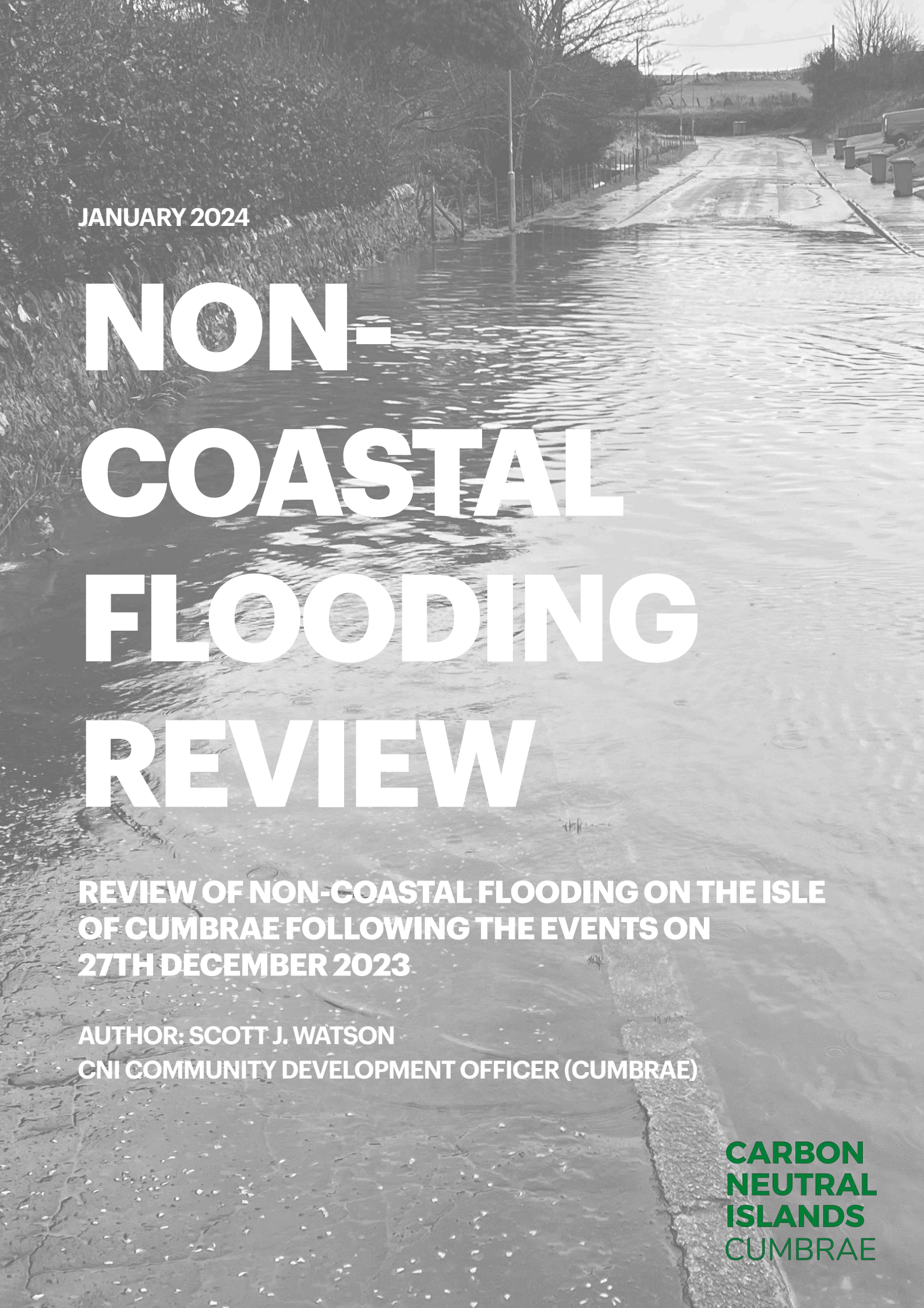

JANUARY 2024

NON-COASTAL FLOODING REVIEW

REVIEW OF NON-COASTAL FLOODING ON THE ISLE OF CUMBRAE FOLLOWING THE EVENTS ON 27TH DECEMBER 2023

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CARBON NEUTRAL ISLANDS
CUMBRAE

MILLPORT

ISLE OF CUMBRAE

INTRODUCTION

On Wednesday 27th December 2023, Millport on the Isle of Cumbrae, along with other parts of the country, experienced a significant flooding event as a result of heavy rainfall during Storm Gerrit. This affected and caused damage to infrastructure, as well as both domestic and commercial properties at various locations throughout the town.

According to the Met Office, Millport experienced 58mm of rainfall, making it the highest recorded area for rainfall in Scotland during that reporting period, and the third highest in the UK.

In response to the flooding event, emergency services were dispatched throughout Millport including three fire appliances from Scottish Fire and Rescue Service, one Police Scotland and one HM Coastguard vehicle.

The purpose of this report is to provide an overview of what, where, and why the flooding took place on 27th December 2023. To provide a means of identifying future recommendations to help minimise the risk or impact of flooding.

It is not the purpose of this report to provide a complete technical analysis or interpret observations and measurements resulting from this flooding event or to provide a complete description of what happens next.

This report details the flooding that occurred throughout the town of Millport as a result of river, surface water, sewer flooding in areas including:-

Lower Cumbrae Reservoir
Millport Golf Club
Golf Road
“Old Millport” Crawford Street, Miller Street and Crichton Street
Bute Terrace
Stuart Street
Glasgow Street
Kames Street and Barend Street

Coastal flooding is outside the scope of this report as no coastal flooding occurred on this date. However for context the risk to Cumbrae from this flooding type and the ongoing Coastal Flood Protection Scheme[1] should be noted.

Where available photos from the events on 27th December 2023 have been included, many of which have been provided by members of the local community affected. Historical images have, at points, been included for context and have been labelled as such in the captions.

[1] https://www.north-ayrshire.gov.uk/your-community/community-safety/flooding/millport-coastal-fps.aspx

Summary of Key Challenges from 27 December 2023:

- Water levels within Cumbrae Reservoirs prevent surge attenuation during excessive rainfall events
- Mill Burn was unable to cope with quantity of water leading to overtopping at several key points
- Drainage and Infrastructure failures led to large quantities of water above what could reasonably be pumped
- No publicly available sandbags or flood defence resources
- Flood response limited to only Category 1 emergency services both during and following the flooding event
- Cancellation of ferry service due to weather conditions prevented additional resources
- Preparedness, awareness and ability to self-help

Glasgow Street, Millport. 27 December 2023

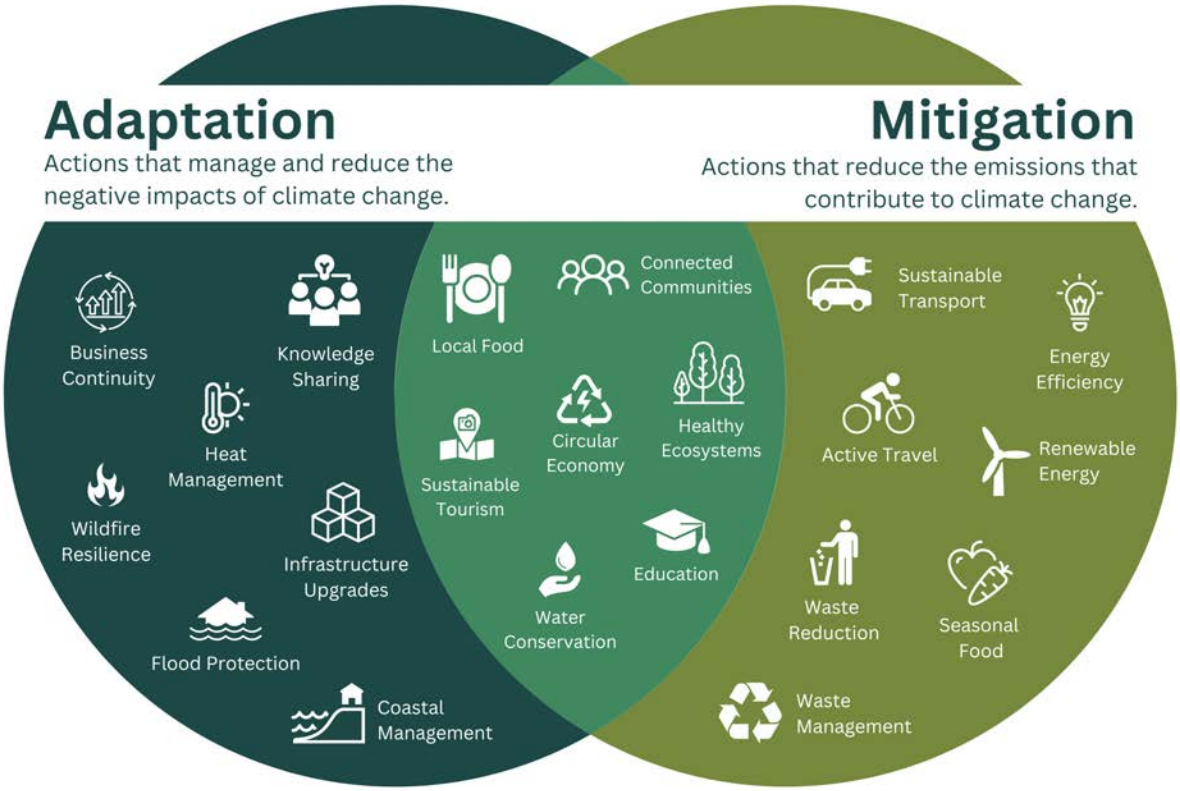
CONTENTS

1. CARBON NEUTRAL ISLANDS PROJECT

The Carbon Neutral Islands (CNI) project is a Scottish Government Programme for Government commitment that aims to demonstrate the climate-resilience and low carbon potential of islands.

