guidance required for surface water	SEPA undertaking appraisal guidance update - SWM group should	Yes	Maybe	Short	
	of integrated drainage on a city						Need for SWM to be "planning and place" led and not "modelling				
	wide scale				Modelling	Surface water modelling not representative at a local scal	led. Scottish Water development of 2Di modelling. Share modelling best practice and support queries.	Yes	Yes	Medium	
	In the second se		P	Planning	Co-ordination (internal & external)	N II-li-misk ski ski ski ski ski ski ski ski ski	Need for SWM to be imbedded early on in all projects (not just				
							flooding). Some examples from SDP's can be shared	Yes	Yes	Short	
					Resilience	Flood Warning	Confident surface water flood warning not available Surface water not currently considered until late in development	Yes	No	Medium	
					New development		process - leading to sub-optimal designs. Some examples from	Yes	Maybe	Short / medium	
					Retrofit projects	Guidance for retrofit is not well understood.	Many opportunities for betterment are being missed through retrofit projects (e.g. road resurfacing). Some examples from SDP's	Yes	Yes	Short / medium	
					Evidence - scoping	How to use available data and information to inform	Better guidance is needed to support the use of existing datasets		Yes	Short	

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SAIFF Surface Water Management Planning

March 2018

PAPER: Key challenges for the sustainable management of surface water flooding

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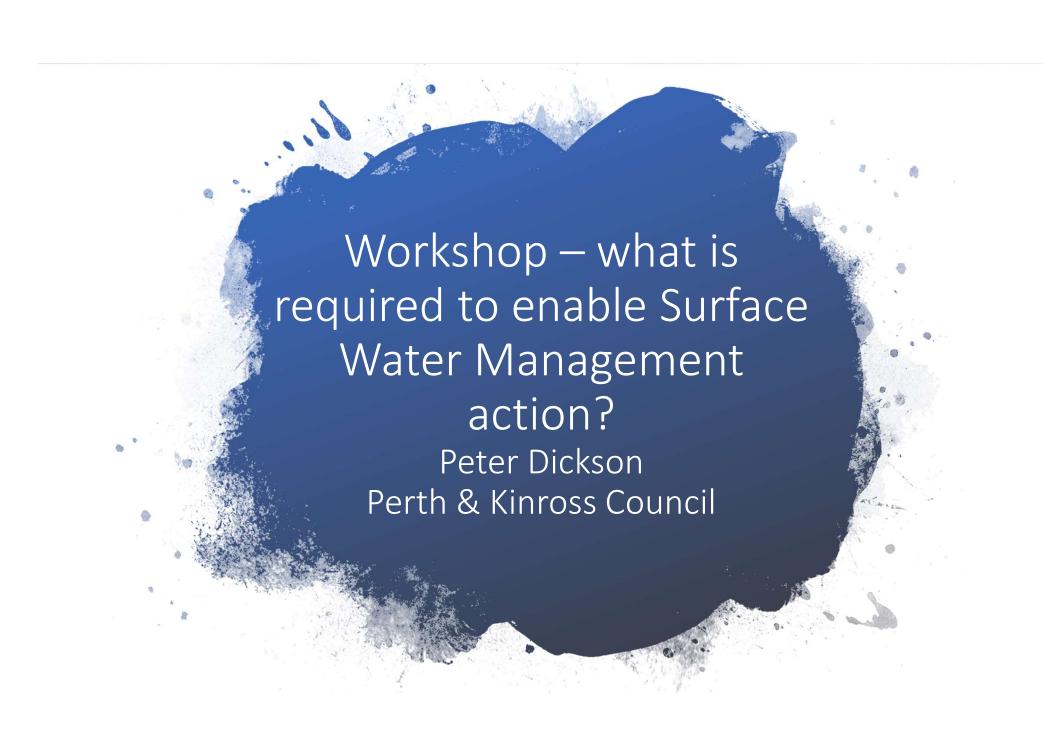
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Consolidating challenges – 6 themes



Legislation and Policy	Conflicting legislation and policy Lack of co-ordination of various pieces of legislation (Flood act, roads act, sewer act, Land Use Planning)
Roles & Responsibilities	Lack of clarity and ownership. Gaps in responsibilities. SWM not a statutory duty for LA's - FRM Act designation order stating relevant functions not yet in place
Integration with Development Planning Policy	NPF4 - Enactment of updated planning framework – how to ensure consistency of application? Surface water is only considered within site boundaries
Government Roadmap	No existing Government Strategy and roadmap for Blue- Green Infrastructure
Co-ordination of SWM policies (internal & external)	Lack of clear owners/decision makers within organisations that can influence/support decisions to enable SWM Progress hindered by organisational structures

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Consulting on challenges and priorities

- What is the priority challenge for you / your organisation (be specific)?
- What practical action is required to overcome this?
- How can this be done (outline practical steps)?
- Who is best placed to take this forwards?

Example

Theme: Technical Delivery

Challenge: Maintenance of Blue-Green Infrastructure (BGI)

Action Required: Increase skills & capability of maintenance staff to manage BGI

Preferred Option: Funding & programme of national training for maintenance officers

Lead: Scottish Government / Responsible Authorities

Example – Governance, Policy & Guidance theme

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Opportunities - Potential Workstreams

- Legislation and Policy which legislation & what should it say?
- Roles and Responsibilities who should be responsible for what?
- Collaboration (internal & external) what is meant by this?
- Government Roadmap what should this include?
- Demonstrating Best Practice who should lead on this?

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Discussion groups

- Find your allocated discussion table
- Place 1 sticker against your priority challenge within table discussion theme
- 20 minutes to identify specifics of priority challenges and suggest ways to progress
- 15 minutes to visit other tables and input on priorities
- Place further 2 stickers against your priorities across all themes
- Suggestion boards and questionnaire sheets to capture input and volunteers for further discussion
- Summary of discussions

- Collate feedback from workshop and produce high level summary report
- Online questionnaire to gain wider stakeholder views
- Feedback will be summarised into a recommendations paper for Scottish Government
- Outcomes intended to influence the focus and remit of re-established SAIFF
 SWM group

Thank You!



Scotland's Flood Risk Management Conference 2023

Questions and Discussion





Coming up next...

Networking drinks & canapé reception Followed by conference dinner at 19:30

We look forward to seeing everyone for tomorrows sessions, starting at 10:00





Day 2 Morning Plenary 23/02/23 Perth Concert Hall foyer 0930-1000 Registration & refreshments Session 5. Flood Warning and Community Resilience 1000-1120 Gannochy Auditorium & online stream Welcome from the Chair: Kirsty MacRae (The Scottish Flood Forum) The Scottish Flood Forecast Service Margo Melotte (The Met Office), Laura Paterson, Richard Maxey (SEPA) TCV Flooding Resilience Project: Building Resilience and Supporting Communities' Engagement with Nature to Combat Flooding Robert Walsh (TCV) Next generation flood resilience Brett Davis (ARUP) and Aaron McNeill (Northumberland County Council) Training for PFR Darren Eckford (CIWEM) East Peckham flood performance certificate pilot Dermot Kehoe (Flood Re), Gareth Boyd (Watertight International) Q and A via Slido #FRM2023-S5





Creating Water Resilient Places





Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Chair: Kirsty MacRae, Scottish Flood Forum







Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Margo Melotte, The Met Office, Laura Paterson and Richard Maxey, SEPA











WELCOME

- Margo Melotte
 - Met Office Senior Account Manager for Devolved Administrations
- Laura Paterson
 - SEPA Project Manager, Hydrology and Flooding
- Richard Maxey
 - SEPA Senior Specialist Scientist, Hydrology and Flooding







Launching of the Scottish Flood Forecast

What is the Scottish Flood Forecast?

- The Scottish Flood Forecast officially launched on 8 February after a 6-month trial period
- It's a new 3-day flood forecast available from SEPA's website
- Produced alongside the 5-day FGS sent to Category 1 & Category 2 responders, a product that has been available for over 10 years
- The webpage illustrates the forecast at a national level, colouring up the map with yellow, amber and red

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Working in Partnership

Critical to everyday and the future

- Strength of partnership Met Office responsible for providing the underlying guidance
- Met Office new supercomputer Driving forward forecasting capabilities
- Partnership is a true reflection of our Met Office purpose:

OUR PURPOSE

Helping you make better decisions to stay safe and thrive





Why we've developed this service

- Feedback commissioned by external research groups told us:
 - Floodline customers:
 - Find Regional Flood Alerts confusing. Cover too wide a geographical area
 - Would like flood information earlier
 - Would like reassurance when significant flooding is not forecast





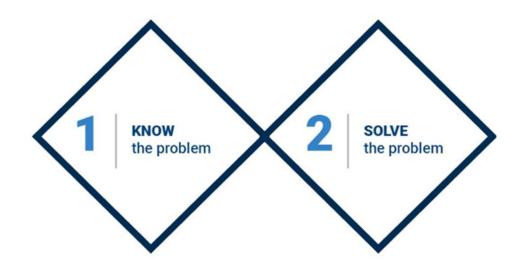


Our approach

Scottish Government Service Design

We're following the Scottish Government Service Design approach to: "Investigate what forecast

"Investigate what forecast information we can provide to the public in the most accessible format to make them aware of flood risk at the earliest opportunity"



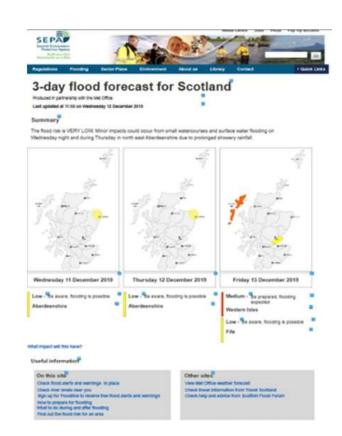




SEPAS Scottish Environment Protection Agency Buildneam Dion Arainteared na II-4lba

Prototyping





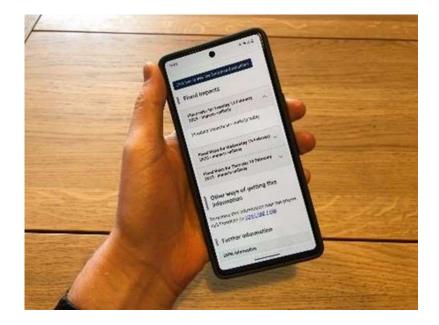




Public beta release

- Launched as a public beta service in May 2022 for 6 months
- Good feedback:
 - Key change clearer language to describe flooding impacts
 - Other improvements will be considered as part of phase 2
- Officially launched service on 8 February with improvements





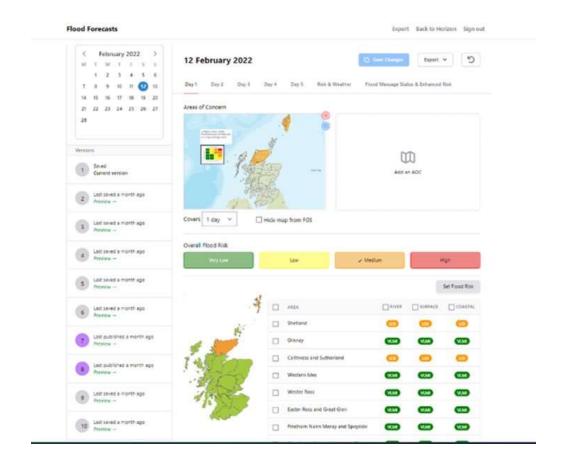
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How we produce it

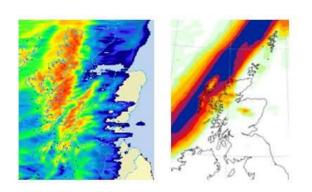
- SEPA Duty Forecaster compiles it each day in collaboration with Met Office Duty Meteorologist (Aberdeen), and after discussions with other SEPA and Met Office colleagues
- Assessment carried out for the Scottish Flood Forecast and the Flood Guidance Statement together
- We use a new application to produce both products
- Issued by 10:30 each day

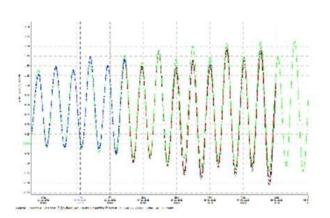


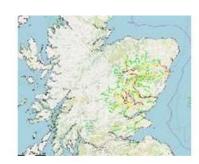
Met Office

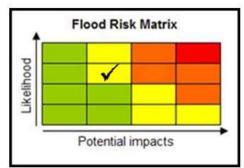


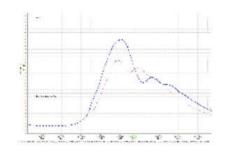
Calculating flood risk













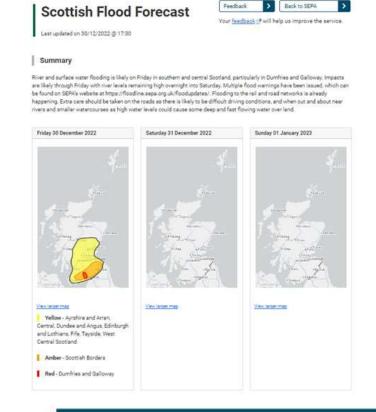
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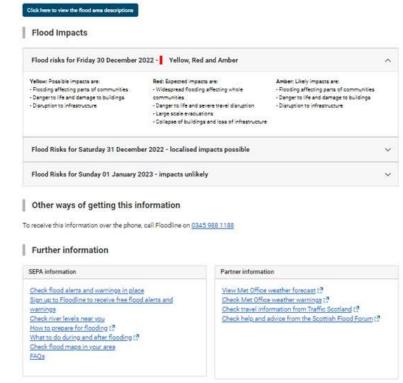


SEPA



https://scottishfloodforecast.sepa.org.uk/public







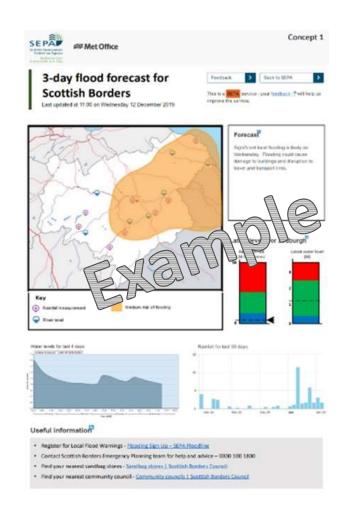




The next phase

- Regionalised version showing flood risk information at a more local scale
- May include specific river and rainfall data
- Currently carrying out user research
- Next couple of years









Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Robert Walsh, TCV – The Conservation Volunteers





TCV Flooding Resilience Project

Ву Robert Walsh Greenspace for Health Senior Project Officer





The Conservation Volunteers (TCV) connects people to the green spaces that form a vital part of any healthy, happy community.

We bring people together to create, improve and care for green spaces.



Our teams of dedicated, passionate staff and volunteers work with communities across England, Northern Ireland and Scotland, and through our community network, we support local community groups across the UK.





Who am I?









Senior Project Officer Present)







My role in Community Flooding

TCV Flooding Resilience Project Funded by Scottish
Government to work with
Scottish Flood Forum with
information provided by
SEPA and Scottish
Government

Targeted focus on high atrisk communities to flooding and flood prevention

Natural Flood Management

Monitoring strategies

Citizen Science – School Engagement

Training

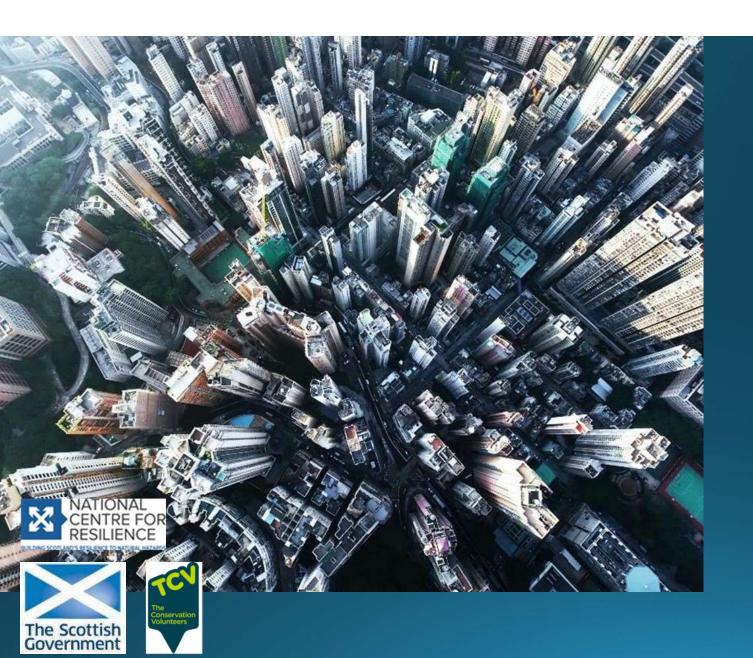
Colleagues – Alex Paterson (Scotland Counts – Citizen Science)

Remit – Scotland-wide









Current and Future Locations and Efforts

- Ochils (Menstrie, Alva, Tillicoultry and Dollar)
- Stirling (Fintry, Aberfoyle and Strathard)
- Perth and Kinross (Alyth, Couper Angus/Meigle)
- Glasgow (Milngavie, Ferguslie Park, Summerhill)
- Highlands (Nairn and Nethy Bridge)

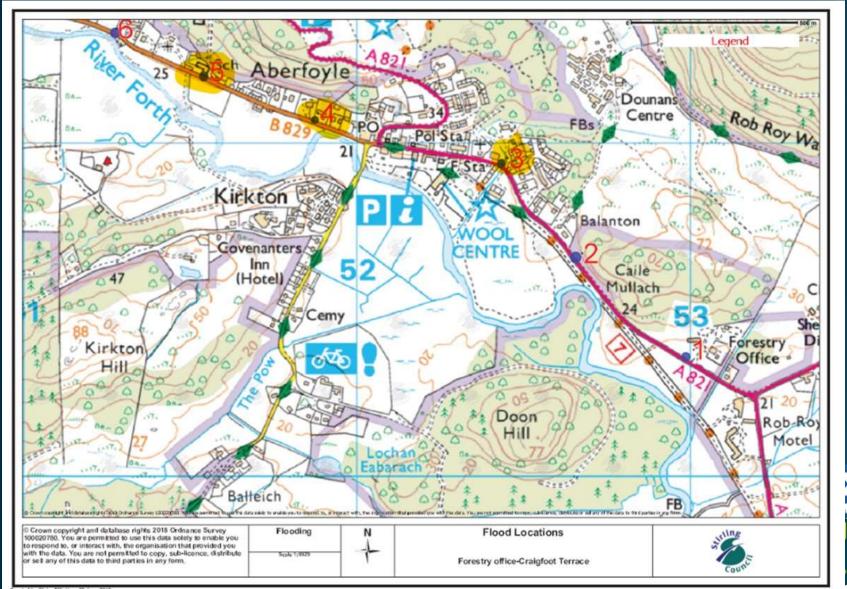
Monitoring Flood Hotspots

- Set points along a body of water in areas highly prone to flooding – typically upstream
- Linked in with Rivertrack locations
- Tree branches, larger foliage, tree trunks, blockages/damming
- Feedback system with local council –TCV assess debris/blockages and gets in contact with Council as necessary
- Allows a targeted, resource-based approach, led by the community
- In addition to what councils have set up for communities to monitor drains or report flooding













Flood hotspot #5

5. Aberfoyle Primary school: River flooding onto road from playing fields: B829 Loch Ard road. Need to record what time road starts to flood out of the playing fields onto the road, when it reaches the highest point, and when it recedes. Take photos during and after flooding.

