

Adaptation and Nature-Based Solutions Options Assessment Report: Evidence Sheets

This document contains Evidence Sheets for each of the Adaptation and Nature-Based Solutions Options and Delivery Actions. These Evidence Sheets provide details of the intended benefits, financial and economic analysis as well as any limitations identified through stakeholder consultation.

Note:

The financial and economic implications for each set of Options and Delivery Actions (along with any cost-benefit analysis) that has been referenced within the evidence sheets have been derived from the *UK Climate Change Risk Assessment* and regionally through analysis undertaken by Climate Ready Clyde (CRC). The CRC *Glasgow City Region Climate Adaptation Strategy and Action Plan* - identified that climate change is an important economic and financial risk for *Glasgow City Region. Annex 1: Financial and Economic Assessment* provided the source for the analysis that is referenced throughout this document. The second phase of the study, the *Economic Implications of Climate Change for the Glasgow City Region* provided the source for information on the economic benefits of managing the identified risks and adapting successfully. These were both undertaken by Paul Watkiss Associates, and can be found here:

- UK Climate Change Risk Assessment – https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf
- Climate Ready Clyde Glasgow: City Region Climate Adaptation Strategy and Action Plan – <https://climatereadyclde.org.uk/adaptation-strategy-and-action-plan/>
- Climate Ready Clyde: Glasgow City Region Financial and Economic Analysis – <https://climatereadyclde.org.uk/report-economic-financial-risk-glasgow/>

Additional sources of information include:

- Climate Action Network - <https://pcancities.org.uk/news/planting-trees-could-benefit-economy-%C2%A3366m-and-create-36000-jobs>
- Croftfoot Adaptation - <https://www.mgsdp.org/index.aspx?articleid=27648>
- Glasgow City Council Active Travel Strategy - <https://www.glasgow.gov.uk/councillorsandcommittees/viewDoc.asp?c=P62AFQDNZLDXT1UTDN>
- East Dunbartonshire Local Climate Impact Profile
- East Dunbartonshire Climate Risk & Opportunities Assessment
- East Dunbartonshire Adaptation and Nature-Based Solutions Options & Projects Excel Sheet

Adaptation and Nature-Based Solutions Options and Delivery Actions

Option:

ANBS1 - Undertake a Climate Ready Planting feasibility study.

Delivery Actions:

1. Map the opportunities for climate ready planting by habitat type (grassland, wildflowers, trees)
2. Create prioritisation for habitat implementation by habitat type and the co-benefit that would alleviate problem (e.g. surface water management, overheating)
3. Support habitat connectivity through the creation, enhancement and joining of habitat corridors (e.g. pollinator networks)

Responsibility / Accountability:

Lead Service - Roads and Environment (Road Network Operations / Greenspace and Streetscene)

In collaboration with Land Planning Development (Sustainability), Roads and Environment (Technical and Engineering Services)

Policy Driver:

Greenspace Strategy

Evidence:

Undertaking a Climate Ready Planting feasibility study provides the following benefits:

- Ensuring appropriate tree species planted in appropriate locations that enhances or restores the existing habitat value while providing climate adaptation benefits. These benefits include a reduction to the urban heat island effect, flood mitigation, carbon sequestration and air pollution reduction.
- Planting of shrub and undergrowth layer can trap particulate matter pollution while absorbing and slowing surface run off during high volume rainfall and extreme weather events.
- Installation of planting as part of nature-based surface water management, such as rain gardens and swales.
- Creating and adapting habitats and corridors to take account of our changing climate.

The Local Climate Change Impact Profile (LCLIP) indicated that Council Services are most vulnerable to flooding incidents – accounting for a third of all extreme weather events – and therefore strategic planting will play a role in the reduction of flooding impacts. This is reinforced throughout the national and regional work, which has identified multiple risks to infrastructure, the built and natural environment. This is then reflected in the Climate Ready Clyde (CRC) Economic Implications Report¹ and local Risk and Opportunities Assessments. These reports identified that there is an amber risk (risks that requires active management) that there will be an increase in air particulates worsening air quality and sensitive habitats, which can be addressed through the increased planting.

The CRC Economic Implications Report shows that surface water flooding costs the Glasgow City Region (GCR) approximately £20 million in annual average damages. The GCR flood risk management appraisal found cost-

¹ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

benefit ratio (CBR) of 5:1 for flood related risks.² Determining the CBR for a planting regime is more difficult to quantify. However, as per research published by Climate Action Network, a conservative estimate of the economic benefit of a tree can range from £1,200-£8,000 annually, with an initial cost of around £6. The long-term economic benefits accrued over 50 years can be over £8,000 per tree. This can also act as a defence to the urban heat island effect to prevent over heating which is estimated to cost £4million a year by 2050.³

Indicative costs to implement this option are anticipated to be in the range of £50,000 - £200,000 over a time period of 1-2 years from the adoption of the Climate Action Plan (CAP). Funding has been allocated from the Nature Restoration Fund to undertake the feasibility work and will be undertaken in partnership with the Green Action Trust.

Identified Limitations/Comments:

Internally, Streetscene noted that further discussion will be required in relation to:

- Implications of resource issues: Staff-time and vacancies;
- Implementation and planting schedules;
- The need for and creation of a Climate Action Implementation Team. Set up post-Options Report;
- Required input by partner agencies;
- Budgetary issues: availability of grant and capital funding; and,
- Maintenance of enhanced sites as there is currently no revenue allocated for this.

Any new planting will unlikely be maintained by existing revenue budgets in Streetscene, and therefore it is critical that there is community buy-in in terms of maintenance carried out by community groups such as Friends of Groups/Countryside Rangers and a realistic costings exercise on additional operational resource required. However, it is also noted that it is very unlikely that anything of real biodiversity benefit in terms of meadow creation could be managed by a Friends of Group or Countryside Ranger Service.

Grassland data remains poorly mapped out and therefore it may be wiser to include the habitat types as set out in the LBAP so that any actions can deliver for both the CAP and the LBAP. The first phase would look to deliver enhanced natural network relating to woodland/trees and future phases could take into account wetland/peatland and meadow creation (if the grassland data is improved). The comment that the grassland/meadow work will contribute to stronger pollinator trails will require to factor in the maintenance of this type of habitat as currently we are probably at our maximum level of budget available for cutting and lifting. We will also require assistance identifying hotspots to inform planting plans as we do not have access to this data. Timescales around initial feasibility are realistic.

Technical and Engineering Services also want to feed into open space strategies for Surface Water Management Plans where possible. They have undertaken SWMP's feasibility studies for Bishopbriggs, Bearsden and Milngavie which can be shared. These studies show opportunities for SUDs, retrofitting and landscaping for climate adaptation and biodiversity. These are to be progressed to concept and then detailed design to be delivered, if possible, between 2022 – 2026. However, under FRM these will be dependent on funding from SG / COSLA.

Streetscene have recently commissioned a very high-level review of mapping opportunities across East Dunbartonshire. The cost of the work is approximately £3,000. This will lead to a finer level of analysis and

² <https://climatereadyclide.org.uk/report-economic-financial-risk-glasgow/>

³ <https://pcancities.org.uk/news/planting-trees-could-benefit-economy-%C2%A3366m-and-create-36000-jobs>

production of site-specific maps. Indicative costs for this follow-on work have not been calculated to date. However, the Ash Dieback survey is starting in July 2023 and is costing approximately £18,000.

Adaptation and Nature-Based Solutions Options and Delivery Actions

Option:

ANBS2 - Increase and improve resilience levels of transport networks and transmission infrastructure.

Delivery Actions:

1. Identification of vulnerable sections of the transport network (road and active travel) frequently affected by weather events (e.g. flooding, road degradation, snow, ice). Transport can be disrupted by severe weather with knock-on effects that interrupt the flows of people and goods throughout the network. The resilience of transport networks, including active travel, can be increased through investing in maintenance, innovative engineering solutions and capital expenditure on improvements. Smart transport networks can improve response and communication.
2. Produce a design brief and resilience hierarchy in relation to the location, design and development of EV charging stations and infrastructure.
3. Use of sustainable materials appropriate for a changing climate when building road / path infrastructure (including carbon accountancy of building materials).
4. Use of permeable surfaces and surface water run-off management adapted to changing climate. Inclusive of existing and new road proposals, and parking.

