Working Group on Adaptation and Climate Resilience

Interim Report

June 2016

EXECUTIVE SUMMARY

Climate change impacts are already being felt across Canada and pose significant risks to communities, health and well-being, the economy, and the natural environment. These impacts are expected to persist and worsen, even with a concerted effort to reduce greenhouse gas emissions. Mobilizing action on adaptation can protect Canadians from climate change risks, build resilience, and ensure that society continues to thrive in the new climate normal.

Addressing the magnitude of the challenge will require a fundamental shift in approach in managing risks and protecting people, the economy, and the natural environment. In the new climate reality, where greater uncertainty will be the normal, significantly reducing risks will require a sustained and ambitious approach to adaptation. This approach will need to build on existing efforts while also driving behavioural change and creating a new culture of resilience. Given the interconnections between the sectors and systems upon which Canadians rely (e.g., health, food, energy, transportation, natural environment), this approach must also be holistic, integrated, and systems-based.

The Pan-Canadian Framework on Clean Growth and Climate Change represents an opportunity to take collective action to make significant advances in adaptation across the country. In response to the Vancouver Declaration, the Working Group on Adaptation and Climate Resilience, with input from National Indigenous Organizations and a wide range of stakeholders, has identified several priority areas where collective effort will build climate resilience in Canada. Rather than considering individual risks in sectors or regions, the Working Group is proposing to develop options in two categories: opportunities for early action and a foundation for ongoing action. The early actions represent areas where there are high levels of vulnerability or where there is a window of opportunity to build resilience and influence decisions in the shorter term. The areas currently under consideration are:

- Building resilience through infrastructure by ensuring that climate change is considered in infrastructure decisions, promoting natural infrastructure, and investing in infrastructure projects that are specifically designed to address climate change impacts
- Valuing and conserving healthy ecosystems, recognizing that resilient ecosystems support the health and well-being and economic prosperity of Canadians
- Safeguarding particularly vulnerable regions, such as Canada's coasts and the North

The foundational elements will drive adaptation efforts across all sectors and regions over the long term, including:

- Supporting decision-making with knowledge and information, as Canadians need authoritative, accessible, and actionable information on changing climate conditions in order to build resilience
- Building capacity and driving behavioural change through greater awareness, leadership, sustained funding, and collaboration

Effective action in these areas will facilitate collective action in specific sectors and regions where required, but will also mobilize action broadly and contribute to the fundamental cultural and behavioural shift required to build a resilient society. The Working Group will continue deliberations and further develop options for action to be presented in the final report.

IMPACTS AND ADAPTATION IN CANADA

Canada's climate is changing. Temperatures have been increasing at roughly double the global rate, and the Arctic is warming even faster. Annual average precipitation has increased, with strong regional and seasonal variability.

While reducing greenhouse gases can help to avoid unmanageable situations in the future, a strong focus on implementing adaptation measures will help Canadians manage the unavoidable impacts they are currently facing and will continue to face in the future. The Paris Agreement aims to limit the rise in global average temperature to 2°C above pre-industrial levels, with attempts to limit warming to 1.5°C in order to reduce the risks and impacts of climate change. Since 1948, Canada's average temperature has increased by 1.6°C, while Canada's North has warmed by 2.2°C, hence the need for urgent action.

CLIMATE CHANGE IMPACTS IN CANADA

Climate change is leading to a wide range of impacts on the natural environment across the country, including the loss of permafrost and sea ice, glacier retreat, reduced snow cover, changes in lake water levels and river flows, higher water temperatures, and increased ocean acidity. Sea level is rising, increasing risks from storm surges. Climate change is affecting ecosystems and biodiversity through changes in plant phenology (i.e., timing of spring flowering) and productivity, shifts in animal ranges and migratory bird routes, and the spread of invasive species. Canadians are also experiencing more frequent extreme weather and weather-related events, including flooding, droughts, storm surges, and heat waves. Climate change is also extending the wildfire season and increasing the average area burned. These impacts can have high human and financial costs.

The health of Canadians and healthcare costs are affected by climate change. Heat waves can cause heat-related illness and death, as well as exacerbate respiratory and cardiovascular diseases. Higher temperatures can cause increased air pollution, and increased production of pollens, worsening allergies and asthma. Increased contamination of drinking and recreational water by run-off from heavy rainfall can cause disease outbreaks. Higher temperatures also make the environment more hospitable for insects, such as ticks and mosquitoes, increasing exposure to diseases previously unseen in Canada. More broadly, climate change can affect the various social determinants of health (e.g., food security, housing, working conditions, income, etc.). Understanding these effects can help make health-related adaptation actions more relevant and effective; this is particularly true with respect to Indigenous Peoples, where areas of concern may be different than those of the general Canadian population.

In the North and in Indigenous communities, climate change impacts have had significant consequences on traditional ways of life (including access to traditional foods and land use), health and safety, infrastructure, and livelihoods. Travel is more dangerous and costs for transporting supplies have increased. However, climate change can also present potential economic opportunities in areas such as agriculture (e.g., longer growing seasons), resource development (e.g., increased access), and seasonal tourism activities.

Infrastructure and transportation networks in Canada can also be affected by a changing climate. The loss of permafrost, coastal erosion, changes to freeze-thaw cycles, and extreme weather contribute to road, bridge, port, rail, and airport disruptions and can increase costs for infrastructure repair and maintenance.

Canadian industries are affected in various ways. Disruptions in productivity, critical trade infrastructure, and supply chains can have broad consequences for many economic sectors. The forestry sector has been impacted by the spread of the mountain pine beetle in the warmer Canadian climate. Agricultural productivity can be affected by increased incidence of drought, floods, storms, heatwaves, and pests/diseases. Fisheries can be impacted by rising water temperatures and ocean acidity. Mining, oil and gas production, hydroelectric power generation, and transportation are all affected by variable water levels. Access to mine sites can be restricted by the loss of ice roads and mine infrastructure (e.g., berms around tailings ponds) is potentially at risk of failure due to unstable permafrost. Social and economic impacts on natural resource–based communities (e.g., safety and security costs, sector jobs, and tourism) can be significant in some regions. Furthermore, climate impacts in other regions of the world have the potential to affect Canada (e.g., possible trade disruptions).

THE IMPORTANCE OF ADAPTATION AND RESILIENCE

Adaptation is about making smart, forward-looking decisions, while resilience is about being able to withstand and recover from impacts. Implementing effective adaptation and resilience measures can save lives, minimize damages, and lower costs over the long term for individuals, businesses, organizations, and governments. Adaptation includes efforts to avoid risk; for example, not building on or using risk areas, as well as removing infrastructure from these areas. Furthermore, broader efforts to reduce the environmental footprint of individuals, communities, organizations, and businesses can contribute to greater resilience, both by reducing resource use (e.g., water conservation contributes to resilience against drought) and by conserving and protecting natural spaces, which can act as a buffer against impacts.

Investing in adaptation can spur innovation, promote clean growth and jobs, and reduce greenhouse gas emissions. There is the potential for a Canadian adaptation export market, as well as areas where Canada can contribute expertise internationally (e.g., food production in northern climates, assessing the vulnerability of infrastructure, coastal zone management, resilient forestry operations). In addition, increasing resilience can have positive benefits for the conservation of nature, health, safety and security, economic prosperity, and disaster risk reduction. Adaptation efforts cover a broad spectrum of activities, from identifying risks, vulnerabilities, and opportunities, to building the capacity to act, to developing and implementing plans to address climate change impacts, to fully integrating climate impacts in decision-making processes.

Despite growing awareness of the impacts of climate change and the value of adaptation, there are relatively few examples of implementation of specific actions to reduce vulnerability to climate change. This is the case in most developed countries, including Canada, though some sectors and regions are further ahead. There are several recognized barriers to planning and implementing adaptation actions, which can sometimes be complicated by the cross-sectoral nature of adaptation or persist due to an unwillingness to act in the face of uncertainty or based on incomplete data and information. These barriers are often related to:

- Governance (e.g., unclear roles and responsibilities, lack of leadership)
- Policy (e.g., unclear policies and liabilities)
- Information (e.g., lack of support for data collection, interpretation, and usage)
- Resources (e.g., lack of capacity and funding, limited technology and innovation)
- Risk perception (e.g., the tendency to discount future adaptation benefits)

Although implementation is generally in its early stages, there are some countries whose approaches to adaptation can help inform adaptation planning and action in Canada. For instance, the United States and the United Kingdom have high-profile, national-level action plans to systematically address climate risks. Their approaches include comprehensive assessments of how climate change is affecting the country, key actions required by law (e.g., planning, information provision, and reporting on progress), significant funding for projects that increase resilience, and detailed, targeted climate data and information to support decision-making.

ADAPTATION ACTION IN CANADA

Adaptation to climate change impacts is a shared responsibility. Governments, communities, the private sector, academia, the non-profit sector, professional organizations, and individuals all have important roles to play in building resilience to climate change.

Climate change adaptation and resilience initiatives are being advanced across Canada at all levels of government and by non-government organizations and individuals. However, there is a need to move beyond project-based actions and scale up collective efforts. Given the range and magnitude of projected impacts, it is necessary to mobilize all sectors and all regions to take significant and sustained action to prepare for the impacts of climate change.

At the federal level, efforts to encourage and support adaptation decision-making have been made in a number of areas, such as: convening partners and stakeholders to discuss shared priorities; producing climate research; developing northern infrastructure standards; and delivering targeted programming in key areas (e.g., health and well-being, Northern and Indigenous communities, key economic sectors).

Many provinces and territories have recognized the need to adapt either through stand-alone plans or strategies or as part of broader climate change plans or strategies. While the scope and scale of efforts vary across the country, some provincial and territorial activities include: funding for research, best practices, and regional risk and vulnerability assessments to support adaptation planning and decision-making; action to strengthen land-use planning processes, infrastructure investments, and building codes through the inclusion of climate change considerations; efforts to increase awareness about impacts and adaptation options for communities; and the development of tools to help integrate adaptation into all levels of decision-making.