4th Feb 2019

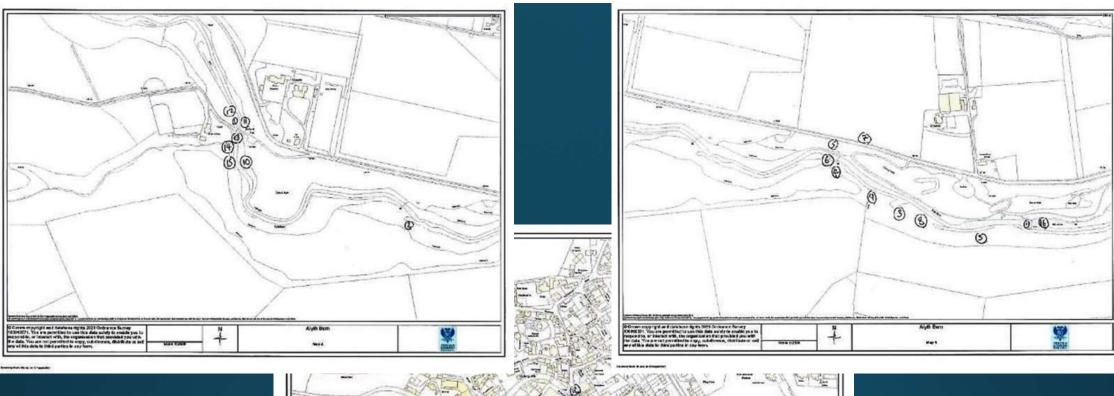


8th Feb 2019

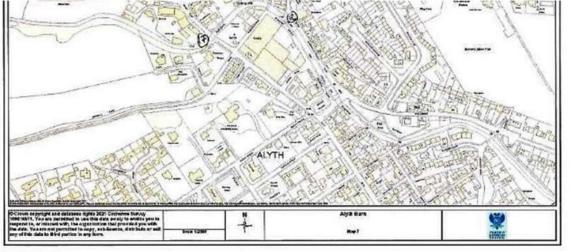














Constitute that a Street W.

Flood hotspot #15
Monitoring of drainage points of the culverts down into the River Alyth is important to ensure that maintenance and lack of erosion happens on the riverbanks, which can lead to further woody debris ending up within the system. This then continues to block further down. Early intervention like this, ensures that everything continues to run smoothly.



5th Feb 2023 -Before 5th Feb 2023 -

After

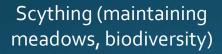






Training and Workshops







Willow Spiling (Riverbank repair/maintenance)











Contact details:

Robert Walsh

Robert, walsh @itcv.org.uk

07483050748





Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Bretton Davis, ARUP and Aaron McNeill, Northumberland County Council





Next Generation Flood Resilience

Exploring resilient flood forecasting





Next Generation Flood Resilience

Our session will cover:

- An introduction to the project, its context, and the project objectives
- How we have used user led design principles to steer the project and build our approach
- Overview of our proposed AI / ML solution and how it aims to enable community resilience











Project Outline

- £5m project funded through DEFRA's Flood and Coastal Risk Management innovation fund
- Project is led by Northumberland County Council, Arup is a project partner alongside Isle Utilities and Northumbria University



The Problem

- Warning is required to prepare for flood events
- Hydraulic models use the 'mechanics' of water
- Over time models have become more computationally expensive
- This has created gaps in response coverage
- Resulting in responders use catchment experience

















Our Objectives

Objectives

- 1. Provide means of flood warning
- 2. To enable communities to make informed decisions
- 3. Create a prototype for national implementation

From our engagement responses, resilience is...

'Being aware that flooding is a possibility; being prepared in case of flooding; knowing when and where flooding is likely; responding quickly and appropriately to mitigate the worst effects when flooding happens.'

'Good honest communication with at risk areas.'

ARUP

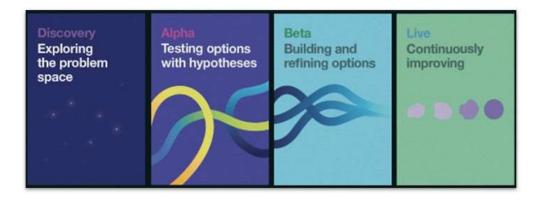
Our Approach

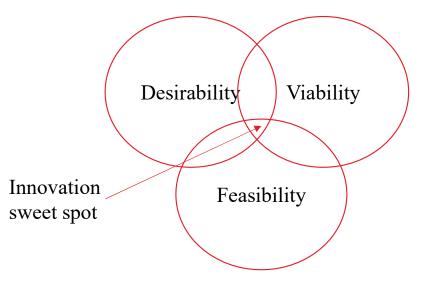
Alignment to UK GDS Principles

Our approach for success is to consider this as digital service from the users perspective, aligned with the Government Digital Service (GDS) principles.

Ultimately the community users create the resilient behaviour, the tech is an enabler.

The first phase of this process, Discovery, is designed to explore the problem space by better understanding user needs, business needs and technical constraints through primary and secondary research.















Interviews

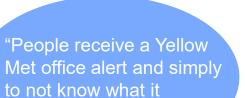


means"











NCC Response Coordinator

"There is an issue of knowledge retention as there is a high level of staff turnover for response coordinators"

"There is a lack of awareness and understanding from local community members, of how flooding actually works, which can put them at risk"



EA Field Team Member





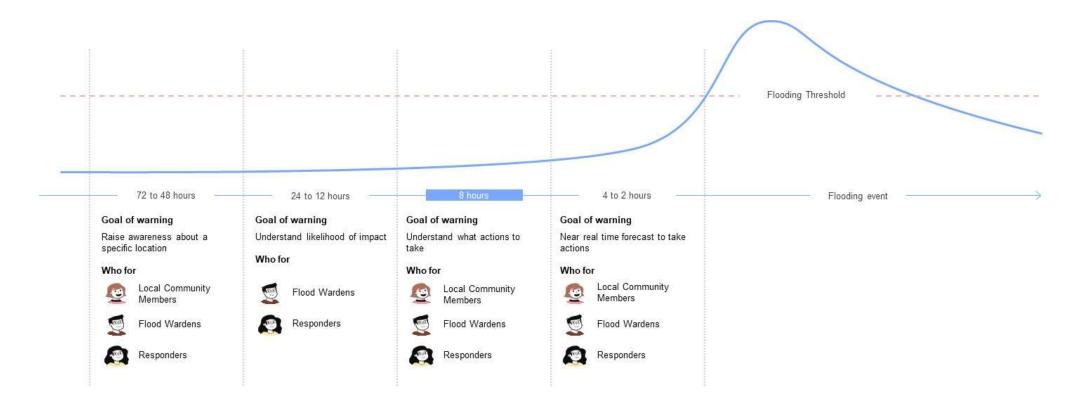








Solution Blueprint



Why is AI the solution?

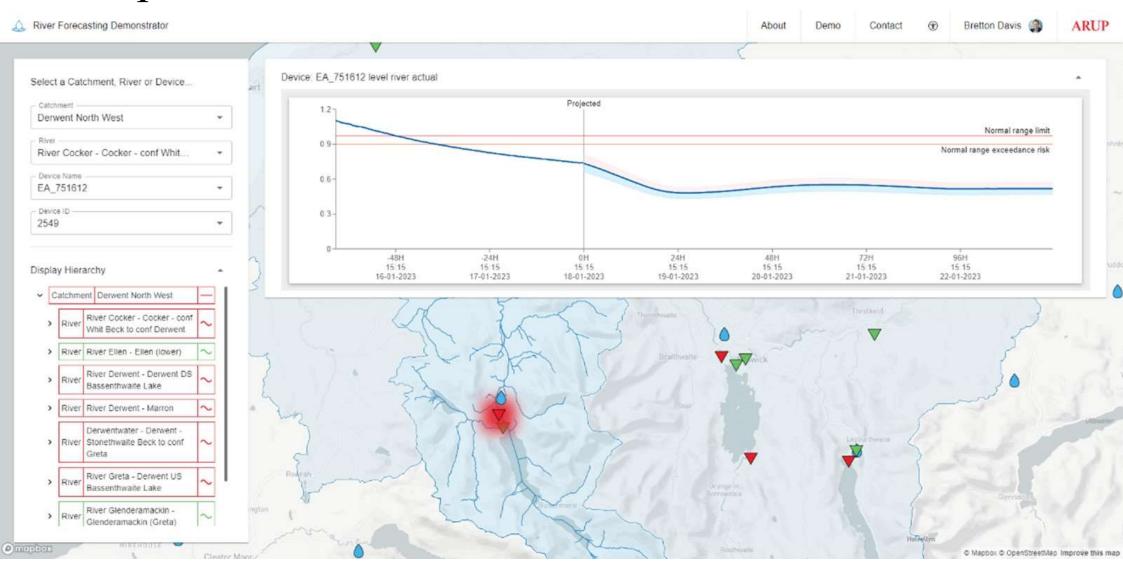
Using Machine Learning to predict behaviour

- Using catchment based monitoring we intend to train models using AI/ML
- Machine learning can be used to create agile 'near-live' with very fast run times that can keep pace with live weather forecasting



Example Wireframe















Next phase: Alpha

Two clear assumptions to test:

- 1. Forecasting Main Assumption: It is possible to forecast flash flooding in the time and at the level of detail necessary to inform local response.
- **2. Service Main Assumption:** It is possible to use forecast information to issue a warning that local communities can understand/act upon.











Thank you



Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Darren Eckford, CIWEM





PROPERTY FLOOD RESILIENCE INDUSTRY TRAINING & CERTIFICATION

FEBRUARY 2023

DARREN ECKFORD

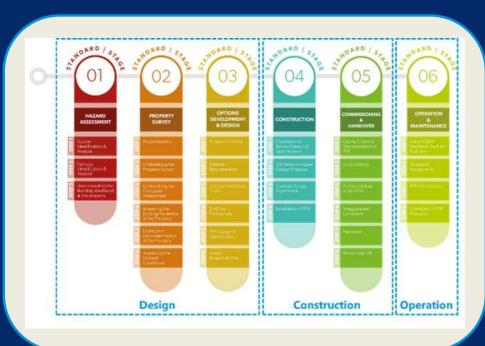
DIRECTOR OF LEARNING AND ORGANISATIONAL DEVELOPMENT - CIWEM

CIWEM PFR PROJECT LEAD





CODE OF PRACTICE FOR PROPERTY FLOOD RESILIENCE



UNIFORM GOOD PRACTICE

- Need identified
- PFR Round Table
- A collaborative project
- A uniform approach to good practice in PFR delivery
- Explore further: CoP Animation

PRESENTED BY





IN PARTNERSHIP WITH









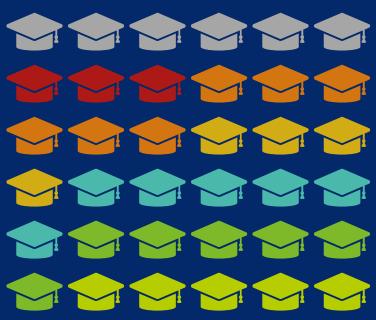


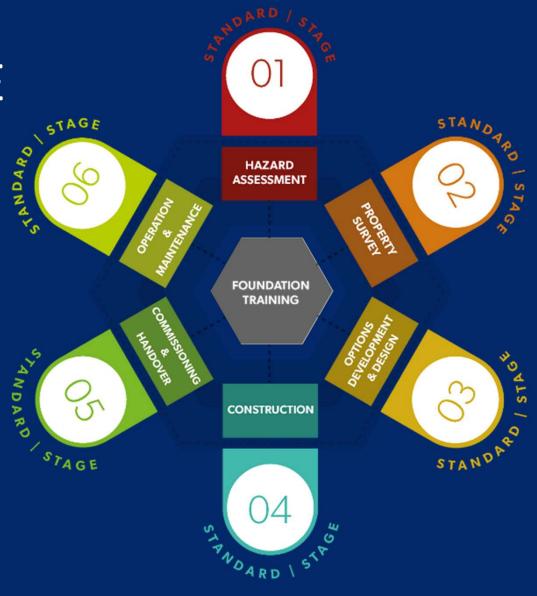




COMPREHENSIVE SUITE OF 24

MODULES





CHOOSE YOUR OWN LEARNING JOURNEY



WHO'S IT FOR?







FOUNDATION TRAINING

- context
- impacts
- options
- supporting organisations and resources for PFR

TECNICAL MODULES

COP STANDARD:

O1. Hazard Assessment

Construction and Installation

O4.

Property Survey

Commissioning and Handover

O5.

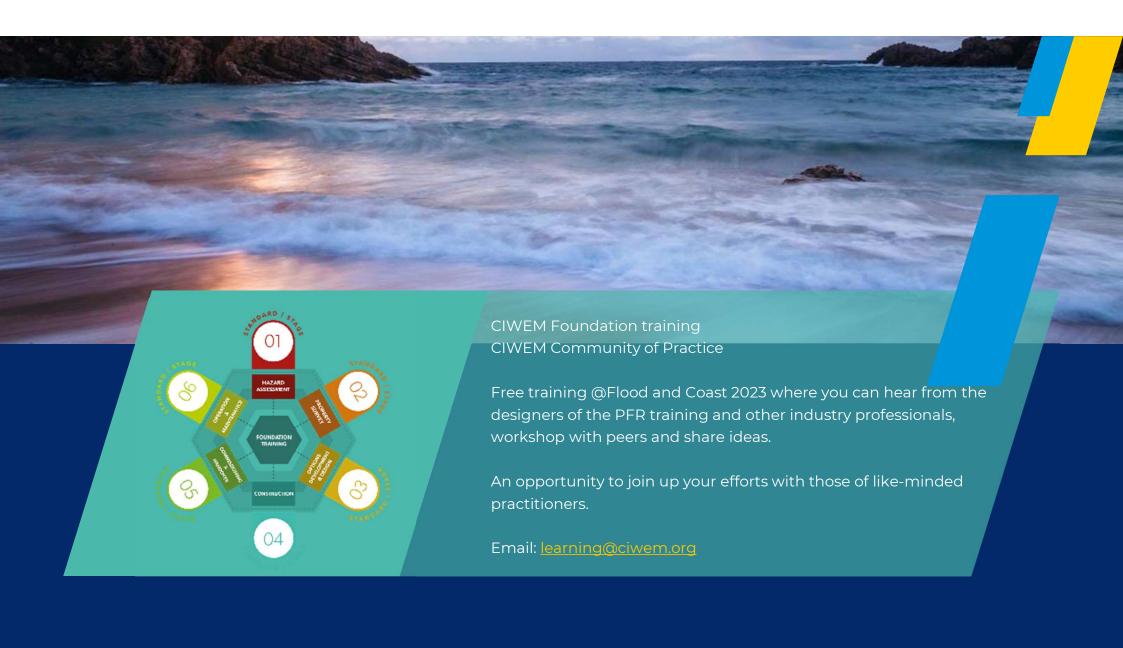
Operations and Maintenance

03.

Options Development and Design

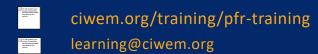
WHAT'S NEXT

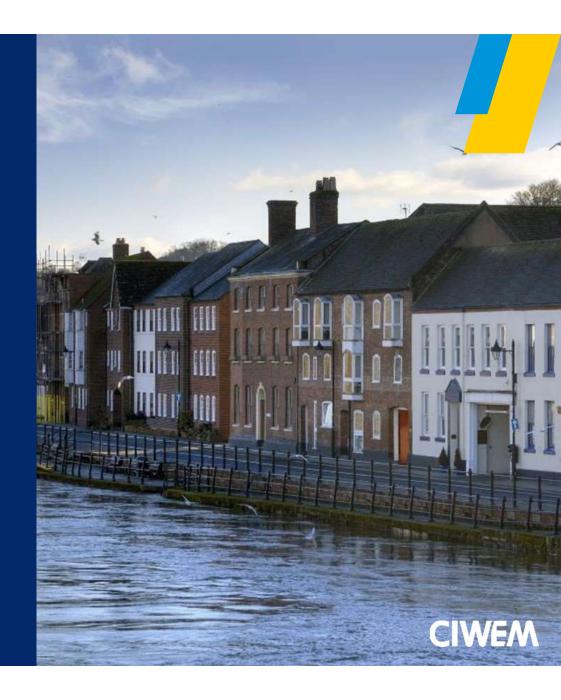
NOW:			NEXT:
01.	Technical Training	Flood Compliance Platform	04.
02.	Certification	Community of Practice	05.
03.	Training Accreditation	Other Applications ?	06.



membership - business partnership - events - training

Thankyou.







Scotland's Flood Risk Management Conference 2023

Session 5: Flood Warning & Community Resilience

Dermot Kehoe, Flood Re and Gareth Boyd, Watertight International







Scotland's FRMC 2023 (Session 5 – Flood Warning and Community Resilience)

East Peckham (Flood Performance Certificate) Pilot

23rd February 2023



Introductions



- 1. Dermot Kehoe Communications and Transition Director Flood RE
- Gareth Boyd CEO Watertight; Resilient Planit (Resilico flood compliance platform)

Background and Context





East Peckham



30 domestic properties

- Existing EA PFR scheme
- Engaged community
- Both fluvial (river) and pluvial (surface water) flood risk
- 30 properties (with resistance measures installed) to be resurveyed for recoverability and also to be provided with preparedness.
 (access to early warnings including surface water flooding, flood plans and maintenance)



Resistance







Recoverability



Preparedness



Key activities



• Data collected via the Resilico flood compliance platform.