Responsibility / Accountability:

Lead Service – Land Planning & Development – Traffic and Transport

In collaboration with Land Planning Development (Sustainability Policy Team, Traffic and Transport), Roads and Environment (Greenspace and Streetscene, Roads Network Operations Team, Technical and Engineering Services (Flooding and Drainage))

External Partnership: Sustrans and SPT

Policy Driver:

New project driven by LDP 2/3 and Surface Water Management Strategy

Evidence:

Increasing and improving the resilience levels of transport networks and transmission infrastructure provides the following benefits:

- Reduced vulnerable sections of the network can improved traffic levels and associated economic activity. The same effects are reflected across the active travel network.
- Improving transmission infrastructure can increase use of EVs and related infrastructure as it becomes more accessible and reliable, which in turn helps foster greater community knowledge and trust and encourages the transition to EVs. This in turn has air pollution benefits which can impact on the health and wellbeing of residents.
- Increasing the use of permeable surfaces reduces the quantity of hardscaping features which contribute to increased surface water flooding and underground sewage/waste-water overflow. Permeable surfaces will slow the build-up rate and reduce the chances of flooding the transport network

The LCLIP outlined that the Councils Road and Environment Service are one of the most vulnerable Services in relation to our changing climate and activity related to extreme weather events. All Services and daily activities require a reliable transport network to operate efficiently. Roads and Environment have been affected by every weather type/event recorded in the time period of the study, whether it is extreme cold, rain, ice or storms. Therefore, this option has multiple benefits across all Council operations and infrastructure. This is reinforced throughout the national and regional work, and the local Risk and Opportunities Assessments, which identified multiple urgent risks (risks that require immediate and urgent action) to road and active travel infrastructure from surface water flooding and deterioration. This is also reflected in the CRC Economic Implication Report.

As per the CRC Economic and Financial Assessment, surface water flooding costs the GCR approximately £20 million per annum, therefore introducing permeable surfaces to make infrastructure and the built environment climate resilience is vital, but also has a strong economic and financial foundations.⁴ The report also found that the cost-benefit ratios for these interventions are typically around 4: 1, and even higher for critical infrastructure (e.g. electricity, water supply, key transport routes) because of the risks of cascading effects. The UK Climate Change Risk Assessment estimates that early measures of adaptation could bring this cost-benefit ratio up to 10:1.⁵

This option would result in high relative cost, with indicative costs anticipated to be greater than £200,000, with the initial feasibility starting after a year from CAP adoption and full implementation after approximately 5 years.

Identified Limitations/Comments:

Streetscene require to be consulted. Changes to the active travel routes may impact on open space and therefore it is key to ensure any changes are discussed to confirm there is no additional maintenance burden and an appropriate level of funding to ensure measures can be maintained to good standard etc.

⁴ <https://climatereadyclide.org.uk/adaptation-strategy-and-action-plan/>

⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

Adaptation and Nature-Based Solutions Options

Option:

ANBS3 - Undertake a SuDS audit and develop an improvement plan.

Delivery Actions:

1. Conduct an audit by type of SuDS feature with ownership details and management of the features.
2. Develop a biodiversity value and habitat networking assessment framework to grade SuDS features on their biodiversity, habitat feature and water pollution characteristics.
3. Prioritise which SuDS features would be of biodiversity value to improve.
4. Develop a SuDS biodiversification implementation and management plan.

Responsibility / Accountability:

Lead Service - Roads and Environment - Technical and Engineering Services (Flooding and Drainage)

In collaboration with Land Planning Development (Sustainability), Roads and Environment (Greenspace and Streetscene, Technical and Engineering Services (Flooding and Drainage))

External Partnership: SEPA and Scottish Water

Policy Driver:

Greenspace Strategy

Evidence:

Undertaking a SuDS audit and developing an improvement plan will provide the following benefits:

- Safeguarding and enhancing biodiversity value and water quality through SuDs features.
- Provide opportunities for natural flood alleviation.

The LCLIP identified flooding to be one of the widest ranging, impactful and frequent weather events across the authority area. Therefore, developing project options which contribute to reducing current and future flood and drainage risks, while creating valuable spaces for biodiversity enhancement will increase the resilience of the authority and could contribute to reducing further biodiversity deterioration. This is reflected in the East

Dunbartonshire Climate Risk and Opportunities Assessment as it identified this is as an amber risk (risk that requires active management).

According to the CRC Economic and Financial Assessment, river and surface-water flooding result in annual average damages in the GCR of approximately £46 million⁶. The flood risk management appraisal also found that dedicated projects related to flooding resulted in a cost-benefit ratio of 5:1 for flood related risks. Additionally, the analysis shows there are a set of interventions that reduce the probability of flooding. These measures are estimated to significantly reduce future flood risk, but not remove it entirely. The analysis also stated that works undertaken for flood adaptation far outweighs the costs, identifying a cost-benefit ratio of 6:1.

The indicative costs of this options are anticipated to range from £50,000 - £200,000 and could even exceed that range depending on the findings of the initial audit, extent of the upgrades proposed and implementation plan costs. Costs are unable to be more accurate until the audit is undertaken. Anticipated timescale for this option is between 1-5 years after the adoption of the CAP.

Identified Limitations / Comments:

It should be noted that there is limited information (nationally or regionally) available quantifying the cost-benefit analysis of biodiversity restoration, so these have not been included at this stage.

Potential funding mechanisms still to be identified.

Streetscene highlighted major issues around resources and the ability to lead on this project as a limitation due to staffing levels and multiple competing work streams. They also queried the variety of SuDS features, which would be implemented as well as how the biodiversity value/diversity will be measured and assessed (investigate Shannon Index). There is a need for quite substantial discussion particularly with:

- Retrofitting older SuDS, many of which would be exceptionally expensive to plant up and maintain.
- Liaising with landowners and residents.
- The cost of planting SuDS areas, which can be exceptionally expensive if there is nothing at the sides to plant up or if there is poor access for maintenance.

It is suggested that it would be prudent to look at the creation of newly planted SuDS features, which could be implemented in Council open space. This could follow flood risk colleague modelling, which could then provide additional capacity to deal with surface water flooding and increased habitat value.

We could tie into EDC SuDS via ongoing flood prevention works. Sites such as Golf Course Road are crying out for biodiversity retrofitting. All new flood prevention schemes, however small, should have biodiversity enhancements factored into the design.

The Council has a Statutory obligation to map SUDs in our area. The current position is that there are many historical SUDs in EDC which predates mapping SUDs under the Flood Act, however we would current only take any action for SUDs which have been adopted by the Council. Other private / factored or Scottish Water SUDs would remain as is and would not be part of the Council maintenance plan. In regard to maintaining existing SUDs there is no budget for this nor any resource to maintain such features either in Streetscene or Roads in house. The future Audit and Improvement Plan will need to set out the scope of the project to capture area-wide SUDs.

⁶ <https://climatereadyclde.org.uk/adaptation-strategy-and-action-plan/>

Adaptation and Nature-Based Solutions Options

Option:

ANBS4 - Proactively identify and deliver wetland habitat creation in the Kelvin Valley.

Delivery Actions:

1. Development of a brief to target biodiversity and habitat connectivity enhancement, water quality improvements and natural flood management opportunities.
2. Desk and site based ecological reviews, river catchment modelling and connectivity mapping exercises
3. Recommendations to implement including costings

Responsibility / Accountability:

Lead Service - Roads and Environment - Technical and Engineering Services (Flooding and Drainage)

In collaboration with Land Planning Development (Sustainability), Roads and Environment (Greenspace and Streetscene)

External Partnership: SEPA, Glasgow City Council and North Lanarkshire Council

Policy Driver:

Greenspace Strategy

Evidence:

The Riverwoods Organisation have undertaken an extensive evidence review and the benefits of biodiversity and tree planting projects along riparian corridors can be found here:

<https://www.riverwoods.org.uk/resource/riverwoods-evidence-review/>

Further information can be found at the rivers trust:

<https://theriverstrust.org/our-work/data-evidence>

Proactively identifying and delivering wetland habitat creation in the Kelvin Valley through a feasibility study provides the following benefits:

- Creation of aquatic habitat.
- Natural flood management measures.
- Enhancement of natural amenity space.
- Improvement of blue/green network connectivity through a wetland corridor

The LCLIP identified flooding to be one of the widest ranging, impactful and frequent weather events across East Dunbartonshire and therefore developing project option, which reduce this while creating spaces for biodiversity increases resiliency and could prevent further biodiversity deterioration. This is reflected in the local Climate Risk and Opportunities Assessment as it identified this is as an amber risk (risks that require active management).

River flooding costs the GCR £26 million in annual average damages. The CRC Economic Implications Report a review of flood risk management appraisal found a cost-benefit ratio of 5:1 for flood related risks⁷. Additionally, as per the CRC Economic and Financial Assessment, there are a set of interventions that reduce the probability of flooding significantly, but do not remove it entirely. The analysis on flood adaptation demonstrated benefits far outweigh the costs, as intervention 6 '*adapt the Clyde Corridor for the twenty-second Century*' has a cost-benefit ratio of up to 6:1.⁸

The anticipated indicative costs of this option could range from £50,000 - £200,000, but it could even exceed that that range and won't be finalised until the option is explored further. This could take up to 5 years to implement due to the complexity of it. Funding has been allocated from the Nature Restoration Fund, the Shared Prosperity Fund (£50,000) and WEF to undertake the feasibility work.

Identified Limitations / Comments:

It should be noted that while there is sufficient information to demonstrate the vast benefits of wetland and habitat creation, there is limited information available quantifying the biodiversity restoration, so these have not been included.