In May 2022 the Cabinet Secretary for Rural Affairs and Islands announced the six Scottish islands to be supported by the Carbon Neutral Islands project: Barra, Great Cumbrae, Hoy, Islay, Raasay, and Yell. The CNI project includes one island from each of the local authority areas with responsibility for islands in Scotland.

More widely, the CNI project helps to deliver key commitments in the National Islands Plan and the National Performance Framework, create island- based jobs, and support islands to adapt to the negative effects of climate change.



Venn Diagram illustrating the overlaps between climate change adaptation and mitigation actions.

1.1 ACCORDING TO ADAPTATION SCOTLAND

"Adaptation is about responding to the changes that we have seen in Scotland's climate over the last few decades, and preparing for the challenges and opportunities that we will face as our climate continues to change in the decades ahead.

Adaptation goes hand in hand with work to reduce greenhouse gas emissions, often referred to as climate change mitigation.

Sadly, whilst our work to reduce greenhouse gas emissions can limit future climate change, the greenhouse gases that we have already emitted into the atmosphere will cause further changes that cannot be avoided. These changes will have serious impacts for people in Scotland and internationally.

Flooding can already have a devastating effect. With climate change likely to alter rainfall patterns and bring more heavy downpours, we expect flood risk to increase in the future. This could impact on properties and infrastructure – with serious consequences for our people, heritage, businesses and communities[2]."

The Carbon Neutral Islands Project has been working with the Climate Charity Sniffer and Adaptation Scotland on adaptation in our communities.

[2] https://adaptationscotland.org.uk/

2. AYRSHIRE FLOOD RISK MANAGEMENT PLAN

Great Cumbrae Island is designated by SEPA and North Ayrshire Council in the various local Flood Risk Management Plans produced from 2014 as a Potentially Vulnerable Area (PVA)[3] due to flood risk. The town of Millport is subsequently designated at Target Area[4].

Plans and related reports from 2014-2022, including the Ayrshire Local Flood Risk Management Plan[5] (published December 2022) states that the main source of flooding on Cumbrae is coastal.

The plan estimates that there are approximately 638 homes at risk of coastal flooding, which is then estimated to increase by 19 properties by 2080 as a result of climate change. It further estimates that 124 properties are at risk of flooding from rivers.

Flood Risk Management Plans and associated documents from 2014-2022 have repeatedly placed an emphasis on Coastal flooding as being the primary source and risk for Cumbrae. However research presented in this report questions this assessment.

Local research has shown 77% of flooding events in the last 20 years have been non-coastal related and therefore suggests data used in the creation of the Local Flood Risk Management Plan for Cumbrae is inaccurate.

[3] PVA Ref: 12/02

[4] Target Area 119 - Local Flood Risk Management Plan Ayrshire Local Plan District - December 2022

[5] https://www.north-ayrshire.gov.uk/Documents/FloodProtection/local-flood-risk-management-plan.pdf

2.1 ALL AYRSHIRE LOCAL FLOOD RISK MANAGEMENT STRATEGY[6]

Published 2014
Coastal: 97%
Surface: 3%
River: 0%

Potential for groundwater flooding stated to be "very low to low" with a moderate predicted increase in rainfall and proportionate increase in flooding as a result of the impacts of climate change.

KEY ACTIONS COASTAL

- Maintain existing coastal defences
- Further investigation to confirm viability of relocation
- Potential for extension of existing defences
- A generic Emergency Plan is in place for all Ayrshire which will be maintained and developed.
- No suitable locations identified for coastal defences
- No potential for surge attenuation identified

KEY ACTIONS RIVER

- Further investigation to confirm viability of relocation
- Field run-off and caravan parks are contributing to increasing rates of run off.
- Management of existing Millport Upper and Lower reservoirs needs improved and could benefit flood management
- Potential to divert water from Upper Millport Reservoir. Culverts have capacity issues.
- Potential to alter discharge arrangement from Upper & Lower Millport Reservoirs.
- Continue and develop existing maintenance of watercourse
- A study has been planned to investigate flooding in Mill Burn catchment

[6] https://docs.east-ayrshire.gov.uk/crpadmmin/2012%20agendas/cabinet/12%20november%202014/all%20ayrshire%20local%20flood%20risk%20management%20strategy.pdf

2.2 AYRSHIRE LOCAL FLOOD RISK MANAGEMENT PLAN[7]

Published June 2016
Coastal: 96%
River: 3%
Surface: 1%

States that the "Annual Average Damages" are approximately £2.2 million, and that according to the national assessment "flooding within the area is primarily from coastal sources with a limited impact from surface water; however there have also been reports of river flooding from the Mill Burn."

The plan recognises the limitations of the national modelling approach and states that North Ayrshire Council has undertaken further studies which identified a risk to over 700 properties from coastal flooding… and a further 30 properties identified at risk of river flooding from the Mill Burn."

SELECTED ACTIONS

- Millport Coastal Flood Protection Scheme (Completed by 2020)
- Shoreline Management Plan (Completed by 2019)
- Mill Burn Flood Mitigation Works (Completed by 2022)
- Organisations such as Scottish Water, energy companies and Historic Environment Scotland to actively maintain and manage their own assets, including the risk of flooding.

[7] https://www.north-ayrshire.gov.uk/Documents/FloodProtection/Section3/12.02%20Great%20Cumbrae%20Island.pdf

2.3 LOCAL FLOOD RISK MANAGEMENT PLAN (AYRSHIRE LOCAL DISTRICT) 2022-28[8]

Published December 2022
Coastal: 96%
River: 3%
Surface: 1%

"The main source of flooding is coastal. There is a history of flooding in the area, with recent flooding being caused by coastal flooding"

OBJECTIVES

- 11901: Avoid an increase in flood risk by the appropriate management and maintenance of all existing flood protection structures.
- 11902: Avoid inappropriate development that increases flood risk in Millport
- 11903: Prepare for current flood risk and future flooding as a result of climate change in Millport - community engagement to be carried out in the area by the responsible authorities to raise awareness.
- 11904: Reduce the risk of coastal flooding in Millport
- 11905: Reduce the risk of river flooding from the Mill Burn in Millport

[8] https://www.north-ayrshire.gov.uk/Documents/FloodProtection/local-flood-risk-management-plan.pdf

3. MILL BURN FLOOD ALLEVIATION SCHEME

The need for a Flood Alleviation Scheme in Millport was initially identified in 2015 within the Ayrshire Local Flood Risk Management Plan to comply with the Flood Risk Management (Scotland) Act 2009 and a Public Consultation was held online in July 2020[9]

An initial discussions was held with a single landowner prior to the online public consultation. The online consultation resulted in 7 responses, 5 of which were in favour of the "preferred option". No further public consultation has taken place.

North Ayrshire Council confirmed the Mill Burn Flood Alleviation Scheme[10] on the 15th June 2021. The "Final Progress Report – Local Flood Risk Management Plan" published December 2022, states that the detailed design is underway, and the scheme is planned to be implemented during the second Local Flood Risk Management Plan cycle (2022-2028).

According to the NAC website, the agreed preferred option is construction of a 494 metre, 900mm diameter overflow diversion culvert between Golf Road/Kirkton Crescent junction and West Bay via Nether-Kirkton Farm following the perimeter of the land. It is stated that this would provide protection for up to 124 properties on the island in a 1 in 200 years flood event.

There has been no public update on this scheme since the progress report published in December 2022. The detailed design phase is expected to be completed in 2024 following recent discussion with NAC and the project consultant RPS Group.