- **Scoring** methodology / system to be developed by FHRC at Middlesex University through the multi coloured manual (MCM)
- Facilitate a scored flood performance certificate
- Prove concept and be the basis for mainstreaming PFR by being simple, credible,
 repeatable and scalable
- Collaborative approach led by Flood Re to include EA, CIWEM, DEFRA, Resilient Planit, Middlesex and others









Success



What's next

- WPI Economics Report on flood performance certificates Dec 2020 "there will need to be significant period of piloting and testing of an iterative FPC design with individuals and communities before a final format is determined"
- East Peckham was the first attempt to create this
- East Peckham has been deemed a success proven concept
- Pilot Phase 2 is to be scoped out in early 2023



FLOODRE

Summary of findings and research insights





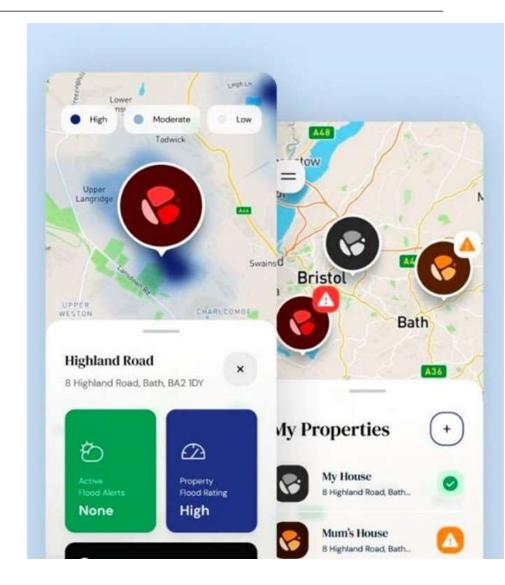
Resilico Connect



A risk management tool, empowering individuals, communities and businesses to take ownership and responsibility for their climate risk and adaptation.

Preparedness

"Know what to do and when to do it."



Research Context



Residents surveyed and interviewed in East Peckham

- c.40 residents invited to participate in survey and research interviews
- 57% experienced flooding
- 79% believe their property is at risk of flooding
- 43% believe the likelihood of flood events will increase in the future (36% didn't know)

What we asked about...



- 1. Past experience with flooding
- 2. Support needs and expectations
- 3. Perceptions of flood risk
- 4. Community support
- 5. Preparedness and PFR measures
- 6. Use of technology and usability of Resilico Connect
- 7. The Flood Performance Certificate concept





Flood Performance Certificates would reduce concerns about flooding

Question: What would help reduce your concerns about the flooding of your property?

Top answer: A certificate which provides a score indicating how flood resistant and recoverable my house is (71%)



Recognition of preparedness and peace of mind are the main benefits of FPCs

Question: What are the potential benefits of a Flood Performance Certificate?

Top answers:

- It could provide a helpful record of flood resistance and recoverability improvements to my property (71%)
- It could provide peace of mind (64%)



Acceptance of FPCs may be improved if mandated for most (or all) properties

"It could make the flood potential real and official to a prospective buyer rather than just vaguely possible? Maybe."

"If it were standard with all houses it would be more acceptable to the ill-informed property buyers who may be put off if they were presented with one when looking at a property."



Flood alerts, FPCs, and preparedness are the most valued aspects of Resilico Connect

Question: If there was a smartphone app to help people whose property is at risk of flooding, what are the most important things it should do?

Top answers:

- Give you flood warnings for your property (93%)
- Show you a certificate which provided a score of your property's flood resistance and recoverability (86%)
- Remind you how and when to maintain resistance measures (86%)

In summary...



- Successful pilot that validated critical assumptions
- A mobile app is the preferred medium for this service
- Preparedness can deliver "Permission to act"
- FPCs should recognise and reward preparedness

Flood Performance Certificates



What's next...

- Flood Re transition workshops Oct 22 and Jan 23
- Flood Re transition plan 2023





Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 5: Flood Warning & Community Resilience



Join at slido.com #FRM2023-S5





slido





Session 5: Flood Warning & Community Resilience – audience Q&A





Coming up next...

Break and networking

Next session starts at 11:45





Session 6: Funding and Finance Gannochy Auditorium & online stream

Welcome from the Chair: Will Burnish (Moray Council)

- Adaptation Scotland Finance Resources challenges and opportunities to financing flood risk management Ben Connor (Sniffer)
- Leith Connections Active Travel Route, Retrofit of SuDS –
 Finance & Funding Hazel MacLeod, Jamie Sutherland (AECOM)
- The Riverwoods Pioneers: combining investment readiness with community participation Ruchir Shah (Scottish Wildlife Trust)
- Funding opportunities for woodland creation and peatland restoration with a view to mitigating flood risk George Hepburne Scott (Forest Carbon) and Dr Derek Robeson (Tweed Forum)
- Q and A via Slido #FRM2023-S6





Creating Water Resilient Places



Scotland's Flood Risk Management Conference 2023

Session 6: Finance & Funding

Chair: Will Burnish, Moray Council







Scotland's Flood Risk Management Conference 2023

Session 6: Finance & Funding

Ben Connor, Sniffer







Adaptation Scotland finance resources:

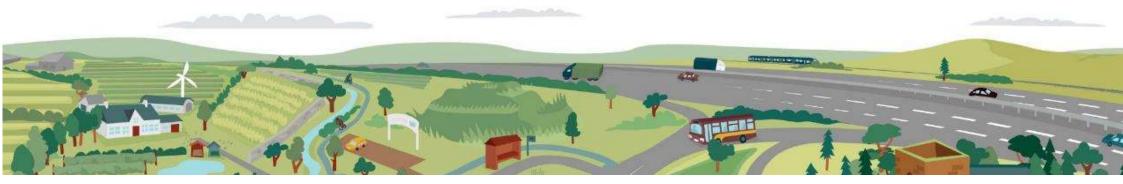
Challenges and opportunities for financing flood risk management

Ben Connor 23 February 2023



The Adaptation Scotland programme is funded by the Scottish Government and delivered by sustainability charity Sniffer.

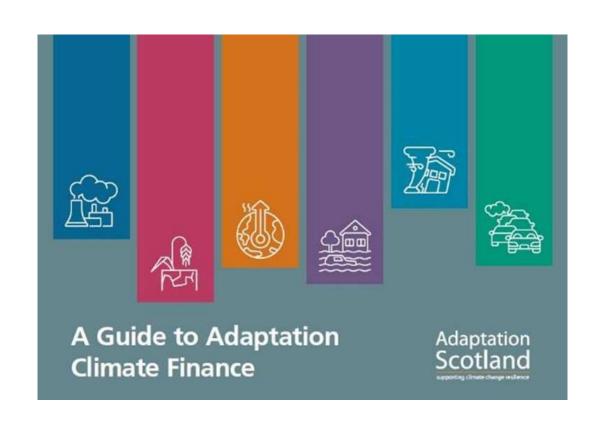




Overview



- Context: the "adaptation finance gap"
- Adaptation Scotland resources:
 - Guide to AdaptationFinance
 - Case studies
- What next?







Adaptation Scotland





Adaptation Scotland is a programme funded by the Scottish Government and delivered by sustainability charity Sniffer

Enabling organisations, businesses and communities to adapt to the impacts of climate change







The "adaptation finance gap"



Global: "Filling the investment gap for adaptation is critical to achieving the goals of the Paris Agreement. Finance to adaptation, from both public and private actors, must be scaled by orders of magnitude to respond to current and oncoming climate risks"

Climate Policy Initiative, Global Landscape of Climate Finance, December 2021

UK: "Across all climate risks facing the UK, the necessary additional investment in climate resilience required this decade could be in excess of £10 billion per year"

Climate Change Committee, Investment for a well-adapted UK, February 2023

Scotland: initial estimate of £184m per year adaptation finance gap in Glasgow City Region alone Climate Ready Clyde, Glasgow City Region Climate Adaptation Strategy and Action Plan, June 2021





Climate Finance Working Group



- "work with local authorities, public bodies, and the private sector to increase understanding of and access to adaptation finance and funding"
 - 1. Knowledge exchange and capacity building
 - 2. Development of adaptation finance guidance
 - Economic advisory services for 3 projects



























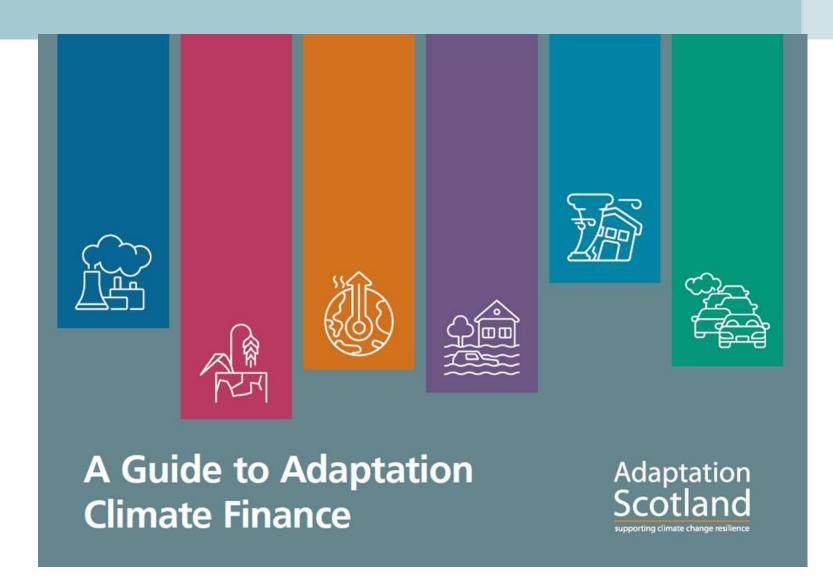






A Guide to Adaptation Climate Finance





Barriers



Economic	 Significant <i>economic</i> benefits, but often no <i>financial</i> returns Public goods with no or underdeveloped markets
Financial	 Lack of revenue streams Upfront costs and long term benefits Difficult to achieve scale attractive to private finance
Technical	Site and context specific project design
Political / regulatory	 Insufficient incentives due to misaligned regulation Conflicting and competing policy objectives
Information	 Limited availability of climate risk and vulnerability data High uncertainty and lack of quantitative data on adaptation benefits

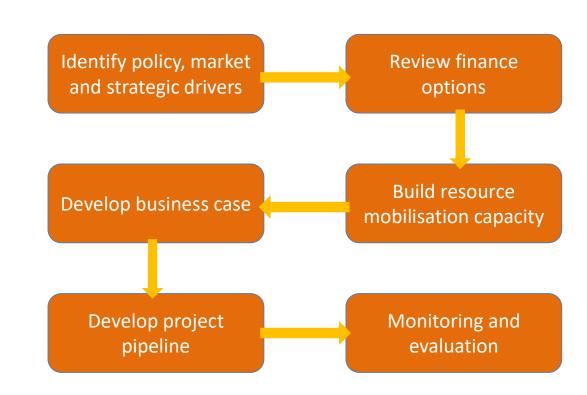




Public sector use case



- Finance provided by the public sector
 - Support core adaptation and create enabling environment for private investment
- Financing options
 - Grants
 - Bonds
 - Household/business charge models
 - Debt
- Links to further resources and case studies



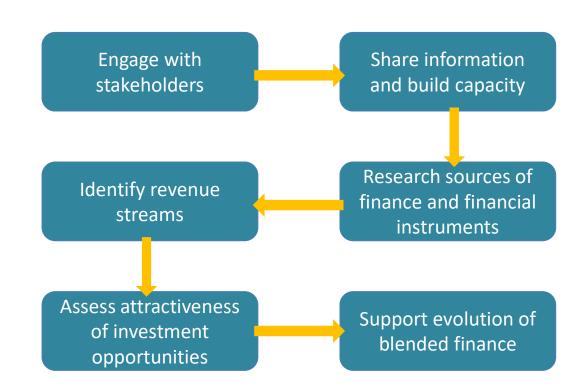




Blended finance use case



- "combining concessional public finance with non-concessional private finance, and expertise from the public and private sector"
- Financing options
 - Direct debt or equity
 - Guarantees
 - Collaborative revenue bonds
 - Insurance
 - Technical assistance grants
 - Value capture
 - Public private partnership







Place based use case



- "Creating economic and social outcomes through investing in a specific geographical region or community"
- Financing options:
 - Impact investing
 - Crowdfunding
 - Bonds
 - Value capture
 - Fees
 - Incentives
 - Grants
 - Payments for Ecosystem Services







Examples



Copenhagen Cloudburst Scheme – using household water charges to co-fund surface water management

IGNITION Project – providing the tools to increase use of naturebased solutions in Greater Manchester

Stormwater Retention Credit
Trading Programme – creating a
market for sustainable drainage
interventions in Washington DC

Landscape Enterprise Networks – bringing organisations together to invest in landscapes

Community Municipal Investment Bond – crowdfunding to support placebased portfolio of adaptation and mitigation projects

Glasgow City Centre Surface Water
Management Plan (SWMP) – using the
B£ST tool to evaluate the benefits of
SuDS and natural flood management





Developing adaptation finance business cases





Case studies



- Newcastleton flood management project
 - Flood management scheme to reduce fluival flood risk
- Uist Community Climate Resilience
 - Integrated adaptation solution to address sea-level risk and climate change
- Inch of Ferryton managed realignment
 - Coastal flood protection by converting farmland to wetland and saltmarsh









Financing options



No.	Financing option			
1.	Mitigation revenue streams from carbon sequestration Payment for ecosystem services			
2.				
3.	Tourism revenues			
4.	Crowdfunding platform Biodiversity habitat bank/biodiversity credits			
5.				
6.	Government grant funds			
7.	Philanthropic based grant funds			
8.	Equity financing			
9.	Flood insurance based on a risk pool model			
10.	Parametric insurance			
11.	Resilience bonds			
12.	Land-use development option/ Green infrastructure finance Household or local business charges			
13.				
14.	Renewable energy revenues			
15.	Landowner investment			

Innovative options:

- Carbon sequestration revenue through Woodland Carbon Code and emerging Saltmarsh Code
- Crowdfunding e.g. through
 Community Municipal Bonds
- Biodiversity offsets and habitat banking
- Ecotourism revenues





Analysis and key lessons



- Potential innovative finance options for all 3 projects
- Time, resources and expertise required to develop and deliver additional revenue streams
- Revenue streams often arise from co-benefits e.g. carbon or tourism
- Financing needs to be considered at the project development stage
- Need for knowledge exchange and capacity building

No.	Financing option	Inch of Ferryton Managed Realignment	Newcastleton Flood Protection Scheme	Uist Community Climate Resilience
1.	Mitigation revenue streams from carbon sequestration	High	High	N/A
2.	Payment for ecosystem services	Low	Low	Low
3.	Tourism revenues	High	High	N/A
4.	Crowdfunding platform	High	Low	Medium
5.	Biodiversity habitat bank/biodiversity credits	Low	Low	Low
6.	Government grant funds	High	High	High
7.	Philanthropic based grant funds	Medium	Medium	Medium
8.	Equity financing	Low/Medium	Low/Medium	Low
9.	Flood insurance based on a risk pool model	N/A	N/A	Low
10.	Parametric insurance	N/A	N/A	N/A
11.	Resilience bonds	N/A	Low	Medium
12.	Land-use development option / Green infrastructure finance	Medium	Medium	Medium
13.	Household or local business charges	N/A	Medium	N/A
14.	Renewable energy revenues	Low/Medium	Medium	N/A
15.	Landowner investment	Low/Medium	N/A	N/A





Next steps



- Resources available at:
 https://www.adaptationscotland.
 org.uk/how-adapt/tools-and resources/adaptation-finance guide-and-business-cases
- Further work including:
 - Additional case study
 - Wider scoping of priorities









ben@sniffer.org.uk





www.adaptationscotland.org.uk



The Adaptation Scotland programme is funded by the Scottish Government and delivered by sustainability charity Sniffer.







Scotland's Flood Risk Management Conference 2023

Session 6: Finance & Funding

Hazel MacLeod and Jamie Sutherland, AECOM







Leith Connections Active Travel Route

Retrofit of SuDS - Finance & Funding

Hazel Macleod & Jamie Sutherland



Leith Connections Active Travel Route

Items Agenda-

- 1) Project Overview
- 2) Detailed SuDS Design
- 3) Funding

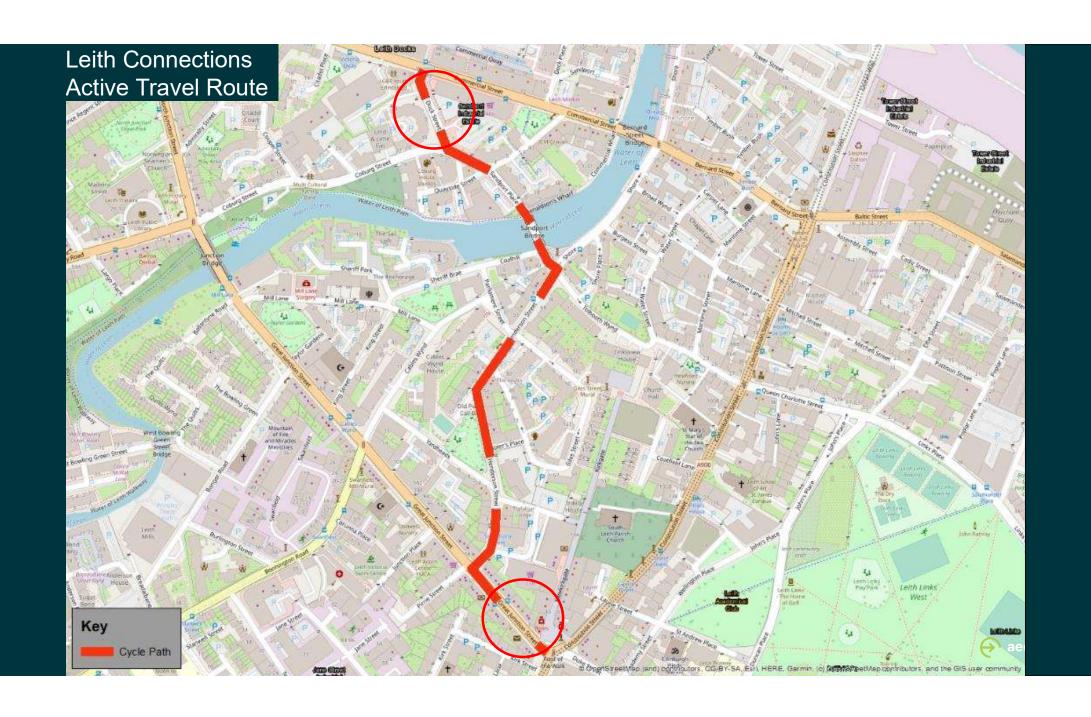














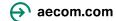


Aim -

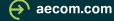
To create a safer and more comfortable environment for residents and visitors walking, wheeling, cycling and spending time in the local streets and outdoor spaces of Leith.