Streetscene are not in a position to lead on this project. Could something be done by the Green Action Trust in terms of delivery? Funding should be sought and allocated to do so as none has been assigned in the existing budgets.

Kelvin Valley wetland creation is a separate project from all other Council river restoration works. The Council are looking at the Kelvin Valley for wetland creation opportunities, however kelvin Tributaries will focus on the three catchments being proposed.

⁷ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

⁸ <https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/>

Adaptation and Nature-Based Solutions Options

Option:

ANBSS – Naturalisation and de-culverting of watercourses for biodiversity and flood attenuation.

Delivery Actions:

1. River restoration projects – Glazert, and Kelvin tributaries, including phased plan for biodiversity enhancement.
2. Council guidelines for new developments regarding best practice to be developed so developments are designed around watercourses or with daylighting as part of design.

Responsibility / Accountability:

Lead Service – Roads and Environment – Technical and Engineering Services (Flooding and Drainage)

Collaboration required with Land Planning Development (Sustainability), Roads and Environment (Greenspace and Streetscene)

External Partnership: SEPA

Policy Driver:

Greenspace Strategy and CAP

Evidence:

Naturalisation and de-culverting of watercourses for biodiversity and flood attenuation provides the following benefits:

- Flood sequestration measures will slow the flow of rainwater into drains and rivers, help to reduce the risk of flooding, improve water quality and ecological status of watercourses and reduce the build-up and debris of litter.
- Create space for vegetation and more public greenspace for wider biodiversity benefits, and habitat protection/creation and networking.
- Daylighting watercourses will also improve the habitat connectivity for a wider range of fauna.
- Improvements for active travel and community amenity space.

The LCLIP identified flooding to be one of the widest ranging, impactful and frequent weather events across the area. Therefore, developing project options which reduce this while creating spaces for biodiversity improves the areas resilience and could prevent further biodiversity decline. This is reflected in the local Climate Risk and Opportunities Assessment as it identified this is as an amber risk (risks that requires active management).

River flooding costs the GCR £26 million in annual average damages, therefore enhancing its catchment through restoration could significantly reduce this cost.⁹ In terms of its cost-benefit analysis, the Economic Implication Report review of flood risk management appraisal found the cost-benefit ratio to be 5:1 for flood related risks.¹⁰

The anticipated indicative costs for this option could range from £50,000 - £200,000 and take up to 10 years to implement. Funding has been allocated from the SEPA, however in order to deliver the full benefits of the project it will most likely require matched funding.

Identified Limitations / Comments:

It should be noted that while there is sufficient information to demonstrate the vast benefits of wetland and habitat creation, there is limited information available quantifying the biodiversity restoration, so these have not been included.

Streetscene don't currently have the resource availability to take the lead of the Kelvin Tributaries project. However, they are currently involved in the design works, with SEPA providing additional funding support for a third party, such as Green Action Trust.

The Glazert is at a final design stage and is hoped to deliver on the ground during 2024/25, however the Kelvin Tributaries is at a very early stage and there are many constraints to fully assess in the coming years. Important to note that for this project the Council are not de-culverting or daylighting rather it's a river restoration project, which will result in better outcomes for biodiversity and accessibility.

⁹ <https://climatereadyclde.org.uk/report-economic-financial-risk-glasgow/>

¹⁰ <https://climatereadyclde.org.uk/report-economic-financial-risk-glasgow/>

Adaptation and Nature-Based Solutions Options

Option:

ANBS6 - Undertake a Nature-Based Surface Water Management programme

Delivery Actions:

1. Identify problem areas for surface water management.
2. Identify mix of appropriate nature-based solutions and traffic / engineering solutions.

Responsibility / Accountability:

Lead Service - Roads and Environment - Technical and Engineering Services (Flooding and Drainage)

In collaboration with Land Planning Development (Sustainability), Roads and Environment (Greenspace and Streetscene)

External Partnership: SEPA and Scottish Water

Policy Driver:

Greenspace Strategy

Evidence:

Undertaking a Nature-Based Surface Water Management programme to provide the following benefits:

- Sequester carbon and trap particulate matter pollution from vehicles.
- Slows down surface run off to avoid road drainage being overwhelmed during high volume rain extreme weather events

A recent example of this is in Croftfoot in the southside of Glasgow.¹¹ The South-East Glasgow Surface Water Management Plan delivered a number of surface water management interventions including swales,

¹¹ <https://www.mgsdp.org/index.aspx?articleid=27648>

raingardens and new SuDS basin to manage storm water and reduce flood risks for communities downstream. Further information can be found here:

<https://www.mgsdp.org/index.aspx?articleid=27648>

The LCLIP identified flooding to be one of the widest ranging, impactful and frequent weather events across the area, accounting for a third of all extreme weather events. In particular, it identified issues regarding surface water management on the road network, and the increasing difficulty in providing underground drainage systems as a means for capturing and diverting surface water. The need for this is reflected in the local Climate Risk and Opportunities Assessment, which identified multiple related infrastructure risks, such as roads and property, which are classified as an urgent risk (risks that requires immediate and urgent action) from surface water flooding.

As per the CRC Economic Implications, the annual average damages for surface floods in the GCR are around £20 million. Therefore, developing project options which aim to minimise this impact can provide significant economic benefits. The report, through a flood risk management appraisal, found a cost-benefit ratio of 5:1 for flood related risks¹². In addition, the report outlines that there are a set of interventions that reduce the probability of flooding. These measures are estimated to significantly reduce future flood risk, but not remove it entirely. These works typically resulted in a 3:1 cost-benefit ratio but would mean a large increase in flood defence expenditure in GCR in future.¹³

As this programme aims to increase the level of green infrastructure and planting, there are a range of co-benefits that can be achieved through this option, such as improvements to health and wellbeing through reduce ambient pollutants; biodiversity habitats and steppingstones; as well as improved efficiency of the network, which can enhance economic activity.

The anticipated costs for this are expected to cost anywhere from £50,000, up to and perhaps exceeding £200,000. It is expected this will take from 1-3 years, with funding allocated from the Shared Prosperity Fund.

Identified Limitations / Comment:

This option should be predominantly led by SEPA/Scottish Water but will need significant collaboration and agreement with the Councils Flood Risk officer. It offers the opportunity to combine a nature-based solutions into sustainable surface water management projects.

Streetscene note that this can be very costly in terms of the capital required for design and implementation of e.g., rain gardens and their subsequent management. This Option needs significant investment and particularly the staffing or cost to have maintenance carried out by a third party.

The scope of this work is under the Surface Water Management Plan's umbrella. The Council are to progress with SWMP for three areas as highlighted in FRM cycle 2 actions - for concept with design thereafter. It will include opportunities for SUDs / retrofitting, however, will require Streetscene input for landscaping these features i.e. rain gardens / swales etc and discussion on how the Council maintains these once in place. There are both flooding, and biodiversity benefits for nature-based SWM and the Council are currently encouraging some of this work through major assets and access travel routes for blue green infrastructure. Again, delivery of this would be dependent on available resource, constraints assessment and most importantly funding.

¹² <https://climatereadyclide.org.uk/report-economic-financial-risk-glasgow/>

¹³ <https://climatereadyclide.org.uk/report-economic-financial-risk-glasgow/>



Adaptation and Nature-Based Solutions Options
<p>Option: <i>ANBS7 - Development of implementation plan to deliver the Climate Ready Planting feasibility study.</i></p>
<p>Delivery Actions:</p> <ol style="list-style-type: none"><i>In conjunction with the LBAP, develop an implementation plan for recommendations made in climate ready planting feasibility study.</i>
<p>Responsibility / Accountability: Lead Service - Roads and Environment (Greenspace and Streetscene)</p> <p>In collaboration with Land Planning Development (Sustainability policy team, Traffic and Transport), Roads and Environment (Roads Network Operations team, Technical and Engineering services).</p>
<p>Policy Driver:</p> <p>Greenspace Strategy and LBAP</p>
<p>Evidence:</p> <p>The development of an implementation plan to deliver a Climate Ready Planting feasibility study provides the following benefits:</p> <ul style="list-style-type: none">• Ensuring appropriate tree species planted in an appropriate location that enhances or restores the existing habitat while providing climate adaptation benefits. These benefits include a reduction to the urban heat island effect, flood mitigation, carbon sequestration and air pollution reduction.• Planting of shrub and undergrowth layer can trap particulate matter pollution while absorbing and slowing the flow of water during extreme rainfall events.• Installation of planting as part of nature-based surface water management, such as rain gardens and swales.• Creating habitat for insects and fauna ensures there are adapted habitats and corridors as the climate changes.

The Local Climate Change Impact Profile (LCLIP) indicated that Council Services are most vulnerable to flooding incidents – accounting for a third of all extreme weather events – and therefore strategic planting will play a role in the reduction of flooding impacts. This is reinforced throughout the national and regional work, which have identified multiple risks to infrastructure, the built and natural environment. This is then reflected in the Climate Ready Clyde (CRC) Economic Implications Report¹⁴ and local Climate Risk and Opportunities Assessments. These reports identified that there is an amber risk (risks that require active management) that there will be an increase in air particulates worsening air quality and sensitive habitats, which can be addressed through the increased planting.

