

FRAMING OUR FUTURE



OTTAWA'S LONG-TERM RISK PREVENTION & MITIGATION PLAN



The Project Partners

City of Ottawa
City of Gatineau
National Capital Commission

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An Executive Summary of this Plan is available in French. The City of Ottawa will translate the Plans in their entirety once they are received by Council.

Un sommaire exécutif de ce Plan est disponible en français. La Ville d'Ottawa fera traduire intégralement les Plans une fois qu'ils auront été reçus par le Conseil.

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Foreword

Choosing our Future is an initiative of the City of Ottawa, in partnership with the City of Gatineau and the National Capital Commission, to guide Canada's Capital Region towards a more sustainable, resilient and liveable future. Inspired by goals for economic prosperity, social well-being, culture and identity and a healthy environment, proposes strategies that position the Region to thrive in a changing world.

Almost every aspect of our communities will likely change over the next 50 years. The forces of change include a shifting global economy, resource scarcity and rising energy prices, a changing climate, new population dynamics, and unforeseeable events such as ice storms and other natural disasters. New technologies will change everything from how we communicate with each other to how we heat our homes. While many of the changes ahead are unclear, we can make choices today that build more sustainable communities, resilient in the face of change and offering residents a highly desirable quality of life.

Three Plans¹ were developed to guide the Partners:

- The *Sustainability and Resilience Plan* is an overarching plan that identifies a long-term vision and set of goals which speak to all dimensions of sustainability—economic, social, cultural and environmental. A set of strategies outlines the broad directions to be pursued to achieve these goals over the long-term, while examples of actions show specific ways to implement the strategies now and in the future.
- An *Energy and Emissions Plan*, a sub-plan of the *Sustainability and Resilience Plan*, focuses on increasing renewable energy and reducing energy demand. It describes a comprehensive approach to reducing greenhouse gas emissions through land use as well as strategies for buildings, energy supply, transportation and waste. This Plan also provides direction on reducing energy costs for citizens, businesses and institutions.
- The *Risk Prevention and Mitigation Plan*, also a sub-plan, combines sustainability planning with long-term risk management. It assesses the effects of long-term risks on our communities and describes how the *Sustainability and Resilience Plan* mitigates or prevents them. It then considers the vulnerabilities we may still face and recommends additional measures for Ottawa's emergency management program.

These Plans build on the spirit of cooperation shared by the Partners in the initiative. They are intended to provide a common framework to guide the Partners' decisions on major plans, policies and programs going forward. The Plans are also a call to action—
an invitation to organizations, businesses and individuals across the Region to get involved in the process of making the transition to a more sustainable community.