The AECOM Team





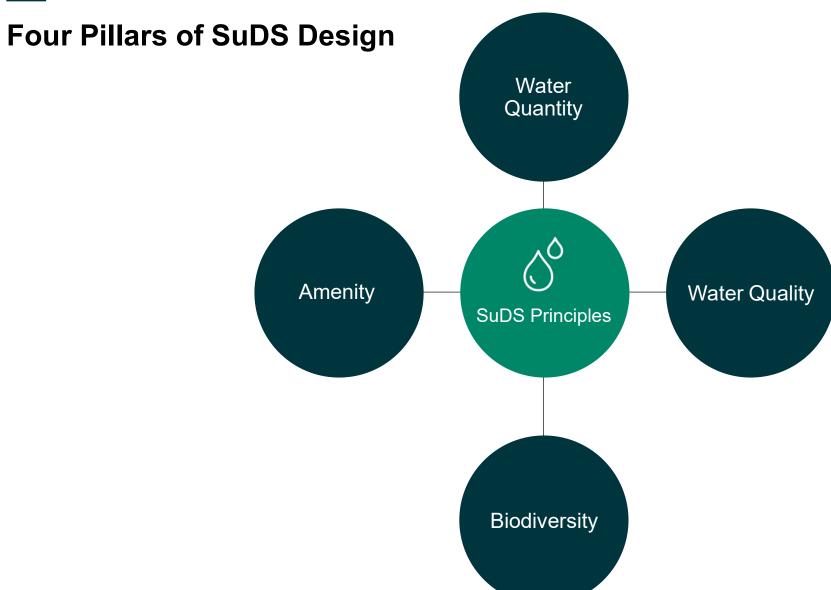
Guiding Design Principles

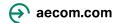


The City of Edinburgh Council's Water Vision



"We must think about and value water, keep water above ground and use it creatively to deliver multiple benefits."





SuDS Features













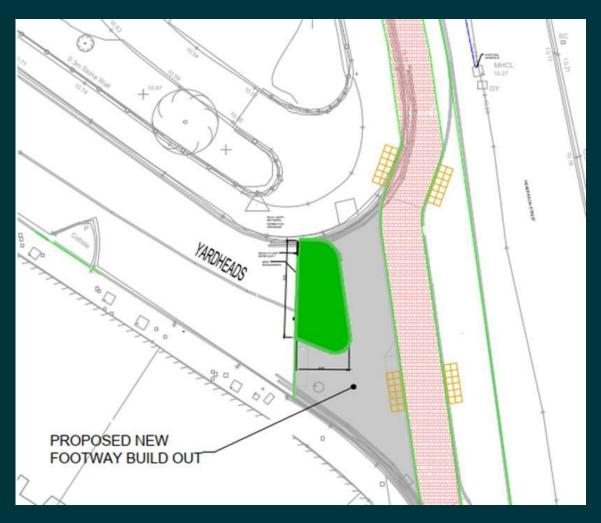


Leith Connections Active Travel Route





Leith Connections Active Travel Route

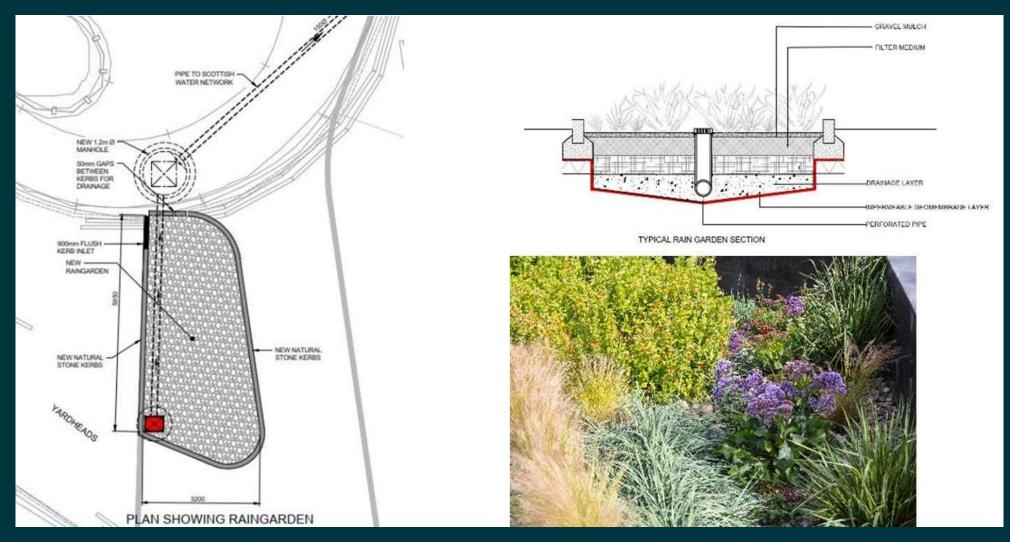


Design Challenges –

- Utilities
- Topography & Kerb Lines
- Foot Traffic
- Planting



Detailed Design – Rain gardens



Funding and Collaboration

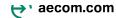






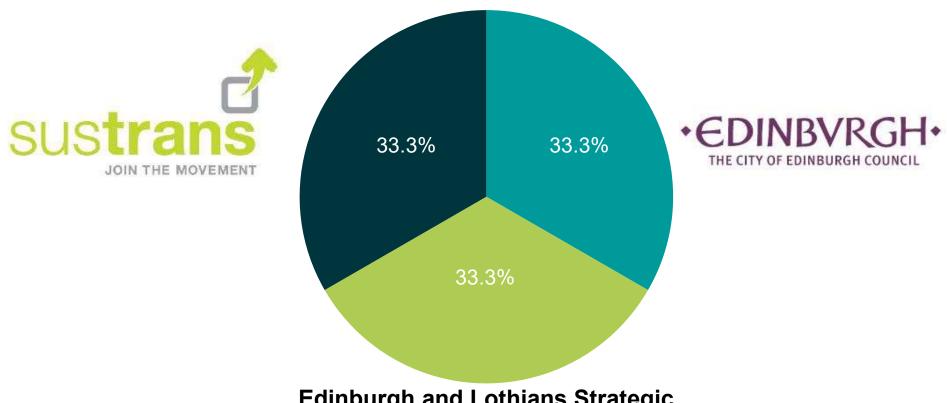
Edinburgh and Lothians Strategic Drainage Partnership





Funding

Leith Connections SuDS Funding Split



Edinburgh and Lothians Strategic Drainage Partnership

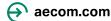


Project Funding - Costing split

- Strategy developed identifying all opportunities
- Concept Design developed full strategy
- CAPEX Cost split
- Gaining buy in from the partnership
- Develop agreed upon design to Outline then Detailed design







AECOM

Thank you.





Scotland's Flood Risk Management Conference 2023

Session 6: Finance & Funding

Ruchir Shah, Scottish Wildlife Trust





Riverwoods Pioneers

Combining investment readiness with community participation

Ruchir Shah

Director of external affairs Scottish Wildlife Trust





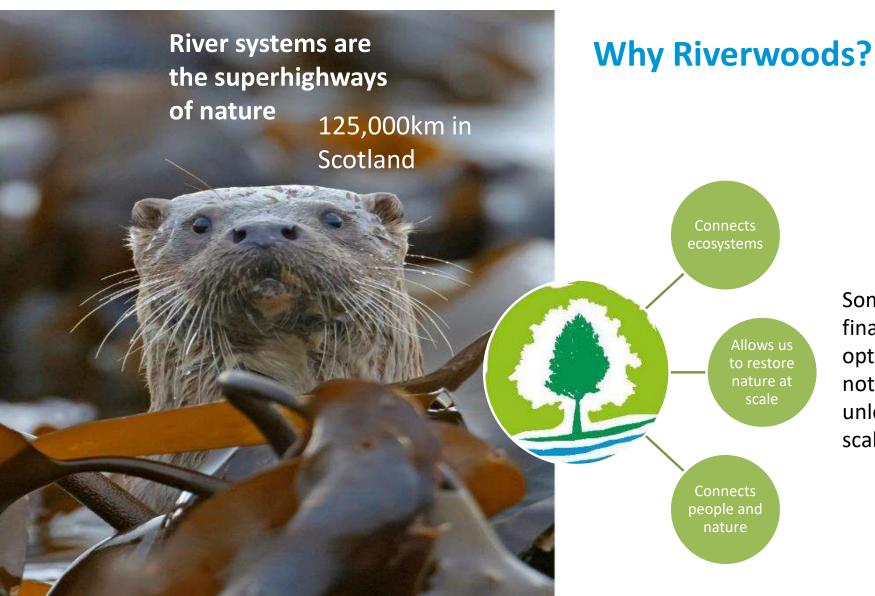


What is Riverwoods?

RIVERWOODS

A network of riparian woodland and healthy, resilient river systems throughout Scotland

delivering a range of environmental, socio-economic and financial benefits





Some financing options are not viable unless we scale up

Riverwoods Investment Readiness Pioneers

A project stream within the overall Riverwoods initiative

The Opportunity

"Nurture prospective commercially viable river woodland restoration initiatives with the best solutions to accelerate positive change towards nature restoration."

- Different levels of support, from online resources to workshops
- For commercially viable, additional one to one support and mentoring
- Participative community selection process to allocate £4k to five projects.
- £125k of investment readiness funding and support **for two** selected by panel.













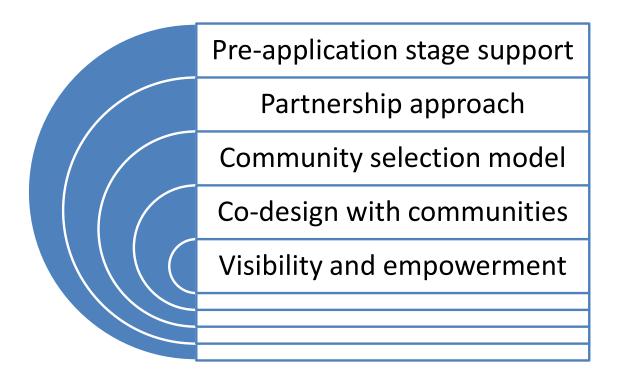






Support model



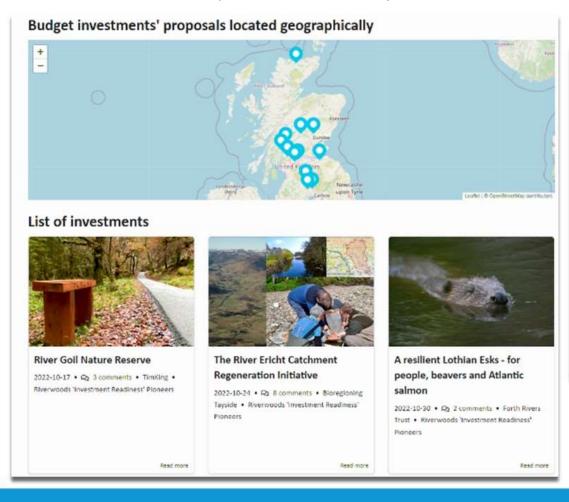




Community engagement model

Developed by our partners Democratic Society with support from CoSLA

riverwoodspioneers.communitychoices.scot





-3

-

-





Recipe for success

What we are learning so far....

Process

Need for market governance standards and regulation

innovating

Open source: sharing, learning and iterating



innovation

Transparency of process when



Thank you





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he slide.

Riverwoods is a partnership initiative led by the Scottish Wildlife Trust









































Scotland's Flood Risk Management Conference 2023

Session 6: Finance & Funding

George Hepburne Scott, Forest Carbon and Dr Derek Robeson, Tweed Forum





Funding opportunities for NFM – Lessons from the Eddleston Water

(for Prof Chris Spray)

Look at -

- Real-life examples of valuing flood risk reductions & Ecosystem Service provision on the Eddleston Water Project
- This Project was established by Tweed Forum and partners in 2010, to assess:
- 1) How effective are NFM measures in reducing flood risk and improving riparian ecology?
- 2) Can we value these contributions in terms of costs and benefits.

We also looked at-

- 1) How can NFM be integrated within 'routine' Flood Scheme Options Appraisals?
- 2) Where can finances be attracted from, to achieve this?



Barriers to considering and using NFM measures

A recent survey by Mott McDonald in 2021 confirmed that:

A lack of funding may not be the main barrier

But:

- A lack of clarity around NFM integration into Flood Scheme Appraisals.
- 2. A lack of standardised tools for valuation.
- 3. A lack of methodologies for assessing cost-benefits.
- 4. A lack of data.

.....Are more likely barriers



What can we learn from our experiences at Eddleston?

All our NFM works have been achieved using 'Blended finance'

- Public -Flood funding Scottish Government / SEPA Water Env' Funds and the EA
- Public -Forestry funding Forestry Grant Schemes (no Agri-Env' or AECS)
- Public Biodiversity funding Nature Restoration Fund (via NatureScot)
- Local Authority support Scottish Borders Council
- Research funding Including EU Interreg, Universities, BGS, etc.
- Local company 'sponsorship' CEMEX (offset monies) and Scottish Power
- NGO grants Woodland Trust Scotland
- Help-in-kind By partners and landowners themselves
- Private Carbon moneys Woodland carbon & Peatland carbon
- Others i.e. SUSTRANS

Reflects delivery of a wide range of ecosystem services & benefits



What NFM Measures have been delivered?



116 debris dams



330,000 trees (207ha)

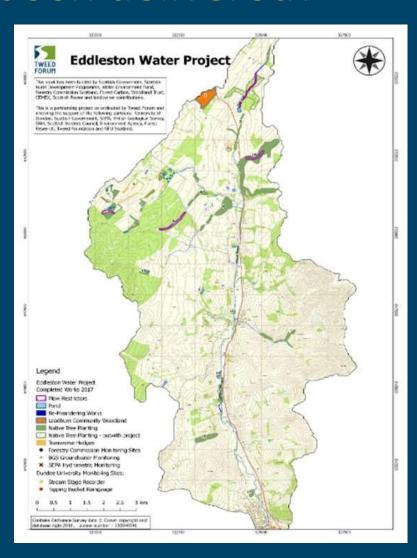


3.5 km re-meandered



28 Flood storage ponds

70km² Catchment (Facilitator - Hugh Chalmers)



Plus a small area of peatland restored at top of catchment

Leadburn - 9ha of conifer removal, some ditch blocking and peat smoothing (Community Group – Restoration Funded by Peatland Action)



During restoration



After restoration

All NFM Measures delivered depend on 'Negotiation & Compromise'

- Tweed Forum staff act as a 'trusted intermediaries'
- Tweed Forum plays a key central role in identifying & collating finance packages & facilitating NFM projects across Scottish Borders



An Example: Re-meandering on the Eddleston Water near Cringletie-

NFM design and location depends on hydrological analysis & landowner agreement (- with 3 different farmers)



A successful outcome depends on :

Balancing NFM principles and farmer's desires.

Sites can be very good but seldom the most ideal.

Several excellent NFM designs still await 'the right package for the farmer & farm type'

So, we require a more integrated approach to targeting NFM measures



What about Payments for (NFM delivered) Ecosystem Services (PES)

What is missing?

Most obvious are key beneficiaries, i.e.

- Flood Insurance companies
- Downstream impacted residents
- Water quality beneficiaries (Fisheries)
- Recreation and leisure businesses
- Tourism businesses
- The natural environment itself (through more Biodiversity & Carbon Credits)



New SUSTRANS path along the Eddleston Water – A major added recreational value?



We have demonstrated that potential flood damages avoided values can be measured

- 1. Work by JBA and Mott MacDonald Potential damages avoided by recent NFM works to be around £950k (NPV/100yrs)
- 2. For a hypothetical maximum use of NFM in the catchment, this could be £2.8M (NPV/ 100yrs).





We have demonstrated that ecosystem service values can also be measured effectively using tried and tested methods

- 1. Total value of all other Ecosystem services delivered by current NFM measures is estimated at £4.2M (NPV/100yrs)
- 2. For a hypothetical maximum use of NFM, this could increase to approximately £17.7 million (NPV/100yrs)

Benefit category	Actual NFM implemented (£k)	Additional NFM (£k)
Amenity	1,489	3,724
Biodiversity and ecology	627	4,594
Carbon sequestration	717	4,857
Education	383	383
Flows in watercourse	365	2,678
Water quality and pollution	628	1,424
Total	4,201	17,660

Estimated ecosystem services benefits for the NFM options (£k, Net Present Value, 100-year Appraisal Period). These are on top of the flood damages avoided (£950k actual; £2.85m hypothetical scenario).

- The value of other ecosystem services delivered by NFM measures across the catchment, are 4x larger than the flood damages avoided benefit.
- So, what should be seen as 'best value' for sustainable Flood Risk Management?



What else is missing from a financial perspective?

The success of Tweed Forum and 'Blended finance' can only go so far. It is not a long-term solution, because:

- It relies entirely on the goodwill of the relevant landowners
- It relies on the presence of a long-established 'trusted intermediary' to 'negotiate' and 'facilitate' each NFM measure with each landowner
- It relies on the availability and accessibility (and timing) of finance that is 'permissible' to use for the purposes desired
- It can only deliver NFM measures where the landowner is willing to let them be undertaken, and such locations (and measures) are not necessarily the best or most effective sites for achieving flood risk reductions.
- Much better NFM solutions may be available (and were shown to be) but they require both serious long-term funding and an element of policy direction and the means to 'persuade' relevant landowners to enable NFM to be developed on their land.



In summary

We need to make NFM financing long-term and sustainable, to attract buy-in from farmers & investors

- Post CAP agricultural support systems must recognise delivery of public goods and protection of natural capital, as well as food & timber security.
- Flood schemes should include assessment of NFM, in an integrated options appraisal, with money made available for NFM work (i.e. hard engineering v soft engineering).
- River & Wetland and Woodland & Peatland restoration funding, should be targeted at the landscape scale and their ecosystem services fully valued.
- NFM+ can deliver measurable flood reduction, climate change adaptation & biodiversity enhancement.