The CRC Economic Implications Report shows that surface water flooding costs the Glasgow City Region (GCR) approximately £20 million in annual average damages. The GCR flood risk management appraisal found cost-benefit ratio of 5:1 for flood related risks.¹⁵ Determining the cost-benefit ratio for a planting regime is more difficult to quantify. However, as per research published by Climate Action Network, a conservative estimate of the economic benefit of a tree can range from £1,200-£8,000 annually, with an initial cost of around £6. The long-term economic benefits accrued over 50 years can be over £8,000 per tree. This can also act as a defence to the urban heat island effect to prevent over heating which is estimated to cost £4million a year by 2050.¹⁶

Indicative costs to implement this option are anticipated to be in the range of £50,000 - £200,000 after the completion of the feasibility study. Funding has been allocated from the Nature Restoration Fund, on top of additional funding which has still to be confirmed.

Identified Limitations / Comments:

Streetscene highlighted that this work will need to be carried out by a consultant, funded by a third party, like the Nature Restoration Funds as there is currently no capacity in Streetscene to carry out the works.

¹⁴ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

¹⁵ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

¹⁶ <https://pcancities.org.uk/news/planting-trees-could-benefit-economy-%C2%A3366m-and-create-36000-jobs>

Adaptation and Nature-Based Solutions Options

Option:

ANBS8 - Identification of climate ready parks across East Dunbartonshire.

Delivery Actions:

1. Undertake an area-wide audit of parks and open space capacity for climate adaptation.
2. Deliver the recommendations from the audit.

Responsibility / Accountability:

Lead Service - Roads and Environment (Greenspace and Streetscene)

In collaboration with Land Planning Development (Sustainability policy team, Traffic and Transport), Roads and Environment (Roads Network Operations team, Technical and Engineering services).

Policy Driver:

Greenspace Strategy and Food Growing Strategy

Evidence:

The identification of Climate Ready parks includes (but is not limited to) and provides the following benefits:

- Flood alleviation.
- Habitat protection/creation.
- Community food growing.
- Community gathering space.

Adaptation Scotland have created a number of resources and tools to assist the public sector in adapting to our changing climate. One such tool is the Climate Ready Park visuals tools, showing a 'before' image of a typical urban park and an 'after' image of how a park could look when it is managed to support climate change mitigation and adaptation. It also highlights a wider range of greenspace actions and identifies their role in supporting climate change mitigation and/or adaptation, including green networks, soil conservation, floodplain restoration, street trees, green roofs and living walls.

Adaptation Scotland: Climate change park¹⁷

The LCLIP identified that Council Services are most vulnerable to flooding incidents – accounting for a third of all extreme weather events and often impacts on the ability to use parks and open spaces, as well as causing general landscaping and green infrastructure damage. While this can render these spaces unusable for long periods, they often provide critical adaptation benefits of water attenuation and therefore absorb and reduce the potential impact of extreme rainfall from surrounding infrastructure such as roads and properties. These large-scale greenspaces designed to be natural flood plains can extend beyond urban parks and using fields and agricultural land to protect key road networks and smaller villages.

Through this option, there could be an array of co-benefits through improving/creating these public spaces by providing enhanced community gathering space and habitat creation. This is reflected in the local Climate Risk and Opportunities Assessment, which identified multiple urgent risks (risks that requires immediate and urgent action) to parks and open spaces from extreme weather and flooding.

Surface and water flooding costs the GCR approximately £46 million in annual average damages.¹⁸ This option is estimated to significantly reduce future flood risk, but not remove it entirely, depending on the specific location being considered and upgraded. As per the CRC Economic Implication Report and a review of flood risk management appraisal found the cost-benefit ratio ranging from 3:1 to 5:1 for flood related risks.¹⁹ This can also act as a defence to the urban heat island effect, which is estimated to cost £4million a year by 2050.²⁰

Indicative costs for the implementation of this option are anticipated to be up to £50,000 and could take around 10 years to fully implement post-adoption of the CAP.

Funding mechanisms to be identified.

Identified Limitations / Comments:

Streetscene have queried whether this could be incorporated into the Green Action Trust led planting/meadow creation study.

This Option will require significant investment to implement and officer time to develop. Streetscene highlight that instead of area-wide as intended, it might be more appropriate to look at the larger areas where we can get maximum benefit and in line with requirements from hydrological studies/surface water management plan.

Important to note, that there may be significant replanting for areas where Ash has been felled and this will not be in parkland areas (roadside/verges/transport networks). The Council should assess the improvements from our Climate Park and learn lessons as to how this can be developed elsewhere. There is likely to be a range of lessons learnt as not every park will be suitable.

¹⁷ <https://www.adaptationscotland.org.uk/how-adapt/tools-and-resources/climate-change-park>

¹⁸ <https://climatereadyclde.org.uk/adaptation-strategy-and-action-plan/>

¹⁹ <https://climatereadyclde.org.uk/report-economic-financial-risk-glasgow/>

²⁰ <https://pcancities.org.uk/news/planting-trees-could-benefit-economy-%C2%A3366m-and-create-36000-jobs>

Adaptation and Nature-Based Solutions Options

Option:

ANBS9 - Ensure that the Council has the relevant skills, knowledge and resources to deliver adaptation Options and Delivery Actions.

Delivery Actions:

1. Undertake skills gap analysis in all relevant policy and project delivery services of the Council to ensure delivery of nature-based solutions.
2. Develop and roll-out a programme to upskill existing operational staff.
3. Identify projects with key partner agencies (TCV, HSCP, TFC)

Responsibility / Accountability:

Lead Service - Roads and Environment (Greenspace and Streetscene)

In collaboration with Land Planning Development (Sustainability policy team, Traffic and Transport), Roads and Environment (Roads Network Operations team, Technical and Engineering services).

External Partnership: HSCP, Trees for Cities and The Conservation Volunteers

Policy Driver:

CAP and Green Skills Development

Evidence:

Ensuring that the Council has the relevant skills, knowledge and resources to deliver adaptation Options and Delivery Actions will provide the following benefits:

- Ensure that the Council is in a position to deliver projects for adaptation and nature-based solutions, including wetland habitats, peatland restoration and rewilding habitats
- Enhance the climate resilience of the natural and built environment and infrastructure

The LCLIP, through the questionnaire process found that there were multiple services who felt they did not have the information or current knowledge to undertake many of the climate-based projects their service requires, as well as many services having little to no resilience measures in place, which reinforces the need for this option.

Through the skills gap analysis, this will enable the Council to identify key service delivery areas that require development and improvement. Through the upskilling of existing operational staff, this should enable them to undertake new forms of work or working patterns that will be required due a changing climate. While this is not physical adaptation project specifically, it should enable East Dunbartonshire to become more adaptable and resilient as a whole through increasing the skill and resources required to undertake climate adaptation-based projects. This option is important to contribute to mainstreaming the role of adaptation and nature-based solutions in the Council and putting climate change at the heart of Council projects development and its policy framework.

The anticipated indicative costs associated with option is expected to reach at least £200,000 but studies would need to be undertaken to quantify this fully. The costs should be met with existing staff resources and should take about 1-3 years to implement after the adoption of the CAP.

Identified Limitations / Comments:

Streetscene agree with this and think there is a need to be given more training opportunities in regard to this, Operational Team Leads included.

Adaptation and Nature-Based Solutions Options

Option:

ANBS10 - Develop strengthened actions for climate adaptation and biodiversity within LDP3.

Delivery Actions:

1. Creation of brownfield site hierarchy screening checklist for development sites.
2. Development of a fossorial water vole trigger map.
3. Development of guidance on nature networks and green corridors.
4. Develop buffers from key ecological sites (LNR, LNCS) and ecologically sensitive habitats (protected species).
5. Strengthen protection for trees in allocated development sites.
6. Development of ecological and climate constraint maps for allocated housing sites.
7. Working alongside colleagues in planning to develop an effective post-development monitoring framework to ensure compliance with planning constraints and annual review of projects development. Funding allocated for biodiversity and climate adaptation and mitigation should be ring-fenced.
8. Incorporate climate change (adaptation and mitigation) into Developer Contribution policies. Align with ANBS12.
9. Development of an adaptation retrofitting framework to promote and develop climate resiliency within existing buildings and developments.
10. Develop policy framework to restrict development within flood risk areas and appropriately zone construction proposals to consider flooding (at various scales 1:100 events etc). Align with NPF4 and anchor in a policy approach policy 2 relate to the 6 qualities of successful places. One of the 6 qualities need to be adaptable. Policy 9 relates to homes - requirement to support householder developers where there's adaptation to climate change.