[9] https://storymaps.arcgis.com/stories/cd33db76395345cc84d18639b0460ed2

[10] https://www.north-ayrshire.gov.uk/your-community/community-safety/flooding/millburn-millport-fas.aspx

4. FLOODING HISTORY ON CUMBRAE

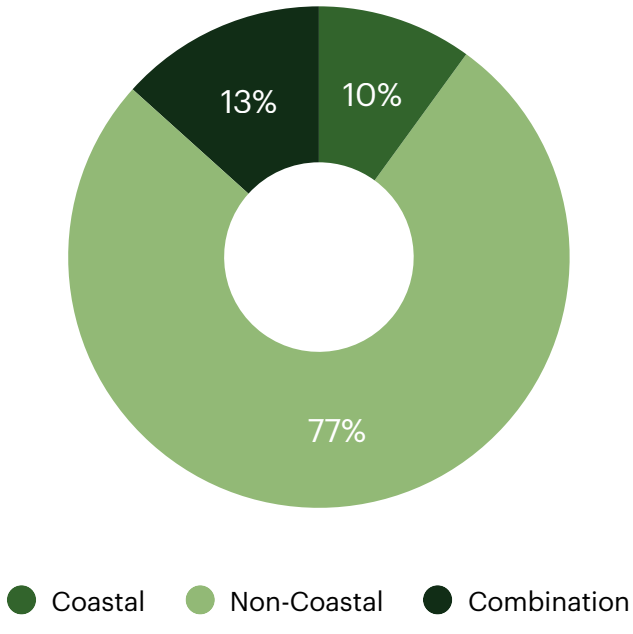
Local review of known events has shown there to have been at least 30 significant flooding events in the last 20 years on Cumbrae. This figure is deemed to be the minimum number of events during this period and were confirmed via online research through local news reports, local social media groups and through speaking with members of the community involved or affected.

A freedom of information request (FOI) submitted to Scottish Fire and Rescue Service, Police Scotland and HM Coastguard, who regularly respond to these types of incidents would likely add to this data.

Using data available at the time of writing however, of the 30 known events 77% were found to be non-coastal related flooding, 13% were a combination of coastal and non-coastal, and only 10% entirely coastal related.

This is contrary to the data within the Local Flood Risk Management Plans between 2014 - 2022, and associated documents, suggesting data used to generate the plan for Cumbrae is inaccurate.

Cumbrae Community Council have raised concerns to North Ayrshire Council over flooding on Cumbrae multiple times in recent years, with local media also reporting on the issue in 2019[11] and 2021[12] .



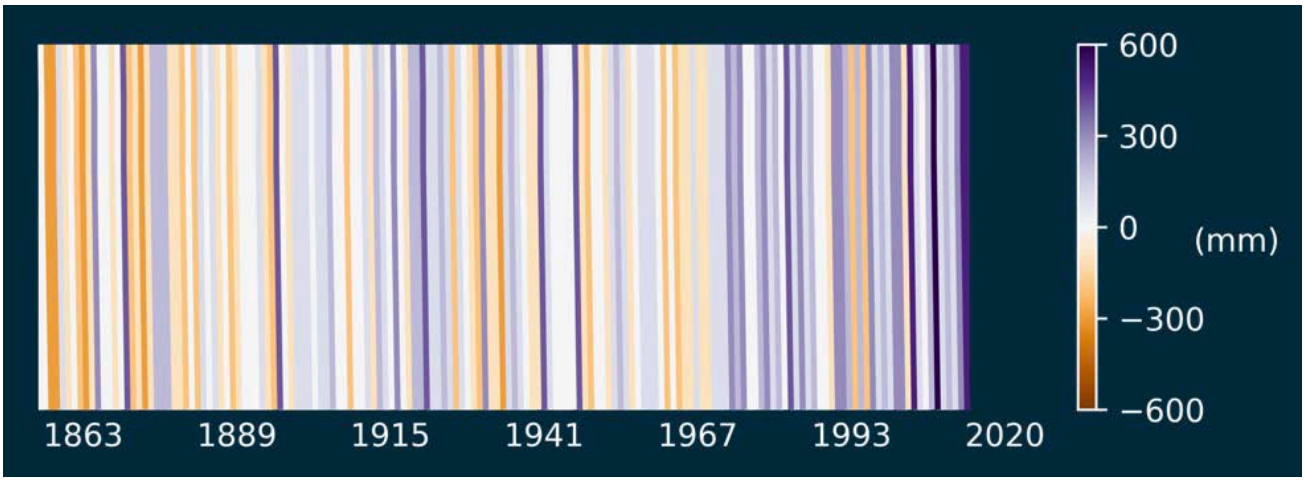
[11] https://www.largsandmillportnews.com/news/17970191.flooding-issue-putting-lives-risk-say-local-campaigners/

[12] https://www.largsandmillportnews.com/news/19108675.potholes-flooding-highlighted-problem-cumbraes-roads/

5. CUMBRAE CLIMATE & COASTAL PREDICTIONS

As part of the Carbon Neutral Islands Project, Sniffer[13], JBA Consulting[14] and Adaptation Scotland[15] completed a "Climate and Coastal Change Assessment" specific to Cumbrae. A review of historic and future precipitation was included in this.

75% of the annual average rainfall recorded for Cumbrae between 2002 and 2020 was above the historic average[16].



Stripe Graph showing historic rainfall recorded for Cumbrae

BROWN indicates years with average rainfall **BELOW** historic average
PURPLE indicates years with average rainfall **ABOVE** historic average

Using UK Climate Projections Data Precipitation is expected to intensify in all three global emissions scenarios included in the assessment. In both a "Very Low Emissions Scenario" in which global temperatures would be no higher than 1.5°C above pre-industrial levels, and a "Low to Medium Emissions Scenario" with a rise in 1.5 - 2°C, Cumbrae can expect to see a

[13] https://www.sniffer.org.uk/

[14] https://www.jbaconsulting.com/

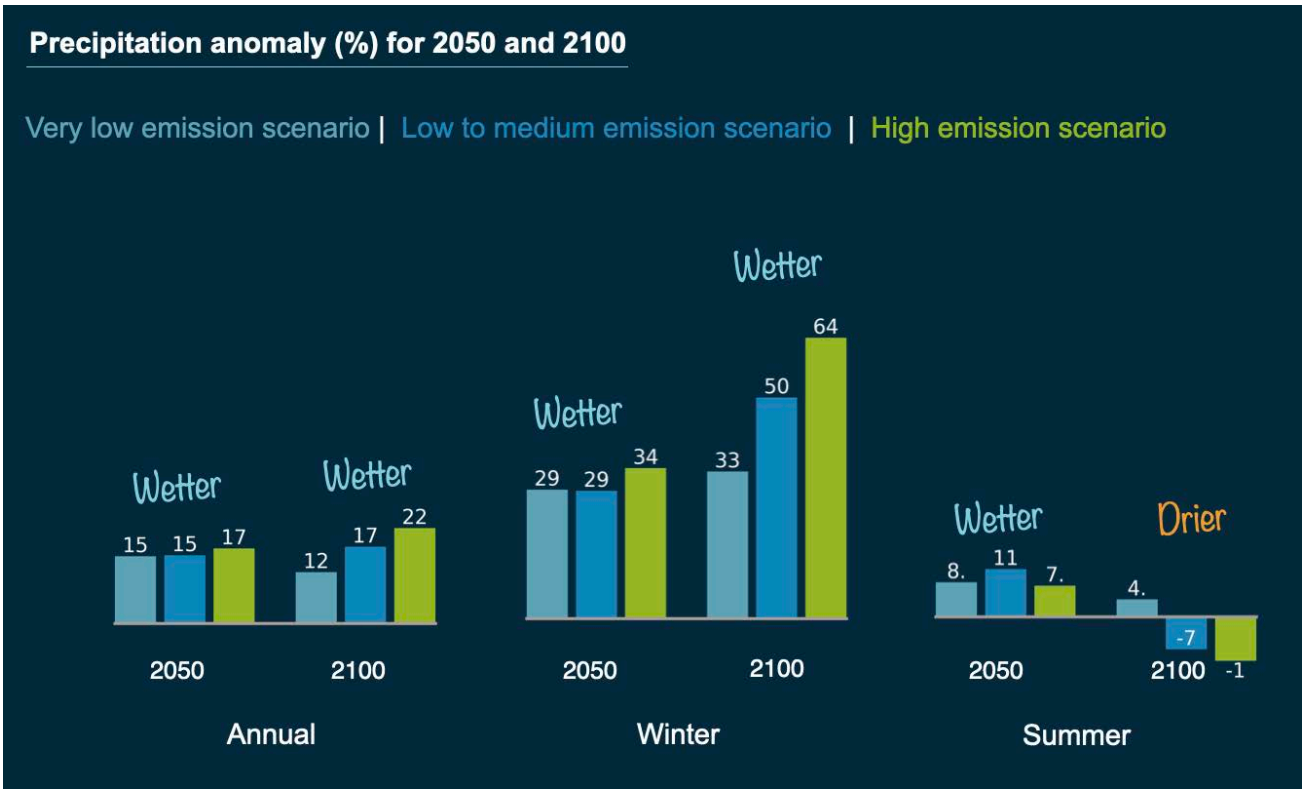
[15] https://www.adaptationscotland.org.uk/

[16] Climate and Coastal Change Assessment - Great Cumbrae. Published March 2023

15% increase in rainfall annually and a 29% increase over the winter months.

