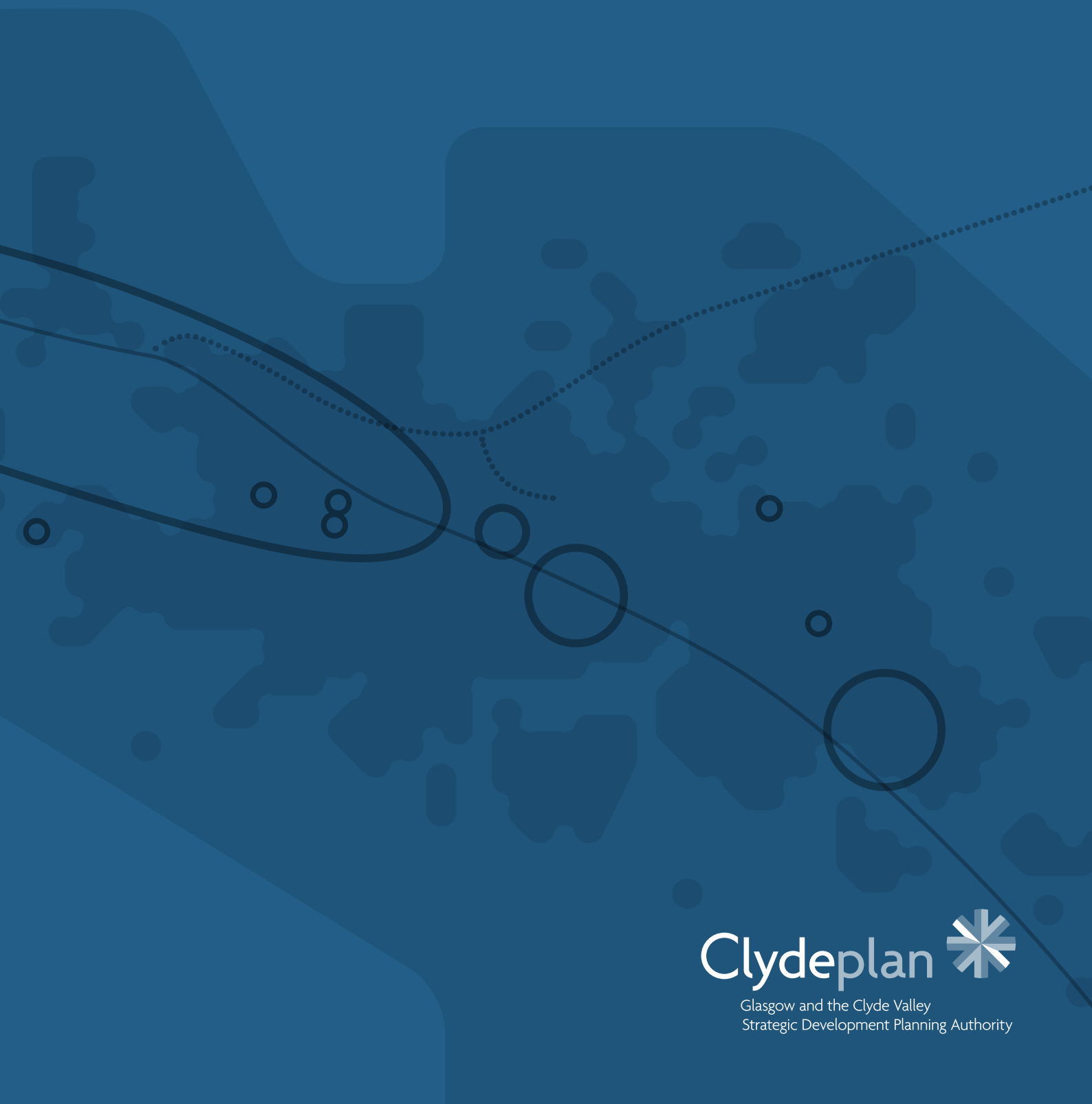
Strategic Development Plan

Proposed Plan - Background Report

January 2016

Climate Change Adaptation



Clydeplan

Glasgow and the Clyde Valley
Strategic Development Planning Authority

Clydeplan

Glasgow and the Clyde Valley
Strategic Development Planning Authority

STRATEGIC DEVELOPMENT PLAN

BACKGROUND REPORT 3

CLIMATE CHANGE ADAPTATION IN GLASGOW AND THE CLYDE VALLEY

January 2016

1 Contents

1 Introduction 4
Purpose 4
Sea level rise and coastal change 5
2 Impacts of climate change 5
Increased risk of flooding 5
Coastal change 5
Population health and wellbeing 5
Business resilience 5
Building performance 5
Infrastructure – Network Connectivity and Interdependencies 5
Secure and efficient energy supply 6
A healthy natural environment 6
Agriculture and forest productivity 6
The occurrence of pests and disease 6
Soil quality 6
Water quality and availability 7
A healthy marine environment 7
Cultural heritage and identity 7
Food security 7
The need for action 7
Figure 1: Climate change: the need for action 8
3. Response in Glasgow and the Clyde Valley 9
Introduction 9
Appropriate locational responses 9
City and strategic centres 9
Figure 2: Increasing the resilience of city and town centres 11
Regeneration areas 12
Figure 3: Increasing the resilience of regeneration areas 13
Suburban and urban expansion areas 14
Figure 4: Increasing the resilience of suburban and urban expansion areas 15
Upland areas 16
Figure 5: Upland areas 17
Rural communities 18
Figure 6: Rural communities 18
Cross boundary, system and networks 19
Clyde Area Management Plan – SEPA 19

4 What this means for the city region 20
Introduction 20
City and strategic centres 20
Regeneration areas 21
Suburban and urban expansion areas 21
Cross boundary, system and networks 21
5 Conclusion 22
6 Recommendations 22

1 Introduction

Purpose

1.1 Climate change will have a major impact on business, society and the environment in the decades ahead. We are already experiencing changes in climate here in Scotland and there is strong recognition that the planning system has a key role to play in helping Scotland adapt and increase resilience[1].

1.2 This report provides information about changes in climate and likely impacts for Glasgow and the Clyde Valley and outlines the role of the Strategic Development Plan in supporting the region to build resilience and adapt.