Responsibility / Accountability:

Lead Service - Land Planning and Development (Land Planning Policy)

In collaboration with Land Planning Development (Sustainability policy team, Traffic and Transport), Roads and Environment (Greenspace and Streetscene, Roads Network Operations team, Technical and Engineering services)

External Partnership: Glasgow City Council, Glasgow University, Glasgow and Clyde Valley Green Network Partnership, NatureScot and Scottish Government

Policy Driver:

LDP3 (NPF4) and CAP

Evidence:

Developing strengthened actions for climate adaptation and biodiversity within LDP3 provides the following benefits:

- Safeguarding of brownfield sites of ecological and green network importance.
- Safeguarding of protected species habitat from development and development of appropriate mitigation
- Ensure green network links and habitat corridors are functional and joined up
- Prevents cumulative impact from adjacent development for sensitive sites
- Safeguarding improvement for established trees and habitat connectivity
- Identifies site constraints prior to detailed design phase, so any sensitivities inform how the site is developed.
- Ensures that climate and biodiversity related actions are undertaken and funding for such projects utilised as expected.
- Ensure climate change considerations and financing are taken into account and allocated within the Developer Contributions policy framework.
- Ensure existing developments and buildings are adapted and resilient to climate change.
- Ensures future housing will not be impacted by future flooding events.

Without long-term climate planning through the LDP, this would increase the vulnerability of critical infrastructure and the natural and built environment, which could have substantial economic, social and environmental risks. It ultimately supports biodiversity and improves habitat creation, contributes to natural flood attenuation and carbon sequestration, and aids the development of resilience and adaptability for the rest of East Dunbartonshire. The LCLIP identified the major risks associated with flooding due to past development and the threat to biodiversity, habitats and green networks. Furthermore, the local Climate Risk and Opportunities Assessment identified multiple urgent risks (risk which demands immediate and urgent action) to existing and new developments of domestic and non-domestic properties; to the natural environment such as parks and open space; as well as key infrastructure such as transport and sewage. Through the above delivery actions, this will contribute to integrating climate policy into the long-term planning framework across all services and will enable the ring-fencing of climate adaptation finance to secure long-term projects; preserve key green belt areas, brownfield and biodiversity networks; and avoids development on land which can support climate-based activities – such as functional flood plains - all of which are risks that have been highlighted in the local Climate Risk and Opportunities Assessment and should be reflected in the LDP policy framework.

For the majority of the delivery actions, they don't have any costs associated with them as they are more process based and involve strengthening the policy development framework and mainstreaming adaptation into Council processes by the Sustainability Policy and Land Planning Policy Teams. This option explores a range of different policy measures around adaptation from flooding prevention, biodiversity and habitat restoration, greenspace development and zoning restrictions for development. These measures have a range in their cost-benefit ratio and will vary depending on implementation and timing of delivery. But generally speaking, the outcomes of the new policy framework are as follows:

- Some early adaptation investments are highly effective and deliver high value for money with cost-benefit ratios typically range from 2:1 to 10:1, depending on the emissions scenario and measures

implemented. This includes climate smart agriculture, climate resilient infrastructure, and upland peatland restoration.²¹

- Adaptation is shown on the whole to have significant GDP benefits and possess a strong cost-benefits ratio. For example, the overall analysis from the CRC Financial and Economic Assessment highlights that enhancing the climate resilience of key infrastructure has benefits that outweigh costs by a ratio of 4:1 on average.²²
- A review of flood risk management appraisal found a cost-benefit ratio of 5:1 for flood related risks.²³

As these are all delivery mechanism and outcomes that can already be achieved in-house as they lie in control of the Council, there will be limited costs and staff resources associated with significant benefits.

Actions 2 & 6 have anticipated costs of up to £200,000 but will require additional feasibility work to quantify this further.

Identified Limitations / Comments:

Streetscene believe they can feed into this if required, however capacity is very limited and would ideally require to be carried out by a consultant or an Ecologist post, if funds could be found to create this post.

Reference made to the flexibility of the capital budgets but really important to identify revenue for ongoing maintenance. This is often the forgotten part but nevertheless an essential component to protect the investment made.

²¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

²² <https://climatereadyclide.org.uk/adaptation-strategy-and-action-plan/>

²³ <https://climatereadyclide.org.uk/report-economic-financial-risk-glasgow/>

Adaptation and Nature-Based Solutions Options

Option:

ANBS11 - Development of the Authority Construction Requirements in alignment with Climate Change and relevant Sustainability Policies.

Delivery Actions:

1. Development of the housing estate should be undertaken in accordance with the ACR and the CAP. Align ACR with existing and emerging building standards regulations.

Responsibility / Accountability:

Lead Service - Assets and Facilities (Housing Investment)

In collaboration with Assets and Facilities (Estates) and Housing.

Policy Driver:

Building Standard Regulations

Evidence:

The Development of the Authority Construction Requirements in alignment with Climate Change and relevant Sustainability Policies provides the following benefits:

- Ensuring that council-led housing and infrastructure projects are undertaken to the highest environmental standards.
- Ensures alignment of infrastructure projects with existing and emerging policy frameworks.

The LCLIP highlighted the need for climate resilient infrastructure, such as bringing new builds up to the highest environmental standards, with elements such as improved fabric of buildings to withstand more extreme weather conditions like driving rain; energy efficiency measures such as insulation and double glazing to improve energy performances of buildings; and clean energy systems to reduce emissions. These measures help improve the standards of buildings and reduce the chances of buildings falling into disrepair, reduce their energy consumption and enable them to adapt to new weather conditions. This is reinforced in the local Climate Risk

and Opportunities Assessment as there are many risks, both amber (risks that requires active management), and urgent (risk which demands immediate and urgent action) that have been identified and which relate to the damage of buildings and other infrastructure.

Annual average damages in GCR are approximately £46 million from rivers and surface flooding, so it offers the opportunity for significant economic savings and a high-cost benefits based on indicative costs below. ²⁴

While this is not a construction project, the policy development of the Authority Construction Requirements could facilitate the following cost benefits:

- Some early adaptation investments are highly effective and deliver high-value for money with cost-benefit ratios typically ranging from 2:1 to 10:1, depending on the emissions scenario and measures implemented. This includes investments in heatwave alerts and plans, early warning systems, climate smart agriculture, and climate resilient infrastructure.²⁵
- Adaptation is shown on the whole to have significant GDP benefits and possess a strong cost-benefit ratio. For example, the overall GCR analysis highlights that enhancing the climate resilience of key infrastructure has benefits that outweigh costs by a ratio of 4:1 on average.²⁶
- The CRC review of flood risk management appraisal found cost-benefit ratio of 5:1 for flood related risks. ²⁷
- There are also household level options for enhancing resilience and resistance. These are more cost-effective when fitted in new buildings. Analysis of the costs and benefits of these options suggests that resistance measures (that stop entry of water) could be cost-effective in all new build properties; some resilience measures (that reduce recovery time, so that the building can quickly be returned to use after the flooding) are cost-effective, but these depend on flood frequency. ²⁸

It is anticipated that this Option is likely to have a low indicative cost, approximately up to £50,000. From the point of adoption, it is expected it would take approximately 2-3 years to implement this option with costs met through existing staff resources.

Identified Limitations / Comments:

²⁴ <https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/>

²⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

²⁶ <https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/>

²⁷ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

²⁸ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

Adaptation and Nature-Based Solutions Options

Option:

ANBS12 - Ensure climate adaptation and building resilience is adequately financed.

Delivery Actions:

1. Investigate the flexibility of the 30 year capital programme - needs to reflect societal changes (the current war in Ukraine, inflation, the cost-of-living emergency and climate change).
2. Ring-fencing of budgets allocated for each service for CAP implementation (both mitigation and adaptation). Align with ANBS10: Delivery Action 8.
3. Investigate finance mechanisms to deliver climate adaptation.
4. Continue to collaborate with Climate Ready Clyde (and Partner organisations) on the development of a City-Region Adaptation Finance Lab.

Responsibility / Accountability:

Lead Service - Finance

In collaboration required with Land Planning and Development (Sustainability Policy) and Finance.

External Partnership: Climate Ready Clyde (and partner organisations)

Policy Driver:

CAP

Evidence:

Ensuring climate adaptation and building resilience is adequately financed provides the following benefits:

- Ensures prioritisation of resources adaptation so funds are not re-allocated
- Ensures sufficient flexibility in budgets to ensure projects can still progress
- Future proofs adaptation and nature-based solution measures

These intended benefits link with the finding from the LCLIP. The report made it clear that essentially every service commented on funding and resourcing issues and are the largest barrier to progressing climate-based projects. This Option should help ring-fence funding to ensure the implementation of critical climate adaptation measures. While this was not identified in the local Climate Risk and Opportunities Assessment, this option helps safeguard and ensure the risks and opportunities identified in the local Climate Risk and Opportunity Assessment are actioned.

The outcomes of this Option could have significant economic benefits, but the pertinent element of this Option is that it should safeguard the long-term capital budgets to improve the resilience of the area and ensure critical adaptation measures are implemented.

To help accelerate progress in unlocking adaptation finance, Flagship Action 12 of the CRC Adaptation Action Plan sets out the establishment of an Adaptation Finance Lab to:

- Support innovative financing models for adaptation action within Glasgow City-Region.
- Develop a pipeline of investable adaptation projects to match with suitable financing.