A “High Emissions Scenario” (rise of 3°C from pre-industrial levels) could see a rise in annual precipitation on Cumbrae of 17% annually and 34% over the winter months.

Projections to 2100 show that precipitation could increase on Cumbrae by up to 64% over the winter months.



Bar Charts provided as part of the Climate and Coastal Change Assessment showing the projected precipitation change for Cumbrae based on UK Climate Projection data.

This research from Adaptation Scotland shows that regardless of future emissions levels Cumbrae most likely still experiences an overall increase in precipitation, baked in as a result of existing climate change. As a result, non-coastal flooding is only likely to intensify without intervention.

6. CUMBRAE RESERVOIRS

Lower Cumbrae Reservoir to the left and Upper Cumbrae Reservoir to the right. © Copyright Thomas Nugent and licensed for reuse under this Creative Commons Licence

The Lower Cumbrae Reservoir is one of two reservoirs, designated Millport High[17] and Millport Low[18] by SEPA, originally used to supply drinking water to Millport. They became surplus to requirements and were transferred to private ownership in the early 1990s.

The reservoirs are surrounded by Millport Golf Course, however, the reservoirs are not owned by Millport Golf Club[19].

Both are considered Controlled Reservoirs in accordance with the Reservoirs (Scotland) Act 2011 and both have a Risk Designation of 'High'.

Several alterations have been made to the Lower Cumbrae Reservoir over many years to increase the water level and overall capacity, including the

[17] Upper Cumbrae Reservoir: RES/R/1128142

[18] Lower Cumbrae Reservoir: RES/R/1128143

[19] Ownership details have been provided on pages 19 and 20 of this report

top of the runoff slipway on the Lower Cumbrae Reservoir which was artificially raised around the 1960s following local droughts. Assuming both reservoirs where the same capacity when built, this has added an estimated 1,000m3 of water to the Lower Cumbrae Reservoir.

The Lower Cumbrae Reservoir is utilised by Cumbrae Angling Club, with fish stock stated as one of the reasons that water level can not be managed as a flood risk prevention measure in the online consultation in July 2020 for the Mill Burn Flood Alleviation Scheme.

The flooding event of 27th December 2023 saw extreme quantities of water above the capacity of the Mill Burn exiting the Lower Cumbrae Reservoir via the run off slipway and into the watercourse.

Top of run off slipway on Lower Cumbrae Reservoir showing artificially raised lip. 27 Dec 2023

Water entering the Mill Burn via the runoff slipway from the Lower Reservoir. 27 Dec 2023

Run off from Lower Cumbrae Reservoir joining Mill Burn prior to the running through 18th fairway of Millport Golf Course. 27 Dec 2023

6.1 MANAGING WATER LEVELS IN RESERVOIRS

The water levels in both the Upper and Lower Cumbrae Reservoirs appear to be at or near capacity year round. Meaning there is little additional capacity during for natural catchment and surge attenuation during periods of heavy rainfall like that experienced on 27th December 2023.

Both the Upper and Lower Cumbrae Reservoirs have a large natural catchment area with the Upper feeding into the Lower Reservoir. Traditionally water levels would have been managed via controlled release through the sluice gates on both reservoirs. The current status of these gates is unknown.

As part the online "Non-Statutory Community Consultation" dated 9 July 2020[20] for the Mill Burn Flood Alleviation Scheme, and with reference to managing the water levels of the Upper and Lower Reservoirs, North Ayrshire Council stated that:-

Managing the water level in reservoirs *to provide holding capacity for surface water in case of heavy rainfall. The reservoirs are privately owned and the owner is not living on the Island. This level of responsibility/ liability cannot be placed upon a private individual. The local Angling club has fishing rights and their interest is to keep a steady high water level for the fish. The Reservoir dam is an earth structure, rapid changing water-level in the reservoir could destabilise the earth embankments.*

Where flooding caused entirely or in part by a reservoir results in potential risk to life and property, the statement that *"This level of responsibility/ liability cannot be placed upon a private individual"* would appear to be contrary to Scottish Government and SEPA guidance[21] that:-

[20] https://storymaps.arcgis.com/stories/cd33db76395345cc84d18639b0460ed2

[21] https://www.gov.scot/policies/water/reservoir-safety/

"The ultimate responsibility for the safety of a reservoir lies with its manager. This is the person who controls or operates the reservoir and its dam, or, if no such person exists, the owner of the reservoir."

- *the reservoir manager is responsible for monitoring the reservoir day-to-day, in line with the recommendations made by the Inspecting or the Supervising Engineer.*
- *a manager of a high or medium-risk reservoir must ensure it is being supervised by a Supervising Engineer at all times.*

The "All Ayrshire Local Flood Risk Management Strategy" published 2014[22] stated that:-

"Management of existing Millport Upper and Lower reservoirs needs improved and could benefit flood management" and "Potential to divert water from Upper Millport Reservoir. Culverts have capacity issues and varying diameters. Capacity reduced by utility pipeworks through culverts"

Both of these actions were removed from subsequent Flood Risk Management Plans.

The lack of additional capacity means the volume of water entering the Mill Burn (as the only outlet) is above what can be reasonably dealt with by the watercourse in it's current state. This situation regularly results in flooding events along the route of Mill Burn and down the entirety of Golf Road, many of which are upstream of the proposed Mill Burn Flood Alleviation Scheme and are therefore unlikely to be resolved as a result of this work.

It is uncertain to what extent the Reservoir Manager has engaged with the Mill Burn Flood Alleviation Scheme process to date.

[22] https://docs.east-ayrshire.gov.uk/crpadmmin/2012%20agendas/cabinet/12%20november%202014/all%20ayrshire%20local%20flood%20risk%20management%20strategy.pdf

6.2 MILLPORT LOW (LOWER CUMBRAE RESERVOIR)

Controlled Reservoir Reference No	RES/R/1128143
Reservoir Name	Millport Low
National Grid Reference	NS 15862 55963
Risk Designation	High
Risk Designation Date	20/01/2023
Maximum Cubic Capacity of Reservoir at Top Water Level (m3)	92,000

RESERVOIR MANAGER

Contact Name:	Mr & Mrs D Robb
Organisation:	Mr & Mrs D Robb
Contact Address:	10 Eastfield,Tarbert
Contact Postcode:	PA29 6TJ
Start Date	31/01/2017
End Date	Current

RESERVOIR SUPERVISING ENGINEER

Contact Name:	Vanora Ford
Organisation:	Fairhurst
Contact Address:	225 Bath Street, Glasgow
Contact Postcode:	G2 4GZ
Start Date	07/02/2022
End Date	Current

RESERVOIR INSPECTING ENGINEER

Contact Name:	James Whitelaw Findlay
Organisation:	James Whitelaw Findlay
Contact Address:	4 Laggard Park, Rhu, Argyll & Bute
Contact Postcode:	G48 8LY
Start Date	07/02/2022
End Date	05/09/2022

6.3 MILLPORT HIGH (UPPER CUMBRAE RESERVOIR)

Controlled Reservoir Reference No	RES/R/1128142
Reservoir Name	Millport High
National Grid Reference	NS 16140 56206
Risk Designation	High
Risk Designation Date	20/01/2023
Maximum Cubic Capacity of Reservoir at Top Water Level (m3)	91,000

RESERVOIR MANAGER

Contact Name:	Mr & Mrs D Robb
Organisation:	Mr & Mrs D Robb
Contact Address:	10 Eastfield,Tarbert
Contact Postcode:	PA29 6TJ
Start Date	31/01/2017
End Date	Current

RESERVOIR SUPERVISING ENGINEER

Contact Name:	Vanora Ford
Organisation:	Fairhurst
Contact Address:	225 Bath Street, Glasgow
Contact Postcode:	G2 4GZ
Start Date	07/02/2022
End Date	Current

RESERVOIR INSPECTING ENGINEER

Contact Name:	James Whitelaw Findlay
Organisation:	James Whitelaw Findlay
Contact Address:	4 Laggard Park, Rhu, Argyll & Bute
Contact Postcode:	G48 8LY
Start Date	07/02/2022
End Date	05/09/2022

7. MILLPORT GOLF COURSE

Millport Golf Club sits at the top Golf Road, above the town of Millport. It's land surrounds the Lower Cumbrae Reservoir and Mill Burn runs directly through the fairway of the 18th Hole and car park.