At the municipal level, some larger cities are actively planning for climate risks on a local scale, for example, through the development of adaptation strategies that inform city planning and infrastructure, and that encourage action by homeowners and businesses. While there is increasing awareness and a willingness to act in many communities, there is often limited capacity to advance adaptation efforts. There is a need to address the unique challenges faced by large urban centres, as well as the capacity issues encountered in smaller communities.

In the private sector, some companies are also integrating climate considerations into their investment, planning, and operational decisions in order to improve their long-term resilience and competitiveness, while some professional associations are working to inform and equip their members to be able to address a changing climate in their professional practice.

CLIMATE CHANGE AND DISASTER RISK REDUCTION

As the climate continues to change in the future, it will continue to move away from the normal range to which society has become accustomed, increasing the social, health, and economic risks associated with extreme weather and climate events.

Recent extreme events, including floods in Alberta, Manitoba, and Ontario, and fires in Alberta and British Columbia, have caused considerable property damage and disruption to the lives of thousands of people. Although individual extreme events cannot be directly attributed to climate change, increasing occurrence of these events is consistent with the current understanding of climate change. These events highlight vulnerabilities and the urgent need for action to reduce risks.

Both adaptation and disaster risk reduction activities contribute to enhanced resilience. In general, adaptation can buffer society from negative climate-related impacts, while disaster risk reduction can better position society to reduce and manage disaster impacts more broadly. The shift from disaster recovery toward disaster risk reduction is well aligned with the principles and objectives of adaptation. Disaster risk reduction is a systematic, whole-of-society approach to identifying, assessing, and analyzing the causes of disasters and reducing the risks and impacts of disasters based on risk assessments.

Given the linkages between climate change adaptation and disaster risk reduction, efforts should be made to align resources, capacity, and progress in increasing resilience. For instance, to be effective, work to reduce disaster risks must consider the impacts of a changing climate. Proposed work to develop authoritative and accessible information on climate change will support better integration of climate change impacts.

WORKING GROUP OVERVIEW

On March 3, 2016, Canada's First Ministers released the Vancouver Declaration on Clean Growth and Climate Change. As a result, provincial, territorial, and federal governments are working together to build on existing provincial and territorial actions and develop a Pan-Canadian Framework on Clean Growth and Climate Change to encourage clean economic growth, reduce greenhouse gas emissions, and prepare for the impacts of climate change. First Ministers agreed to identify measures that governments could take to reduce emissions and grow the economy in the longer term by establishing working groups in four areas: clean technology, innovation and jobs; carbon pricing mechanisms; specific mitigation opportunities; and adaptation and climate resilience.

The Working Group on Adaptation and Climate Resilience is led by a federal and a provincial co-chair, and is composed of members from federal, provincial, and territorial governments. It has been mandated to identify ways to adapt to climate change impacts, support affected communities—including Indigenous communities—and build greater resilience to these impacts. It is working to identify specific priorities to support adaptation and is also considering a range of policy tools to foster research, innovation, and investments in resilient infrastructure, integrate information, expertise, and best practices from Indigenous Peoples, and support the development of jurisdictional policies.

The Working Group has held initial discussions with representatives of the three National Indigenous Organizations (the Assembly of First Nations, Inuit Tapiriit Kanatami, and the Métis National Council), with the goal of advancing action in areas of importance to Indigenous Peoples and communities.

In order to understand and reflect the breadth of climate change impacts and potential for adaptation action across regions and sectors, the Working Group has engaged a broad group of stakeholders. Summaries of these discussions are below and a list of participating stakeholders is attached in Annex 2.

As a result of its work to date, the Working Group has identified several areas where collective effort is needed in order to advance adaptation across the country, and is proposing to develop options in these areas. These areas are consistent with the priorities identified by individual jurisdictions, as well as by stakeholders. Options will be presented to the Canadian Council of Ministers of the Environment in a final Working Group report in September.

INDIGENOUS ENGAGEMENT

Representatives of the three National Indigenous Organizations are continuing to work with their memberships over the coming months to develop substantive contributions to this process, and will be invited to continue discussions with the Working Group. The messages below are based on discussions to date.

Adaptation and resilience are not just about the climate impacts felt by Indigenous communities; rather, Indigenous Peoples want to be presented as active agents of environmental, social, and cultural change. Building resilience in the face of climate change is fundamentally about food, water, and energy independence, where Indigenous communities are self-sufficient and are not dependent on importing what is needed for their survival and expression.

While discussions are still underway, emerging priorities for Indigenous communities include infrastructure and the built environment, regional land management arrangements, and social and cultural resilience. Establishing a meaningful dialogue between Traditional Knowledge and science will likely also be a key issue. There will be a need to ensure that integrating Traditional Knowledge into adaptation planning and action is done in an appropriate way that is mindful of intellectual property issues, and that values Traditional Knowledge as equal to scientific knowledge.

Representatives of the National Indigenous Organizations expressed the hope and expectation that this is the beginning of a renewed, sustained dialogue, and prefer to see issues of importance to their communities integrated into all areas of the report.

STAKEHOLDER ENGAGEMENT

In order to understand the breadth of adaptation challenges and identify innovative solutions, the Working Group has engaged a range of partners and stakeholders. Engagement was carried out through a multi-day stakeholder engagement event held in Toronto on June 2-3, 2016. The Working Group invited approximately 50 organizations that represent the broad range of adaptation stakeholders and are national in scope (or have a significant presence across multiple jurisdictions).

At the event, participants provided brief presentations followed by moderated discussion with the Working Group members and other stakeholders. The following questions were provided in advance to help focus the presentations:

- What barriers do you face in adapting to climate change?
- What opportunities for innovation exist in your sector?
- What are your proposed solutions?

The general themes and ideas from the stakeholder engagement event are summarized below.

INFORMATION BROKERS

Information brokers are organizations that facilitate the translation of foundational climate data into information, tools, and support for adaptation decision-making.

The urgency for action on adaptation was broadly recognized by information brokers. It was noted that voluntary measures are insufficient; current policies and policy tools enable adaptation, but few are drivers of adaptation.

Recommended actions for governments included incorporating adaptation into all government decision-making and promoting collaboration at all levels. Increased investments in research and development to support innovation, leadership training, and national and regional climate services (that include tailored, science-based, regional information and knowledge) were highlighted as important elements for success.

Information brokers noted that a national climate change adaptation strategy should include a national strategy on climate services. Furthermore, a national risk assessment framework and monitoring and evaluation framework would support increased investments, and also more strategic investments through improved priority setting.

Several recommendations were presented to support the shift from providing climate information to creating knowledge products and tools for informing decisions and action. These included valuing the role of extension agencies and boundary organizations (organizations that specialize in translating science, information, and knowledge for use in decision-making) and reframing the issue by putting climate change in the context of other priorities for communities. Recommendations from information brokers also included developing methods and tools for integrating climate change considerations into decision-making that are scalable; developing projects in collaboration with end users; and focusing on simple tools underpinned by sound science. Stakeholders encouraged taking a broad view of resilience, as it was noted that there is not always a need to differentiate between climate resilience and resilience writ large in order to achieve desired outcomes.

PEOPLE AND COMMUNITIES

From a municipal perspective, barriers to adaptation include a lack of local capacity (human and financial) and a lack of accessible and locally relevant data and information on climate risks, particularly with respect to infrastructure.

Identified needs included capacity building, accessible information, resources (both human and financial) for undertaking risk and vulnerability assessments and adaptation planning, and investments in climate-resilient infrastructure. Stakeholders also expressed an interest in flexible and scalable approaches to meet the varied needs of communities (e.g., depending on region or size), and collaboration and partnerships with other institutions, organizations, and local communities to help local governments understand and plan for current and expected impacts.

Representatives from the health sector expressed a need for healthcare facilities to better assess and prepare for climate change impacts to ensure essential services are maintained during extreme events. Stakeholders also identified a need for a wildlife health monitoring program to support public health objectives and the maintenance of traditional lifestyles.

Stakeholders also underscored the lack of capacity of small and remote communities to plan and prepare for climate change risks and access funds, as well as the need for support for them in doing so (in contrast to larger municipalities, which tend to be better equipped, have greater capacity, and are already taking action). Where communities are too small or remote to support local capacity, stakeholders identified creating mobile regional capacity as an option.

ENVIRONMENT AND CONSERVATION

Groups underscored the critical roles that natural systems play in responding to a changing climate, including as carbon sinks, refuges for species, buffers against impacts (e.g., floods, droughts), and support for built infrastructure. Barriers include a lack of incentives, gaps in regionally specific information, a lack of understanding about the role of natural systems, and inadequate valuing of ecosystem services.

Recommendations included promoting land-use planning that incorporates nature-based solutions; giving priority to adaptation solutions that work with nature and promote ecological resiliency; restoring, valuing, and employing wetlands as adaptation solutions; and properly valuing ecosystem services. The importance of undertaking systemic, large-scale conservation planning and incorporating climate change considerations into all conservation and species at risk activities were highlighted. The conservation of habitat corridors and increasing connectivity can allow for species and habitat shifts, and keeping working landscapes and seascapes closer to their natural conditions can increase resilience. The importance of demonstration projects was also noted.

ECONOMIC SECTORS

Groups from a variety of sectors (e.g., forestry, mining, energy, agriculture) highlighted the importance of resilient trade and support infrastructure (e.g., bridges, roads, rail, water networks), and the need for a strong focus on innovation. There were calls for improved information, including: scientific research; national climate data; climate change information that is accessible, usable, and appropriate to local contexts; tools for integrating information into decision-making; and information on the financial risks of climate change (e.g., the risk posed by inaction on both reducing emissions and adapting).

Perceived barriers to adaptation identified by stakeholders included: a lack of climate information (at the appropriate geographic and temporal scales); a lack of private sector awareness of risks, opportunities, and specific industry vulnerabilities; and inadequate understanding of the importance of

investments in resilience. Groups highlighted the need to address the tension between short-term competitiveness and potential long-term investments required for resilience. Protecting economic competitiveness must therefore be a priority of adaptation policy.

Recommended policy responses put forward by stakeholders included land-use planning frameworks that incorporate adaptation, as well as flexible and responsive policy and legal frameworks. Other suggestions included the need for investments in northern infrastructure and the establishment of formal mechanisms for ongoing partnerships and collaboration across sectors and with government.