The expected indicative costs for this are relatively low, costing up to £50,000 and being implemented 1-2 years after adoption of the CAP. It is expected that the costs will be met with existing staff resources and continued partner membership with Climate Ready Clyde.

Identified Limitations / Comments:

Streetscene have highlighted that this is a critical Option and also call on a review and increase of revenue budgets to create additional posts to implement the work, and also to maintain areas that have been enhanced through the Climate Action work.

Adaptation and Nature-Based Solutions Options

Option:

ANBS13 - Improve "Best value" process to raise the priority of sustainability and climate change criteria in procurement processes

Delivery Actions:

1. Develop a methodology for climate and biodiversity oversight of decision-making.
2. Create a stage in the procurement process for Sustainability Policy Team to be consulted on the carbon and biodiversity costs associated with any major development or high value purchases.
3. Investigate the potential to embed a sustainability procurement officer.

Responsibility / Accountability:

Lead Service - Procurement

In collaboration with Land Planning Development (Sustainability Policy) and Finance

Policy Driver:

CAP and EDC Procurement Policy Framework

Evidence:

Improving "Best value" process to raise the priority of sustainability and climate change criteria in procurement processes includes (but is not limited to) and provides the following benefits:

- Mainstreams sustainable development at the inception of projects and reduces environmental liability for the council
- Ensures that carbon and biodiversity costs are considered at the point of purchases
- Potential criteria: Sustainability of materials sourced, demonstration of supply chain sustainability and demonstration of environmental or net zero credentials from companies for large scale projects
- Longevity should also be considered in materials to be procured to reduce ongoing costs and prevent waste

One of the recommendations from the LCLIP states, '*Integrating climate change mitigation and adaptation elements into Council procurement and tendering procedures.*'. It is recognised that this is a committed Early Action as part of the Councils emerging Climate Action Plan. Early Action 15 '*Update of standard procurement documentation to improve embedding of climate considerations*' and 16 is to '*Include additional climate change considerations in annual Procurement Strategy update*'. Due to the impacts, essential changes could be required across Council services such as new clothing for a changing climate, purchasing machinery for maintaining green spaces, or mandating any partner organisations have a net zero strategy (or equivalent) including an

adaptation/resilience strategy. However, further examples should be explored across all services. This should aid in enabling climate change requirements are the forefront of Council policy framework and decision-making and ensure progress against climate change and biodiversity targets.

The anticipated costs for this are expected to be low, up to £50,000 and it is expected to 1-2 years from the implementation of the CAP.

Identified Limitations / Comments:

It is also important to factor in the circular economy, cost of management of materials and expected life spans of materials.

Adaptation and Nature-Based Solutions Options

Option:

ANBS14 - Support communities to build resilience and create climate ready places throughout East Dunbartonshire.

Delivery Actions:

1. Develop community-built resilience plans specifically for areas vulnerable to flooding and lower resilience areas.
2. Investigate the potential to create climate and biodiversity community hubs (involving community groups) which provide a central location to co-ordinate emergency response to severe weather, access to local services and workspace bringing people together to develop local projects and social enterprises.
3. Incorporate climate and biodiversity criteria for the development and implementation of place and locality plans. Achieved through generation of milestones and project targets.
4. Investigate the potential to create climate and biodiversity education resources to equip communities with the knowledge and tools to become climate resilient.
5. Explore options to provide climate resilience and biodiversity skills training to communities to support them in adapting to the challenges of severe weather events and protect and enhance local biodiversity.

Responsibility / Accountability:

Lead Service – Community Planning

In collaboration with: Land Planning Development (Land Planning Policy, Sustainability Policy), Place and Community Planning, CPP, HSCP, Roads and Environment (Greenspace and Streetscene, Technical and Engineering Services)

External Partnership: EDVA and relevant Community Groups

Policy Driver:

CAP and LDP

Evidence:

Supporting communities to build resilience and create climate ready places throughout East Dunbartonshire includes will provide the following benefits:

- Builds capacity to adapt to more frequent and severe weather events. The development of Lennoxton pilot can be used as an exemplar for other localities. This helps community coordination and people will be less reliant on travel to access services. Community hubs can support community groups, demonstrate good practice and co-ordinate emergency response to severe weather which is reflective of local circumstances.
- Inter-disciplinary expertise informs the development of the plans to create and improve resilience to safeguard the most vulnerable communities from the effects of climate change and biodiversity decline.

The LCLIP highlighted that there is a need and demand for local communities to become more engaged in matters local to them, primarily around concerns of flooding hotspots, in order for them to be able to respond to extreme events more effectively and reduce their impacts. This is also an urgent risk (risks which demands immediate and urgent action) that has been identified in the local Climate Risk and Opportunities Assessment as the least resilient areas tend to be the most financially vulnerable, and therefore are the demographic which are least likely to be able to adapt their properties and communities to fit a changing climate or react/recover to extreme weather events. This is linked to the Local Outcome Improvement Plan, which is designed to support and drive positive change in more vulnerable local communities through empowering residents to have a larger influence over local matters and create a step change in behaviour for both the Council and its residents. There are co-benefits of this option from both a mitigation and adaptation perspective as the Lennoxton project is aimed at creating a modal shift in travel behaviour from cars to more active and sustainable options, which in turn improves local air pollution and creates more community space. The long-term benefits from the Lennoxton development could help mainstream these ideas into Council design processes to be replicated across East Dunbartonshire.

Putting mechanisms and process in place to enable communities to become climate ready by designing them to be adapted, resilient and climate ready has strong economic savings and a high-cost benefit ratio. Flood risk management measures can range in their benefits depending on the measures, but generally they have a cost-benefit ratio of 3:1²⁹. Furthermore, the CRC Financial and Economic Assessment highlights that enhancing the climate resilience of key infrastructure has benefits that outweigh costs by a ratio of 4:1 on average³⁰. According to Glasgow's Active Travel Strategy 2022-2031, the new funding committed to developed 270km of cycling infrastructure around the City has been estimated to have cost-benefits of approximately 3.8:1.³¹

The anticipated indicative cost of developing this option is expected to cost up to £50,000. However, this could increase to up to £200,000 depending on the collaboration with communities and plans that come thereafter. This will take 1-5 years after adoption of the CAP.

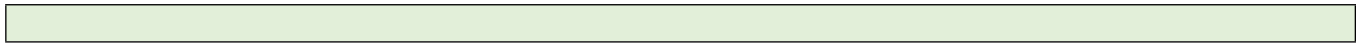
Identified Limitations / Comments:

Streetscene highlighted that this would require discussion with Streetscene and Community Planning Partnerships etc. as this will be resource intensive and would require additional posts in order to develop and support groups to seek funding for projects, developing and maintaining assets.

²⁹ <https://climatereadyclide.org.uk/report-economic-financial-risk-glasgow/>

³⁰ <https://climatereadyclide.org.uk/adaptation-strategy-and-action-plan/>

³¹ <https://www.glasgow.gov.uk/councillorsandcommittees/viewDoc.asp?c=P62AFQDNZLDXT1UTDN>



Adaptation and Nature-Based Solutions Options
<p>Option: <i>ANBS15 - Develop a climate change and biodiversity impact assessment which is to be undertaken at the inception of every project / policy under development and Council decision-making.</i></p>
<p>Delivery Actions:</p> <ol style="list-style-type: none"><i>1. Implement the SSN checklist in alignment with wider regional approach.</i><i>2. This assessment will be integrated as a key requirement through the Councils existing Impact Assessment Guide and Council / Committee approval process.</i>
<p>Responsibility / Accountability: Lead Service – Land Planning Development (Sustainability Policy) In collaboration with wider Land Planning and Development</p>
<p>Policy Driver: CAP</p>

Evidence:

Develop a climate change and biodiversity impact assessment to be undertaken at the inception of every project / policy under development and Council decision-making will provide the following benefits:

- Review of council decisions and actions from a climate mitigation and adaptation perspective. Highlight climate and biodiversity impacts and limitations to inform council decisions. As part of the IAG process, this would ensure that Services are accountable for the completion of this assessment.
- Integration of biodiversity impacts into a wider Climate Change Impact Assessment will reduce duplication of assessments and align climate and ecological impacts under a single assessment process.

The LCLIP outlined the importance of adaptation and nature-based solutions as a means to improve resilience but also to support biodiversity where possible. The local Climate Risk and Opportunities Assessment further identified multiple different risks to biodiversity, habitats and ecological services. The sustainability and climate agenda often tend to focus on mitigation, but the role of ecological services and nature-based solutions are often overlooked. This option will help integrate and reinforce the importance of this into the mainstream culture of Council processes and the planning framework by having to consider biodiversity from the outset.

The expected indicative costing for this option ranges from up to £50,000-£200,00 and take roughly 1-3 years to implement from time of adoption of the CAP.

Identified Limitations / Comments:

Streetscene identified the need for additional staff resources, such as in Major Asset's team, in order to undertake this option.