Funding opportunities for woodland creation and peatland restoration for flood risk mitigation

Sniffer Flood Risk Management Conference

23rd February 2023

George Hepburne Scott
Director – Forest Carbon

Forest Carbon



Since 2006 we have been helping to fund woodland creation and peatland restoration projects:

- Across the UK and Ireland
- Of all shapes and sizes
- Funded by the sale of certified carbon credits
- Projects provide wide ranging co-benefits beyond carbon capture
- The UK projects are quality assured under the UK government's Woodland Carbon Code and IUCN's Peatland Code

Our Role:

- To assist a wide range of land holders and corporates in accessing the market
- We provide a mix of consultancy and transactional services to meet differing requirements

Our Purpose:

- Drive a step change in private-sector investment into natural climate solutions, primarily in the UK
- Innovate to expand the remit of UK carbon markets and ecosystem markets more broadly







How our UK projects are quality assured



Woodland Carbon Code

- Developed by UK government, launched 2011
- Conservative, scientifically sound and project specific carbon capture estimates
- Projects meet all international carbon project rules:
 - Additionality, Quality assurance, Conservatism, Permanence, & Monitoring
- One of the world's leading domestic carbon standards
- Endorsed by ICROA

Peatland Code

- Developed with, and owned by International Union for Conservation of Nature
- Built on the same principles as the WCC
- Newer than the WCC, and fewer projects but rapidly gaining momentum

UK Land Carbon Registry

- Hosted by IHS Markit Registry part of S&P Global
- Leading environmental credit registry home to Gold Standard, VCS and others
- Provides publicly available data on project certification status and credit ownership
- Allows transparent demonstration of fulfilment of environmental commitments







Woodland Carbon Code Audit Process





Differing forms of credit



One carbon credit equates to 1 tonne of carbon dioxide equivalent (tCO2e). There are two types of credit available to sell and purchase:

Pending Issuance Unit (PIU)

- A PIU is effectively a 'promise to deliver' a Woodland Carbon Unit (WCU) or Peatland Carbon Unit (PCU) in future, based on predicted sequestration or avoidance.
- It is not 'guaranteed', and cannot be used to report against UK-based emissions until verified.
- It allows companies to plan to compensate for future UK-based emissions, or make credible Corporate Social Responsibility ('CSR') statements in support of woodland creation or peatland restoration.

Woodland Carbon Unit (WCU) or a Peatland Carbon Unit (PCU)

- Represents 1 tonne of CO2e which has been sequestered in a WCC-verified woodland or prevented from being released in a PC verified restored peatland.
- It has been independently verified, is guaranteed to be there, and can be used by companies to report against UK-based emissions or to use in claims of carbon neutrality or Net Zero emissions.





Same market, different prices:



The price of a project's carbon is determined by what a buyer will pay

 Two projects validated by the Woodland Carbon Code may be able to achieve very different prices

Location, location

• For businesses buying carbon, proximity to a project is often a key factor on price

'Bundled' Ecosystem Services

 Where a carbon-generating project is also delivering other, nested ecosystem services, the carbon can often be sold at a premium

Overall Charisma

 The combination of location, bundled ecosystem services and the narrative of a project can lead to buyers to pay different prices for the same amount of carbon





UK voluntary carbon market – buyer & investor profiles



Corporate Social Responsibility or 'impact' buyers

- Organisations who are looking to make 'soft' statements in relation to helping support UK woodland creation or peatland restoration.
- Between 2006 2019 market interest was almost exclusively driven by those from this buyer pool.



- This pool typically represents those seeking to invest in the purchase of PIUs today, on the basis of then retaining these long term and reporting the delivery of verified WCUs or PCUs against future residual emissions.
- Interest from these buyers began to emerge late 2019 / early 2020
- Most will be aligning with the likes of SBTi (Science Based Targets initiative Net-Zero Standard) or UK Green Building Council Net Zero Carbon Buildings

Institutional investors

- Organisations seeking to invest in the direct delivery and financing of projects today on the basis of then taking full or partial ownership of verified WCUs or PCUs long term
- Current approaches include: the direct acquisition of land (i.e. Aviva's acquisition of 15,000 acre Glen Dye Estate), leasing of land, joint ventures, off-take agreements and FCA regulated organisations aggregating PIUs

















Some current challenges in UK carbon market



Agriculture net zero requirements

• Lack of clarity around what future requirements are likely to be on UK farmers and land managers.

Interaction between public and private funding

Uncertainty around future agriculture support and how payments will interact with private funding sources

Lack of clarity around tax treatment

• There is limited guidance from HMRC on the tax treatment of carbon income or carbon value

No standardised legal contracts

• Currently there are no standardised templates. Work is being done to potentially develop these to help sellers and buyers participate in the market.

Uncertainty around future pricing

Concerns about when is the right time to sell – i.e. going too early....or too late.

Impact on local communities

• Growing concerns relating to the rise of the 'green laird' and associated impact on land values





Could Scotland see a 'green laird gold rush'?

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A land inflows camping space than harmost of their beauth buffings possible Scotland to affect that carbon underlies sinher than reducing should they are:

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Emerging UK carbon standards



Hedgerow Carbon Code – led by the GWCT Allerton Project

- The code will encourage hedgerow habitat improvements to increase the amount of carbon stored by UK hedges
- It will allow land managers to calculate and verify the carbon capture potential of their hedgerows, enabling them to trade carbon credits.

Saltmarsh Code – led by UK Centre for Ecology and Hydrology

- The aim is to create a rigorous and scientifically-based voluntary certification standard, enabling saltmarsh carbon to be marketed and purchased by private investors.
- This may give rise to other 'Blue Carbon' standards for the likes of Seagrass.

Agro-forestry Carbon Code – led by Soil Association

- A range of organisations are exploring the feasibility of developing a carbon code for Agroforestry.
- This will explore the potential for the carbon captured and stored by trees in agroforestry systems to be quantified and potentially used to support the net zero strategies of farmers, land managers and their partners and funders.

UK Farm Soil Carbon Code (UKFSCC) – led by Sustainable Soils Alliance

- Currently there are a number of soil carbon schemes operating in the UK including the likes of Agreena, and Soil Capital.
- The UKFSCC is an Environment Agency funded project that aims to bring clarity, consistency and integrity to the market in farm soil carbon and meet the needs of farmers, investors and other stakeholders.









Markets for other ecosystems services – biodiversity



Biodiversity Net Gain - a 'compliance' market for biodiversity

- Under the <u>Environment Act 2021</u>, all planning permissions granted in England (with a few exemptions) will have to deliver at least 10% biodiversity net gain from November 2023 (expected).
- BNG will be measured using Defra's biodiversity metric and habitats will need to be secured for at least 30 years.
- It measures a habitat and assigns these Biodiversity Units. It does not include species explicitly, using habitat as a proxy. Degradation of habitat can then be converted into units that need to be offset.

Biodiversity credits - a 'voluntary' market

- Biodiversity credits, tokens or certificates have been defined by the World Economic Forum (WEF) as an economic instrument that can be used to finance actions that result in measurable positive outcomes for biodiversity (e.g. species, ecosystems, natural habitats) through the creation and sale of biodiversity units.
- The intention is that these will form part of a company's nature-positive journey a Nature Positive Impact investment in nature's recovery, rather than an offset for damage.
- The Taskforce on Nature-related Financial Disclosures is aiming to shift global financial flows away from nature-negative outcomes and toward nature-positive outcomes. This is giving rise to rapidly increasing interest in biodiversity enhancement.



Source - Berkeley Homes



Source - Farmer Clusters

Stacking & bundling



The climate change emergency is going to require more than government and philanthropic funding sources to meet the scale and urgency of the challenge.

Two important definitions:

- **Bundling** means packaging the biodiversity and environmental services produced by a nature-based project on a single area of land, and selling the package (typically as a single unit of trade or credit) to a single buyer.
- **Stacking** means measuring and accrediting the different types of environmental services from a nature-based project on a single area of land, and selling the services to different buyers, or receiving multiple payments from a single buyer for each service delivered.

Current uncertainty around rules for stacking and bundling is creating practical problems for landholders and organisations looking to fund nature-based solutions and is resulting in delays to action on the ground

Some challenges:

- Landholders run the risk of missing out on other markets if they only sell one service
- Additionality may be hard to evidence where multiple services are being sold
- Risk of 'double dipping if services are overlapping
- Some services are harder to monetise and measure

Questions





www.forestcarbon.co.uk



Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 6: Finance & Funding



Join at slido.com #FRM2023-S6





slido





Session 6: Finance & Funding – audience Q&A session







Coming up next...

Lunch and networking

Parallel sessions start at 14:10

Session 7a: Funding & Finance Workshop – Tilt

Session 7b: FRM & Adaptation Guidance Review Workshop – Norie-Miller

Session 7c: Nature-based Solutions Plenary - Auditorium





Day 2 Afternoon parallel sessions

23/02/23

1310-1410

Lunch and marketplace

Perth Concert Hall foyer

1410-1525

Session 7a. Funding and Finance Workshop

Tilt Room (in person only, not available online)

An opportunity to explore in more detail the practicalities of developing innovative financing – including using blended and finance mechanisms for FRM. We will hear from NatureScot about upcoming opportunities to access investment readiness funding and support, and explore how Dark Matter Labs' TreesAl project is tackling the challenge of developing new business models to fund urban nature-based solutions.

Ben Connor (Sniffer), Louise Bond (SEPA) and Patrick Jean-Martel (NatureScot), with Carlotta Conte, Chloe Treger, Konstantina Koulouri and Raj Kalia (Dark Matter Labs)





Creating Water Resilient Places





Scotland's Flood Risk Management Conference 2023

Session 7a: Funding and Finance Workshop

Ben Connor (Sniffer), Louise Bond (SEPA) and Patrick Jean-Martel (NatureScot), with Carlotta Conte, Chloe Treger, Konstantina Koulouri and Raj Kalia (Dark Matter Labs)



Workshop outline

14:10	Welcome and introduction	Ben Connor, Sniffer Louise Bond, SEPA	
14:15	Facility for Investment Ready Nature Scotland	Patrick Jean-Martel, NatureScot	
14:25	TreesAl	Carlotta Conte and Chloe Treger, Dark Matter Labs	
14:40	Roundtable discussion		
15:10	Plenary feedback		
15:20	Wrap up and close		

FIRNS

The Facility for Investment Ready Nature in Scotland programme

Patrick Jean-Martel

23rd February 2023







What is FIRNS

- New grant scheme (following IRNS in 2022)
- Delivered by the Scottish Government (SG) and NatureScot in partnership with the National Lottery Heritage Fund (NLHF)
- £1.8 million funding possibly matched by NLHF
- Grants of up to £240,000







Who will we be funding? (and what?)

Who:

eNGOs, community groups, land owners, farmers and other private sector organisations, individually or in consortia

What types of projects:

- Natural Capital restoration projects
- Projects supporting the development or scaling up of Natural Capital Markets (nature-based solutions, ecosystem services...)
- For any types of habitats



New codes

Carbon Codes



More than just Funding

- Gateway activities
- Creation of a community of practice
- Great networking capabilities and synergies to be expected
- Direct link with the Scottish Government PINC programme



Aims and purposes

Programme level :

- Enabling the outcomes of Scottish Government's PINC programme
- Developing the Scottish pipeline of investible natural capital projects
- Valuing and monetising restoration of natural capital assets, in a model that will be innovative and attract private investment in a replicable way
- Helping grow natural capital markets across rural, urban and marine settings, as well as a
 wide variety of natural assets and ecosystem services
- Creating or supporting the creation of new market infrastructures looking at transparency,
 efficiency as well as the related supply chains
- Generating good quality local green jobs and generating socio-economic benefits in line with Scottish Government's just transition principles.
- Significantly advancing the knowledge base, experience and business maturity across nature based projects.

Photo by Maria Orlova from Pexels

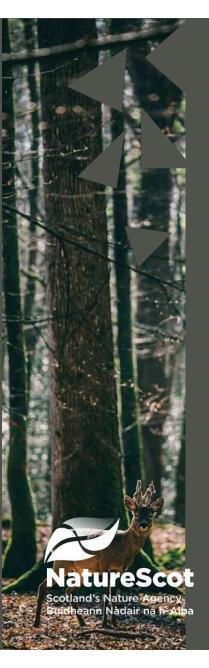


Aims and purposes

All supported projects will:

- Support the restoration of nature and growth of natural capital backed by robust sciencebased methodologies
- Enable or generate revenue and /or cost savings from ecosystem services in order to attract and repay private sector investment
- Explore and demonstrate how to engage community interests in project design, and contribute to a just transition
- Explore and demonstrate the means to share benefits with community interests, and contribute to a just transition

Photo by Maria Orlova from Pexels



The FIRNS Timeline

- Launch announcement : 17th February

- Launch event (webinar): 28th of February

- EoI phase start: 28th of February

- Full Applications open mid-April

- Applications dead-line mid-June

- Winning bids announcement mid-August

- Expected duration of the programme : up to 18 months



Additional information

Official website:

https://www.nature.scot/funding-and-projects/firns-facility-investment-ready-nature-scotland

• Launch Webinar on the 28th hosted by the Scottish Nature Finance Pioneers: (link available on the NatureScot's Website)

https://scottishwildlifetrust.zoom.us/meeting/register/tZloc-mgqDooEtPG376A8w55YCC6MDy4A_gL

For any queries or to register to the mailing list:

FIRNS@nature.scot





Workshop: Innovative funding and finance

23 February 2023 Sniffer Flood Risk Management Conference

TreesAl

Driving investments in nature-based solutions for climate adaptation in cities

Carlotta Conte and Chloe Treger

Dark Matter Labs

Discussion questions

- 1. How could the key challenges highlighted by the Trees AI case study be addressed?
- 2. Thinking more broadly to financing flood risk management interventions, especially nature-based solutions. What the key challenges and barriers related to this topic and what do we need to overcome them?



Coming up next...

Closing Reflection & Women in FRM Networking

Foyer





1410–1525 Session 7b. Adaptation Guidance Review Workshop

Norie-Miller Studio (in person only, not available online)

SEPA and The Scottish Government are developing a set of guidance to support future flood studies and schemes. This is an opportunity to explore key themes and guidance needs going forwards.

Leigh Fraser, Helen Panter, Heather Forbes, Nicola Melville (SEPA), and Michelagh O'Neill (Scottish Government)

Scotland's Flood Risk Management Conference 2023



Creating Water Resilient Places





Scotland's Flood Risk Management Conference 2023

Session 7b: Adaption Guidance Review Workshop

Leigh Fraser, Helen Panter, Heather Forbes, Nicola Melville, SEPA and Michelagh O'Neill, Scottish Government





Adaptation and appraisal for flood risk management

Practitioner workshop
FRM conference 23 February 2023



Workshop plan

- Welcome and introduction to the team
- Introduction and context (10 minutes)
- 2 rounds of discussions (25 minutes)
- Wrap up and thanks (5 -10 minutes)



What we have - Current guidance



Options Appraisal

- Published in 2016
- Audience: responsible authorities and consultants
- Built on previous guidance and policy statements
- Aimed to support sustainable FRM ambitions

he Scottish overnment

- Adaptation Planning for Flood Risk Management
 - There is no specific guidance currently in place.



First Edition May 2016

What we want

Guidance that supports flood risk management decisions now and in the future Centred on HM Treasury Green Book

- Support local and national decisions to deliver local and national outcomes
- Reflect current policy environment (climate and biodiversity emergencies, focus on place)
- Bring together adaptation planning and socio-economic appraisal
- Use up to date methods
- Work for different types of actions



Where we'd like to get to

Good information

Good decisions

Good projects

Good outcomes



Three key areas to explore in today's workshop







DEVELOPING BETTER BUSINESS CASES



VALUING WIDER IMPACTS



Building adaptation plans

- Provides ideas around how to work with others to develop place based adaptation plans centred on the needs of the community and how these needs are, or will be, impacted by flooding.
- Aid consideration of what decisions might need to be made now, or in the future, to increase the community's resilience.
- Support appraisal of specific actions within the context of the adaptation plan.

Developing better business cases

- Guidance built around Treasury Green book
- Translates the Treasury business case model to make it meaningful for FRM.
- Allows levels of detail to be built up as a project is developed
- Emphasises the importance of checking for continued project viability



Valuing wider impacts

- Maximise the socio-economic value of projects to deliver sustainable flood risk management.
- Respond to local authority request for additional support in valuing social and environmental benefits/disbenefits of different types of action.
- Bring together background on related statutory duties/ policy drivers that support this approach.



Next steps

- Incorporate learning from workshop and reviewers
- Summer 2023 Issue as interim guidance to allow testing and user feedback





Coming up next...