PROFESSIONAL ASSOCIATIONS

The roles of professionals were highlighted in a number of areas, including mainstreaming adaptation into decision-making, bringing different disciplines together, valuing investments in resilience, and creating pathways to translate science into practice. The value of public-private partnerships was noted.

There are opportunities to better engage the private sector, particularly corporate leaders, and make the business case for adaptation investments. The investment community, institutional investors, and bankers are critical audiences to engage. Professionals need accessible and up-to-date information, policy direction on new design standards, innovation in tools, technologies, and systems, and high-level support for advocating for alternative approaches and methodologies.

Recommendations were provided on building climate-resilient infrastructure, such as vulnerability assessments, codes, standards, and related instruments, and underlying datasets and projections. A National Flood Strategy was proposed, and the potential of programs to reduce climate change risks at the homeowner level, such as the home adaptation assessment program, was noted.

ONLINE ENGAGEMENT

The Working Group has also received input via the interactive website set up to allow the public to engage in the pan-Canadian framework process. Many submissions were focused on adaptation activities in urban areas, particularly relating to traditional infrastructure (e.g., transportation and building codes) and natural infrastructure, such as green roofs, urban forests, and urban agriculture. Natural infrastructure was identified as a way of reducing the urban heat island effect, aiding with stormwater management, and contributing to food security. There were also several submissions concerning research and monitoring, with calls for research funding and for support for research networks (in order to develop regional data and expertise), community-university research initiatives, and Northern-specific research efforts. Related to research and monitoring were submissions that emphasized the need for up-to-date and reliable climate data and services, as well as vulnerability and risk assessments, which were identified as essential tools to inform adaptation efforts.

ESTABLISHING AN AMBITIOUS, LONG-TERM, PAN-CANADIAN APPROACH TO ADAPTATION

Building climate resilience in Canadian communities, the environment, and the economy will require a long-term, sustained, and ambitious pan-Canadian approach. The Working Group has identified a proposed vision and principles to guide collective efforts, and is developing options for collaborative action in a number of priority areas that can:

- Build resilience through infrastructure
- Value and conserve healthy ecosystems
- Safeguard vulnerable regions
- Support decision-making with knowledge and information
- Build capacity and drive behavioural change

PROPOSED VISION AND GUIDING PRINCIPLES OF A CLIMATE-RESILIENT CANADA

Vision

A Canada where policy and action, from the national to the local scale, support the resilience and prosperity of communities, the economy, and the environment in the face of a changing climate.

Guiding principles

- Adaptation should be undertaken proactively at all levels and targeted at reducing risk
- Decision-making should be informed by the best available science, information, and local and traditional knowledge, but uncertainty and incomplete information should not preclude action
- Adaptation approaches should be flexible, scalable, reflect unique regional circumstances, and promote experimentation and innovation
- Resources for adaptation should be appropriate for the scope of the work needed, and should recognize that inaction is likely to cost more than action
- Adaptation planning should look beyond individual risks and sectors and use ecological boundaries where possible in order to consider the resilience of interconnected systems
- Collaboration should be strengthened between all levels of government, Indigenous Peoples, the private sector, academia, the non-profit sector, and communities and individuals, given that adaptation is a shared responsibility
- Adaptation actions should not put people or ecosystems at risk and should aim to maximize socio-ecological co-benefits wherever possible
- Adaptation should be integrated into decision-making

BUILDING RESILIENCE THROUGH INFRASTRUCTURE

With billions of dollars spent annually on new and existing infrastructure by all levels of government and the private sector, there is a need to ensure these substantial, long-lived investments are sound from a climate risk perspective. There is a window of opportunity to ensure that significant current and planned infrastructure investments are resilient to the impacts of climate change and contribute to broader objectives relating to community resilience, health, conservation, economic prosperity, and greenhouse gas emissions reductions. Ensuring infrastructure (e.g., community, trade-related, transportation, etc.) is climate-resilient will require a shift in planning and funding of infrastructure, and will also require recognition that costs incurred up front to incorporate climate change considerations will ultimately have long-term benefits and cost savings.

Managing climate risk in and through infrastructure can involve a number of different kinds of responses:

- Technical and structural (e.g., standards, codes, how projects are designed)
- Policy and regulations (e.g., project proposal criteria/requirements, standards, procurement policies, urban planning)
- Financial and economic instruments (e.g., what gets funded, insurance, tax levers)
- Socioeconomic (e.g., relocation, behaviour change)
- Institutional (e.g., awareness, capacity building)

Natural infrastructure—for example, green roofs, urban parks and tree canopies, wetlands, naturalized stormwater basins, natural shorelines—can play an important role in building resilience. While infrastructure projects tend to be predominantly traditional infrastructure (e.g., wastewater sewers and pipes), natural infrastructure has the potential to deliver the same results, often for a lower price and with multiple co-benefits (e.g., carbon storage, wildlife habitat, food security, recreational opportunities, health benefits). Investments in natural infrastructure can complement and extend the life of other infrastructure and defer expensive investments to expand capacity of waste- and stormwater systems. In addition, natural infrastructure assets typically appreciate with age.

There are significant infrastructure needs in Indigenous and northern communities. The Working Group will consider the unique circumstances and needs of these communities while developing options to build resilience through infrastructure.

The Working Group will develop options for:

- Systematically considering climate change in infrastructure investments
- Promoting natural infrastructure
- Investing in adaptation-specific infrastructure projects

CONSIDERING CLIMATE CHANGE IN INFRASTRUCTURE INVESTMENTS

With the critical role infrastructure plays in social and economic well-being, and the understanding that climate change impacts will increase the vulnerability of infrastructure, there is a compelling case for climate resilience to be incorporated into all decisions regarding infrastructure, including those related to urban and land-use planning, design and location, operation and maintenance, and decommissioning. The Working Group is examining opportunities to better incorporate climate change considerations in infrastructure investment decisions in several areas, including: codes and standards, climate vulnerability / impact assessments, and procurement processes.

Consideration of climate resilience when developing or updating codes and standards helps ensure that climate considerations are embedded in all the decisions made regarding the lifecycle of the infrastructure. The federal government's 2016 Budget included funding for initiating and advancing these efforts over the next five years. This work will include the development of standards for weather and climate monitoring station data, deriving climate design values based on historical climate data, and deriving climate design values that incorporate climate change projections. Also under development are a revised national building code by 2020 (residential, institutional, commercial and industrial buildings), and guides that integrate climate resilience into the design and rehabilitation of public infrastructure (e.g., bridges, roads, potable water, and wastewater systems). In the future, additional codes and standards related to climate resilience could potentially be developed or updated (e.g., natural infrastructure, mines, emerging technologies).

A second approach for considering climate change in infrastructure investments is through climate vulnerability or impact assessments. Incorporating these kinds of assessments in infrastructure projects ensures that extreme weather and future climate are considered in the design and building stages, as well as in the full lifecycle costing of the infrastructure, thereby ensuring safe and resilient infrastructure and guarding against expensive damage and recovery. In addition, these considerations should also be incorporated when rebuilding infrastructure after a disaster. There are existing tools, such as the Public Infrastructure Engineering Vulnerability Committee Protocol (PIEVC), that can be used to carry out climate vulnerability assessments on both new and existing infrastructure projects.

There are several ways jurisdictions can ensure that these assessments are undertaken, including:

- Mandatory requirements on infrastructure funding (which could be harmonized across jurisdictions)
- A points system that rewards proposals that have undertaken climate vulnerability assessments
- A dedicated top-up fund that proponents could access to fund the additional costs of vulnerability assessments and/or specific measures to ensure a project is climate resilient
- Criteria or requirements on disaster recovery assistance to ensure that reconstruction efforts aim to increase resilience in the face of climate change

Finally, making infrastructure climate resilient can increase project costs. If infrastructure-related procurement is based solely on the lowest price, without consideration of climate change, initial cost savings may be prioritized at the expense of longer-term advantages and cost savings. By encouraging the replication of older, cheaper technologies, lowest-price procurement practices can lead to higher costs over the lifespan of infrastructure. Procurement processes that include the consideration of climate change can encourage innovation, improve safety, result in long-term savings, and ultimately make the project more resilient.

To ensure climate resilience, governments could review design and procurement policies with a view to including climate change considerations as evaluation criteria or requirements.

PROMOTING NATURAL INFRASTRUCTURE

Climate impacts will require a shift in current thinking about infrastructure, as traditional infrastructure alone is unlikely to be able to adequately address all impacts (and doing so would have high associated costs). Natural infrastructure solutions should be implemented alongside traditional infrastructure solutions to climate risks (e.g., increased stormwater runoff, extreme heat) in order to increase efficacy and decrease costs. In addition to the cost savings and multiple co-benefits that natural infrastructure provides, it can also provide an alternative where hard infrastructure would have negative consequences on local species and ecosystems (e.g., the impact of seawalls on coastal species and ecosystems).

There are several ways to promote the use of natural infrastructure, including:

- Ensuring that natural infrastructure projects are eligible to receive available infrastructure funding
- Adopting a points system for infrastructure funding that rewards the maximization of co-benefits
- Developing guidance and best practices related to the use of natural infrastructure to manage climate impacts
- Establishing best management practices and standards for the maintenance of critical natural infrastructure (similar to the approach that already exists for traditional infrastructure)

INVESTING IN ADAPTATION-SPECIFIC INFRASTRUCTURE PROJECTS

While ideally all infrastructure projects would be built to be climate resilient, there is also a subset of projects that are needed to directly address specific climate impacts (e.g., extreme precipitation, coastal erosion, storm surge, higher temperatures). These include both hard infrastructure solutions (e.g., seawalls, floodways, permanent roads to replace seasonal ice roads, etc.) and natural solutions (e.g., urban tree canopies, wetlands, rain gardens, natural shorelines, etc.), as well as retrofits and upgrades to existing infrastructure. Some investments in adaptation infrastructure can also be considered disaster risk reduction initiatives (e.g., those related to flooding).