Adaptation and Nature-Based Solutions Options**Option:**

ANBS16 - Embed and mainstream adaptation considerations and actions throughout the Local Authority.

Delivery Actions:

1. Support council services in the implementation of adaptation options and delivery actions.
2. Work towards mainstreaming climate adaptation within Council processes and decision-making.
3. Support the development of and delivery of a retrofitting framework to promote and develop climate resiliency (ANBS10).
4. Develop a standardised approach to climate change (mitigation and adaptation) through Service, Corporate and Civil Contingency Risk Registers.

Responsibility / Accountability:

Lead Service – Land Planning Development (Sustainability Policy)

In collaboration with wider Land Planning and Development and Finance (Risk)

Policy Driver:

CAP

Evidence:

Embedding and mainstreaming adaptation considerations and actions throughout the Local Authority will provide the following benefits:

- Provision of specialised sustainability, climate advice and guidance to achieve improved resilience area wide. This would support a Council-wide understanding of climate change risks across all service areas which may in turn could lead to an increased understanding of the financial impact of events and the return on investment from climate change projects.

The LCLIP highlighted the lack of resilience or adaptation measures across many Council services. Without long-term planning and mainstreaming considerations of adaptation, it will increase the vulnerability of critical infrastructure and the natural and built environment, which could have substantial economic, social and environmental risks for the Council and area wide. Delivery action 4 is key as it places emphasis on the need for a mechanism to be in place, which enables services to effectively monitor, record and understand extreme weather events and correlate their impacts against remediation costs, delays and staff resources. This should in turn help increase the awareness of the financial implications these weather events cause and help justify future projects, which increase resilience to climate change.

The funding for this option will be met through the existing staff resources and should have a low cost associated with it. This will be an ongoing process which will last the CAP lifespan.

Identified Limitations / Comments:

Adaptation and Nature-Based Solutions Options

Option:

ANBS17 - Develop an internal process to comprehensively record the impacts of climate change on Council Services, Infrastructure and Operations.

Delivery Actions:

1. Develop a standardised data management and recording process.
2. Implement and promote the agreed process across the Council to record the impacts of extreme weather events on an annual basis.

Responsibility / Accountability:

Lead Service - Land Planning and Development (Sustainability Policy)

In collaboration with Land Planning Development (Land Planning Policy), Place and Community Planning, CPP, HSCP, Roads and Environment (Technical and Engineering Services)

Policy Driver:

CAP

Evidence:

Develop an internal process to comprehensively record the impacts of climate change on Council Services, Infrastructure and Operations will provide the following benefits:

- Ensure best practice and recommendations from the LCLIP are implemented. This will enable a more complete understanding of the full extent of the impacts these events have on East Dunbartonshire as a whole and enable Council policy and infrastructure to evolve and become more focussed on resilience.

One of the key recommendations from the LCLIP was the need to develop more succinct and standardised processes for recording the impacts from climate change and extreme weather events. It was clear from the information gathering process in the LCLIP that there was very little in terms of recording the impacts of such events, and therefore it is difficult to quantify the disruption caused to infrastructure, operations and service delivery and assets, the cost to remediate and the impact on staff resourcing. This in turn becomes a barrier to develop effective policy and implement resilience measures.

It is anticipated that that the indicative costs for this shall be low, up to around £50,000. This will also have an impact on existing roles within the Council and take 1-2 years to implement from the adoption of the CAP.

Identified Limitations / Comments:**Adaptation and Nature-Based Solutions Options****Option:**

ANBS18 - Protect critical services (external and internal) to ensure functionality in our changing climate.

Delivery Actions:

1. Undertake an audit of external critical infrastructure and services (HSCP, NHS / Ambulance Service, Police Scotland, Fire Service).
2. Investigate the scope to expand current emergency response plans to produce an extreme weather event multi hazard early warning system in alignment with GCR approach within CRC Climate Adaptation Strategy and Action Plan Flagship Action 5.
3. Conduct an audit of current emergency mobilisation plans for extreme weather events, including water and energy shortages incorporating an area-wide vulnerability mapping exercise.

Responsibility / Accountability:

Lead Service - Land Planning and Development (Sustainability Policy)

In collaboration with Land Planning Development (Land Planning Policy), Place and Community Planning, CPP, HSCP, Roads and Environment (Technical and Engineering Services)

External Partnership: Climate Ready Clyde, Community Councils, Emergency Services and NHS

Policy Driver:

CAP

Evidence:

Protecting critical services (external and internal) to ensure functionality in our changing climate will provide the following benefits:

- Ensure critical services are able to be accessed and function in all weather conditions (including severe weather events). Emergency services and their critical assets, like fire stations and ambulance depots, need to operate during severe weather events. These sites and access routes need a high degree of protection and resilience to ensure they remain operational in emergencies.
- Enables early warning and readiness in alignment with GCR approach. Identified shelters, resources, accountable services, accessibility and supply chains in preparation for climate related events and energy shortages. HSCP operate the strategies of their parent bodies. This exercise will ensure a cohesive streamlined approach between the two organisations to give the HSCP a clear pathway for adaptation of estates and services.

The LCLIP identified the need for the protection of critical services, such as first responders and utility providers through having an efficiently functioning transport network, which can tolerate the impacts of extreme weather events and protect critical services routes and infrastructure. This also require their critical assets to be developed in a climate resilient way so patients can be effectively managed, and key services can be delivered.

The UK Climate Change Risk Assessment concluded that many early adaptation investments are highly effective and deliver high-value for money with cost-benefit ratios typically range from 2:1 to 10:1³². This includes investments in early warning systems and climate resilient infrastructure. Ensuring the climate resilience of critical assets and infrastructure such as Fire Service, Police, HSCP, NHS and ambulance depots can be difficult to quantify, however, the CRC Financial and Economic Assessment suggest that flood adaptation far outweigh the costs, with the literature review identifying a cost-benefit ratio of 6:1 for intervention 6 & 7 - *adapt the Clyde Corridor for the twenty-second Century and enhance early warning and preparedness for floods and heatwave*; Intervention 8 - *ensure our homes, offices, buildings and infrastructure are climate resilient* – to shocks and stresses of climate change, was shown to have on average a cost-benefit of 4:1 and even higher for critical infrastructure (e.g. electricity, water supply, key transport routes) because of the risks of cascading effects³³. For measures to enhance preparedness such as evacuation plans are shown to have a higher cost-benefit ratio with studies reporting the highest (10:1) of all direct risk reduction interventions.³⁴

³² https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

³³ <https://climatereadyclde.org.uk/adaptation-strategy-and-action-plan/>

³⁴ <https://climatereadyclde.org.uk/report-economic-financial-risk-glasgow/>

It is expected this option will take 1-2 years to implement fully once the CAP is adopted and will have a low cost associated with it, anticipated to cost up to £50,000.

Identified Limitations / Comments:

While the funding for this is to be met through existing staff resources, it is noted that an additional officer for impact and procurement work is required and would need more resources than currently exists.

Adaptation and Nature-Based Solutions Options

Option:

ANBS 19 - Peatland conservation and restoration across the whole of East Dunbartonshire.

Delivery Actions:

1. Undertake area-wide baseline and feasibility study for peatland habitats.
2. Develop management plans for peatland.
3. Identify potential peatland restoration plans.
4. Align conservation and restoration works with carbon sequestration requirements identified through the mitigation consultancy work to inform the CAP development.

Responsibility / Accountability:

Lead Service – Land Planning Development (Sustainability Policy)

In collaboration with Land Planning Development (Land Planning Policy), Roads and Environment (Greenspace and Streetscene, Technical and Engineering Services)

External Partnership: GCVGNP and NatureScot

Policy Driver:

Campsie Peatland Management Plan

Evidence:

Peatland conservation and restoration across the whole of East will provide the following benefits:

- Peatland, peatland habitats and carbon rich soils have historically been drained, degraded and disturbed due to development and agriculture.
- As the climate continues to change, peatland is vulnerable to further degradation, emitting greenhouse gases that further contribute to climate change.
- Healthy peatland provides ecosystem services such as flood water retention, carbon sequestration and water filtration.

One of the recommendations from the LCLIP was *encouraging collaborative action wherever possible to address climate impacts*. There are two risks identified in the local Climate Risk and Opportunities Assessment which relate to peatland with one of them, *degradation and loss of peatland habitat*, assessed as an urgent risk (risks that requires immediate and urgent action).

It can be difficult to define the economic impact and cost-benefits of ecological measures. However, the CRC Economic Implications Report estimated the benefits from peatland restoration within the GCR. Future climate induced damage costs range from £7.5m p.a. to £10.3 p.a. based on the extent of peatlands within GCR. Restoring could bring benefits from £3.2m p.a. - £14.9m p.a. with assumed size of 25,000 Ha – 36,000 Ha. All sites have different benefits, but this would have an overall cost-benefit ratio of 1.3:1 – 12:1³⁵. Peatland protection and restoration is one of the few Options which has significant benefits for climate mitigation and adaptation outcomes.