Closing Reflection & Women in FRM Networking

Foyer





Day 2 Afternoon Parallel Sessions

23/02/23

1410–1525 Session 7c. Nature-based Solutions Parallel Plenary
Gannochy Auditorium & online stream

Welcome from the chair: John Wright (Mott MacDonald)

 Working with Natural Processes Evidence Directory and Learnings from the NFM60 pilot

Dr Daniel Hine (The Environment Agency)

 Demonstrably different approach to to integrated drainage and flood planning

Dawn Lochhead (Scottish Water), Julie Waldron (City of Edinburgh Council)

- Challenges to NFM and riparian restoration
 Ryan Jennings (JBA Consulting) and Dr Derek Robeson
 (Tweed Forum)
- Enhancing NFM with digital tools
 Alex Fraser (Mott MacDonald)
- Q and A via Slido #FRM2023-S7c





Creating Water Resilient Places



Scotland's Flood Risk Management Conference 2023

Session 7c: Nature-based Solutions Plenary

Chair: John Wright, Mott MacDonald







Scotland's Flood Risk Management Conference 2023

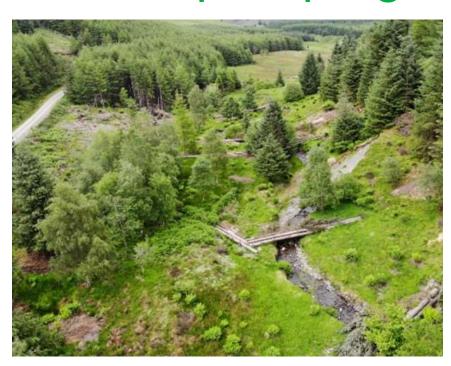
Session 7c: Nature-based Solutions Plenary

Dr Daniel Hine, The Environment Agency





Update to working with natural processes evidence directory & key findings from the NFM pilot programme

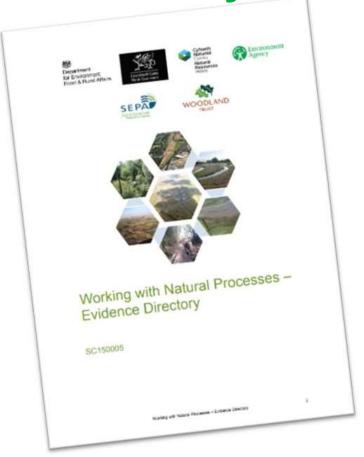


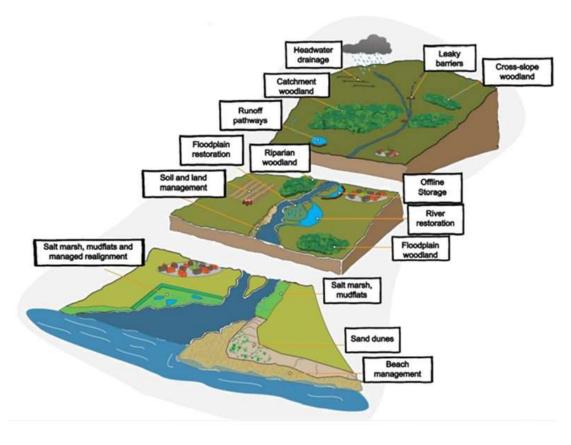
Daniel Hine
Principal Scientist - Joint FCERM R&D Programme
Environment Agency



Working with Natural Processes Evidence

Directory

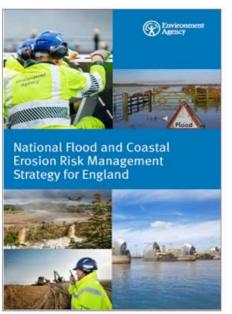






Strategic context

- FCERM flood policy statement: double the number of government funded projects which include nature-based solutions to reduce flood and coastal erosion risk
- FCERM Strategy: risk management authorities will work with catchment partnerships, coastal groups, land managers and communities to mainstream the use of nature-based solutions
- FCERM Roadmap: mainstream the use of nature based solutions





器 HM Government



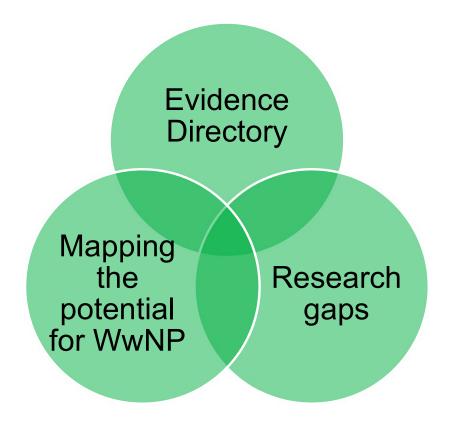
July 2020

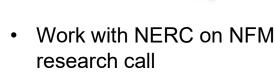


Products from 2017 Evidence Directory

- Evidence directory report
- Literature review
- 14 one page summaries
- 65 case studies

- GIS maps
- PDF maps
- User guide
- Technical report





Monitoring of NFM pilot projects



NFM Pilot Programme

Sustainable Drainage Systems in Sutton Schools

- Used a range of SuDS measures in 6 schools in the London Borough of Sutton.
- Pilot programme funding helped unlock a further £40,000 of funding to allow the work to go ahead.
- The project will disconnect nearly 4.3 hectares of hard surfaces (such as roads, paths, roofs)

from the drainage network flowing into the River Wandle.



Shipston Area Flood Action Group

- A community led volunteer team working to reduce flooding to homes and businesses using NFM measures
- They have over 700 leaky barriers, and ponds to slow the flow of water during heavy rainfall. This has reduced the flood risk to 17 villages and towns.

NFM Pilot Programme



The main achievements from the natural flood management programme between 2017 and 2021



slowing and storing water upstream of 15,000 homes in areas at risk of flooding (the equivalent of 1.6 million cubic metres)



attracting £6 million of funding contributions



involving 85 partners - including government agencies, charities, local community groups and environment non-government organisations



improving 610 kilometres of river



improving 4,000 hectares of habitat



planting 100 hectares of woodland



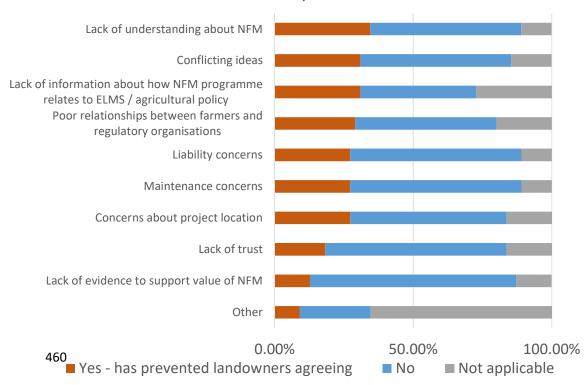
Learning from the NFM programme

- Partnership working
- Assessment of NFM projects for funding and valuing the flood benefits from NFM projects
- Implementing NFM projects
 - Funding eNGOs
 - · Permits, consents and permissions
- How to monitor NFM and sustain projects long term
 - Asset maintenance
 - Linking with Environmental Land Management funding and Local Nature Recovery Strategies

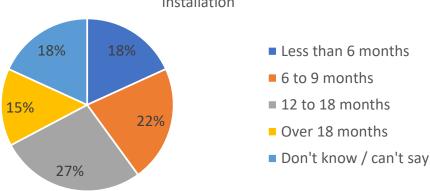


Key lessons: Successful NFM projects are dependent on strong community based partners and support of land owners







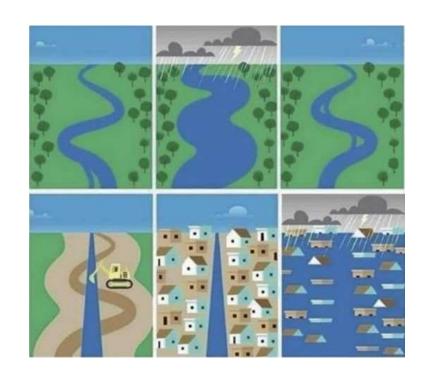


50% used catchment sensitive farming officers



Key lessons: Standard funding rules and business cases can be a barrier to NFM

- Hard for NFM to demonstrate changes in risk bands, which is needed to access GiA
- NFM projects are often small and the costs of modelling and business case development can be disproportionate
- NFM works best at the catchment level how can we package projects?
- NFM best delivered through third sector and community groups



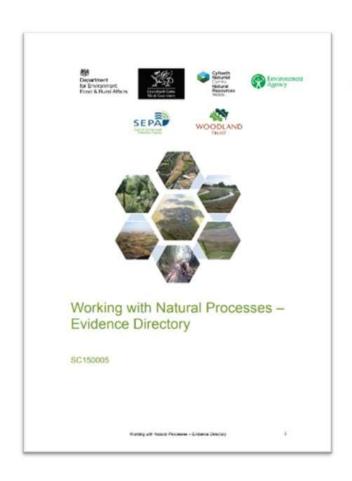


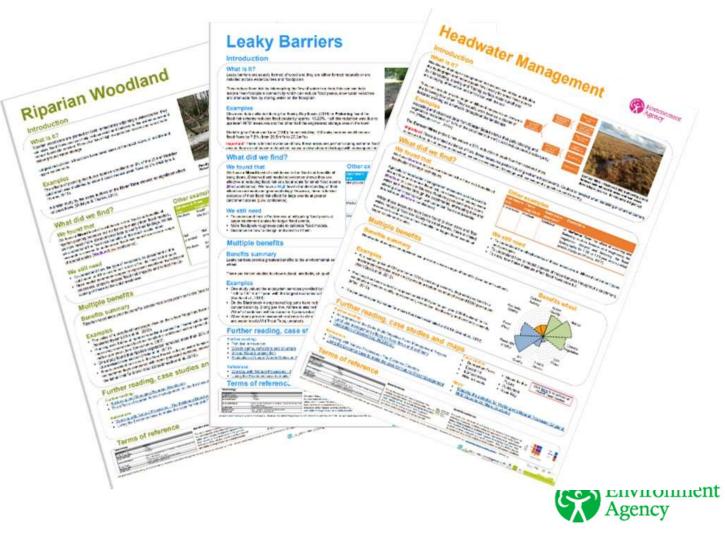
Updating the Evidence Directory

- Update to the 2017 Evidence Directory covering new evidence produced in last 5 years.
- Working collaboratively with NRW, Welsh Government, SEPA & Defra.
- Literature scoping review already underway to identify published and grey literature from last 5 years.
- Will collate existing evidence including;
 - Quantitative analysis of data available from pilots
 - Key learning from NERC NFM programme
 - Findings from literature review.
- · Will only update case studies where these provide significant new learning or strong evidence.
- Will be published by end of 2023.



Updating the Evidence Directory





Thank you!

Daniel.Hine@environment-agency.gov.uk

Useful links:

Working with Natural Processes Evidence Directory

https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/working-with-natural-processes-to-reduce-flood-risk

Natural Flood Management Evaluation Report

https://www.gov.uk/government/publications/natural-flood-management-programme-evaluation-report



Scotland's Flood Risk Management Conference 2023

Session 7c: Nature-based Solutions Plenary

Grant Vanson, Scottish Water and Julie Waldron, City of Edinburgh Council







Thriving Green-Blue Neighbourhoods: Collaborative planning for a Water Resilient Edinburgh

Julie Waldron & Grant Vanson

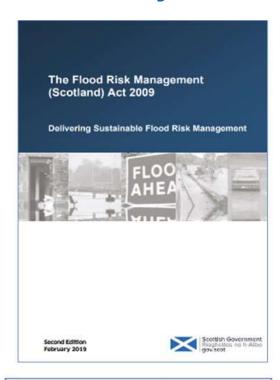






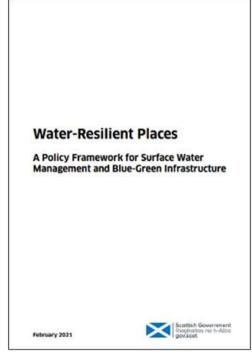


National Policy context

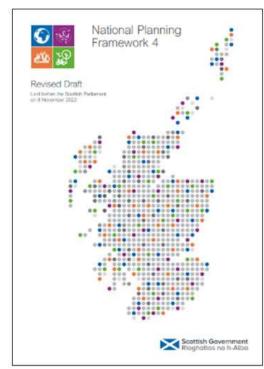


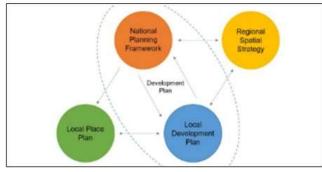
Outcome 4:

Sustainable surface water management that decreases burdens on our sewer systems while also delivering reduced flood risk and improved water quality













Our challenges

Ageing drainage assets & delivery of new blue-green (SUDS) assets	Forecast population growth - 200,000 by 2040
Changing climate – extremes of weather in the urban environment	Evolving community & elected member expectations – solve floodin and environmental impact now
Achieving Net Zero - As a city, as a region & organisationally	Historical regulatory duties & responsibilities





Objectives and aims



Create better places through consideration of wildlife, water and wellbeing



Enhance and safeguard biodiversity by protecting and expanding habitat networks



Maximise sustainable water management using nature-based solutions



Increase Edinburgh's climate change resilience



Enhance quality of life making Edinburgh a great place to live work and visit



Integrate and expand walking and cycling networks with green/ blue infrastructure



Provide a integrated framework of information to support Council decision making and strategies

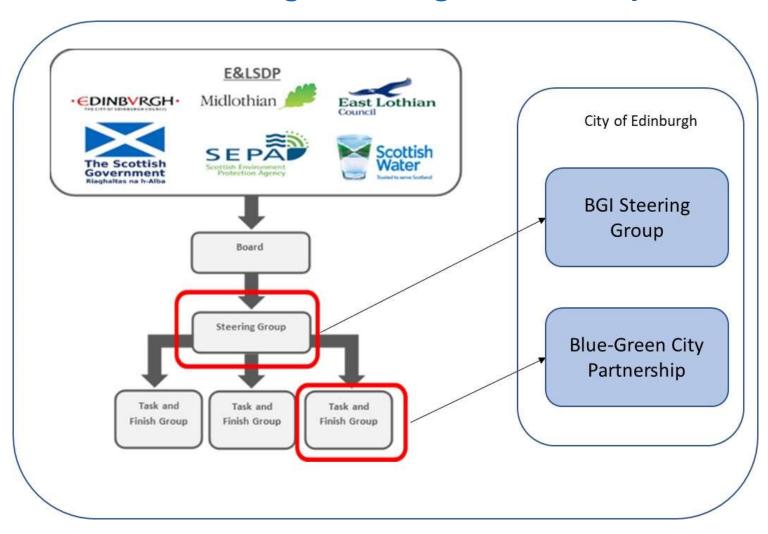


Investment in communities





Edinburgh & Lothians Strategic Drainage Partnership



Blue-Green City Partnership









Develop and deliver a multi-agency, place-led approach to sustainably manage drainage and surface water and create flood resilient communities

- 1. Stormwater should be removed from the combined wastewater system and managed on the surface through Blue-Green infrastructure (BGI)
- 2. BGI will enhance the environment with improved placemaking, access to green space, biodiversity with benefits to health and active travel
- 3. Scotland will be an international exemplar and is exporting expertise

Platform for creating a radically different, replicable approach to urban water planning and management at catchment scale

1. Policy, Process & Guidance

2. New Development ('No more in')

3. Retrofit ('What's in, out')

We will create a multidisciplinary team to drive forward the transformation at pace, adopting an "Agile Sprint" approach.

Blue-Green City Partnership Multi-disciplinary team









Landscape Architecture/ Biodiversity/ Planning

Environmental Planning





Surface water/Sewer Flood Risk Management



Flood/Structural/ Roads Engineering management



Multi-disciplinary 'Agile' working

Meet 3 x a week





Water Vision & Policy hierarchy

Vision for Water Management in the City of Edinburgh

Final: November 2020





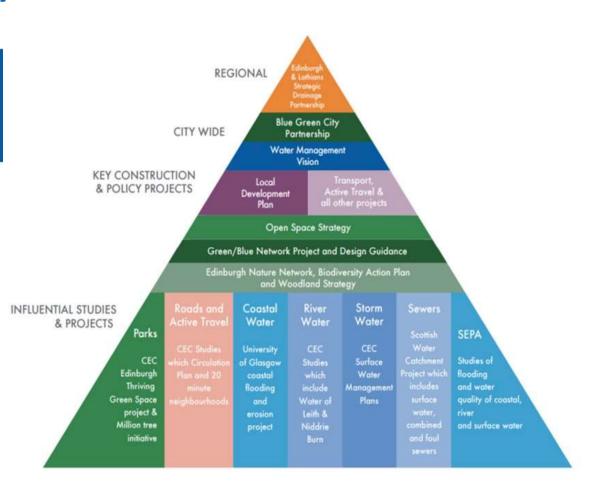












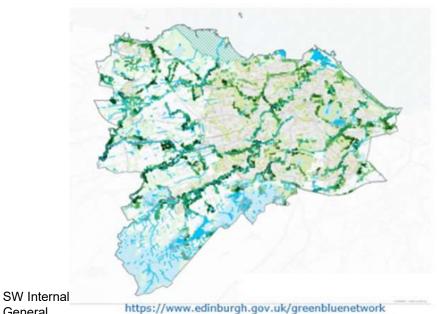


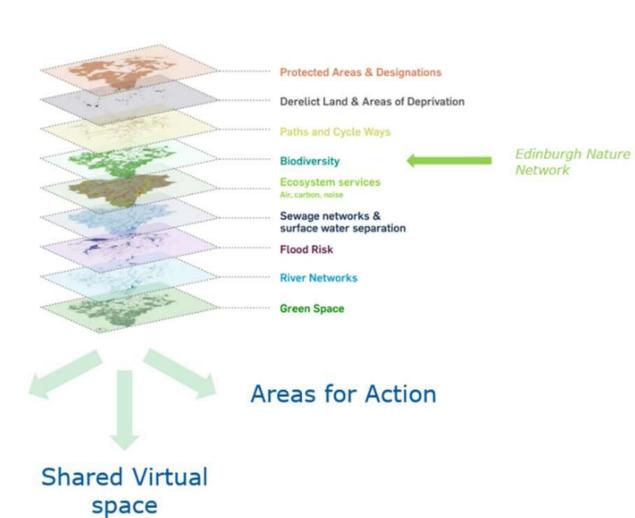
General



Green Blue Network project



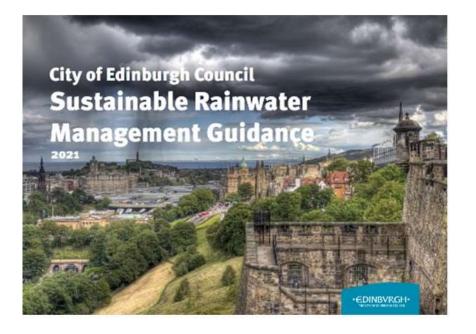








Delivery: Policy, Process & Guidance







S......General





Key Learning – Policy, Process & Guidance

Understanding of requirements & challenges for each partner organisation is crucial

Critical to join up competing strategies & policies – 'water' not always considered, but should be!

Place-based policy & planning can enable multiple outcomes — active travel, green space, climate adaptation, flood risk reduction

Engagement across multiple disciplines to win 'hearts & minds' to key to buy in at senior leader and officer level



Developing a

Replicable

Process



Delivery: Retrofit: Thriving Green Blue Neighbourhood

Developing a proof-of-concept integrated drainage and storm water management plan for priority areas within the City of Edinburgh

Multi-agency 'knowledge exchange' workshop

Filled gaps in knowledge where required

Developed & prioritised workstreams to develop a short, medium and long term plan of surface water management opportunities

Key constraints & opportunities for BGI documented (e.g. Orchard Park)

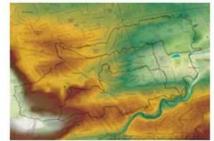
BGI Opportunities built into model to assess potential impacts of BGI delivery





Background & Analysis

Topography



Craigleith forms a small valley between two natural ridges to the north and south and Crstorphine Hill to the west

Historic Development



Looking at the expansion of the City into

Heritage



The World Heritage Site, conservation areas.

Planning



Oty Plan 2030 policy areas, development sites, place briefs and vacant & derelict land, areas of deprivation

Transport, Active travel & Quiet Routes ENN, Biodiversity and Green Spaces



Existing and proposed cycle routes and paths. off road routes. Strava data, active travel routes and investment programme, and 20 Minute Neighbourhood principles, proposed 20 mph zones, parking and the reserved tram route.



Natural Heritage designations, priority habitats.