1.3 The Scottish Government's commitment to a low carbon economy through reduced carbon emissions and adapting to climate change is embodied in climate change legislation[2]. National Planning Framework (NPF3) confirms the planning system will facilitate adaptation to climate change and ensure sustainable infrastructure networks build resilience to climate change.

1.4 NPF3 emphasises the continuing challenge of adaptation and the importance of continual evolving action in order to strengthen longer-term resilience. This will impact on a wide range of planning–related activities including waste and water management, infrastructure (existing and proposed), coastal management, investments in air connections, enhancing ecosystem services as well as contributing to the Climate Change Adaptation Action Programme[3].

More heavy rainfall and severe weather events

1.5 Scotland's climate is changing and evidence of this can be seen across the city region. There has been an increase in rainfall, especially in winter, and more heavy downpours which contribute to damage to infrastructure, property and business. This can be very challenging to deal with, especially when heavy rainfall causes flooding. In recent decades there has been an increase in rainfall, especially in winter. This trend is expected to continue in the future, with autumn and winters likely to become wetter through the 21st century. As well as an increase in total rainfall, there is also likely to be more intense, heavy downpours which could make it difficult to predict surface water flooding, especially in urban areas.

Increases in temperature

1.6 Over the last few decades temperatures in the west of Scotland have been on the rise, increasing by 1°C between 1961 and 2004. This trend is expected to continue in the future. Climate projections show that it is very likely that average temperatures will rise by at least two degrees by the 2050s. This would mean that temperatures in Glasgow and the Clyde Valley could become more similar to those currently experienced in the south of England and it is possible they could even go beyond these temperatures.

[1] Scotland's third national planning framework: http://scotland.gov.uk/Resource/0045/00453683.pdf

[2] Climate Change (Scotland) Act 2009: http://www.scotland.gov.uk/topics/environment/climatechange/scotlands-action/climatechangeact

[3] Climate Ready Scotland: Scottish Climate Change Adaptation Programme: http://www.scotland.gov.uk/Resource/0045/00451392.pdf

Sea level rise and coastal change

1.7 The Clyde estuary is the heart of the city region and its connection to the sea provides a rich maritime and industrial heritage. However, it also poses a risk. Sea level rise has been accelerating in recent decades and relative sea level is projected to rise by up to 70 cm by the end of this century. This will increase the risk of flooding in the Clyde estuary and affect coastal erosion. The Firth of Clyde Forum is due to publish a report on Rising Sea Levels[4].

2 Impacts of climate change

Increased risk of flooding

2.1 Flooding can already have a devastating effect on those affected. With climate change likely to alter rainfall patterns and bring more heavy downpours, it is expected that flood risk will increase in the future. This could impact on properties and infrastructure with serious consequences for population, heritage, businesses and communities.

Coastal change

2.2 Sea level rise is already having a widespread impact on the coast. With this set to accelerate over the coming decades, more coastal flooding, erosion and coastline retreat can be expected. This will bring consequences for coastal communities and supporting infrastructure.

Population health and wellbeing

2.3 The predicted increase in temperature may provide more opportunity for outdoor living and the pursuit of healthy and active lifestyles. Warmer climate could lead to lower fuel bills and a reduction in fuel poverty which impacts on the poorest sectors of the population. However, it could affect patterns of disease and other health issues. Climate change and associated extreme weather may disrupt the lives of individuals and communities, limiting access to vital services and impacting on people's physical and mental health.

Business resilience

2.4 Climate change and associated extreme weather may disrupt transport, energy and communication networks impacting on markets, affecting supply chains and raising insurance costs.

Building performance

2.5 The built environment is made up of existing and newly constructed buildings. Climate change will have an impact on the design, construction, management and use of these buildings and surroundings including the man-made surroundings such as green and blue spaces. Buildings will need to continue functioning throughout this century under a significantly different climate. Whether retrofitting existing or building new, it is likely that there will be issues with water management (in flood and drought), weather resistance and overheating.

Infrastructure – Network Connectivity and Interdependencies

2.6 Our energy, transport, water, and Information Communications Technology networks support services are vital to health and wellbeing and economic prosperity. The effect of

[4] http://www.clydeforum.com/

climate change on these infrastructure systems will be varied. They are likely to be impacted by an increase in disruptive events such as flooding, landslides and heatwaves. Infrastructure is closely inter-linked and failure in any area can lead to wider disruption across these networks.

Secure and efficient energy supply

2.7 Climate change may influence capacity to generate weather-dependent renewable energy. For example, varying water availability will affect hydro generation schemes. Within Glasgow and the Clyde Valley area there are currently two hydro electric power stations on the River Clyde above and below Lanark namely, Bonnington (11 Mw) and Stonebyres (5MW) both constructed in 1927.

2.8 Climate change can also affect power distribution, with impacts ranging from damage caused by extreme weather events, to reduced transmission efficiency occurring as a result of temperature fluctuations. Impacts on global energy markets may also affect energy supplies and consequently our overall energy security.

A healthy natural environment

2.9 Climate change may affect the delicate balance of our ecosystems and alter habitats and biodiversity, adding to existing pressures. Some distinctive species may struggle and could be lost, invasive non-native species may thrive, while a degraded environment may not be able to sustain productive land or water supply.

2.10 As well as losing species some other more welcome ones may thrive e.g. the climate may be suitable for species like the plant louse which can combat invasive Japanese Knot Weed. If actions are taken to alleviate problems arising from climate change this may have positive outcomes for nature, however, there is a danger that actions taken to save particular species from the effects of climate change could interfere with natural selection. Change will happen as species adapt. The same applies to the marine environment.

Agriculture and forest productivity

2.11 A warming climate has the potential to improve growing conditions and increase the productivity of agriculture and forestry. However, climate change will also pose a number of threats, from more variable and extreme weather to the spread of pests and diseases, which may limit this potential. This will be explored in the Forestry and Woodland Strategy for the next Strategic Development Plan (SDP).

The occurrence of pests and disease

2.12 As the climate changes, it will create new conditions that may allow existing pests and disease to spread and new threats to become established. This may impact on the health of our people, animals, plants and ecosystems if risks are not properly managed.