Using targeted infrastructure investments to adapt to specific climate impacts requires that decision-makers are aware of impacts and the risks they pose, are able to evaluate the best approach to adapt, and can access funding. Cost-benefit analyses of adaptation infrastructure, including natural infrastructure, can help decision-makers make informed choices about their infrastructure investments. A dedicated stream of funding for adaptation and disaster risk reduction projects (traditional and natural) could directly target adaptation through infrastructure investments. In addition, various ways of financing adaptation-specific infrastructure projects beyond government funding will be explored (e.g., green bonds, loans, public-private partnerships, user-pay models).

VALUING AND CONSERVING HEALTHY ECOSYSTEMS

Valuing ecosystem services and promoting action to conserve and restore natural spaces (including working landscapes and seascapes, like agricultural lands and managed forests) has a high potential for positive co-benefits, including disaster risk reduction, health, and carbon sequestration. Healthy, biologically diverse ecosystems are more resilient to the adverse effects of climate change. Steps taken to protect biodiversity today will determine the diversity of species and ecosystems of the future. Conservation and restoration efforts will also help protect the ecosystem services that benefit human health, the economy, and society as a whole (e.g., food, raw materials, pollination, fresh water, recreation).

Conservation work related to adaptation could include the protection, restoration, and stewardship of key habitats (e.g., to facilitate the adaptation of species and/or deliver key ecosystem functions). Undertaking large-scale land-use and conservation planning initiatives (including Indigenous land-use planning) could help strategically identify areas for protection or restoration (e.g., habitat corridors), maximize the long-term effectiveness of protection efforts, and enhance the ability of systems to provide a buffer against impacts. In addition, integrating climate considerations in both conservation plans and species at risk efforts can also ensure that these efforts remain viable as the climate changes.

There are several possible tools and levers to support and incent conservation in an adaptation context, including:

- Filling key information gaps (e.g., inventories, monitoring, modelling)
- Creating incentives for land owners and managers to take action
- Establishing demonstration sites for nature-based adaptation solutions
- Advancing work on valuing ecosystem goods and services (e.g., moving toward valuing and managing natural areas and systems as assets)
- Earmarking a portion of adaptation funds for conservation / nature-based solutions

The Working Group has had preliminary discussions and is analyzing stakeholder input on this topic. A range of options will be explored.

SAFEGUARDING VULNERABLE REGIONS

All regions in Canada are faced with unique risks and challenges; however, Canada's coastal and northern regions are particularly vulnerable and disproportionately affected by the impacts of climate change.

COASTAL AREAS

Canada's Atlantic, Pacific, and Arctic coasts extend across 243,000 km. Each region has unique vulnerabilities, sensitivities, and exposures to climate change, including those related to the impacts of sea-level rise, ocean acidification, coastal erosion, higher water temperatures, increased storminess, and changes in hurricane tracks. Coastlines projected to experience the greatest relative sea-level rise are the Atlantic provinces and the southern side of the Gulf of St-Lawrence, the Beaufort Sea, Haida Gwaii, parts of Vancouver Island, and the British Columbia coast.

Relative sea-level rise will negatively impact coastal ecosystems (including dunes, wetlands, tidal flats, and shallow coastal waters) and the services they provide. When combined with high winds, storms, and high tides, sea-level rise causes storm surges to reach higher elevations, affecting both natural shorelines and human built coastal infrastructure. As sea ice acts as a natural protection mechanism against waves and storm surges, reductions in sea ice further increase storm surge risks in the Beaufort Sea and Atlantic region, and the rate of coastal erosion.

Climate change poses considerable challenges for exposed coastal communities, including: unstable shorelines, flooding and damage to residential and commercial properties and cultural assets, contamination of water supplies, increasing costs for protection, maintenance, and insurance, disrupted transportation and trade routes, and impacts on human health (e.g., water-borne diseases). There will also be impacts on fisheries, traditional foods, iconic species (e.g., salmon), and food safety (e.g., algal blooms).

The Working Group has not had deliberations on this topic yet, but may consider options in areas such as land use, flood protection, coastal erosion, relocation, conservation, and disaster recovery. It may also consider options to address barriers such as the lack of local flood mapping for some coastal communities and limited capacity to integrate relevant data into planning decisions.

THE NORTH

The North is already experiencing significant impacts on the coastline, sea ice extent, permafrost, water quality and quantity, food security, and ecosystems. For the large Indigenous population these impacts challenge traditional lifestyles and traditional ecological knowledge. For all of the North, climate change is disrupting infrastructure (e.g., buildings, transportation), economic activity, health, and safety on the land while also presenting potential opportunities for economic development and agricultural growth.

Capacity remains a significant issue in the North and, in the past, uncoordinated investments in northern research have overextended existing territorial capacity. For many years, northern stakeholders have asked for a one-window approach to support collaborative climate change adaptation research and the integration of traditional knowledge to support community resilience. Ongoing support and enhanced coordination is required to continue building capacity to respond to the rapid changes being experienced in all three territories. The territorial governments have established many actions to respond and adapt to the impacts being experienced and have established partnerships with northern communities, universities, and the private sector to implement a variety of measures to increase community resilience.

Led by Indigenous and Northern Affairs Canada, work is underway with northern partners to develop a Northern Adaptation Strategy, which will identify priority areas for action on climate change in the North. The Strategy will set the stage for future funding to territorial and northern governments, as well as communities, through federal and provincial initiatives, and will establish a model for collaboration on climate change in the North.

The Working Group has not yet had deliberations on this topic, but will consider whether to develop options in addition to the Northern Adaptation Strategy.

SUPPORTING DECISION-MAKING WITH KNOWLEDGE AND INFORMATION

Resilient people, communities, infrastructure, ecosystems, and economies rely on authoritative, accessible, and actionable information on changing conditions. Decisions to take action to adapt to climate change are enabled by:

- An understanding of the impacts of climate change and related risks, vulnerabilities, opportunities, and interdependencies
- Knowledge of the actions that can help build resilience and realize opportunities
- Access to authoritative information and trustworthy service providers
- Support for how to use information in decision-making

There is already a foundation of information required for adaptation in Canada. Effort is required to ensure that this foundation continues to be delivered and that key gaps are filled. In addition, there is also a need to support decision-makers by increasing accessibility of experts and by making information available, reflective of local circumstances, and targeted to specific needs.

The Working Group will explore options related to establishing a pan-Canadian assessment framework, a national strategy for climate-related information and services, a network of climate adaptation hubs, and the need for increased monitoring and surveillance of changes.

ASSESSMENTS

Assessment activities can provide authoritative information on climate change scenarios, potential impacts, risks, vulnerabilities, and adaptation progress. Sustained, formalized, and publicly accessible assessments can help to connect research to decision-making, support the regular identification and evaluation of priority areas for action, and enable adaptation planning. Applying a consistent framework can facilitate comparability of different regional or sectoral assessments (e.g., transportation assets, strategic infrastructure, key health system components, critical ecosystems) and allow for periodic syntheses at various scales.

By documenting changes over time, assessments can facilitate the measurement of progress on adaptation and allow governments and organizations to assess whether actions have reduced vulnerability to (or increased resilience to) climate change impacts. It also helps communicate advances in adaptation, which raises general awareness about adaptation and resilience and builds support for future investments and programming in this area.

To be of highest value, assessment results should be communicated to both the general public and experts (e.g., high-level overviews written in accessible language for a general audience, with additional technical information provided for those who require it).

The Working Group will develop options for establishing a pan-Canadian assessment framework, including performance measures.

CLIMATE-RELATED INFORMATION AND SERVICES

Individuals, businesses, practitioners, communities, and governments require easily understandable and accessible information targeted to their needs, along with practical guidance on how to use it. This support can range from help selecting the right product for specific applications, to understanding the uncertainty associated with the information, to effectively incorporating it into decision-making processes at all levels.

Climate-related information and services are the foundation for developing adaptation and risk management strategies and underpins decision-making across sectors:

- Health (e.g., air and water quality, heat, infectious diseases)
- Infrastructure and transportation (e.g., design of new projects, retrofits), including disaster risk reduction
- Agriculture (e.g., plant and animal health, food production and security)
- Natural resource management (e.g., water resources, energy, forestry, wildfire, mining)
- Ecosystem management and conservation (e.g., species management, protected areas, connectivity)
- Disaster management (e.g., flood and wildfire maps and risks, disaster risk reduction planning)

The landscape of climate and related information is complex. Information and services are required by a variety of users for an assortment of needs at various geographic and time scales. Information is generated and delivered by a range of partners. Establishing a shared vernacular and effective systems for accessing local information and connecting community members with technical experts and resources will be important.

The provision of knowledge, information products, and tools to support adaptation decision-making is a shared responsibility. Advancing this work requires collaboration within the federal government and between the federal and the provincial and territorial governments, as well as partnerships with Indigenous Peoples, research consortia, non-governmental organizations, communities, and the private sector. While some regional service providers already exist and are playing an important role in informing decision-making, there is an opportunity to expand coverage across the country.

Given the complexity and urgency of the issue, there have been calls for increased leadership from the federal government, but all partners will need to be involved in advancing efforts on a sustained basis and at the scale required. Efforts should be compatible and consistent with existing federal-provincial-territorial information exchange protocols and efforts. In addition, where climate-related information and services already exist, future efforts should also include strengthening the collaboration between existing service providers. This work could leverage existing capacities, bridge information and service gaps, and enhance the delivery of climate services by bringing cohesion to dialogue and action among climate information producers, providers, and users.

The Working Group will formulate options around the development and implementation of a national strategy for climate-related information and services.

CLIMATE ADAPTATION HUBS

Enhancing existing capacity and creating new regional capacity in a network of regional centres of expertise can ensure that Canadians in all jurisdictions have access to locally-relevant information and tools combined with experts and local capacity available to support uptake and action. Translating assessment-level information into action can be challenging. Bringing together adaptation expertise across disciplines (e.g., climate scientists, ecologists, social scientists, Traditional Knowledge experts, health professionals, practitioners, engineers, artists, infrastructure vulnerability assessment experts, specialists in natural infrastructure solutions, home adaptation assessment professionals) can help decision-makers navigate complexities, address interdependencies, and foster innovative responses to climate change impacts.