Flooding of the fairway around the Mill Burn is an annual occurrence due overtopping of the Mill Burn and saturation of land surrounding the Lower Cumbrae Reservoir.

Significant time and resources are invested by Millport Golf Club each year in maintaining the Mill Burn up to the culvert at the top of Golf Road (near the access road to Upper-Kirkton Farm). In recent years, additional drainage ditches and sumps have been installed to try and resolve these issues which are becoming more problematic.

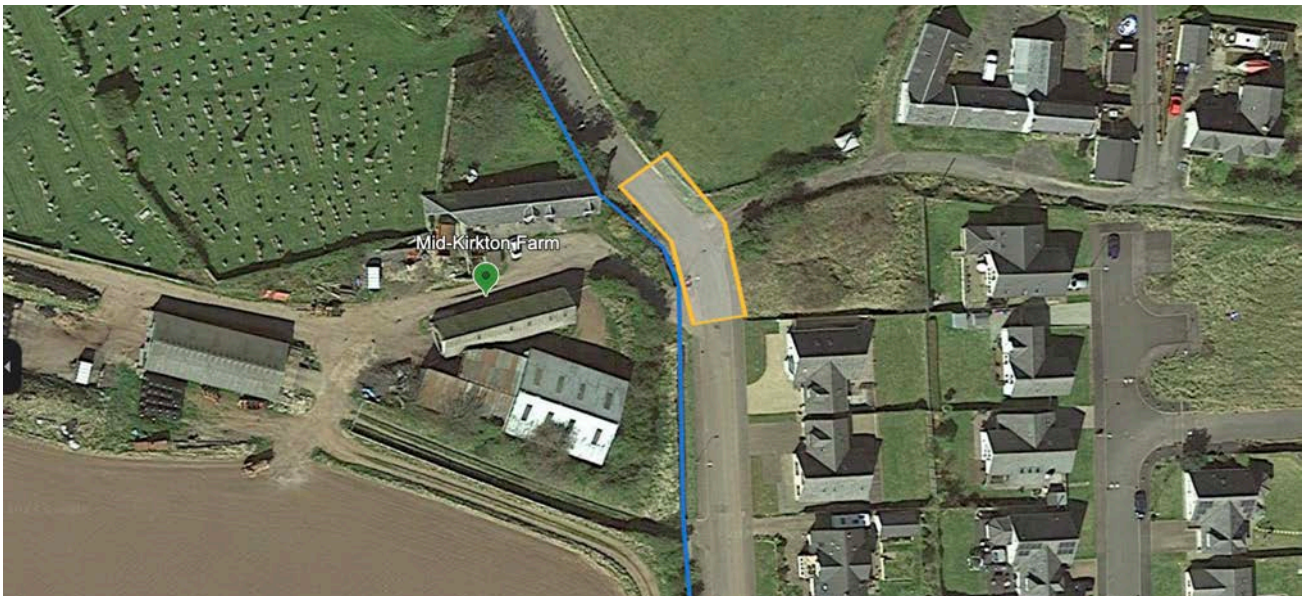
On 27th December 2023, significant flooding was observed in this area with Mill Burn overtopping. This was as a direct result of the Mill Burns inability to cope with the volume of water from Lower Cumbrae Reservoir.

Millport Golf Club have previously engaged with both the Reservoir Manager and North Ayrshire Council on these flooding issues, however, at the time of writing a resolution is still to be found.

18th fairway of Millport Golf Course, looking South along Mill Burn towards club house and Golf Road. 27 Dec 2023

18th fairway of Millport Golf Course, looking North from Club House towards Lower Cumbrae Reservoir. 27 Dec 2023

8. MID-KIRKTON (GOLF ROAD)



Cat B listed Mid-Kirkton, with Mill Burn and Golf Road adjacent. Google Earth Imagery © 2021

Mid-Kirkton, is located immediately South of Kirkton House and the Old Millport Cemetery. All three are Category B listed sites according to Historic Environment Scotland.

Mill Burn runs immediately East of Mid-Kirkton, parallel to Golf Road, and under the access road to Mid-Kirkton from Golf Road via a culvert. This culvert is prone to overtopping onto Golf Road as was the case during the early stages of the flooding event on 27th December 2023.

Once the level of water in the Mill Burn dropped later in the afternoon of the 27th December 2023, large quantities of water still flowed down Golf Road.

Mill Burn overtopping on to Golf Road near Mid-Kirkton Farm. 27 Dec 2023

Flow of water down Golf Road to the North of Mid-Kirkton, in the vicinity of entrance to Old Millport Cemetry. 27 Dec 2023.

Water flowing down Golf Road at the junction with Mid-Kirkton, after Mill Burn has overtopped and level has dropped. 27 Dec 2023.

A historical video of this site[23] was included in the July 2020 public consultation for the Mill Burn Flood Alleviation Scheme. Screenshots provided below, closely resemble parts of the flooding event on 27th December 2023.

8.1 MILL BURN FLOOD ALLEVIATION SCHEME

Despite evidence of flooding at this section of the Mill Burn and Golf Road being used as part of the consultation process, it was not included in the proposed solution for the Mill Burn Flood Alleviation Scheme.

The proposed flow control structure is downstream from this culvert, therefore it is unclear if the overtopping issue will be improved by the scheme, nor whether it will resolve the flow of water down Golf Road.

NAC have stated that work on this area is expected to be completed independently of the Mill Burn Flood Alleviation Scheme.

[23] https://cdn.arcgis.com/sharing/rest/content/items/cd33db76395345cc84d18639b0460ed2/resources/1592400304534.mp4

HISTORICAL IMAGE: Mill Burn looking North of Mid-Kirkton up Golf Road.

HISTORICAL IMAGE: Mill Burn overtopping at junction of Golf Road and Mid-Kirkton.

HISTORICAL IMAGE: Mill Burn looking South from Mid-Kirkton towards Nether-Kirkton.

9. JUNCTION AT ST. MAURA GARDEN (GOLF ROAD)

Flooding location at junction of Golf Road and St. Maura Gardens. Google Earth Imagery © 2021

The junction of Golf Road and St. Maura Garden suffers from surface water flooding annually, and is usually one of the first locations on the island to flood during moderate to heavy rainfall.

The road dips at this point and any surface water flooding and requires to be pumped by Scottish Fire and Rescue Service approximately 50 metres South along golf road over a crest of the hill alongside Millport Bowling Club.

Flooding in this area is usually a combination of rainfall, water flowing down Golf Road, Mill Burn overtopping and blocked drainage. The events on 27 December 2023, were a combination of each.

Flooding on Golf Road near Nether-Kirkton Farm and junction into St. Maura Gardens.
27 Dec 2023

Locations of blocked drains within flooding area at junction of Golf Road and St. Maura Gardens.
Google Earth Imagery © 2021

9.1 BLOCKED DRAINAGE

There are three drains located at the junction of Golf Road and St. Maura Gardens. On the flooding event of the 27th December 2023, all three were blocked and could not be unblocked by Scottish Fire and Rescue Service.

This is the case with historical flooding events in this area, and has been reported to North Ayrshire Council and Scottish Water by various members of the local community.

9.2 MILL BURN FLOOD ALLEVIATION SCHEME

Whilst the flow control structure in the proposed Mill Burn Flood Alleviation Scheme is located immediately West of this junction, evidence suggests that flooding here is caused by overtopping upstream and by the flow of water down Golf Road. It is therefore uncertain if the Mill Burn Flood Alleviation Scheme would resolve this annual flooding event or would have changed the situation on 27th December 2023.

Mill Burn adjacent to Golf Road, prior to overtopping. 27 Dec 2023.

Junction of Golf Road and St. Maura Gardens taken from the South near the entrance of Nether-Kirkton Farm. 27 Dec 2023.

HISTORICAL IMAGE: Junction of Golf Road and St. Maura Garden in 2020. Caused by flow of water down Golf Road and blocked drainage. Mill Burn DID NOT overtop in this instance.

HISTORICAL IMAGE: Flooding on Golf Road near Nether-Kirkton Farm and St. Maura Gardens estate in 2020, caused by Mill Burn & blocked drainage.

HISTORICAL IMAGE: Scottish Fire and Rescue Service have attended flooding events in this area multiple times over recent years.

10. GROUNDS NEAR NETHER-KIRKTON FARM (GOLF ROAD)

Nether-Kirkton Farm is located immediately West of the Golf Road / St. Maura Gardens junction. Mill Burn runs through the grounds of this property, and it sits immediately South of the "Flow Control Structure for the proposed Mill Burn Flood Alleviation Scheme[24].