Soil quality

2.13 There is a reliance on soils to sustain biodiversity, support agriculture and forestry, regulate the water cycle, provide historic environmental and archaeological value, and store carbon. Soils and vegetation may be altered by changes to rainfall patterns and increased temperatures, as well as the way we use the land. For example, peatlands are of value as a carbon store but these could be at risk of drying out if climate warms and is drier.

Water quality and availability

2.14 As the climate warms and rainfall patterns change, there may be increased competition for water between households, agriculture, industry and the needs of the natural environment.

A healthy marine environment

2.15 The marine ecosystems, from plankton through to fish, mammals and seabirds, are already being affected by climate change alongside other pressures, particularly fishing. Changes will continue, with rising temperatures likely to change species and their distributions.

Cultural heritage and identity

2.16 The changing climate is already altering the unique Scottish landscape and threatening the historic environment through wetter warmer conditions leading to coastal erosion and flooding. The increased pace of climate change presents challenges to all those involved in the care, protection and promotion of the historic environment.

Food security

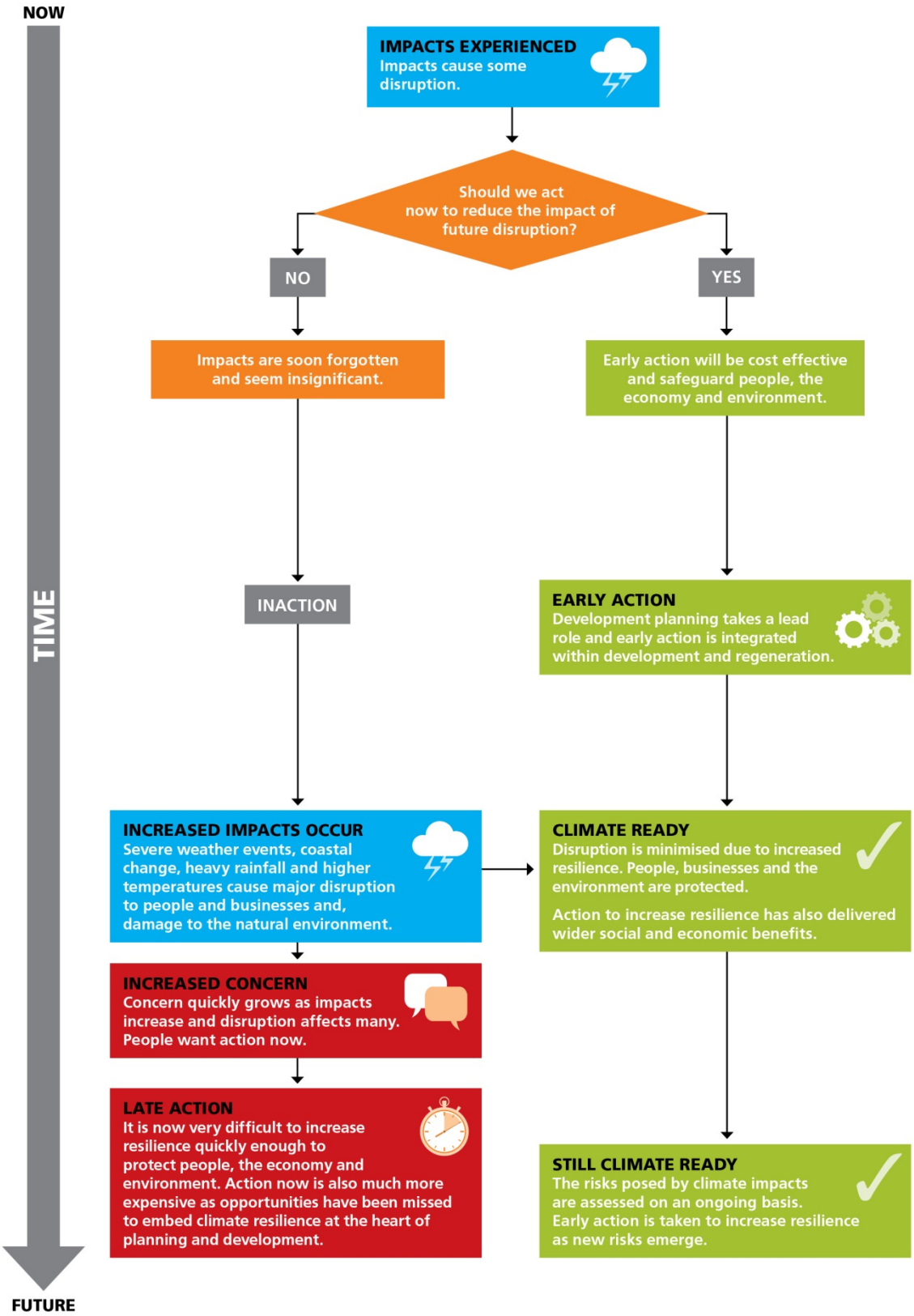
2.17 Climate change may have an impact on global food production. Although Scotland may be able to grow more food, this will not offset the impact of global disruption. The effects of increased volatility in the global commodity market due to exposure to extreme climatic events have an impact on supply and cost of food. The impact of climate change on global food production may be further exacerbated by other factors such as the westernisation of diets in China and Asia leading to an increased demand for specific food types.

The need for action

2.18 Climate change is already occurring and we have an important opportunity to act now to increase resilience and ensure that there is an ability to adapt as different impacts occur in the decades ahead. This is illustrated in Figure 1. Planning can help to achieve this by integrating multi-functioning green networks within the master planning process for large scale developments integrating existing ecology and biodiversity. This approach also supports the placemaking agenda and helps to attracts new populations and commercial investment which ultimately benefit the local and wider economy.

2.19 Floodplains may have already have existing development including infrastructure that is below the water table e.g. transport infrastructure and, in particular, low-lying motorways and railways. Development such as strategic infrastructure situated within these locations may also act as separation between settlements. This could present an opportunity to integrate multi-functioning green network and green infrastructure components that could also address issues of placemaking. Development planning deals with new development or regeneration projects, therefore the majority of major infrastructure projects falls outwith the remit of the SDP to address this issue. The role of the SDP is therefore to raise awareness of risk and opportunities for action and partnerships.