Activities could include:

- Facilitating access to locally-relevant tools and information (e.g., standards, maps, cost-benefit analyses, methodologies, etc.)
- Providing support and guidance on how to use tools and information appropriately
- Developing common methodologies and tools for evaluating vulnerability
- Developing and delivering locally-relevant capacity-building exercises
- Identifying and supporting local adaptation champions in sectors, communities
- Sharing locally-relevant success stories, best practices, and examples

By integrating Traditional Knowledge and tailoring information and tools to the needs of Indigenous Peoples, these hubs could increase access to climate data, best practices, and tools that are currently out of reach for most Indigenous communities.

The Working Group is considering input from partners and stakeholders, and will consider options around expanding and establishing a network of climate adaptation hubs.

MONITORING AND SURVEILLANCE

The need for long-term systematic monitoring of key risks is clear, and understanding the changes already being experienced can help communities anticipate and better prepare for future changes.

Enabling citizen-based science and local observations of climate impacts can raise awareness of changes that are occurring and contribute important information to community adaptation initiatives. Such a mechanism can allow for the application of local and Traditional Knowledge, science, and technology to record observations. A network of local observers can enable connections within communities and with experts to share observations and find answers to significant environmental events. This work can help build collaborative partnerships between communities with researchers, and the engagement of youth in this initiative could have additional benefits including the maintenance of cultural values.

Monitoring sentinel species and ecosystems can provide early warnings of threats to human, animal, and environmental health. A systematic approach to measuring wildlife health can raise awareness of vulnerabilities and impending changes to community resilience. While there are already considerable environmental monitoring efforts underway, enhancing collective understanding of the current state of Canada's ecosystems and monitoring climate change impacts can help inform and advance adaptation efforts.

The Working Group is considering input from partners and stakeholders and will explore options related to expanding monitoring and surveillance.

BUILDING CAPACITY AND DRIVING BEHAVIOURAL CHANGE

Investments in adaptation in Canada have led to the creation of many information products and tools to enable adaptation decision-making. However, information alone will not lead to successful adaptation implementation, as demonstrated by the relatively few examples of actions taken to reduce vulnerability to climate change impacts.

Broad behavioural change will be needed in order to realize the vision of a resilient Canada, where climate change is considered in all decision-making. This change will require a willingness to act, bolstered by the support of constituents, memberships, shareholders, and peers, combined with the human and financial capacity to act. Increasing awareness, understanding how people make decisions, recognizing how to influence those decisions, and building capacity to adapt can start to bring about this change. Local grassroots organizations are often at the leading edge of these efforts and support can enable them to continue acting as social change leaders.

In this context, capacity can include knowledge, skills, and human and financial resources. Capacity-building activities can include a range of issues, such as increasing knowledge within adaptation practitioners and decision-makers, developing local adaptation leaders, increasing awareness of adaptation in individuals working in related fields, hiring staff to manage adaptation initiatives, and providing access to sustained resources to implement adaptation actions.

Audiences include the general public, Indigenous Peoples, professionals and practitioners across many disciplines, and decision- and policy-makers at all levels of government and in the private sector. Challenges related to awareness and capacity building are not unique to adaptation, and the experiences of other disciplines (e.g., health, emergency preparedness) will be considered as options are formulated.

RAISING AWARENESS

There is a need to raise broad awareness of climate change impacts and adaptation in Canada to build support for action. Communication efforts on both adaptation and emissions reduction issues should be done in an integrated and coherent way, recognizing that the two are integral parts in the fight against climate change.

Topic-specific campaigns that are grounded in concrete actions and have clear targets for specific behavioural changes can deliver results and effectively drive long-term social change. Addressing flood risks in communities could be an early area of focus for targeted awareness-raising, and would also contribute to reducing disaster risk.

Culture and the arts can play an important role in building awareness and driving behavioural and social change. Supporting efforts to communicate climate change impacts and adaptation and promote behavioural change through art, literature (fiction), etc. can further drive change.

Options will be developed for targeted awareness campaigns and options will be considered for innovative approaches to raising awareness.

PROMOTING AND DEVELOPING ADAPTATION CHAMPIONS AND LEADERS

The value of peer-to-peer communication, inspiration, and sharing of successes and experiences is well recognized. Identifying and supporting adaptation champions can ensure that their experiences and achievements are shared broadly, and these examples can be powerful tools in motivating behaviour change within and across sectors.

It is important to continue to strengthen the community of adaptation leaders in Canada at all levels (national, regional, and local) and provide regular and ongoing opportunities to learn about advances in adaptation, innovative approaches, and best practices. This work should be complemented by efforts to develop future leaders, with a particular emphasis on promoting opportunities to learn through experience. Leadership training must be developed that is sensitive to the needs and culture of Indigenous Peoples, while allowing for the same opportunities for all, from private sector professionals, to decision-makers from municipalities of all sizes, to Indigenous community leaders.

Training adaptation planners within organizations, communities, or regions can address capacity challenges, particularly in small or Indigenous communities, where possible encouraging cross-sector integration. Scholarship programs can support university and college students studying adaptation-related issues. For professionals and practitioners already in the workforce, secondments, job swaps, communities of practice, and mentorship programs can deepen understanding and broaden perspectives of climate change risks, opportunities, and adaptation actions.

Options will be developed for promoting champions and developing leaders.

SUSTAINING FUNDING

Currently, adaptation across Canada is funded through a number of mechanisms at different levels of government, as well as investments from the private sector. For instance, adaptation-specific funding is available through federal and provincial/territorial programs in a number of areas (e.g., natural resources, the North, health), and adaptation projects are also eligible under various existing funding streams (e.g., infrastructure, Green Municipal Fund, disaster risk reduction, gas tax).

The Working Group has had preliminary discussions on this topic, and may consider options related to:

- Foundational roles for the federal government that require sustained funding (e.g., climate-related science and foundational climate information)
- Priority areas in need of collective funding or cost-shared action
- Sustained financing for a long-term, ambitious, pan-Canadian approach to adaptation
- Developing common climate criteria to inform funding decisions
- Identifying the most effective ways to support successful implementation, recognizing the needs and priorities of the provinces and territories
- Exploring the potential for novel financing mechanisms (e.g., user-pay, public-private partnerships)

ENABLING COLLABORATION

Sustained and strategic collaboration on adaptation is needed. There is a broad range of adaptation issues across sectors and regions, shared responsibility in addressing challenges, interdependencies between adaptation decision-making and the management of other risks, and potential co-benefits with other areas, such as disaster risk reduction, conservation, and health.

The Working Group has had preliminary discussions on this topic. Options may be considered around building on the success of the Adaptation Platform and regional boundary organizations, which are existing mechanisms that foster collaboration between governments, Indigenous Peoples, the private and investment sectors, and research organizations to address shared priorities and leverage collective resources.

CONCLUSION

Subject to the feedback from Ministers, the Working Group will continue to develop specific options in the areas outlined above, taking into consideration the division of responsibilities between the federal government and provincial and territorial governments and recognizing that adaptation touches a wide range of mandates. The options developed will aim to drive collective action forward, rather than dictate action in individual jurisdictions, and will build on initiatives already underway and make use of existing fora for dialogue and collaboration where possible.

The Pan-Canadian Framework on Clean Growth and Climate Change is an opportunity to build widespread resilience across Canada. By focusing work on areas that will support and mobilize action across all sectors and regions, as well as a few areas of particular vulnerability or opportunity, the Working Group hopes to move Canadian adaptation efforts toward a more holistic, system-wide approach that will allow Canadians to continue to thrive in the face of climate impacts.

ANNEX 1: KEY DEFINITIONS

Adaptation: Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change.
(http://unfccc.int/focus/adaptation/items/6999.php)

Climate resilience: The capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a climate change related disruption or impact.
(Adapted from: https://toolkit.climate.gov/get-started/overview)

Conservation: Refers to the careful preservation and protection of something; *especially*: planned management of a natural resource to prevent exploitation, destruction, or neglect.
(http://www.merriam-webster.com/dictionary/conservation)

In the context of climate change adaptation, conservation has a role in ecosystem-based adaptation (EbA), along with sustainable management and restoration of natural ecosystems, to help people and ecosystems adapt to climate change.
(Adapted from: http://www.conservation.org/projects/Pages/adapting-to-climate-change-ecosystem-based-adaptation.aspx)

Disaster risk reduction: The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
(https://www.unisdr.org/we/inform/terminology)

Ecosystem goods and services (EGS): The direct and indirect contributions of ecosystems to human well-being. EGS typically fall into four categories: provisioning (e.g., food, raw materials, fresh water), regulating (e.g., air quality, carbon sequestration), habitat (e.g., species habitat, maintenance of genetic diversity), and cultural (e.g., recreation, tourism, spiritual experience).
(Adapted from: http://www.teebweb.org/resources/ecosystem-services/)

Risk: The potential for consequences where something of value is at stake and where the outcome is uncertain. Risk is often represented as the product of two components: the *probability* of occurrence of hazardous events or trends multiplied by the *magnitude of impacts* (or consequences) if these trends or events occur. Risk results from the interaction of vulnerability, exposure, and hazard (or extreme event).

Agard, J., E.L.F. Schipper, et al, Eds. 2014. Glossary. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group II*.

Scenario. A scenario is a coherent, internally consistent, and plausible description of a possible future state of the world (IPCC, 1994). It is not a forecast; each scenario is one alternative image of how the future can unfold. A projection may serve as the raw material for a scenario, but scenarios often require additional information (e.g., about baseline conditions). A set of scenarios often is adopted to reflect, as well as possible, the range of uncertainty in projections.
(Adapted from: http://www.ipcc.ch/ipccreports/tar/wg2/index.php?idp=125)

Standardization / standards: Standardization is the development and application of standards publications that establish accepted practices, technical requirements, and terminologies for products, services, and systems. Standards help to ensure better, safer, more resilient methods and products, and are an essential element of technology, innovation, and trade.

Vulnerability: In the context of climate change, vulnerability is the predisposition to be adversely affected by a change in climate, depending on sensitivity or susceptibility to harm, and capacity to cope and adapt.