The Strategic Green Blue Network



Strategic GBN including biodiversity connectivity, natural capital, water management and apportunity areas for delivering multiple

Water & Flood Risks

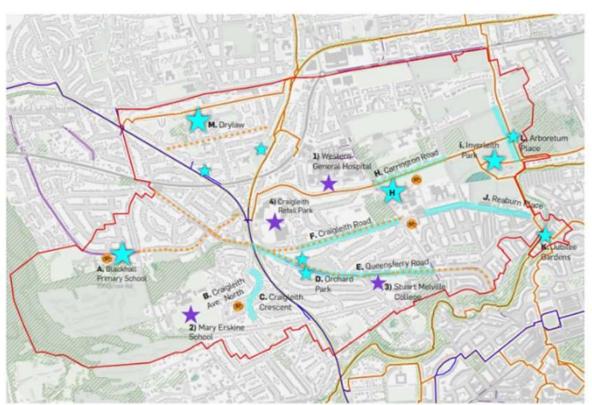


of historic flooding, surface water and river flood risks. Edinburgh's Strategic Flood Risk





Opportunity Areas



An initial network of green blue opportunities with potential to provide multiple benefits has been identified based on existing information, previous studies and parallel flow modelling work by Scottish Water.

KEY



Green Blue Opportunities

- A. Blackhall Primary
- B. Craigleith Ave. North
- C. Craigleith Crescent
- D. Orchard Park
- E. Queensferry Road
- F. Craigleith Road
- H. Carrington Road
- I. Inverteith Park
- J. Raeburn Place & Comely Bank Rd
- K. Jubilee Gardens
- L. Arboretum Place
- M. Drylaw (& deculverting)

Opportunities in private grounds

- 1). Western General Hospital
- 2) Mary Erskine School
- 3) Stuart Melville College
- 4) Craigleith Retail Park



///// Priority Habitat Areas

Active Travel Routes

Quiet Route

National Cycle Route

- Cycle Lanes

**** Proposed Active Travel Route







K. Stockbridge - Jubilee Gardens

Issue - close to historic flooding area in Raeburn Place

Opportunity - create new multifunctional raingarden with trees to take water off the cobbled Kerr Street and reduce pressure on the drainage system.







Rain garden

J. Raeburn Place

Issue – Raeburn Place historic flood risk, EWHS, New Town Conservation area constricted road and footway space, temporary footway extension.

Opportunity - formalise pavement extension to meet streetscape standards - options - permeable paving and porous subbase if services permit, alternative OR Small raingardens or filtration strips

Investigation of future cycle link to George St







Marylebone, London - rain gardens

J. Comley Bank Road

Issue – Comely Bank Road high surface water flood risk, wide pavements, outwith conservation area

Opportunity - small raingardens or filtration strips, SuDS Trees at Comely Bank Rd

Investigation of future cycle link to George St







SUDS Street Trees - Goldhawk Road



Key Learning – Retrofit Planning & Delivery



Aligned approach attracts other partners – NatureScot, Royal Botanic Gardens Edinburgh, retail sector

Multidisciplinary planning teams: strategy, engineering, landscape architects, planning, drainage/flooding

Place-based planning opens up new opportunities for funding & delivery – but simplified BGI funding required

Place based, plan lead approach – supported by modelling (not 'model led' planning)

Learning through a different lens

– move from 'not knowing' to
'curiosity and questioning' to
learn about different disciplines



Summary – Partnership Working



- Clear governance and support structure has been important
- Targeting processes, guidance and policy is key for long term systemic change
- Flexibility to changing priorities and resource availability is essential
- Available resources and skills are a barrier to progress
- Balance of working group representatives is key (planning & flooding)
- Enthusiastic people make a difference
- Not "one size fits all"



Scotland's Flood Risk Management Conference 2023

Session 7c: Nature-based Solutions Plenary

Ryan Jennings, JBA Consulting and Dr Derek Robeson, Tweed Forum





Gala Water

Challenges to NFM and Riparian Restoration



Senior NFM Analyst -JBA Consulting ryan.jennings@jbaconsulting.com



Senior Conservation Officer - Tweed Forum

derek.robeson@tweedforum.org









Introduction

- Catchment Scale Natural Flood Management Analysis
- Challenges & Opportunities Targetting Native & Riparian Woodland Planting for NFM
- Landowner Case Study Example Benefits of Riparian Woodland Planting
- Where does Natural Flood Management sit within Integrated Catchment Management?

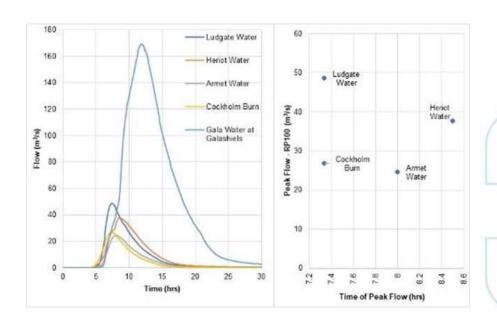






Choice of sub-catchments

- Time-to-Peak analysis
- Identify sub-catchments to focus NFM options in
- Aim to avoid peak flow synchronisation
- Four largest sub-catchments chosen to be included in analysis
- Heriot Water and Armet Water have smaller, later peak flows
- Cockholm Burn runs into Stow







NFM Site Visit

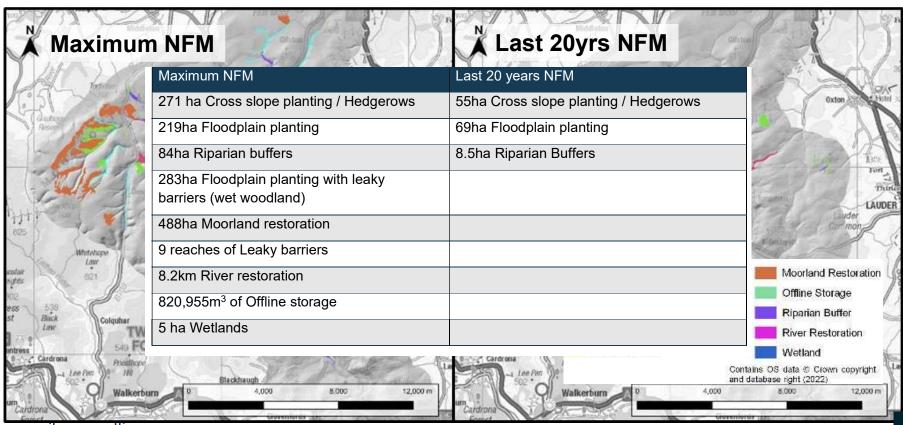








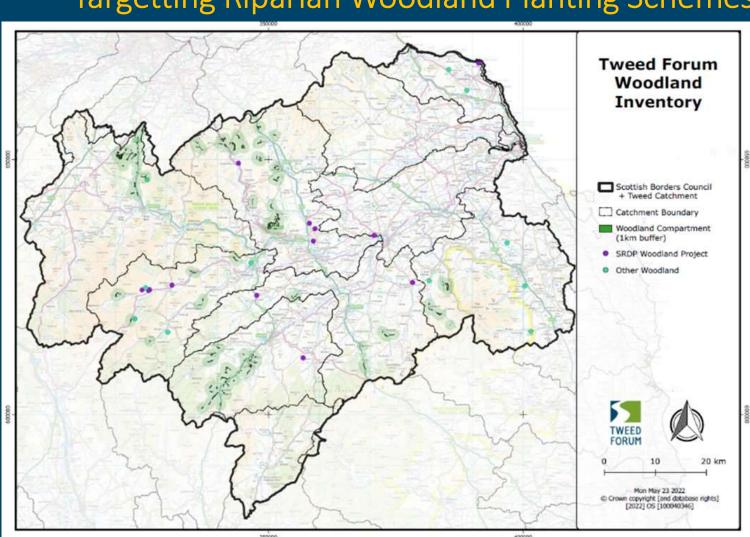
Natural Flood Management Options



www.jbaconsulting.com NFM@JBAconsulting.com

Tweed Forum Targetting Riparian Woodland Planting Schemes for NFM





Landscape scale schemes across Tweed Catchment

1,032ha 1,352,000 trees

Catchments-

- Leader Water
- Gala Water
- Eddleston Water
- Yarrow Valley
- Ettrick Valley
- Upper Teviot
- Oxnam Water
- Bowmont Water





Targetting Native & Riparian Woodland Planting for NFM Challenges & Opportunities

- Project facilitation is key
- We use the Scottish Forestry Grant Scheme to underpin applications
- Finding the Shortfall funding is crucial (c.35% diff between grant & cost)
- Deer fencing is extremely expensive
- Extensive use of SBC facilitated windfarm mitigation funds
- Accessed Carbon funding (via Forest Carbon)
- But we require more value added to Riparian & Native Woodlands in recognition of public services they provide
- For example, Scottish Forestry could offer funding for: Pond creation, wetland creation, placing leaky barriers, alternative watering for livestock, etc, (as part of a functioning woodland ecosystem and in recognition of the many ecosystem services native woodlands provide)

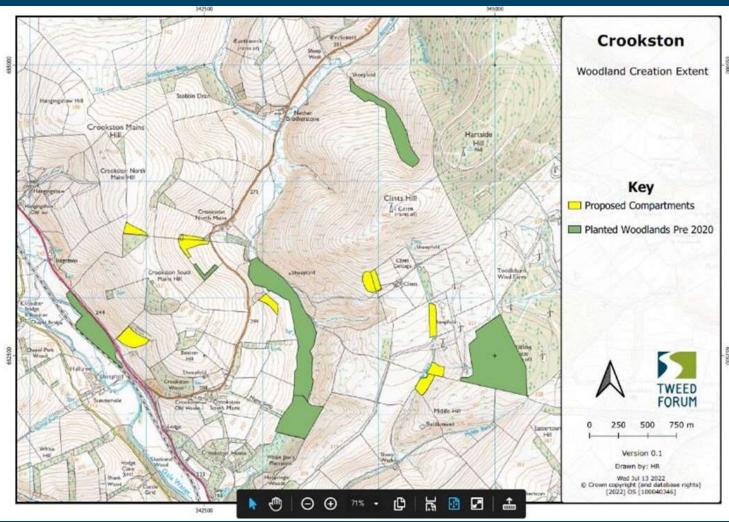


Focus on Crookston Farm (Gala Water) - 70ha planted to date (Facilitated by Hugh Chalmers - Tweed Forum)





Tenant Farmers	Jim and Graeme Sinclair
Landowner	Lord John Borthwick
Farm	Crookston
Locality	Gala Water, Scottish Borders
Farm Type	Upland sheep and beef
Size	815 ha
Staff	3 full time





Tweed Forum

Crookston Farm – Riparian Woodland (Gala Water Catchment) Looking upstream (post planting -2012)







Tweed Forum

Crookston Farm – Riparian Woodland (Gala Water Catchment) Looking upstream (Summer 2022)





Colin McLean Photography



Crookston Farm - Example Benefits of Riparian Woodland Planting Gala Water Catchment Planted 2012 (Photographed 2022)





Benefits to Farmer:

- 1. Slowing the flow.
- 2. Cooling the rivers.
- 3. Helping the fish
- Increasing habitat connectivity.
- 5. Enhancing Biodiversity.
- 6. Improving water quality.
- 7. Capturing carbon.
- 8. Enhancing the landscape.
- 9. Improving tourism.
- 10. Diversifying the farm business.
- 11. Reducing risk from liver fluke.
- 12. Helping livestock management.



JBA consulting

Crookston Farm - Floodplain Woodlands in Gala Water (2012 & 2020)



2012





Crookston Farm (Gala Water) - 70ha planted to date Going forward, what else could the tenant farmer do?





1. Place Leaky Barriers on watercourse?

(not against this idea if it helps slow the flow and research shows that these are very effective at slowing overland flow)

2. Plant new hedgerows (hut hedgerows are not

(but hedgerows are not an eligible item under SRDP in this part of the world)

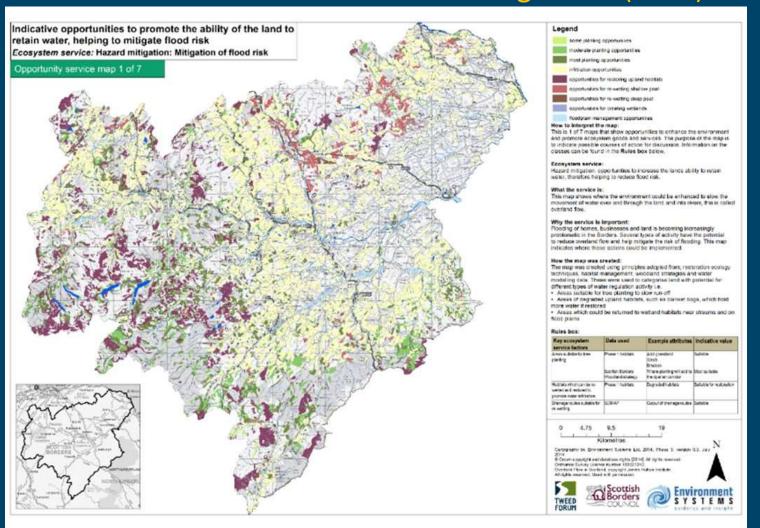
3. Remove plastic tree shelters

(We are currently exploring the use of volunteers to assist)



Target Mapping Tools - Scottish Borders Land Use Strategy pilot: Natural Flood Management (NFM)





Legend-

Opportunities for:

Green- Native Woodland planting

Brown- Peatland /wetland Restoration

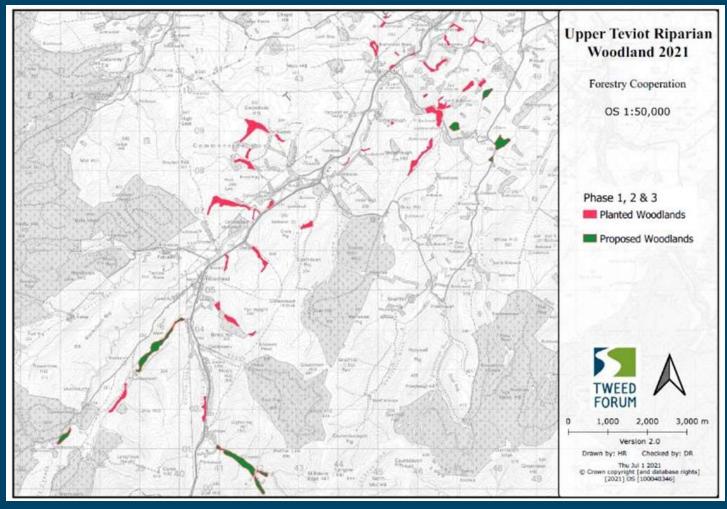
Yellow- Increasing Infiltration (on inbye grassland fields)

Blue- Increasing water storage on floodplain



Targetted Upper Teviot Riparian Woodlands – c.120ha

(Langhope Rig Windfarm Biodiversity offset facilitated by SBC (Help with Hawick Flood Scheme)

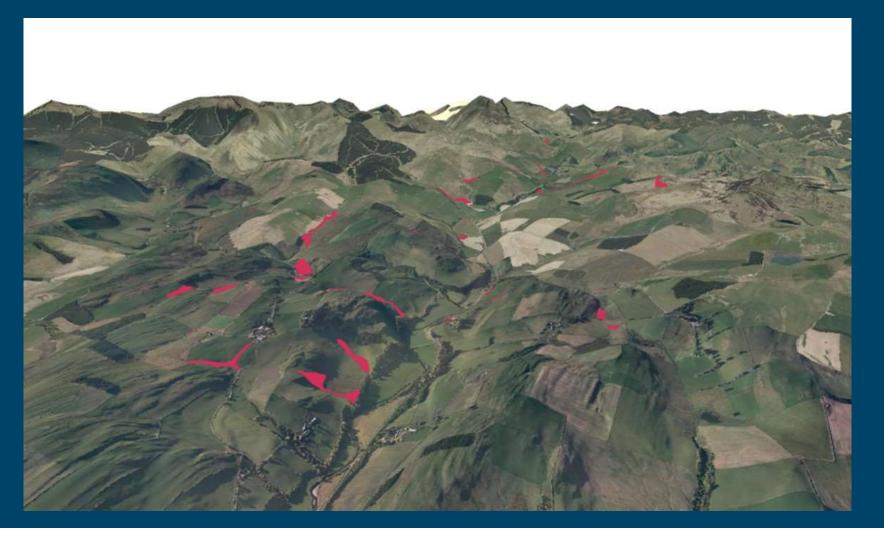






Upper Teviot Riparian Woodlands – 120ha

(Langhope Rig Windfarm Biodiversity offset facilitated by SBC)







Tweed Forum- Riparian Woodlands











Key Achievements

267 ponds & wetlands created/restored



20+ sted buildings

listed buildings & monuments restored

1,352,452 trees planted (1037 ha)

47,653 people engaged in over 1,329 events

440 ha

of floodplain & wetland restored

209 miles
stock exclusion fencing





300 miles of river enhanced



236 engineered log jam structures installed

4,920 ha

of peatland improved



1,195 miles of paths upgraded/created

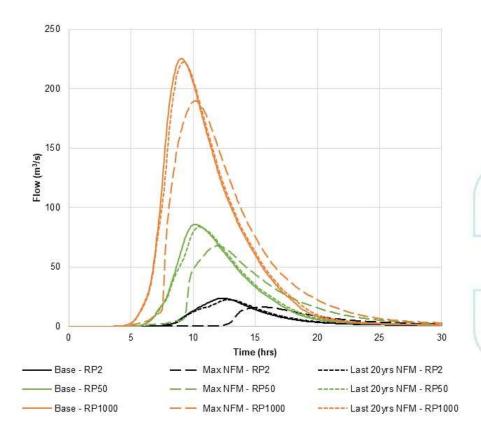






JBA consulting

- 16% to 32% peak flow reduction for Max NFM scenario
- 65 minute to 190 minute delay in peak flow for Max NFM scenario
- 1% to 5% peak flow reduction for Last 20yrs NFM scenario
- 10 minute to 30 minute delay in peak flow for Last 20yrs NFM scenario







Question – Where does Natural Flood Management sit within Integrated Catchment Management?

(Especially important, if the land is expected to provide: More food production, More woodland expansion, More Wildlife & More people.

Fundamental Questions-

- 1- What does society want the uplands to look like (and pay for)?
- 2- Where (and how) do we target public finances to help achieve the integrated objectives of Farming, Forestry, Conservation, Natural Flood Management & Tourism?
- 3- How do we encourage greater farmer co-operation to deliver greater Ecosystem Service Benefits & NFM provision?
- 4. What is the best mechanism to enable the transition?

How do we 'better connect' upstream communities with downstream communities?



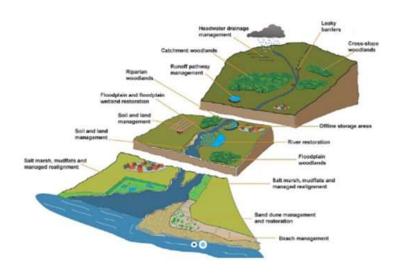


Any Questions?