Mill Burn runs alongside Golf Road and through Nether-Kirkton Farm. Site of proposed flow control structure as part of Mill Burn Flood Alleviation Scheme, indicated.
Google Earth Imagery © 2021

Flooding at Nether-Kirkton Farm, looking from Golf Road. 27 Dec 2023.

Flooding at Nether-Kirkton Farm looking towards Golf Road. 27 Dec 2023.

[24] https://www.north-ayrshire.gov.uk/Documents/FloodProtection/mill-burn-scheme-notification-drawings-revised.pdf

Whilst there was no obvious impact on the building at Nether-Kirkton on 27th December 2023, the grounds immediately surrounding it suffered heavy flooding from the Mill Burn.

Flooding within grounds of Nether-Kirkton Farm as a result of Mill Burn overtopping.
27 Dec 2023

Flooding within grounds of Nether-Kirkton Farm as a result of Mill Burn overtopping. 27 Dec 2023

Any increase in the amount of flooding could result in damage to property within the ground of Nether-Kirkton if left unprotected.

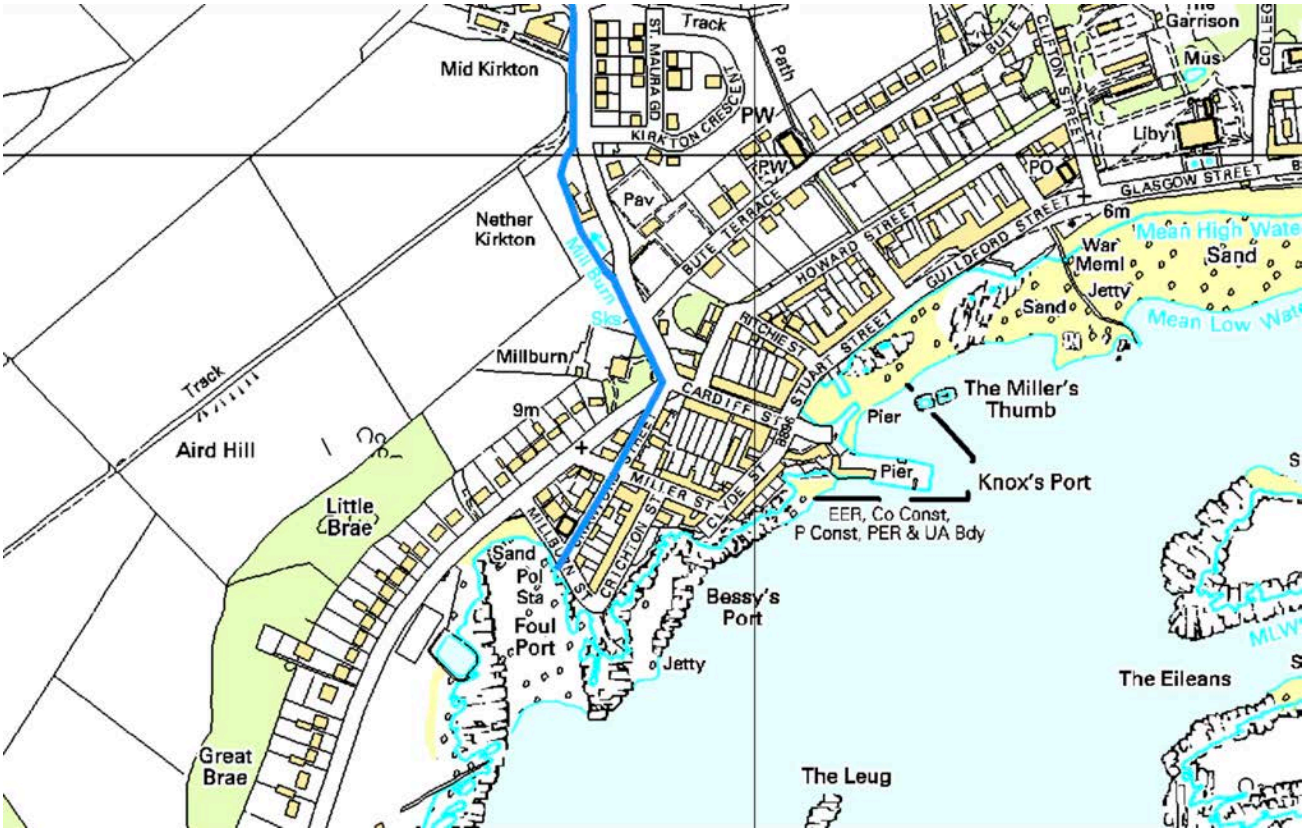
10.1 MILL BURN FLOOD ALLEVIATION SCHEME

As this is downstream from the proposed flow control structure of the Mill Burn Flood Alleviation Scheme it is likely this will prevent future flooding of this nature within the grounds of Nether-Kirkton from Mill Burn.

11. JUNCTION OF CARDIFF & CRAWFORD STREET

The area, commonly referred to as “Old Millport” is located South of Golf Road and to the West of Millport Pier and Quayhead.

Mill Burn currently runs under the road via a 220m culvert from the bottom of Golf Road, across the top of Cardiff Street, and along Crawford Street before discharging into the River Clyde at Foul Port



Map showing the route of Mill Burn adjacent to Golf Road and discharging at Foul Port via Crawford Street.

This area suffered severe flooding during the event on 27th December 2023 with multiple properties affected, damage to roads and infrastructure and a potential risk to life due to fast moving water.

During the flooding event on 27th December 2023, the volume of water flowing from Mill Burn through the culvert system was such that it cracked the road surface and breached.

This joined with the water flowing off Golf Road and resulted in large quantities of fast running water down Crawford Street, Miller Street and Crichton Street for an extended period of time. Multiple domestic properties were affected in this area as a result.

Junction of Cardiff Street onto Crawford Street (Left) looking down towards Millburn Street where Mill Burn discharges into Foul Port. Google Earth Imagery © 2024

Damaged road surface at the junction of Crawford Street with Cardiff Street. 27 Dec 2023

Diversion tactics had to be implemented at Millport Motors. Water flowing through garage was going down into gardens and property behind then on to Miller Street. 27 Dec 2023.

Diversion at junction Crawford St and Miller St. Water continuing down Crawford Street was flooding gardens and property between Crawford and Crichton St. 27 Dec 2023.

Limited resources meant sandbags had to be used sparingly and prioritised. 27 Dec 2023

Resulting damage to the road surface at the top of Crawford Street as a result of the flooding in the 27th Dec 2023. Photo taken 29 Jan 2024

Resulting damage to the road surface at the top of Crawford Street as a result of the flooding in the 27th Dec 2023. Photo taken 29 Jan 2024

Resulting damage to the road surface at the top of Crawford Street as a result of the flooding in the 27th Dec 2023. Photo taken 29 Jan 2024

11.1 PAVED GARDEN

As a result of the water flowing from Golf Road and the damaged culvert at the top of Crawford Street. The paved area at the corner of Cardiff Street and Crawford Street quickly filled with water to road level.

Water then spilled through the back wall and into the lower gardens behind Cardiff Street and Miller Street. This affected domestic properties on Miller Street.

Once diversion tactics were put in place, water was pumped by Scottish Fire and Rescue Service.

The Paved Garden at the junction for Cardiff Street and Crawford Street. 27 Dec 2023

12. CRAWFORD STREET

As a result of water from Golf Road, and the damaged infrastructure at the top of Crawford Street, potentially dangerous levels of water and debris flowed the entire length of Crawford Street during 27th December 2023.

The volume of water was such that multiple diversions had to be implemented by Scottish Fire and Rescue Service on Crawford Street to protect properties and safely control the water towards the shore.

CCTV surveys of the culvert system that runs down this road have been attempted by North Ayrshire Council previously. However, due to blockages and collapses of the culvert these could not be completed.

Looking down Crawford Street towards Foul Port, showing flow of water. 27 Dec 2023

13. MILLER STREET

On 27th December 2023, potentially dangerous quantities of water from Mill Burn (via Crawford Street and gardens at back of Cardiff Street and Miller Street) flooded Miller Street and properties in this area.

Several diversions had to be put in place by Scottish Fire and Rescue Service to safely control surface water from Crawford Street, on to Miller Street, and on to Crichton Street before discharging into the River Clyde.

Some properties on Miller Street suffered flooding from multiple sources, including from sewers rising within the property itself.

Gardens lower than the street level of Miller Street filled up significantly with flood water during this flooding event.

Miller Street looking North towards Crawford Street. 27 Dec 2023

Water and debris at corner of Miller Street and Crawford Street prior to diversion. 27 Dec 2023.

Firefighters attempt to pump water from garden on Miller Street. Flood water has already breached the property at this stage. 27 Dec 2023.