Figure 1: Climate change: the need for action



3. Response in Glasgow and the Clyde Valley

Introduction

3.1 Clydeplan is committed to playing its part in enabling an early and planned response to reducing risks associated with the impacts of climate change. Clydeplan will support action to increase resilience of the population, the economy and the environment to the impacts of a changing climate by supporting and contributing to:

- increasing the resilience of infrastructure networks to sustain and enhance the benefits and services provided;
- sustaining and enhancing the benefits, goods and services that the natural environment provides; and,
- increasing the resilience of our existing built environment and ensure that new development is fit for future climate.

3.2 This will require:

- the inclusion of climate resilience as a cross cutting theme within the strategic development plan;
- working with partners to identify locations of strategic significance to climate resilience; and
- recognising that adapting and increasing resilience to climate change requires a long term commitment and will require a cross sector, partnership approach.

Appropriate locational responses

3.3 Glasgow and the Clyde Valley comprises a diverse range of land types and uses including:

- the city and town centres;
- regeneration areas;
- suburban and urban expansion areas, including Community Growth Areas; and
- upland areas; rural areas; and cross boundary, system and networks.

3.4 Climate change impacts on these locations and the systems that connect them in many different ways. There are numerous opportunities and benefits to be gained from increasing resilience across different land types and uses, these changes will increase resilience to climate change impacts and, support improved health and wellbeing and sustainable economic growth.

3.5 The descriptions and graphics below provide examples of different land types and adaptation responses that support increased resilience.

City and strategic centres

3.6 The functioning of strategic centres, Glasgow city centre and the wider city region is highly dependent on complex and interacting infrastructure networks and hubs. This interaction is illustrated in Figure 2. Many of these converge or have major interchanges within Glasgow City Centre and the strategic town centres. Any disruption to these networks and key hubs results in significant social and economic impacts for the region as the flow of people, goods and services is disrupted.

3.7 Climate change impacts, such as severe weather events, flooding and overheating mean that disruption is likely to occur more regularly and with greater severity. The high concentration of people, organisations and businesses and, prevalence of key hubs and network connections in Glasgow City and the strategic town centres mean that increasing the resilience within these locations should be considered a priority.

3.8 Sustainable drainage systems and green networks should be considered essential infrastructure for Glasgow City Centre and the strategic centres since it reduces current and future risk of flooding through slowing the flow of water through urban areas, reduces pressure on drainage networks and provides safe spaces for flood storage thereby reducing flood risk to homes and businesses. This infrastructure also plays an important role in reducing overheating and, supporting enhanced connectivity between people, places and services in line with placemaking priorities and delivery of health and wellbeing benefits.

3.9 Planning has an important role to play in protecting and enhancing the current resilience of infrastructure networks and hubs and vulnerable network assets, for example, through ensuring that flood risk at key locations is not exacerbated through changes in land use, and ensuring that opportunities are taken to increase resilience though planned development.

3.10 Flooding in Scotland is now being managed across regional and administrative boundaries. Potentially Vulnerable Areas (PVAs) have been identified as locations where the impacts of flooding justify further appraisal and these are the areas where SEPA, working with other responsible authorities for flood risk management, is particularly focusing attention. To simplify this process, Scotland has been divided into 14 Local Plan Districts, including Clyde and Loch Lomond which covers the GCV area.

3.11 Work has already begun to increase the resilience of strategic centres and it is worth noting that Glasgow City Council, along with other local authorities that form the Clyde and Loch Lomond Local Plan District will be undertaking Surface Water Management Plan projects in the coming years to identify and implement surface water management measures. City Deal funding will help to deliver elements on the ground.

3.12 Since 2003, Metropolitan Glasgow Strategic Drainage Plan (MGSDP[5]), which covers seven of the eight Clydeplan local authorities, has carried out a great deal of work to understand and mitigate the effects of flooding throughout the city, enable economic growth and improve the water quality of the River Clyde and other watercourses. As a NPF3 National Development, the MGSDP will lead the planning for a surface water management network that will meet the demands of climate change and be adaptable to the needs of the people living in and around the city of Glasgow over the next 50 years. It aims to:

- enhance urban biodiversity and landscape;
- reconnect to waterways;
- design for the severity of the rain;
- work on the presumption that water will be kept on the surface;
- create integrated blue-green networks;
- integrate urban masterplanning and design;
- expand sustainable and affordable drainage solutions; and
- be climate-change ready.

[5] http://www.mgsdp.org/index.aspx?articleid=1967

Figure 2: Increasing the resilience of city and town centres

2. Green spaces hold water during river or surface water flood events and **protect homes and businesses**. These green spaces also provide wider health and wellbeing and economic benefits.

1. Reducing the risk of impacts such as flooding and overheating **at major transport hubs** have kept people and goods moving during severe weather events.

3. Green roofs and walls have **reduced overheating and flood risk** in built up urban areas. They have also helped to reduce air pollution.

4. Introducing greens spaces to hold water above the surface during flood events has **reduced pressure on drainage systems** enabling them to cope better with expected increases in heavy rainfall.

3.13 Inverclyde is outwith MGSDP, however, within its urban areas Inverclyde projects often involve flood attenuation including trash screens, de-culverting and increasing capacity. Small scale projects include a proposal on the edge of Greenock to alleviate flooding on the main access into the town and include creation of a wetland, public footpaths and improved amenity[6]. Similarly, the Integrated Green Infrastructure Design Study for Spango Valley, Inverclyde also addresses watercourses, SUDs, habitat networks and green networks.

3.14 These examples demonstrate that progress has already been made towards increasing the resilience of strategic centres and Glasgow city, it is vital that work such as this continues to be replicated across the city region.

Regeneration areas

3.15 Regeneration of areas such as the Clyde Gateway, Ravenscraig and the Clyde Waterfront provide important opportunities to build with future climate in mind. The long term sustainability of locations such as these will be influenced by their resilience to climate change impacts such as severe weather, flooding and warmer weather. It is vital that opportunities are taken to support transformation by ensuring that new and regenerated assets, infrastructure, buildings and communities are designed and implemented with future climate in mind.

3.16 Regeneration areas have the potential to emerge as exemplar climate ready locations. Climate resilient infrastructure, assets and buildings will safe guard future generations from severe disruption and encourage inward investment from companies looking to invest in climate resilient locations. This is illustrated in Figure 3.