Agard, J., E.L.F. Schipper, et al, Eds. 2014. Glossary. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group II*.

ANNEX 2: ENGAGEMENT SUMMARY

STAKEHOLDER ENGAGEMENT EVENT

Participating organizations:

- Canadian Association of Petroleum Producers
- Canadian Cattlemen's Association
- Canadian Chamber of Commerce
- Canadian Coalition for Green Health Care
- Canadian Electricity Association
- Canadian Federation of Agriculture
- Canadian Parks and Wilderness Society
- Canadian Society of Landscape Architects
- Canadian Wildlife Health Cooperative
- Chartered Professional Accountants Canada
- Ducks Unlimited Canada
- Engineers Canada
- Federation of Canadian Municipalities
- Fertilizer Canada
- Forest Products Association of Canada
- ICLEI – Local Governments for Sustainability
- Institute for Catastrophic Loss Reduction
- Insurance Bureau of Canada
- Intact Centre on Climate Adaptation
- International Institute for Sustainable Development
- Mining Association of Canada
- Nature Conservancy of Canada
- Northern Climate ExChange
- Ontario Centre for Climate Impacts and Adaptation Resources
- Ouranos
- Pacific Climate Impacts Consortium
- Railway Association of Canada
- University of Prince Edward Island Climate Research Lab
- World Wildlife Fund

Summary to follow in final report

ANNEX 3: JURISDICTIONAL ACTIVITIES

YUKON

The Government of Yukon has clear direction and is taking action to improve its ability to adapt to climate change. This is outlined in its *Climate Change Action Plan (2015).* The territorial government has undertaken adaptation actions both directly and through partnerships with the federal government and non-government organizations. The Government of Yukon approach is guided by the following goals: enhancing knowledge and understanding of climate change, adapting to climate change, reducing greenhouse gas emissions, and leading Yukon action in response to climate change.

The Government of Yukon has heard from local communities and First Nations that climate change impacts on wildlife and wildlife habitat present significant risks for food security and the prosperity of communities. Numerous projects have been undertaken in the territory on the impacts of climate change on First Nations cultural activities, traditional food sources, and the use of Traditional Knowledge to understand and respond to climate change impacts.

Thawing and unstable permafrost creates immediate impacts on buildings and highway infrastructure, causing significant financial costs for Yukon communities. The Government of Yukon has performed risk and/or vulnerability assessments, disaster resiliency planning, and is actively monitoring permafrost temperatures and identifying intervention opportunities to mitigate impacts with the help of the *Yukon Permafrost Knowledge Network*.

Increasing awareness about climate change impacts and adaptation options for Yukoners, as well as creating tools to help build adaptation into all levels of decision-making, is a priority for the Government of Yukon. The *Yukon Climate Change Indicators and Key Findings* report was developed in 2016 to provide an objective and accessible overview of the current state of Yukon's climate system that will be regularly updated. Other areas of interest include communicating the types of impacts and significance of climate change in Yukon, analyzing the financial costs of impacts and adaptation solutions, and enabling integration of climate change considerations (e.g., projections and modelling) into decision-making, particularly for planning and development. Risk and vulnerability assessments, along with reliable and updated data, have been identified as an important mechanism to further help the decision-making process.

Climate change is increasing the risk of catastrophic flood events. The *Yukon Flood Risk Mapping* project uses elevation modelling to identify where and how Yukon communities may be at risk for flooding. The *Emergency Measures Organization*, along with the Department of Environment, has engaged in a pilot project to evaluate the use of LiDAR and historic water-level data for community flood hazard mapping. It is envisioned that the methods and standards developed through this pilot will lead to publicly accessible flood hazard maps for Yukon communities at-risk of flooding.

NORTHWEST TERRITORIES

The Government of the Northwest Territories (GNWT) is currently developing a NWT Climate Change Strategic Framework to describe and coordinate actions on climate change adaptation and resilience. This Strategic Framework will replace the NWT Greenhouse Gas Strategy that has been in place since 2001.

Responsibility for climate change adaptation activities within the GNWT is spread amongst departments with responsibilities for affected sectors and these departments work with many partners, including outside academics and experts, NWT Aboriginal governments and local community governments.

Through taking actions to respond to climate change, the NWT has developed considerable multi-disciplinary expertise in responding to impacts. Sector-specific responses continue to be refined and best practices are being developed, but these actions have placed additional costs on maintaining existing infrastructure and have made new projects more expensive.

As the NWT continues to adapt to the impacts from climate change, the GNWT is also focused on growing the territorial economy. Sustainable and innovative economic development of the NWT's many resources will be key in ensuring the people of the NWT are able to thrive in healthy and strong Indigenous and remote communities.

NUNAVUT

Nunavut's efforts related to climate change adaptation have been guided by a series of policy documents:

- The Nunavut Climate Change Strategy (2003): Identifies actions to reduce Nunavut's greenhouse gas emissions and address the impacts of climate change.
- The Pan-Territorial Adaptation Strategy (2011): Outlines pan-territorial collaboration on climate change adaptation in the Canadian Arctic.
- Upagiaqtavut (2011): Nunavut's updated strategic plan for addressing climate change impacts and adaptation.
- Draft Adaptation Action Plan: Developing a draft action plan intended as the next phase in building adaptation policy in Nunavut (not yet finalized).

Projects that have been undertaken to support adaptation in Nunavut include:

- Nunavut Climate Change Centre (NC^3) Website: Provide Nunavummiut with current information on climate change in Nunavut, including ongoing research in communities, educational resources, traditional knowledge on climate change, and other northern adaptation resources.
- Nunavut Permafrost Databank: Provides access to open-source permafrost data from across the territory in one central location; helps improve community decision-making, research, and monitoring.
- *Tukisigiaqta* Web-Based Risk Tool: An interactive online experience that teaches Nunavummiut about climate change risks in the home and on the land.
- Climate Change Adaptation Training Course for Nunavut Decision-Makers: A two-day training course for government and community staff that teaches about climate change impacts and adaptation and builds on both scientific and traditional knowledge. Trains staff to incorporate adaptation into decision-making across all sectors.

- Community Permafrost Hazard Mapping: Mapping community permafrost thaw and developing land-use recommendations for community development by incorporating maps into community plans and infrastructure programs.
- Climate Change Community Outreach Program: Working with schools across the territory to deliver youth climate change education activities (K-12) to increase knowledge around climate change impacts and adaptation. Additional outreach programs include community-wide consultations with elders groups, industry, and community decision-makers to build awareness of climate change impacts and adaptation.

BRITISH COLUMBIA

In 2010, the Government of British Columbia released *Preparing for Climate Change: British Columbia's Climate Adaptation Strategy*, a plan to increase knowledge about climate change and its impacts on key economic sectors, and government programs and services; and produce tools to help governments, businesses, and communities find out how climate change will affect them, and what they can do now to prepare. Key elements of British Columbia's approach to adapting to climate change include:

- Climate change assessments for the agriculture, forestry, mining, hydroelectricity, and oil and gas sectors identify climate-related risks and actions that can help these sectors prepare for climate change.
- The Pacific Climate Impacts Consortium, a regional climate service centre, supports adaptation by providing projections of future climate conditions for British Columbia.
- A new *Water Sustainability Act* protects aquatic ecosystems during times of water scarcity, and allows water for essential household use during droughts.
- Provincial ministries and partners continue to operate and improve hydrological monitoring (climate, snow, surface water, and groundwater) in order to provide better data to support decision-making for drought, flood, infrastructure planning, Environmental Flow Needs, and ecological modelling.
- Guidance on sea dike design and coastal development enables local governments and qualified professionals to protect people, buildings, and infrastructure from sea-level rise.
- Guidance on tree species selection and reforestation ensures that future forests are resilient to future damage from fire, pests, and disease in a changing climate.
- Provincial ministries are taking climate change into account in designing and maintaining highways, managing parks and forest landscapes, and financing agricultural innovation.
- Local governments in British Columbia are planning ahead for climate change; some have already started to implement their plans.
- Following completion of a series of climate risk and opportunity assessments, the agriculture sector has focused on developing and implementing multi-partner regional adaptation strategies in key agricultural areas of the province (Cowichan, Delta, the Peace, the Cariboo , the Fraser Valley, and the Okanagan), and is piloting and demonstrating adaptation practices on B.C. farms and ranches.

In 2015 British Columbia initiated a process to develop a new Climate Leadership Plan. The process included two rounds of public and stakeholder consultation, as well as convening an expert advisory panel to make recommendations to the provincial government. A new plan will be announced in 2016.

For more information:
http://www2.gov.bc.ca/gov/content/environment/climate-change

ALBERTA

Alberta views action on climate change adaptation as critical and complementary to all efforts to mitigate emissions. The province's Climate Leadership Discussion Document (August 2015) noted "Alberta's new government is also committed to developing a provincial adaptation strategy to help ensure the province is better prepared for and more resilient to a changing climate. The strategy will be developed with input from Albertans through a separate engagement process that recognizes the unique challenges and opportunities of adaptation."

Extreme weather events are increasing, and Alberta is focused on disaster mitigation, preparedness, and response. The current Fort McMurray area fires, the 2013 floods, and other such incidents were devastating for many Albertans. Severe damage to public and private property occurred.

To reduce the damage from future flooding, the Provincial Recovery Framework outlines government functions to support local recovery efforts, mitigate future floods, and preparedness for future disasters. Province-wide, regional and community-based flood mitigation projects are complete and underway to reduce the impact of future events. A provincial assessment of flood vulnerability, for instance, investigates how changes in duration and intensity of rainfall affect the timing of flood events. Regional engineering studies assess options for Alberta's most flood-prone river basins, while detailed debris hazard and risk assessments are undertaken for mountain creek communities. Proactive preparedness for future events includes policy to restrict development in floodplains, mandatory standards for infrastructure, upstream infrastructure expansion, and enhancement and restoration of natural ecosystems to increase the ability of watersheds to reduce the intensity, magnitude, duration, and effects of flooding and drought. Hundreds of hectares of wetlands are being restored in high priority areas through the province, and riparian areas are being restored to improve resiliency.