12.1 WATER DIVERSION STRATEGY

Due to the volume of water from Golf Road and Mill Burn as a result of the damaged road and culvert at the top of Crawford Street, crews from Scottish Fire and Rescue diverted water at several points within the streets of this area to safely control the water along Crawford Street, Miller Street and discharging back into the River Clyde on Crichton Street to reduce the threat to both life and property.

A lack of resources available for this purpose meant the use of a mixture of sandbags and scaffolding from a nearby work yard. This was time consuming, impractical and only possible due to the location and availability of items that could be used for this purpose.

Without these measures a large number of properties would have been affected and the risk to life increased.

Flooding areas (prior to diversion tactics) indicated by yellow polygons. Red lines indicate diversion measures implemented by Scottish Fire and Rescue Service, with the resulting flow of water indicated in blue. Google Earth Imagery © 2021

14. STUART STREET

Properties on Stuart Street, including several commercial properties were affected by flooding on 27th December 2023. There is a long standing history of non-coastal related flooding in this area relating to the drainage system.

The capacity of the drain system is overloaded from streets behind; water rises from the drains in front of the shop.

Stuart Street, Millport. Google Earth Imagery © 2021

On Saturday 27th December the rate and volume of water from the drain system in front of the buildings was rising quicker than could be pumped away resulting in a large area of standing water and flooding within.

There are multiple drains located directly in front of The Ritz Café and Cumbrae Pharmacy. All of these were blocked and efforts to unblock them were unsuccessful. Other properties in this area have historically experienced issues with water under floors.

Large area of surface water flooding in-front of The Ritz Cafe and surrounding properties. 27 Dec 2023

HISTORICAL IMAGE: The same area of Stuart Street in front of The Ritz Cafe following a coastal flooding event in 2014.

15. GLASGOW STREET

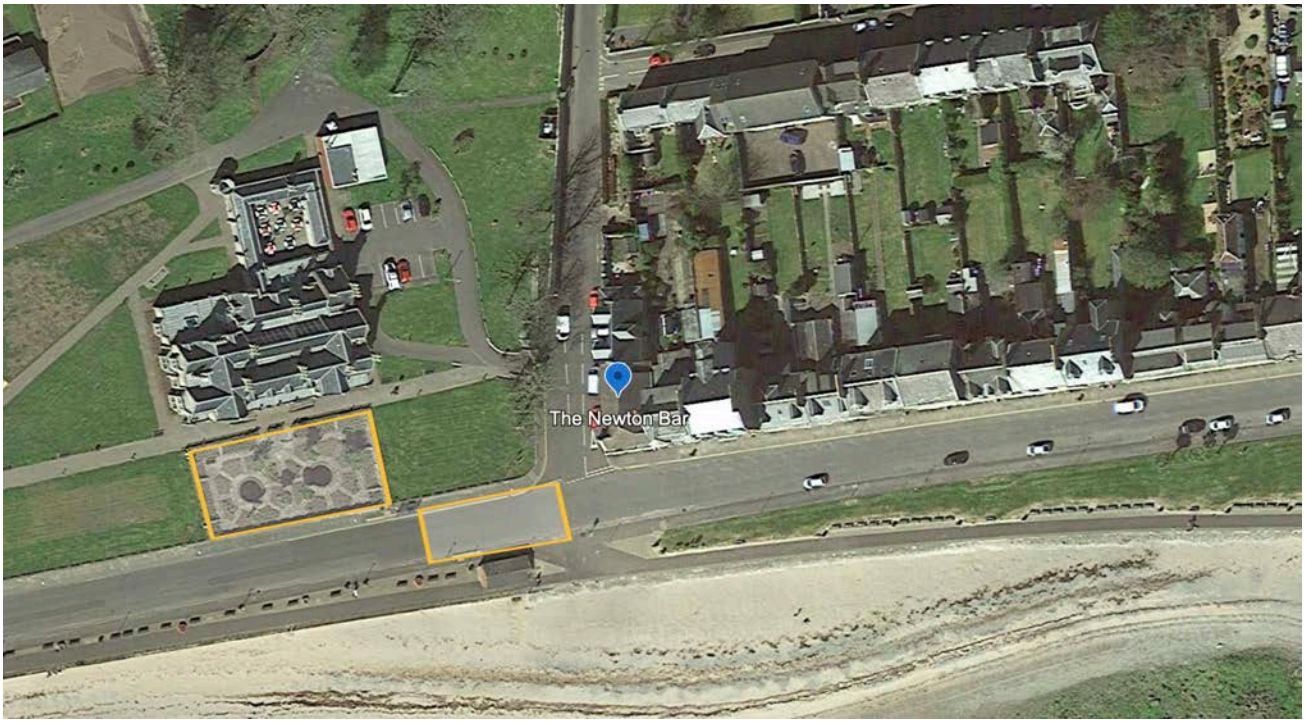
On 27th December 2024, Glasgow Street experienced two areas of significant surface water flooding.

15.1 CORNER OF COLLEGE STREET

Surface water flooding at this junction is a regular occurrence throughout the year both as a result of coastal flooding and non-coastal flooding.

Natural springs run through this area. If the outlet located in the beach wall just South of the flooded area is blocked this can make the flooding significantly worse.

The flow of water down College Street contributes significantly to flooding in this area particularly if combined with blocked drains as was the case during the flooding event of 27th December 2023.



Glasgow Street, Millport - in the vicinity of The Newton Bar and Garrison House.
Google Earth Imagery © 2021

Surface water flooding on Glasgow Street at the junction with College Street. This picture was taken in the days following the flooding event of 27th December 2023. This happens several times a year during heavy rainfall as a result of blocked drainage.

Water flowing down College Street towards the front on Glasgow Street. This picture was taken in the days following the flooding event of 27th December 2023.

HISTORICAL IMAGE: Flooding across Glasgow Street near the junction with College Street and Garrison House.

15.2 GARRISON HOUSE (THE SUNKEN GARDENS)

The grounds of Garrison House suffered several areas of flooding throughout it's grounds, however the most affected area was to the front of Garrison House itself in the Sunken Gardens.

The Garrison House, including walled gardens and entrance archways are a Category B listed building. The Sunken Gardens were designed by the London based arts & crafts architect Robert Schultz and are one of the few examples of the architects work in Scotland making it of significant historical merit.

The sunken gardens were completely submerged for a period of more than 24 hours as a result of the flooding event on the 27th December 2023 and resulted in damage to the community Christmas light display located within the gardens and operated and funded by members of the local community and Isle of Cumbrae Tourist Association.

"Sunken Gardens" within Garrison House. Community Christmas light display suffered significant flood damage. 27 Dec 2023

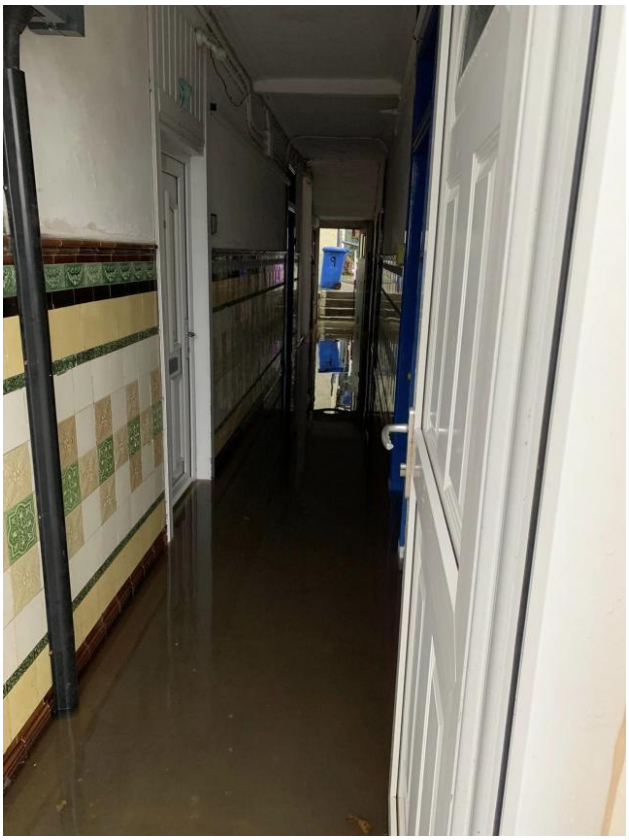
15.3 GLASGOW STREET (NEAR CROSS HOUSE)

Glasgow Street, Millport - in the vicinity of Cross House and Craigard etc…
Google Earth Imagery © 2021