3.17 Work has already begun to increase the resilience of regeneration areas:

- a flood risk assessment and drainage strategy has been prepared for the Shawfield area in relation to Clyde Gateway in South Lanarkshire; and
- supplementary guidance in the form of local development frameworks have been adopted by Invercylde Council for two developments; the Harbours, Greenock and James Watt Dock/ Garvel Island, Greenock.

[6] http://www.inverclyde.gov.uk/planning-and-the-environment/planning/development-plan/ldp

Figure 3: Increasing the resilience of regeneration areas

2. Green networks span regeneration areas connecting habitats, supporting nature to adapt and, helping to reduce flood risk and overheating.

3. New train stations and rail infrastructure are resilient to heavy rain.

5. Managed retreat of land on the river estuary creates a new wetland habitat and recreation area, providing health and wellbeing benefits and making good use of land that would otherwise be highly vulnerable to coastal change and flooding.

1. Climate ready buildings perform well with increased temperatures and severe weather and are protected from flooding

4. Harbour improvements and infrastructure provide increased resilience to storm surges.

Suburban and urban expansion areas

3.18 Established suburban communities will face new challenges as a result of climate change impacts. Existing housing estates, schools, shops and community buildings were designed and built to cope with past climate and may already be affected by climate change and increasingly at risk in the future. In some cases major engineering projects such as flood prevention schemes may be required to deliver increased resilience. These projects offer the opportunity to work with nature by including natural flood risk management as part of the solution to addressing flood risk.

3.19 There are also opportunities to increase resilience through retrofitting green and blue infrastructure such as swales and street trees as part of planned maintenance and development work. Supporting community development initiatives such as local food growing, and the establishment of community enterprise companies will also support wider community resilience helping people to adapt and be resilient to climate change impacts alongside wider social and economic change. These elements are illustrated in Figure 4.

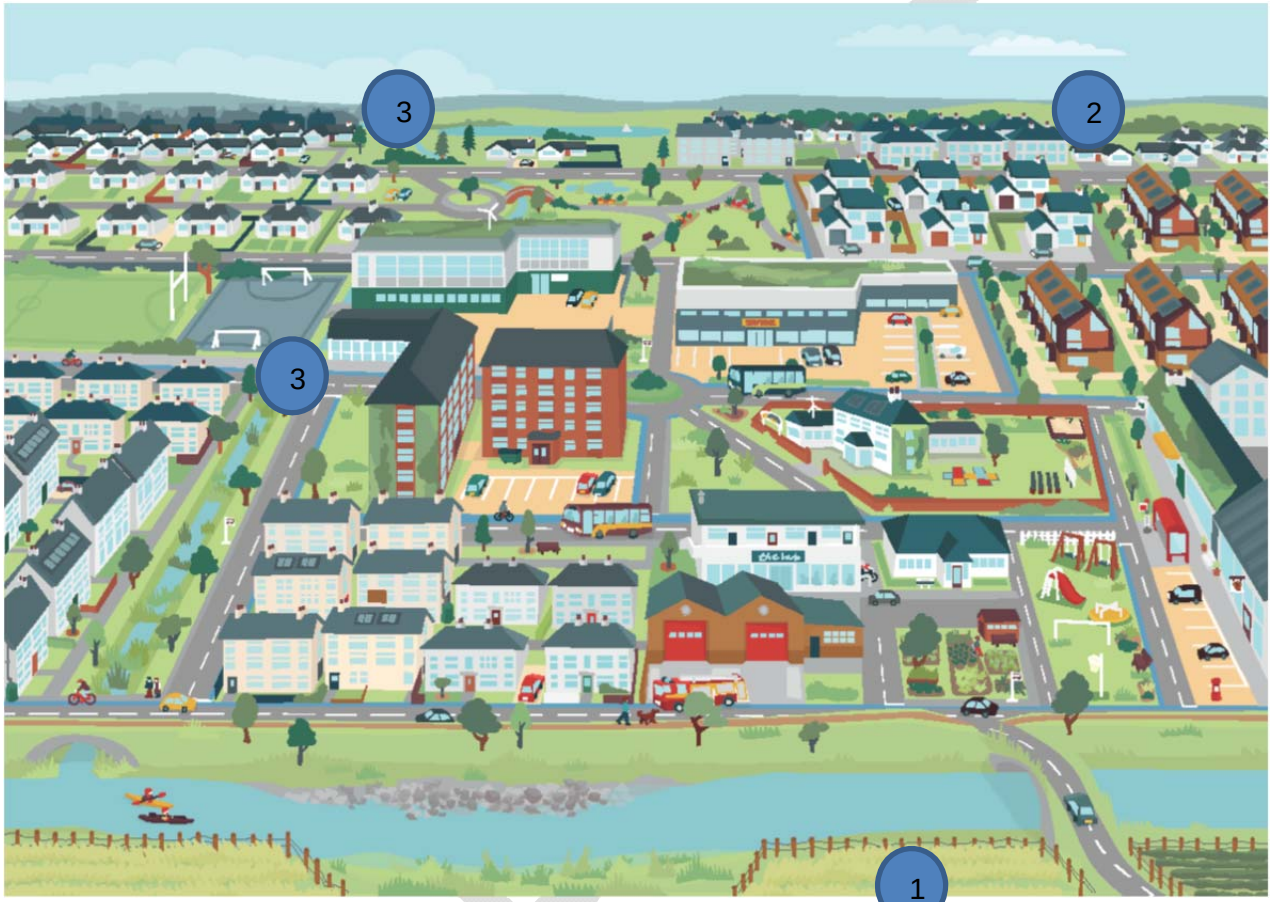
3.20 Strategic land releases for significant new development including the SDP designated Community Growth Areas and flagship initiatives provide an important opportunity to build climate ready communities and avoid the need for retrofitting in the future. New infrastructure linked to these areas such as climate ready road and rail networks also offer an opportunity to increase resilience of surrounding areas.