¹ Available at <http://www.ottawa.ca>

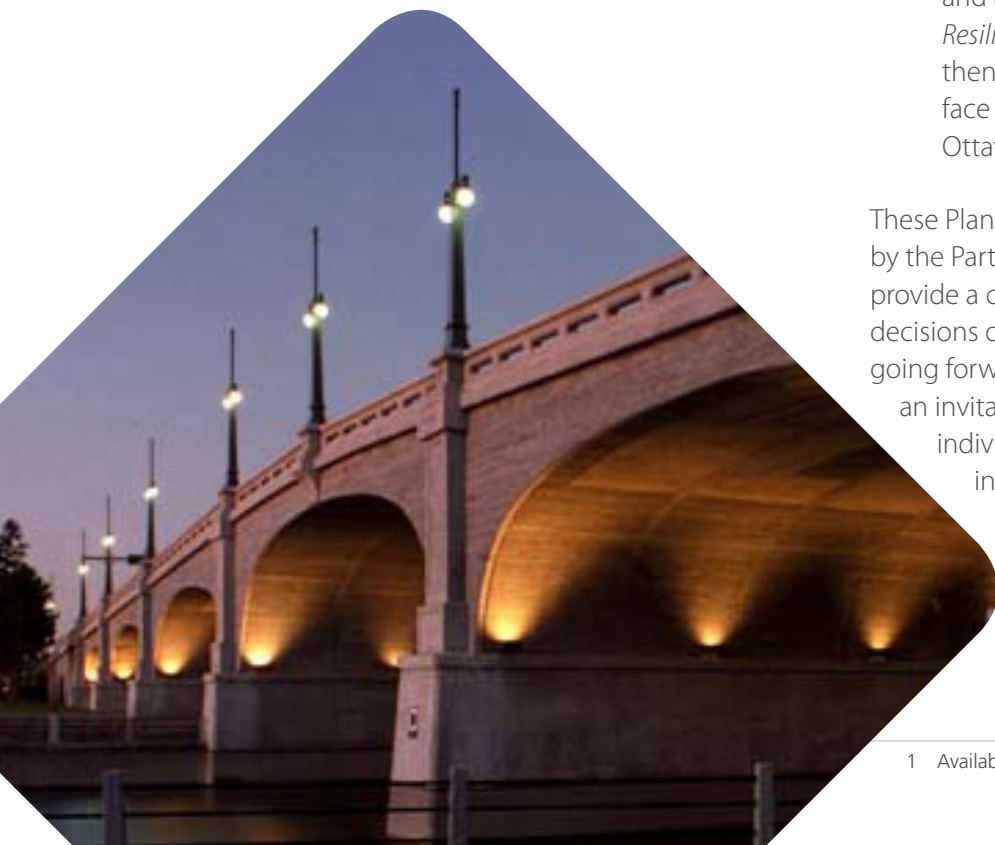


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Executive Summary

The *Risk Prevention and Mitigation Plan* (RPMP) addresses the long-term prevention/mitigation component of emergency planning for the Region as a whole and the City of Ottawa. While Ottawa's current Emergency Management Program examines windows of five years to address the City's identified vulnerabilities, the three *Choosing our Future* Plans respond to the Region's need to be more proactive in addressing prevention, mitigation, adaptation, and shock resiliency to respond to emerging future trends and conditions.

The challenges of a changing world suggest a need to become more proactive, designing infrastructure systems and communities to be inherently less vulnerable. Where the risks are unknown or difficult to predict, the best design solution may be diversity, self-reliance and systems that are flexible and adaptable by nature. By looking at the challenges of the future, the question this Plan is setting out to answer is—what can we do in the short- and medium-term to ensure a safe and sustainable future?

The Risk Prevention and Mitigation Plan explores existing vulnerabilities alongside long-term trends for the Region and what these vulnerabilities could mean if we do not adopt a different path. The Plan describes

how the *Sustainability and Resilience Plan* addresses many vulnerabilities through a series of preventive, mitigation or adaptive strategies. For example, a water conservation strategy addresses the water consumption, energy consumption and cost-related issues of our water supply while also helping to address the vulnerability associated with a changing climate that may affect rainfall patterns in coming decades.

The Sustainability and Resilience Plan, however, contains strategies that may not fully address certain vulnerabilities. For example, a move toward greater intensification of neighbourhoods may increase the heat island effect and exacerbate vulnerabilities associated with heat waves unless measures such as 'cool roofs' are introduced. In response, this Plan suggests a further set of measures that can address these remaining vulnerabilities.

This long-term Plan complements Ottawa's Vulnerability Analysis¹, which examined the probability, consequence and response capabilities for a list of potential threats in the short-term (5 years).

¹ City of Ottawa, Security and Emergency Management, 2011)

Based on short-term vulnerabilities, the sustainability path, and long-term prevention and mitigation strategies, the City of Ottawa will develop its Mitigation Program that will inform short- and medium-term policy and program decisions covering issues such as land use planning, infrastructure development and emergency services. The *Risk Prevention and Mitigation Plan* will provide guidance and strategic direction to the Official Plan, Infrastructure and Transportation Master Plans, Environmental Strategy, People Services Plan, Cultural Strategy, Emergency Management Program, and Long-Range Financial Plan.

While the Plan can be used as a stand-alone document, for important details it should be read in conjunction with the *Sustainability and Resilience Plan*.

**Quote from the 2011
Vulnerability Analysis**

“ While it is unclear how many of the forces of change will precisely shape the Region and the threats it will face, what is clear is that the potential for change and volatility of the types of threats Ottawa will face is incredibly high. Consequently, the City will need to be prepared for the modes of action of a wide range of threats, and will benefit from tracking and considering emerging trends as it updates its vulnerability analysis every five years. ”





1 Introduction

1.1 Purpose

The purpose of the *Risk Prevention and Mitigation Plan* (RPMP) is to specifically address the long-term prevention/mitigation component of emergency planning for the Region as a whole and for the City of Ottawa.

The RPMP is part of an integrated set of initiatives dealing with long-term community sustainability and resilience. Building a sustainable community is a proactive way to strengthen the capacity of the Region to respond to change and potential disasters.

While the RPMP is applicable to the entire Region, it was born out of Ontario's Emergency Management and Civil Protection Act requirement that each municipality develop an emergency program that includes four core components: mitigation/prevention, preparedness, response and recovery. For this reason, this Plan is addressed more specifically to the City of Ottawa.

The *Risk Prevention and Mitigation Plan* is a long-term Plan that complements Ottawa's updated Vulnerability Analysis (2011), which examined the probability, consequence and response capabilities for a list of

potential threats in the short-term (5 years). Ottawa's first Vulnerability Analysis (2003) was updated in 2010/11 using an improved methodology. The updated analysis also considered long-term forces for change (or the challenges of the 21st century) and potential implications for emergency planning.

The Plans complement Ottawa's current Emergency Management Program by addressing prevention and mitigation from a long-term, integrated perspective. The three Plans respond to the Region's need to be more proactive in anticipating and addressing prevention, mitigation, adaptation, and shock resiliency to respond to emerging trends and conditions.