NFM@JBAconsulting.com

Ryan.Jennings@jbaconsulting.com

Natural flood management



www.jbaconsulting.com NFM@JBAconsulting.com

info@tweedforum.org

derek.robeson@tweedforum.org

The Eddleston Water Project

Funded by the Scottish Government and the Scottish Environment Protection Agency (SEPA), this project aims to reduce flood risk and restore the Eddleston Water for the benefit of the local community and wildlife

The Eddleston Water project, supported by the Scottish Government, is investigating the effectiveness of natural flood management (NFM) techniques and habitat restoration measures at a catchment scale. NFM is one part of the wider sustainable flood risk management approach which, alongside structural measures, flood warning and behavioural responses provides a risk-based and plan-led approach to reducing flood risk, as well as a potential climate change adaptation response. The project looks to provide the evidence base to assess the value, costs and benefits of restoring a typical Scottish river system through changes to land management practices, delivered across the whole catchment.



Remeandering on the Eddleston Water

https://tweedforum.org/





Scotland's Flood Risk Management Conference 2023

Session 7c: Nature-based Solutions Plenary

Alex Fraser, Mott MacDonald







Enhancing NFM with Digital Tools





I'm passionate about promoting the use of Nature Based Solutions across our landscape to make improvements to our hydrological readiness

Alex Fraser

Natural flood management specialist

E alex.fraser@mottmac.com

T 0113 397 2738

W mottmac.com





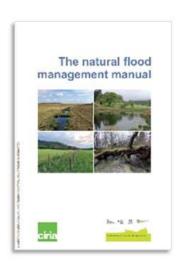
What is natural flood management?



Natural flood management is used across the landscape to protect, restore, or mimic the natural functions of catchments, floodplains, rivers and the coast.

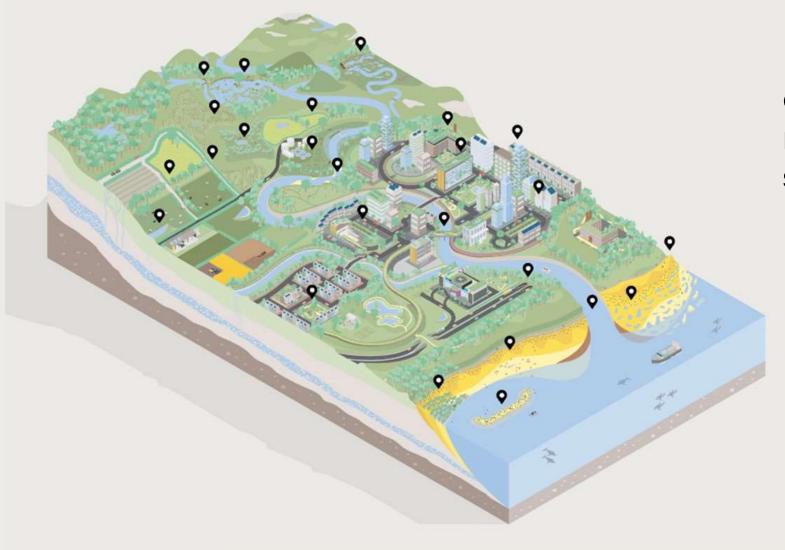
A range of techniques working with hydrological processes





The natural flood management manual (C802F)

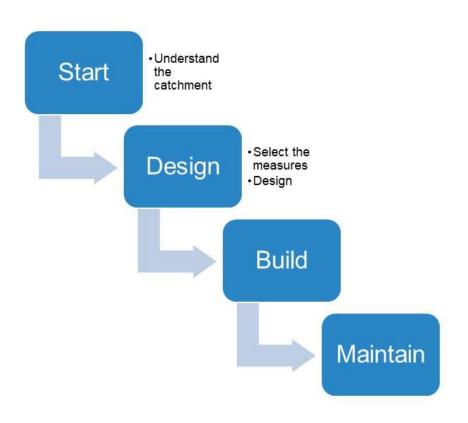
So what are Nature Based Solutions?

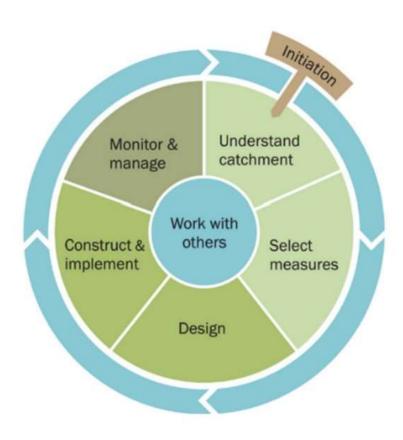


Find out using our interactive nature-based solutions tool

The NFM delivery process

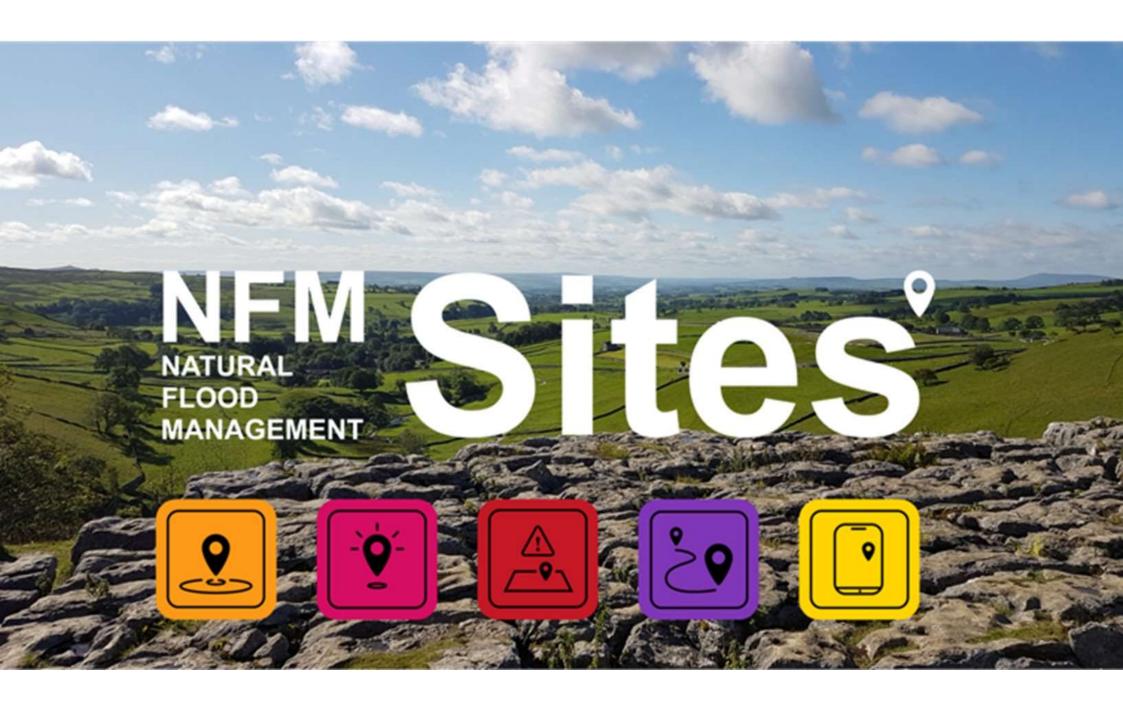
The NFM delivery process





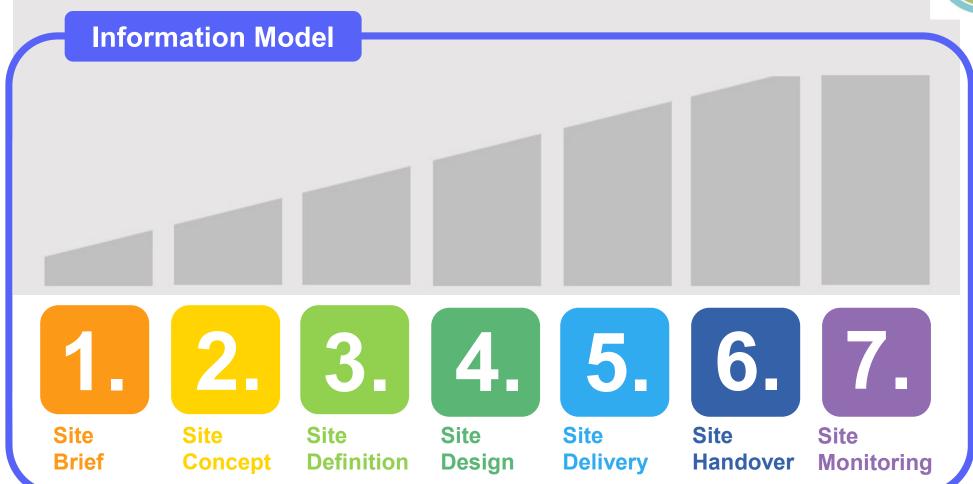
NFM tools

Nature Based Solutions Framework (NFM sites)



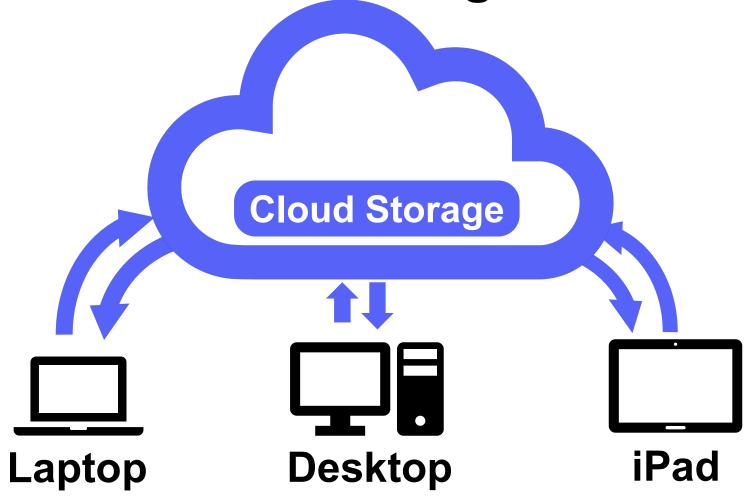
Better information management





Mott MacDonald

Better information management







1.1 Identify a Site



1.2 Site Potential



1.3 Site Desk Study



1.4 Plan a Site Visit

2 Site Concept



2.1 Site Concept



2.2 Site Summary

3 Site Definition



3.1 NEAS Screening



3.2 Site Definition



3.3 PCI Client



3.4 Detailed Site Summary

4 Site Design



4.1 PCI Designer

5 Site Delivery





6.1 Site Data Capture

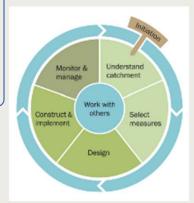


6.2 Site Records





7.1 Site Monitoring



NFM Sites NATURAL FLOOD MANAGEMENT



NbS Opportunity and constraints

M NbS opportunities tool

MACDONALD GIS based tool to understand catchment spatially



M

MOTT

M NbS constraints tool

MACDONALD GIS based tool to understand catchment spatially

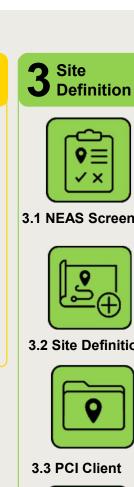
Mott MacDonald NFM Opportunity & Constraints Tool

Total area of NFM: Total area of the Site 514ha 67ha There are 7 potential constraints identified on this site Click each list item below to show the location of the constriant on the map-**Historic Landfill Site** Level of Effort: Lots of Effort **Listed Building** Level of Effort: Moderate Effort Local Road Level of Effort: Moderate Effort **National Road** Level of Effort: Moderate Effort Urban Area Level of Effort: Moderate Effort **Ancient Woodland** Level of Effort: Little to No Effort Open Greenspace Level of Effort: Little to No Effort Areas of No Identified Constriants Level of Effort: No Identified Constraints

NPV Contraints

Congress thecomp Opportunity Mapping

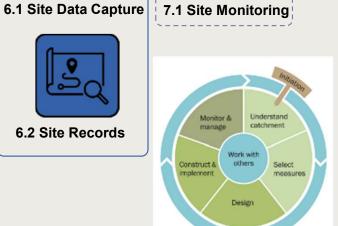
















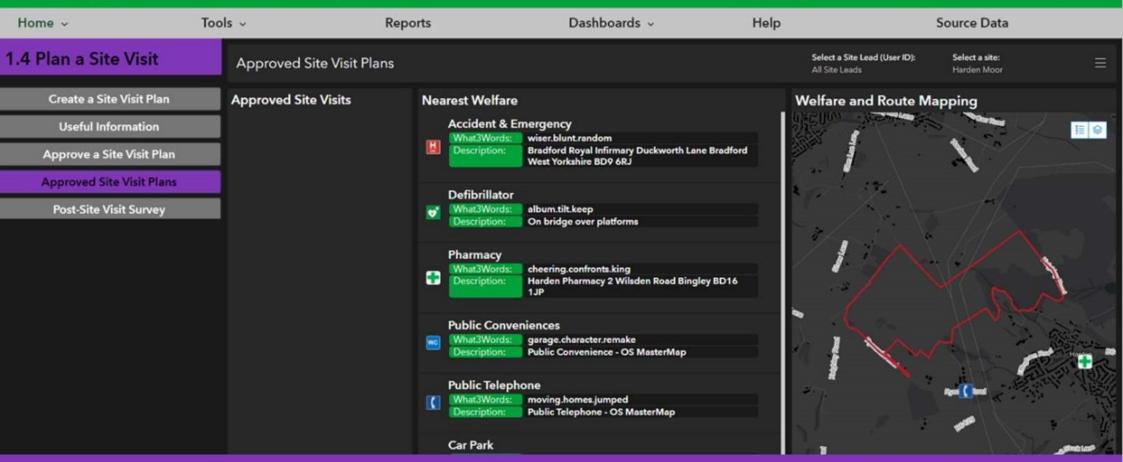
Leeds FAS2 NFM



LIVE V1.0









1.4 Plan a Site Visit



Leeds FAS2 NFM



LIVE V3.0



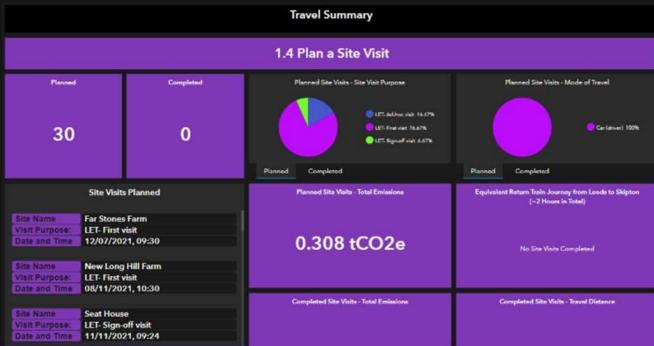


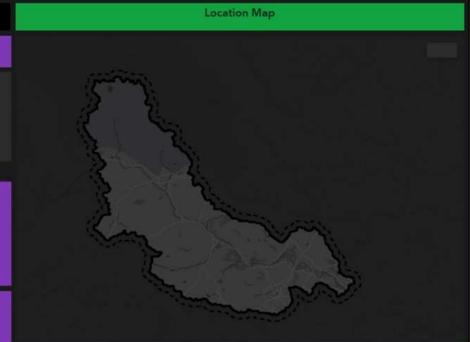
Home v Tools ~ Reports Dashboards v Help Source Data

Project Overview Dashboard



Project Overview Dashboard







1.4 Plan a Site Visit



UK natural capital map

Our UK natural capital map

- Digital reconstruction of natural capital assets
- Quantify the baseline of natural capital stocks
- Inform decision-making e.g.
 - improved asset management
 - opportunities to enhance environmental protection
 - developing business cases and optioneering to compare potential constraints and opportunities
- Map quickly shows how changes to land use can be profitable and enhance the environment





Mott MacDonald 30 September 2021





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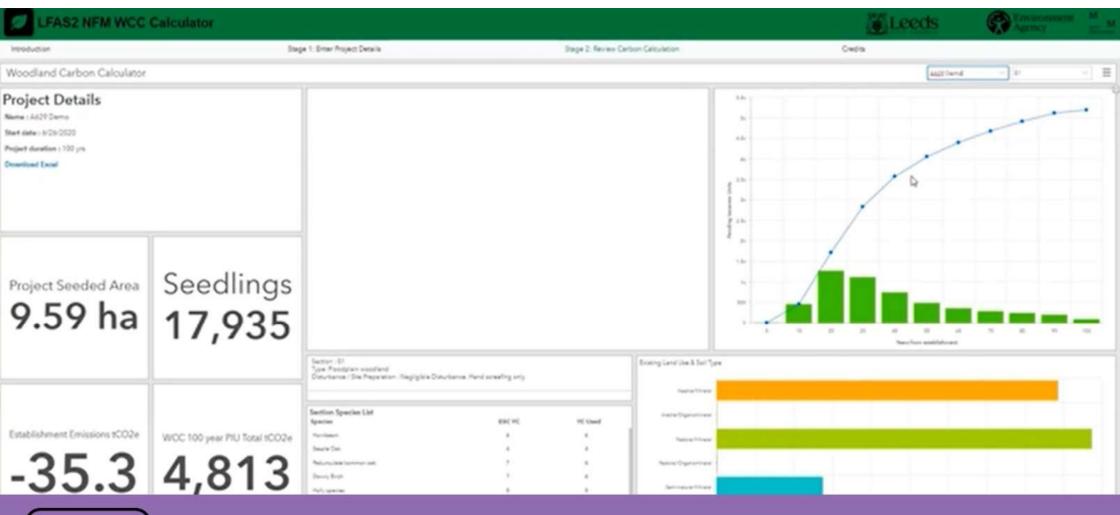




7.1 Site Monitoring



NFM Sites NATURAL FLOOD MANAGEMENT





7.1 Site Monitoring

To Summarise

By adopting a Digital Framework that is fully auditable and evidenced we are able to:

- Layer Nature Based Solutions with other delivery programmes.
- Empower communities, charities and other NGOs to deliver NFM in a managed way.
- Diversify the income streams for NFM and Nature Based Solutions.





Thank you

Alex Fraser

Natural flood management specialist

E alex.fraser@mottmac.com

T 0113 397 2738

W mottmac.com

Confidential - Standard



Scotland's Flood Risk Management Conference 2023

Creating Water Resilient Places

Session 7c: Nature-based Solutions Plenary



Join at slido.com #FRM2023-S7c





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Session 7c: Nature-based Solutions Plenary: Audience Q&A Session







Coming up next...

Closing Reflection & Women in FRM Networking

Foyer