3.21 Work has already begun to increase the resilience of suburbs and community growth areas. For example, the White Cart flood attenuation scheme includes two significant upstream flood attenuation areas on the Kittoch water between Carmunnock and Busby and on the White Cart Water south of Kittoch Bridge. These straddle the boundary between South Lanarkshire Council and East Renfrewshire and illustrate that the solution to one authority's flooding issues may be delivered within a different authority

3.22 North Lanarkshire Council and partners including Glasgow City Council and the Glasgow and Clyde Valley Green Network published the Seven Lochs Wetland Park vision and masterplan (2012). The Gartcosh / Glenboig Community Growth Area within the Seven Lochs boundary will be expected to contribute to delivering the Seven Lochs vision and Seven Lochs masterplan. This Community Growth Area will provide green infrastructure, protect and enhance existing habitats, create new habitats and incorporating green network elements across a range of levels from the strategic to street level. Proposed locations of strategic SUDS storage measures will be linked to existing and newly created multi-functional networks and both open space areas and green networks will perform a flood storage role during extreme rainfall events.

Figure 4: Increasing the resilience of suburban and urban expansion areas

3. Green and blue networks connect people to local places and services, help to reduce flood risk and overheating and **support the natural environment to adapt** to changes in climate.



2. New developments, including Community Growth Areas, provide an opportunity to **build in climate resilience from the onset**. Investment in climate resilient infrastructure for these locations can also increase resilience of the wider area.

1. Creating space for rivers and wetland areas can reduce flood risk at the location and further downstream.

Upland areas

3.23 Climate change is impacting on the natural environment with changing, growing conditions and new pests and diseases set to influence the way habitats and landscapes function. Upland areas have a particularly important role to play in catchment wide flood risk management with land use in these areas influencing downstream flood risk. Actions such as the restoration of peatland and wetland areas and tree planting in upland areas has the potential to reduce downstream flood risk and support nature to adapt by improving biodiversity and habitat connectivity. These elements are illustrated in Figure 5.

3.24 Upland areas such as the Southern Uplands, Campsie Fells, Clyde Muirshiel and other plateau moorland areas around the watershed contain some of the region's most valued landscapes and provide many ecosystem services that are of benefit to the wider region.

3.25 Planning can support partnerships seeking to achieve this Glasgow Clyde Valley Green Network Partnership, MGSDP and the Southern Uplands Partnership. However, it is recognised that many of the actions required in these areas relate to land management regimes that are outwith the planning system and is more likely to apply to Strategic Rural Development Programme fund and Forestry Commission Scotland.

3.26 There are opportunities for natural floodplain and washland management in Glasgow and the Clyde Valley including:

- Lochwinnoch;
- Upper Kelvin Valley;
- Clyde Valley Haughs/Low Parks; and
- Upper Clyde tributaries.

Figure 5: Upland areas

1. Introducing woodlands in upland areas may help to reduce flood risk downstream by slowing the rate of runoff.

2. Peatland areas are important habitats for rare plant species. They need to be protected and restored in order to be resilient to climate change impacts and, provide a service through holding water and helping to manage flood risk further downstream.

3. Restoring natural wetlands and flood plains can protect wetland species and reduce the risk of flooding downstream by *holding water* in areas where there are multiple benefits.

Rural communities

3.27 Rural communities will experience first-hand changes in landscapes as climate continues to change. They will be affected by the need to alter traditional land management and farming practices in the face of climate change impacts such as increased flooding and waterlogging of farmland, variations in water availability, increased soil erosion and introduction of new pests and diseases. Actions such as creation of wetland areas, re-meandering of rivers and restoration of habitats such as lowland bogs will support nature to adapt and also offer the potential to protect agricultural land and, reduce flood risk both in the immediate community and further downstream.

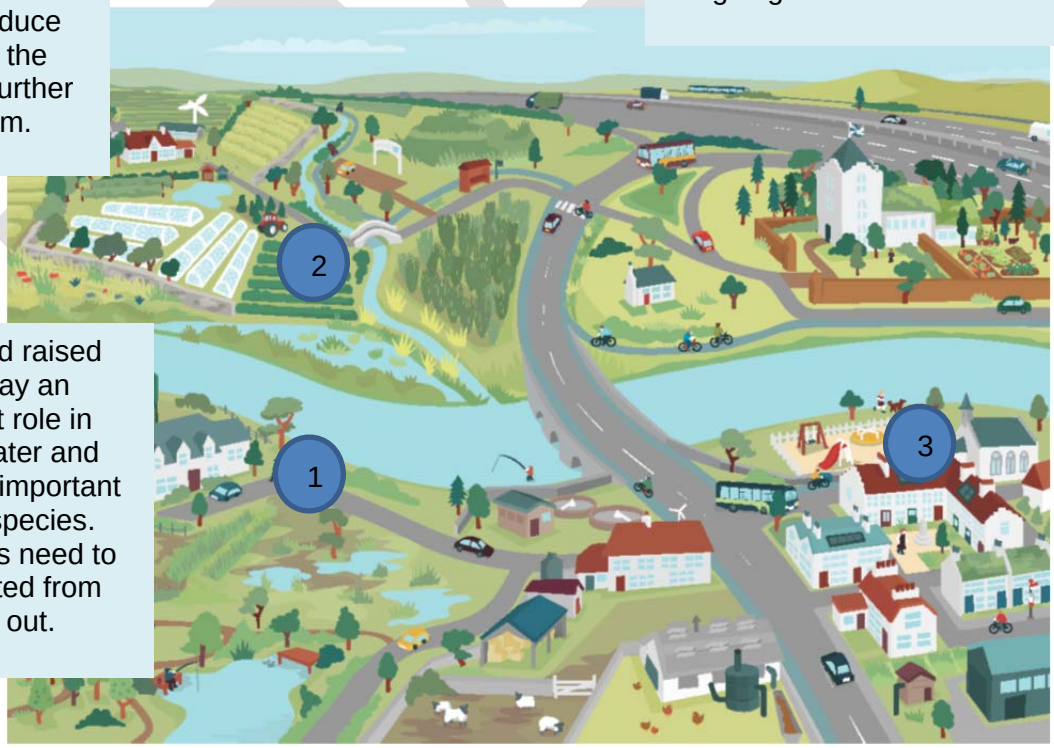
3.28 Ancient buildings and archaeological sites will increasingly be impacted by severe weather events as will community buildings, schools, homes and shops. As with established suburban communities there are opportunities to increase resilience to climate change impacts through introducing green and blue networks and improvements to buildings as part of planned maintenance and development.