Alberta has also been improving the knowledge on adaptation of forests to future climate. Since the mid-1990s, Alberta has been modelling different planting sites using different climate change scenarios, providing information on the extent to which climate change could affect forest productivity. This work has also facilitated the adjustment of seed use guidelines to allow seed transfers across zones.

Alberta invests in adaptation research and learning. The Climate Change and Emissions Management Corporation has supported three key projects to provide insight into climate change impacts throughout the province to enhance Alberta's ability to respond appropriately: the South Saskatchewan River Basin Adaptation to Climate Variability project helps communities explore possible impacts of climate variability and identifies opportunities for environmental and economic improvement in water storage, infrastructure, and alternative timing of withdrawals, releases, and flows; the Tree Species Adaptation Risk Management Project builds resilience to climate stressors; and the Biodiversity Management and Climate Change Adaptation Project estimates impacts on native species and ecosystems, including response of invasive plants to climate change, as well as tools to support sensitive species at risk.

Alberta also recognizes the important roles played by municipalities in building resilience at the local community level, and has recently worked municipalities to complete a Resilience Tool Kit to facilitate community-level vulnerability assessments, as well as adaptation and resilience planning.

SASKATCHEWAN

Saskatchewan's recently approved natural hazards risk assessment project under the *National Disaster Mitigation Program* is required to account for future climate change impacts. This will include estimating changing hazard risks under anticipated climate shifts and could be used as a basis for new adaptation strategies.

The Government of Saskatchewan has identified multiple areas for interventions. For instance, highways and infrastructure are a top priority due to freeze-thaw cycles. In order to sustain current infrastructure, Saskatchewan has increased the design flow for new culvert installations on the National Highway System highways from a 1:25 year return period to a 1:50 year return period, and modified culvert design to improve efficiency and safety. Moreover, Saskatchewan is using technology in winter maintenance to provide early warning of weather events and gather better road information and data, thereby improving response times and ensuring the plows are properly equipped for the weather events.

The Government of Saskatchewan is in the process of developing a drought strategy, conducting research on water quality at Lake Diefenbaker, and is developing a new water allocation policy and legislation that will provide flexibility to manage shortages. The province has developed an Irrigation Strategy, with a strong focus on long-term capacity building in the irrigation sector and continues to work with the industry to determine feasibility for large-scale irrigation development.

In partnership with the *Crop Development Centre* at the University of Saskatchewan, the province supports public sector plant breeding and several plant breeders who focus on developing crop varieties that can better withstand changing climatic conditions. In addition to the improvement of existing crop varieties, the province supports the development of new crops that will be suited to future climatic conditions in Saskatchewan. Saskatchewan also works with the federal government to support a strong suite of Business Risk Management programs for the agriculture sector, including Crops Insurance that assist growers in managing risks associated with crop yield declines that can be the result of extreme climatic events.

MANITOBA

Manitoba has taken significant measures over the past twenty years to reduce the impacts of flooding within the Red and Assiniboine River basins, as well as developed strategies to conserve polar bear, caribou, and moose populations, and address invasive species in Manitoba. Actions include enhancing infrastructure resiliency, provincial strategies on surface water management and drought preparedness, further adaptive initiatives in land-use and watershed planning, and working with municipal and Indigenous communities in the south and in northern Manitoba.

Other initiatives include the release of *TomorrowNow – Manitoba's Green Plan* in 2012, which included a three-phase adaptation pathway approach towards enhanced climate resiliency. Manitoba partnered with the University of Winnipeg to develop a weather and climate data inventory leading to the development of the Climate Atlas, and with International Institute for Sustainable Development to establish the Prairies Climate Centre. Following the Task Force Report on Agricultural Risk Management, early stages of a high-level provincial agricultural adaptation strategy are now underway, climate change adaptation considerations have been integrated into the Provincial Land-Use Policies, and a planning

resource guide has been developed to help municipal officials incorporate adaptation into land-use planning. Manitoba has also partnered with Health Canada on a Heat Alert and Response System initiative with Regional Health Authorities in Southern Manitoba.

In April 2016, a new government was elected and has made a commitment to develop a new made–in-Manitoba climate action plan, which will include measures to adapt to a changing climate across key sectors. Further stakeholder engagement will be undertaken. The new climate plan will include land-use and conservation measures that sequester carbon and foster adaptation to climate change, and incorporate climate change into watershed-based planning. Manitoba will also work with partners to implement a province-wide program based on the Alternative Land-Use Services model to help reduce flooding and improve water quality and nutrient management, and develop a framework to reconcile the needs of industry and rural and northern communities while continuing to enhance the network of protected areas in Manitoba. Collectively these measures support enhanced landscape resiliency to flood, drought, and other risks posed by a changing climate, thereby helping to ensure communities and economic sectors are better prepared and less vulnerable to these changes.

Manitoba was a key partner in both of the Prairies Regional Adaptation Collaboratives (PRAC) from 2010-12 and 2014-2016 with several initiatives accomplished within and across the three Prairie Provinces. Manitoba is a member of the Natural Resources Canada-led Plenary and Platform Working Groups and has participated in several sector-based projects funded under the Platform over the past three years.

ONTARIO

Building on recommendations from a climate change adaptation Expert Panel, the province released *Climate Ready: Ontario's Adaptation Strategy and Action Plan* in 2011. The Plan served as a first step at taking action across government on adaptation. It outlined 37 actions to be taken by ten ministries over the course of four years (2011 to 2014), including two overarching actions to ensure the ongoing mainstreaming of impacts and adaptation across ministries. Many of the commitments and actions outlined in *Climate Ready* have been completed, capitalizing on existing relationships, activities, and investments across government.

Based on commitments made in *Climate Ready*, ministries have continued to integrate climate change considerations in decision-making processes, both internal and external to government. In order to guide internal government decisions, climate change adaptation is to be considered in the ten-year *Infrastructure Plan*, including requiring the province or transfer payment partners (e.g., universities and municipalities) to prepare asset management plans that consider climate change adaptation in the project design. Additionally, future projected rainfall intensity-duration-frequency curves to understand the capacity and thresholds for key infrastructure in the province are being developed. Moreover, research partnerships for climate modelling and reviewing monitoring programs to support adaptation efforts are encouraged.

In order to guide decision-making by external parties, the development and demonstration of a range of tools to identify and assess vulnerabilities to infrastructure is supported. Projects have included the Public Infrastructure Engineering Vulnerability Committee's (PIEVC) risk analysis approach that was used to support municipal water sustainability planning. In addition, the plan supported stormwater-related projects and research, action, and capacity-building efforts related to adapting agricultural production.

Education and training programs on climate change impacts, vulnerability, and risk assessments to different stakeholders were delivered. Updating *Ontario's Building Code* to support climate change adaptation is an integral part of *Climate Ready*. Finally, ensuring climate considerations are reflected in environmental assessment by developing guidance material to assist proponents on projects.

In 2016, Ontario will commit to the release an update to *Climate Ready: Ontario's Adaptation Strategy and Action Plan*, which will include highlights of recent achievements on adaptation and provide details on the proposed Ontario Climate Change Modelling Collaborative that will help decision-makers so they can make effective, climate-resilient decisions. It will also create a one-window repository for information about current impacts and projections for the future. Finally, it will improve access to plan for and manage risks in areas such as farming, infrastructure, trade and shipping, and public health.

QUEBEC

In 2012, Quebec adopted its 2013-2020 government strategy for Climate Change Adaptation. Through commitment and action, the Strategy aims to reduce the impacts of climate change, to strengthen the resilience of Quebec society and to seize new opportunities provided by climate change. The Strategy is structured around eight priorities and seventeen underlying objectives that focus on specific challenges for Quebec: (1) maintain the health of individuals and communities, (2) preserve economic prosperity (3) improve the safety and longevity of buildings and infrastructures, (4) conserve biodiversity and the benefits of ecosystems, (5) integrate climate change adaptation into the public administration, (6) develop knowledge and know-how, (7) build awareness and provide training, and (8) modify land use and manage risks to reduce vulnerabilities.

The vast majority of the Strategy's objectives are realized through the implementation of the 2013-2020 Climate Change Action Plan that puts forward a complementary approach to reducing greenhouse gas emissions and adapting to climate to change. The Action Plan is financed through the revenues of Quebec's carbon market. As such, more than $200M is being invested in a wide range of concrete actions that will strengthen Quebec's collective capacity to adapt.

To better inform decision-making at all levels, the Government of Quebec has a strong partnership with the Ouranos consortium, which it helped create in 2001 to provide specialized information on regional climate science and adaptation. Ouranos has realized over 100 projects in collaboration with government, academia and industry. In addition to developing knowledge and decision-making tools, the Strategy and the Action Plan support specific initiatives in all sectors of adaptation, including ecosystem conservation, urban and municipal planning, disaster mitigation, and vulnerability assessment in coastal communities. The Strategy and the Action Plan also aim to strengthen collaboration at the international level. Following the Paris Agreement, the Quebec government announced a set of cooperative measures totalling $25.5M to fight climate change in Francophone countries that are the most vulnerable to the consequences of climate change.

Meant to be a collaborative effort, the Strategy and the Action Plan bring together stakeholders and key players in implementing actions from the Quebec government, municipalities, civil society, and research organizations.

For more information:
http://www.mddelcc.gouv.qc.ca/changements/plan_action/stategie-adaptation2013-2020-en.pdf
http://www.mddelcc.gouv.qc.ca/changements/plan_action/pacc2020-en.pdf

NEW BRUNSWICK

New Brunswick's Climate Change Action Plan 2014-2020 has a solid strategy and a range of actions identified to address climate change adaptation and enhance our collective resilience to the impacts of climate change. These actions are centred on a premise of providing information to help influence decision-makers to consider future climate in all aspects of decision-making. Goal 1 of the Action Plan speaks to Enhancing Resilience to the Impacts of Climate Change, identifying key actions in the focus areas of data collection and research into climate change impacts, risk and opportunity assessments, and mainstreaming adaptation.