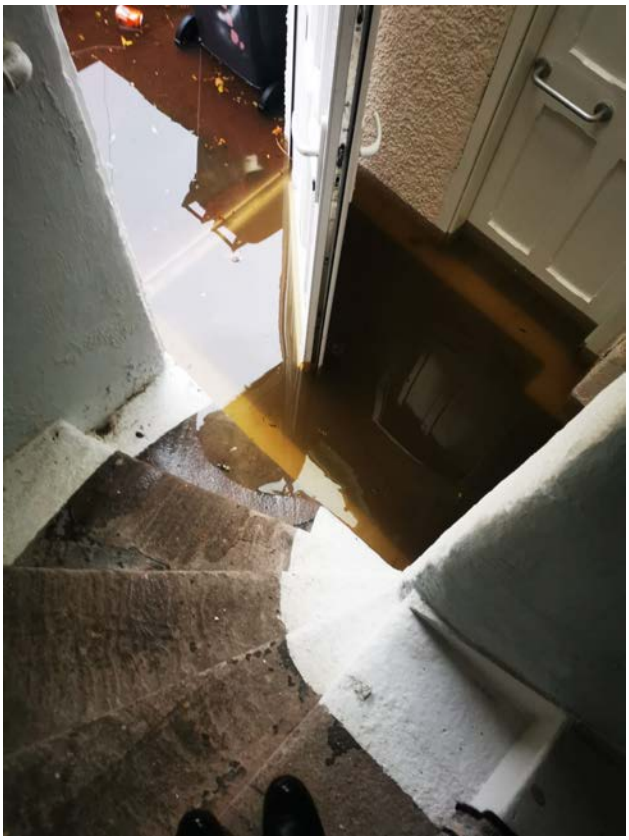
This area has a long standing history of flooding, both surface and coastal. During the events of 27th December 2023, the flooding was entirely caused by rainfall and blocked drainage.

Glasgow Street. 27 Dec 2023

Flooding on Glasgow Street looking towards Cross House.
27 Dec 2023



Entrance to property near 49 Glasgow Street showing close flooded. 27 Dec 2023



Flooding affecting the interior of a property on Glasgow. 27 Dec 2023

This lead to large area of standing water across the road, with water in multiple ground floor properties. This was the second flooding event experienced in this area in a matter of months.

The shore side of the road is currently undergoing large construction efforts as part of the Millport Coastal Flood Protection Scheme[25] with large areas to the West and North East of Cross House completely fenced off. This resulted in Scottish Fire and Rescue Service having to access the construction site in order to pump water from the street and affected properties into the River Clyde.

The walled garden at the front of Cross House was submerged.

[25] https://www.north-ayrshire.gov.uk/your-community/community-safety/flooding/millport-coastal-fps.aspx

16. KAMES AND BAREND STREETS

Large quantities of water flowed down from the vicinity of Breakough Farm at the top of “farm hill” down on to Kames Street, Barend Street and Woodland Street. Residents of this area described it as the worst they had seen and like a fast running river.

This resulted in several areas of pooling that would have affected ground floor properties on the streets had a local tradesperson that lives on Barend Street not unblocked the drains on these streets during the flooding event of 27th December 2023.

Kames Street and Barend Street, Millport. Google Earth Imagery © 2021

HISTORICAL IMAGE: Barend Street looking towards Kames Street.

HISTORICAL IMAGE: Barend Street looking towards George Street and Woodland Street.

Equestrian Field adjacent to Kames St.
27 Dec 2023

17. BUTE TERRACE

Fields behind Bute Terrace and to the South of the Cumbrae Reservoirs and Millport Golf Club, slope towards Bute Terrace and act as a large natural catchment area.

Drainage ditches at the rear of properties fill with water and overtop into the gardens, which then flows across into the much lower gardens on the South side of the road, which are the same height as the properties that sit within them and higher than the properties on Howard Street.

Flooding in this area can only be pumped into the drains by emergency services and results in adding to the situation with overloaded drains on Stuart Street and Guildford Street.

18. QUAYHEAD

Significant amounts of surface water gathered at Quayhead primarily from Cardiff Street and Stuart Street during the flooding event of 27 December 2023. This was entirely non-coastal related with tide levels well below that of the road and pier height and a mix of Mill Burn and drainage.

Quayhead looking towards the Millport Pier Hotel and River Clyde. 27 Dec 2023

19. FLOOD RESPONSE AND AVAILABILITY OF RESOURCES

During the flooding event of 27th December 2023 emergency crews were deployed by Scottish Fire and Rescue Service (including mainland crew), HM Coastguard and Police Scotland.

Local North Ayrshire Council employees responded on a voluntary basis along with other members of the community.

Only a small supply of unfilled sandbags were available to emergency services and the local community. Without the voluntary support of members of the local community in potentially hazardous conditions, capacity to fill and deploy these would have been extremely limited and resulting in emergency services being pulled from other tasks.

Approximately 30 members of the local community, filled any sandbags available from Newton Beach ready for deployment by Scottish Fire and Rescue Service, Police Scotland and HM Coastguard. 27 Dec 2023

Cancellation of the Largs-Cumbrae ferry service impacted the response of additional Emergency Services, until service could be resumed.

The “Final Progress Report - Local Flood Risk Management Plan (2016-2022) Ayrshire Local Plan District” published in 2022 states that:-

“Providing an emergency response to flooding is the responsibility of many organisations, including local authorities, the emergency services and SEPA. Effective management of an emergency response relies on emergency plans that are prepared under the Civil Contingencies Act 2004 by Category 1 and 2 responders. Scottish Water are a Category 2 responder under the Civil Contingencies Act 2004 and will support regional and local resilience partnerships are required. The emergency response by these organisations is coordinated through regional and local resilience partnerships. This response may be supported by the work of voluntary organisations.”

Further that *“North Ayrshire Council commissioned emergency plans, aimed at Category 1 and 2 responders, for population centres within North Ayrshire that have a notable flood risk. These plans were completed in September 2020.”*

At the time of writing this document could not be located publicly and it is uncertain at the time of writing if these emergency plan were enabled during the flooding events on 27th December 2023, beyond that of the Emergency Services previously mentioned.

19.1 AFTER THE FLOODING EVENT

Some of the temporary flood defences and water diversions remained in place for several days following the flooding event of 27th December 2023.

As of 22nd January 2024, the road surface remains damaged at the top of Crawford Street. Any significant rainfall is likely to result in large quantities of water flowing from this and down Crawford Street and Miller Street as was the case on the 27th December.

Various quantities of filled sandbags and debris lie stacked at locations on Glasgow Street, Stuart Street, Guildford Street, Crawford Street, Miller Street and Crichton Street.

There appears to be no recovery plan in place for measures installed by Emergency Services following a flooding event on Cumbrae.

20. SUMMARY AND CONCLUSIONS

The flooding events throughout Millport on 27th December 2023, were as a result of extreme rainfall in a short window. Whilst this scale of flooding is seen only once or twice per decade based on known events to date, the frequency is increasing and almost certain to continue to do so as a result of the impacts of climate change. This increase will place life and property at greater risk as a result of flooding events.

Known flooding events locally show that the risk and frequency from non-coastal flooding appears much higher than assessed by SEPA and the Local Authority in Local Flood Risk Management Plans. Inaccurate data used in the writing of these plans has likely influenced recommend actions contained within them, and could therefore impact future decision making.

The drainage and sewage system in Millport is failing as a result of its capacity and maintenance regime. Blocked drains are creating areas of surface water flooding on almost every street in Millport.

Whilst the Mill Burn Flood Alleviation Scheme will most likely resolve flooding issues around Crawford Street and Miller Street, it is unlikely to to resolve any flooding issues further up Golf Road between Nether-Kirkton and Millport Golf Club.

Agreement with the Reservoir Manager over water level management for the Lower and Upper Cumbrae Reservoirs, would create additional capacity and surge attenuation during winter months and ensure continued safe operation of both within the Reservoirs Scotland Act 2011 whilst mitigating future flooding risk.

More work is required in preparing the local community for such events, both in terms of awareness and self-help. Access to resources both informational and physical, is at present limited. Either an update to the

Local Flood Risk Management Plan or additional work locally should be considered as a result of the highlighted inaccuracies in the data and assumptions made within.

A local “Flood Response Plan” publicly available to the local community and emergency responders would help increase community resilience and forward planning. Active community involvement in flood preparedness is essential.

Any response plan must also take into account the likely disruption or cancellation of the Largs-Cumbrae Ferry Service due to adverse weather therefore any personnel, equipment and resources should therefore be on the island.

As an island community Cumbrae must prioritise a comprehensive and adaptive approach to flood management, ensuring the safety and sustainability of our community in the face of evolving climate conditions.

Underestimated risks, inadequate infrastructure and limited resources highlighted in the wake of the flooding events on 27th December 2023 demonstrate the need for a strategic review specific to the island.

21. POINT OF CONTACT

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