3.29 Rural communities may benefit from some aspects of climate change including extended increase agricultural productivity and increases in opportunities for outdoor activities during warmer direr summers and milder winters. This is illustrated in Figure 6.

Figure 6: Rural communities

2. Restoring natural river processes and creating wetland areas can reduce flood risk at the location and further downstream.

3. The resilience of homes, buildings and road networks can be improved as part of ongoing maintenance and development.

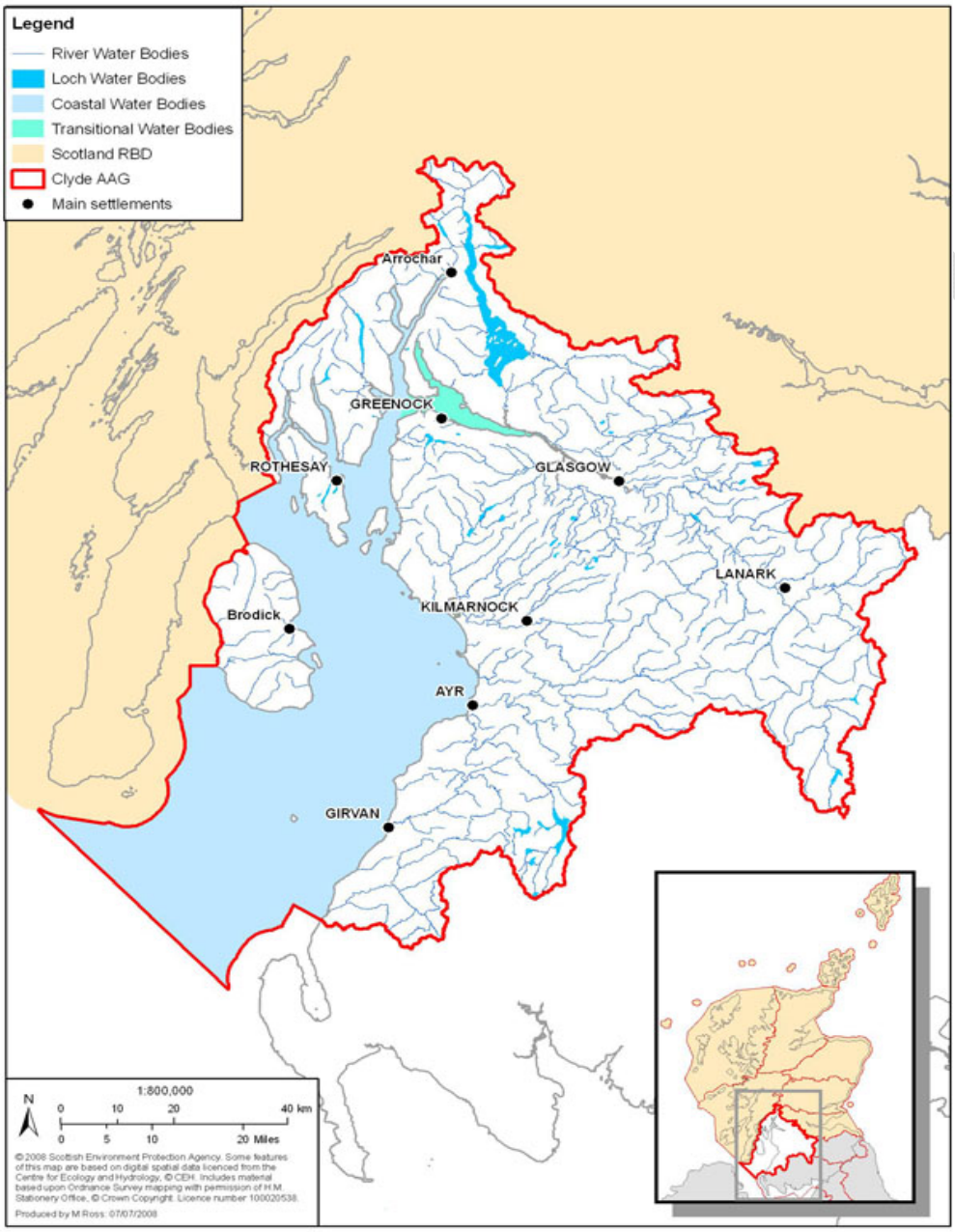


1. Lowland raised bogs play an important role in storing water and supporting important wetland species. These bogs need to be protected from drying out.

Cross boundary, system and networks

3.30 The impacts of climate change will cut across spatial boundaries and land use types. Whilst considering climate change impacts and responses in the context of different land use types is a helpful first step, increasing resilience to the impacts of climate change requires us to look beyond spatial boundaries and land use types and there is an obvious link to river basin management planning[7].

Clyde Area Management Plan – SEPA



[7] http://www.sepa.org.uk/water/river_basin_planning/area_advisory_groups/clyde.aspx

3.31 Climate change impacts at one location can result in many knock-on consequences both in the immediate location and further afield. For example, disruption such as a landslide or flood affecting a major road or rail link would cause widespread disruption. Or, a change of land suitability at one location due to change in flood risk or land productivity could impact on demand and availability of land at other locations.

3.32 There are likely to be significant opportunities to minimise risks and maximise opportunities across the city region through identifying locations and points in systems and networks where increasing resilience would support resilience across boundaries. Identification of these opportunities will require a joined up, systematic assessment of climate risks and opportunities across the region.

4 What this means for the city region

Introduction

4.1 The city region has an important opportunity to take early action to increase resilience to the impacts of climate change. We have identified examples of where climate resilience could be integrated as part of development and regeneration across different land use types. We have also identified a clear need for a regional climate change adaptation partnership that will develop a regional adaptation strategy and action plan ensuring that cross boundary, system and network impacts, risks and opportunities are identified and addressed in the years ahead.