Efforts in these areas include the dissemination of climate change knowledge (updated sea-level rise projections, climate-adjusted intensity-duration-frequency curves, coastal erosion monitoring, and updated climate indicators from Ouranos) used to inform decision-makers and the public as to future climate conditions and projected impacts to sectors such as health, infrastructure, and natural resources. Targeted workshops and conferences have been very effective in rolling out the latest climate change knowledge and adaptation measures.

The Province's efforts on climate change adaptation have focused on three main areas: engaging communities, infrastructure owners, and the natural resource sector to identify vulnerabilities and offer solutions and options to address climate impacts. These efforts have resulted in the undertaking of vulnerability assessments and the development of adaptation plans in numerous municipalities, the creation of an Adaptation Planning Guide for municipalities, the completion a cost-benefit analysis of adaption measures in the major trade corridor for New Brunswick and Nova Scotia, and providing Environmental Impact Reviews that guide project proponents to consider climate change in their project design, construction, and operation.

Key to success on climate adaptation is the ability to collaborate and leverage funding opportunities. The Climate Change Secretariat leverages a range of funding sources, including the Environmental Trust Fund, Natural Resources Canada, and the Gulf of Maine Council. The Secretariat has made significant efforts to collaborate with our neighbouring jurisdictions in the Atlantic region and leverage our individual contributions to achieve greater results as a collective than any individual province could achieve on its own.

The province is currently undertaking an initiative to explore options to enhance our current climate change action plan. A Select Committee of the New Brunswick Legislature was established to engage with New Brunswickers on the issue of climate change and report back to the Legislature with its recommendations.

NOVA SCOTIA

Nova Scotia's approach to climate change adaptation focuses on building capacity to mainstream adaptation into provincial government planning policies and operations. We do this by delivering an integrated program of work—the Adaptation Workplan—based on well-established social change and behaviour change theory and research. The Workplan emphasizes building socio-cultural competencies found to be associated with making progress on complex problems like climate change adaptation. The Nova Scotia Government launched the Adaptation Workplan in 2015.

The Workplan promotes and supports: information sharing, communication, collaboration, engagement, empowerment, leadership, commitment, simplification and informal networks—all of which are associated with building capacity to adapt to climate change in the Nova Scotia government context. The elements include an interdepartmental adaptation network for skill sharing and knowledge exchange, a formal commitment with partner departments, as well as co-designing adaptation projects and mainstreaming strategies. The Workplan approach also involves learning opportunities, ongoing monitoring and evaluation, and an annual symposium to highlight results. Participating departments include: Environment, Fisheries and Aquaculture, Agriculture, Transportation and Infrastructure Renewal, and the Office of Planning and Priorities. Additional partner departments will be added.

In addition to building adaptive capacity throughout the provincial government, Nova Scotia provides information and support to municipalities, industry, and community groups. Through our adaptation fund, Nova Scotia supports community groups and researchers who are directly at the frontlines of climate change. Since 2010, we have provided funding to support over 20 local, community-scale projects. These programs have enabled communities to build their capacity to prepare for climate change. Nova Scotia has also strived to raise awareness by sharing climate change information through workshops and presentations, conferences, and a dedicated climate change website (www.climatechange.novascotia.ca) that includes information about the impacts of climate change for Nova Scotia, future climate projections, research, and approaches that can be applied to prepare for climate change.

PRINCE EDWARD ISLAND

Prince Edward Island (PEI) is vulnerable to the impacts of climate change. Increased storm intensity and frequency, along with sea-level rise, are leading to increased coastal erosion and coastal flooding. PEI's coastal communities are particularly vulnerable, with publicly- and privately-owned properties, buildings, and infrastructure at risk to storm surges and receding shorelines.

Adaptation efforts on PEI in recent years have focused primarily on risk assessment, community engagement, capacity building, and supporting provincial and municipal decision makers. Since 2008, with funding from Natural Resources Canada's (NRCan) Regional Adaptation Collaborative (RAC) program, PEI has partnered with the Atlantic provinces and the University of Prince Edward Island Climate Lab to form the Atlantic Climate Adaptation Solutions Association (ACASA). Through RAC I (2009-2012), PEI's adaptation efforts included the enhancement and update of its coastal data (e.g., erosion rates, coastal flooding vulnerability, shoreline classification), vulnerability assessments of select coastal communities, and outreach to increase adaptive capacity amongst local decision-makers on PEI. Through RAC II (2012-2016), PEI continued its efforts in building capacity through local conferences and workshops (e.g., for engineers, planners, scientists, municipalities), and also continued its work

assessing coastal risk (i.e., coastal erosion and coastal flooding) for municipalities and coastal property owners. PEI also increased its efforts to better integrate climate considerations across provincial government, particularly in the area of infrastructure design, placement, and maintenance.

Through its partnership in ACASA, PEI also co-led two regional projects (funded by NRCan): the development of a decision support tool for small coastal communities and an economic analysis of adaptation option for coastal infrastructure and property. Both projects included extensive stakeholder involvement across federal, provincial, and municipal governments.

Future adaptation efforts on PEI will focus on the dissemination of existing products that will assist provincial and local decision-makers as they seek to minimize climate change impacts. PEI is also currently developing both a climate change mitigation strategy (to be released July 2016) and a climate change adaptation strategy (to be released July 2017) that will seek to minimize the impacts of climate change on PEI. These strategies will replace PEI's previous climate change strategy, *Prince Edward Island and Climate Change: A Strategy for Reducing the Impacts of Global Warming* (2008).

NEWFOUNDLAND AND LABRADOR

In 2011, the Government of Newfoundland and Labrador released *Charting Our Course: Climate Change Action Plan*, a five-year strategy that contained 18 commitments aimed at improving the province's resilience to the impacts of climate change. Progress has been made on all 18 of these commitments and implementation is ongoing. The commitments focus broadly on improving the understanding of climate change impacts in Newfoundland and Labrador and mechanisms to integrate that understanding into decision-making by individuals, businesses, communities, and governments. This action plan expires at the end of 2016 and the current Government has committed to developing a new climate change strategy.

With the collaboration of various stakeholders, provincial efforts related to adaptation have put forth programs and actions. To increase collaboration on this issue, the Government of Newfoundland and Labrador established an *Adaptation Network* that includes representatives from government departments, industry, and Memorial University. The network identifies research needs and shares best practices for integrating climate change adaptation into decision-making. As a result of this network, the impacts of climate change are being more thoroughly considered in the government's decision-making processes for environmental assessments and the granting of crown land.

Additionally, climate data and science, facilitated through a *Climate Information Portal*, such as climate projections and updated intensity-duration-frequency (IDF) curves for Newfoundland and Labrador inform planning and decision-making to improve resilience to climate change. IDF curves are critical tools for ensuring that infrastructure designs are able to withstand increases in precipitation, including vital transportation, municipal, marine, and mining infrastructure. Moreover, the establishment of 112 coastal erosion monitoring sites inform planning and development decisions given the risk of more rapid coastal erosion in a province where 90% of the population lives along the coast.

Capacity building and education is facilitated and maintained through workshops in partnership with Engineers Canada to raise awareness of climate change impacts on infrastructure and available datasets among local decision-makers, engineers, and planners at the provincial and municipal levels. In addition, public awareness is encouraged through the development and roll out of an award-winning public

campaign including a comprehensive and authoritative website (www.turnbackthetide.ca) to provide tips, information, and resources to individuals, business, and communities about how to enhance resilience to climate impacts and reduce greenhouse gas emissions.

FEDERAL GOVERNMENT

Domestic action on adaptation by the Government of Canada is guided by the *Federal Adaptation Policy Framework*, approved in 2011. The objectives of the Framework include ensuring that Canadians understand the impacts of climate change and have the information and tools they need to adapt effectively. The Framework established a federal role that includes generating and sharing knowledge, building capacity, and supporting the integration of adaptation into decision-making processes. This role recognizes unique federal expertise (e.g., climate research and related information) and the federal government's ability to generate knowledge and information that can be applied across regions and sectors, thereby minimizing duplication of efforts. The Government also has direct responsibilities for areas and populations particularly vulnerable to climate change, including oceans, the North, and Indigenous peoples.

Programs
Currently, seven departments and agencies deliver targeted programs which provide information and tools to support risk assessment, planning, and decision-making in the most vulnerable sectors and communities. The federal government has committed to working with provinces and territories, Indigenous Peoples, and municipalities to bring together partners to share and leverage knowledge, capacity and resources.

Natural Resources Canada's *Adaptation Platform* is an example of such an initiative. It brings together key groups from government, industry and professional organizations, to collaborate on adaptation priorities. The *Adaptation Platform* was built to promote collaboration among those who have a collective stake and role to play in making Canada more climate-resilient. The overarching goal of the *Adaptation Platform* is to create an enabling environment for adaptation, where decision-makers in regions and key industries are equipped with the tools and information they need to adapt to a changing climate.

The 2016 federal budget provided funding for a range of activities that will build resilience across Canada. More specifically, $129.5M is dedicated to seven departments and agencies for a suite of federal adaptation programs related to science, health, northern and Indigenous communities, and key economic sectors. Moreover, $40.0M is given to the National Research Council to develop climate-resilient building and infrastructures codes and guides, building resilience in our communities and making economic sectors more competitive. Additionally, $75.0M is committed to the Federation of Canadian Municipalities, part of which will help local governments conduct climate risk assessments and planning.

Assessments
Assessments have been performed by departments and agencies as a tool to further highlight the importance of understanding and addressing climate change impacts. These assessments are scientific reports that assess, critically analyze, and synthesize the growing knowledge base on the issue. Working with subject matter experts in government, universities, and non-government organizations, departments produce science assessments that are current, relevant, and accessible sources of

information, to help inform planning of policies, program, and actions. Assessments have been completed at the national scale, namely, through *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation (2014)*, *Canada's Marine Coasts in a Changing Climate (2016),* and *Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity (2008).*

Climate Science and Information

The federal government undertakes science and monitoring activities related to past, present and future states of the climate system and how it functions, as well as on the changing composition of the atmosphere and related impacts. These activities include foundational climate and climate change science and climate information and services provided by federal departments to inform effective adaptation planning and implementation.