It is expected this will have a medium to high indicative costs, ranging from £50,000 - £200,000 and will take 1-2 years after the adoption of the CAP. Funding mechanisms for this option will be met from existing resources as well as through procuring an external consultant.

Identified Limitations / Comments:

Streetscene agree this work is required, however it would require to be funded and carried out by an external consultant. The work should also include hydrological assessment of the peatland areas and climate change modelling to determine proactive work to protect neighbouring houses from residential flooding, as well as access, species restoration and interpretation and ongoing monitoring of peatland condition.

- Updated management plans and hydrological surveys of our two sites managed by EDC are required.
- There are many fragments of peat bog, such as that at Bearhill Farm and near Westerhill Road that are not really identified and recorded in any meaningful way. This needs to be rectified.

³⁵ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

- Strongly recommend that fen peat is factored in here as well. The Kelvin Valley has many areas of fen peat including, Millersneuk Marsh and West Balgrochan Marsh.

Adaptation and Nature-Based Solutions Options

Option:

ANBS20 - Ensure the council estate is resilient to climate change (including but not limited to offices, schools, leisure facilities, community facilities).

Delivery Actions:

1. Undertake an audit of the Council estates resilience to the impacts of climate change to develop an evidence base and required adaptive measures.

2. *Implement all Audit recommendations for adaptation and nature-based solutions to build resilience of the Council estate.*

Responsibility / Accountability:

Lead Service - Assets and Facilities (Estates)

In collaboration with Land Planning Development (Land Planning Policy, Sustainability Policy), Roads and Environment (Greenspace and Streetscene, Technical and Engineering Services)

Policy Driver:

CAP and Climate Change Legislation

Evidence:

Ensure the council estate is resilient to climate change (including but not limited to offices, schools, leisure facilities, community facilities) will provide the following benefits:

- With an increase in flooding, key infrastructure such as water and sewage facilities will need improved flood protection. A variety of methods can be used to adapt sites to flood risk, for example, constructing hard defences (in built up environments where natural flood management cannot be achieved), creating upstream storage for flood waters, and raising control equipment above flood level to maintain services during floods.
- Better ventilation and maintenance of the building increases resilience to wind driven rain, damp conditions and overheating. A green roof can improve insulation, prevents overheating and reduces run-off. Increase the climate resilience of the school and raise awareness in the community.

The LCLIP identified the need for the protection of key infrastructure through a variety of adaptation measures, such as protecting council estates from a variety of extreme weather events and a changing climate. Such facilities were further identified in the local Climate Risk and Opportunities Assessment as an amber risk (risks that requires active management).

Ensuring the climate resilience of the Council's infrastructure such as schools and offices can be difficult to quantify due to the varying climate impacts. However, as per CRC Financial and Economic Assessment, it found that the cost-benefit ratios for these interventions are typically around 4:1³⁶. General adaptation measures are highly effective and deliver high value for money with cost-benefit ratios typically range from 2:1 to 10:1³⁷, depending on the emissions scenario and when measures implemented. The GCR analysis states there are a set of interventions that reduce the probability of flooding and are estimated to significantly reduce future flood risk, but not remove it entirely. These have good cost-benefit ratios (typically 3:1) but would mean a large increase in flood defence expenditure in the GCR in the future³⁸. For measures to enhance preparedness such as evacuation plans are shown to have a high cost-benefit ratios with studies reporting the highest (10:1) of all direct risk reduction interventions.³⁹ Heat may also be an increasing risk in the future, and it is expected there

³⁶ <https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/>

³⁷ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

³⁸ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

³⁹ <https://climatereadyclyde.org.uk/report-economic-financial-risk-glasgow/>

will be 5,700 extra cases a year from heat by the 2050s, with estimates at an additional £4 million a year for morbidity cases, as per the CRC Economic Implications report⁴⁰.

It is expected this option will take anywhere from 1-5 years to implement fully once the CAP is adopted and will have a high cost associated with it, costing over £200,000.

Identified Limitations / Comments:

This requires the Option to be fully costed up with plans and funding to carry out any recommendations and future maintenance/additional operational staffing requirements.

Adaptation and Nature-Based Solutions Options

Option:

ANBS21 - Continuing to engage with external stakeholders to identify adaptation issues and vulnerabilities to produce relevant Options to action.

⁴⁰ chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://climatereadyclyde.org.uk/wp-content/uploads/2020/03/Full_Report_climate_risks_finance_and_opportunity_position_paper.pdf

Delivery Actions:

1. *Liaise with all relevant external stakeholders and service providers regarding resilience planning and capacity.*

Responsibility / Accountability:

Lead Service - External Stakeholders (utility companies, business community and external partnership agencies)

In collaboration with Land Planning Development (Land Planning Policy, Sustainability Policy), Roads and Environment (Greenspace and Streetscene, Technical and Engineering Services)

Policy Driver:

CAP

Evidence:

Engaging with utility companies and service providers regarding resilience planning and capacity will provide the following benefits:

- Ensures long term resilience of critical services to continue service delivery during extreme weather events and to adapt to a changing climate.

The LCLIP detailed the critical nature of external stakeholders such as utility companies to have adaptation and resilience measures in place to ensure the continuity of their services in extreme events. Utility companies in particular enable a host of various key economic activities to be carried out in these events, such as enabling people to work from home – which is further required due to lack of resilience measures throughout Council services – as well as schools, facilities management, social work and HSCP. This is dependent on utility providers keeping their critical assets functioning which allow internet services, electricity transmission and water services to function.

The LCLIP detailed the critical nature of external stakeholders such as HSCP to have adaptation and resilience measures in place to ensure the continuity of their services in extreme events. External partnerships agencies need to have their own measures on their premises. However, they are also dependant on other Services, such as the Roads teams who work to keep the network running, as well as other transport systems. This is critical to enable community health and care services, social care services for children and families, and criminal justice social workers to get to appointments and provide the required care to patients.

This will require ongoing engagement to ensure sufficient protection and capacity of systems, identification and monitoring of vulnerable communities, and updating systems based on new emerging climate models and risks.

The cost of this cannot be defined clearly due to the nature of it, but it is expected that this will occur over a 1–2-year period from the implementation from the CAP.

Identified Limitations / Comments:

Limited response by external stakeholders to date, despite multiple requests for information and invitation to all CAP engagement events so far.

Adaptation and Nature-Based Solutions Options

Option:

ANBS22 - Contribute to the delivery of adaptation at a Glasgow City-Region level

Delivery Actions:

1. Continued membership to be a key partner organisation with Climate Ready Clyde.
2. Continued involvement with all existing and emerging CRC Forums and Working Groups to help deliver the Interventions and Flagship Action from the City-Region Adaptation Strategy and Action Plan

Responsibility / Accountability:

Lead Service – Land Planning & Development (Sustainability Policy)

In collaboration with all Council Services.

External Partnership: Climate Ready Clyde, Adaptation Scotland and SNIFFER.

Policy Driver:

Climate Ready Clyde Glasgow City-Region Adaptation Strategy and Action Plan

Evidence:

Continuing membership, engagement and contribute with all CRC Forums and Working Groups to support the delivery of adopted Flagship Actions and Interventions at the City-Region level to improve overall adaptation, resilience and enhance biodiversity. Creating a well-adapted environment will provide the following benefits:

- Reduce future losses and damage, create economic benefits – for example through reducing risk, increasing productivity and promoting innovation, and can bring about a range of social and environmental benefits.
- Co-benefits of adaptation include the positive effects on biodiversity, air quality, reducing flood risk and water management, greenhouse gas emission reductions, and health and well-being.

The economic case for adaptation has been assessed to have the following benefits:

- Some early adaptation investments are highly effective and deliver high value for money with cost-benefit ratios typically range from 2:1 to 10:1, depending on the emissions scenario and measures implemented. This includes climate smart agriculture, climate resilient infrastructure, and upland peatland restoration.⁴¹
- Adaptation is shown on the whole to have significant GDP benefits and possess a strong cost-benefits ratio. For example, the overall analysis from the CRC Financial and Economic Assessment highlights that enhancing the climate resilience of key infrastructure has benefits that outweigh costs by a ratio of 4:1 on average.⁴²
- The UK Climate Change Risk Assessment estimates that early measures of adaptation could bring this cost-benefit ratio up to 10:1.⁴³

The supplementary work streams such as the LCLIP and Risk and Opportunities Assessment have detailed the role and relationship between GCR Local Authorities and the CRC Adaptation work streams. This is particularly important in terms of the methodology that has been provided to enable the development of local adaptation, nature-based solutions and resiliency plans.

⁴¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

⁴² <https://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/>

⁴³ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

It is expected this option will be on ongoing process through the lifetime of the CAP, and will have a low cost associated with it, anticipated to cost up to £50,000.

Identified Limitations / Comments:

Committed staff-time and resources will be required to fully engage with and support all the associated Working Groups, Task and Finish Groups and Forums to gain the maximum benefits from continued partnership with CRC.