City and strategic centres

- Glasgow city centre is the focus of public transport networks. Disruption at the core of this network has severe implications for the Clydeplan city region. For example, Queen Street tunnel is a key rail connection to east and north serving the whole city region and connections to wider areas including Edinburgh, Stirling etc. Flooding of this tunnel potentially would cause severe disruption;

- the city centre is a core business area for the city region and it is predicted that, particularly George Square and the Blythswood area, are likely to have extreme overheating events in the future[8]:

- the North Glasgow Integrated Water Management Study aims to facilitate the regeneration of north Glasgow;

- Hamilton Low Parks / Mid Clyde Haughs is a key area of the flood plain separating settlements of Hamilton and Motherwell and is an important element of the strategic green network. It has a strategic function as a transport corridor as the M74 passes through this area. The major junction at Raith interchange is currently being remodelled and includes land that is below the water table. There is a need to retain this area as floodplain/green network and avoid additional development pressure; and

- Clyde Waterfront covering Clydebank to Dumbarton is an area of considerable economic importance. There is a wider implication of flood events in these locations

[8] GCVGNP Overheating and Green Infrastructure Study, Emmanuel, R., Glasgow Caledonian University, 2013

e.g. Bowling, A82, M8 and Greenock, in relation to impact further downstream in urbanised part of the River Clyde as well as Glasgow city centre. This is a potential opportunity to undertake some managed realignment to better manage flood risk.

Regeneration areas

- Ravenscraig is a NPF3 National Development and a regeneration priority with important linkages with the existing urban form of Motherwell and Wishaw. The integration of water management will have implications for neighbouring road and drainage networks and river system of South Calder / Strathclyde Loch / Clyde. There are ongoing contaminant issues with Strathclyde Loch. Lessons learned from the regeneration of this heavily contaminated site could be replicated throughout the city region with its legacy of long-standing heavily contaminated former industrial sites;

- Clyde Gateway is a NPF Spatial Priority for Change. It is designated as a regeneration priority in SDP1 and contains a Strategic Economic Investment Location at Shawfield. This is a key economic priority for the city region. It therefore offers the opportunity to build in flood resilience. The creation of a new urban forest at Cuningar in South Lanarkshire (in partnership with the Forestry Commission Scotland) will have benefits in terms of carbon storage and water management; and

- The urbanised section of the River Clyde from Rutherglen to Clydebank. The international profile of this asset makes it a potentially very important adaptation demonstrator allowing us to 'set a bar' and showing how adaptation can be done including green network functions that span local authority boundaries;

Suburban and urban expansion areas

- Gartcosh / Glenboig (3,000 housing units) is adjacent to the vulnerable asset of Seven Lochs. There are potential implications for GCV Green Network in terms of the water network; and

- Cumbernauld South Community Growth Area (2,000 housing units) is adjacent to Slammanan Plateau. There are potential implications for the GCV Green Network in terms of the water network.

Cross boundary, system and networks

- There are various linear infrastructure routes passing through South Lanarkshire falling under this category. For example, the west coast rail line, the M74, and the Scotland/England interconnector. These are nationally important and will already have a high level of resilience through their operators' contingency plans;

- Protection of A8 / M8 in Inverclyde / Renfrewshire including links to Arygll (Dunoon Ferry and North Ayrshire, as well as more isolated / rural/ coastal communities. There are also duties under the Birds Directive for SPAs (Ramsar, SSSI etc.); Protection of the A8, Inverclyde in relation to flooding on the railway lines;

- Protection of pinch point of main transport links (railway and A82) to Dumbarton, Argyll and Bute and beyond to west coast. Disruption here has significant implications for commuters, tourism, local businesses, fishing (distribution). There are also duties under the Birds Directive for SPAs (Ramsar, SSSI etc.); and

- Newshot Island may have the potential as a managed realignment project[9]. It would offer protection to Erskine housing, business and retail and it would help fulfil duties under the Birds Directive for SPAs (Ramsar, SSSI etc.)

5 Conclusion

5.1 Impacts from climate change are complex and interacting. Impacts at one location can have far reaching effects across the region. Detailed analysis is required in the years ahead to improve understanding of the risks and vulnerabilities for different locations, systems and services and increase knowledge of the likely impacts of climate different locations.

5.2 The need to contribute to climate change adaptation is interwoven through the SDP, particularly in terms of the Vision of the Plan and though the priority given to the Integrating Green Infrastructure approach.

5.3 The impacts of climate change are complex and interacting and are not confined by boundaries. The impacts at one location, such as the flooding of a major transport hub, would have knock on consequences for the whole region. Early action is therefore vital and the SDP is part of a wider response. Climate resilience will deliver multiple benefits to policy areas pertinent to spatial planning including placemaking, health and well-being, water quality and flood risk management planning. A partnership approach to these issues would enable the development of a shared vision and understanding. This would consolidate and add value to work that is already ongoing in the city region e.g. Metropolitan Glasgow Strategic Development Plan[10], Climate Ready Clyde[11], Glasgow and the Clyde Valley Green Network Partnership[12] the Firth of Clyde Forum[13], SEPA etc. to name but a few.

6 Next Steps

6.1 Clydeplan is currently working with other strategic partners to consider potential options around the establishment of a regional Climate Change Adaptation Partnership. The intention is for such a partnership to undertake detailed analysis and produce an Adaptation Strategy for the city region and related Action Plan to inform such documents as future Strategic Development Plans, Local Development Plans, and wider strategic strategies and programmes and develop resilience building.

6.2 Such partnership working would enable public bodies to work together efficiently to comply with statutory Public Bodies Climate Change Duties[14] relating to climate change adaptation, minimise duplication of effort and, maximise opportunities for innovative and cost effective action.

[9] http://www.clydeforum.com/
[10] http://www.mgsdp.org/
[11] http://www.adaptationscotland.org.uk/4/110/0/Climate-Ready-Clyde.aspx
[12] http://www.gcvgreennetwork.gov.uk/climate-change-adaptation/introduction
[13] http://www.clydeforum.com/
[14] Publication of the first Scottish Climate Change Adaptation Programme in May 2014 brought into force the adaptation requirement of the public bodies climate change duties introduced by section 44 of the Climate Change (Scotland) Act 2009 which requires that a public body within the definition of the Act, must, in exercising its functions, act in the way best calculated to help deliver the Programme.

Clydeplan
Lower Ground Floor, 125 West Regent Street, Glasgow G2 2SA
0141 229 7730 • info@clydeplan-sdpa.gov.uk • www.clydeplan-sdpa.gov.uk