This new long-term resiliency perspective changes our perception of the number and nature of threats. Over the long-term, cities can expect to encounter a shifting global economy, resource scarcities and price fluctuations, a changing climate, new population dynamics, and new energy and technological systems. This new perspective underscores the importance of multiple disciplines including urban planners, engineers and designers becoming fully engaged in emergency planning. By taking a resiliency perspective over the long-term, we can design communities to

be not only prosperous and liveable but also ensure our communities and critical infrastructure systems are inherently less vulnerable. Where the risks are unknown or difficult to predict, the best design solutions may be to increase diversity, self-reliance and systems that are flexible and adaptable by nature.

1.2 Why Do We Need To Consider Vulnerabilities and Resilience?

“Resilience” is the capacity of a system (such as a city or region) to withstand stress and /or undergo change and still retain its basic function and structure. Canada’s Capital Region faces many challenges and choices about how to ensure that the Region is sustainable, liveable and resilient. The *Choosing our Future* initiative (CoF) has identified a clear set of long-term sustainability goals to guide these choices and to move the Region towards an enhanced sustainable and resilient future.

The Region’s governments and its citizens are working toward these goals in the face of uncertainty regarding future physical and socio-economic conditions. For this reason, any choices made about the future need to contribute to, rather than diminish, the Region’s level of resilience.

1.3 What constitutes “Vulnerability”, “Resilience” and “Risk”?

The world’s population lives in an increasingly complex, volatile and interdependent world. There are a number of socio-economic, environmental, and technological forces shaping the world in which we live. These forces have been described and analyzed in a series of Forces Papers and Foundation Papers prepared to lay the groundwork for the *Choosing our Future* initiative. These papers describe global and local patterns and trends that will affect Canada’s Capital Region as well as most other parts of the country. These include economic change, technological change, resource and energy scarcity, demographic change, change to our climate, and sudden shocks or

unforeseen events. Each of these forces presents a risk for the Region. The choices made in the Region about land use, transportation, buildings, energy systems, infrastructure and social, cultural, and economic development will increase or decrease its vulnerability to these forces.

A **vulnerability** can be understood as an “intrinsic property that can result in the susceptibility to a risk.”¹ In other words, a vulnerability is like the unlocked front door of a house when the occupants are away—the existence of the unlocked door does not guarantee that a burglary will take place, but it makes the house more susceptible to the risk of burglary. As an example, the Region’s continued reliance on fossil fuels for transportation increases our vulnerability to fuel price increases.

A **risk** can be understood as the “effect of uncertainty on objectives”². Identifying and assessing risk involves considering events or conditions for which there is uncertainty and how those events could affect achievement of objectives. Therefore, risk is a function of likelihood and impact. The risk of a financial loss due to burglary could be assessed based on the likelihood of the house being burgled and the impact (in terms of the financial loss) of the stolen items. In this case, it is assumed that financial security is an objective of the household. Other objectives, such as safety, could also be considered in assessing impact. A vulnerability increases the likelihood or the impact of the event. Factors that increase resilience help prevent or mitigate (reduce the scale or impacts of) risk.

Resilience can be understood as the ability to mitigate risk and recover quickly from adverse events or conditions. A resilient community therefore has two distinct qualities:

1. It has a low level of vulnerability, meaning that it can withstand adverse events; and
2. It has the capacity to adapt and quickly recover from disasters.

1 As defined in ISO 31000, the International Risk Management Standard.

2 *Ibid.*

Diversifying and decentralizing the Region's energy supply infrastructure is an example of a resiliency measure. Not only does this mitigate the risk of fossil fuel energy price increases (reducing a key vulnerability) but it also means that the community would be able to more quickly recover from a disaster that impacts key energy supply lines.

Resilience is one of the foundations of sustainability. A more resilient entity is more likely to be a sustainable one. Sustainability is concerned with long-term patterns that affect health and well-being. Because we live in an era of increasing uncertainty, the ability to bounce back from or withstand major disruptions is critical to ensuring long-term health and well-being. A resilient community is adaptable, durable and self-reliant.

In the words of another author, "In theory, sustainable and resilient communities should be able to withstand extreme geophysical processes and recover rapidly from disasters whenever they occur. Sustainability and resilience, then, are contingent upon careful planning and organization of society, both to ameliorate the impacts of disasters and to facilitate the recovery processes. Such comprehensive planning must encompass mitigation strategies to reduce risk and exposure, post-disaster plans to promote short- and long- term recovery, and careful consideration of structural and cognitive factors that will influence program effectiveness."³

1.4 Plan Organization

This Plan is presented in five sections:

Section One presents the purpose of the Plan, introduces the concepts of vulnerabilities, resilience, and risk prevention and mitigation, and explains the linkage between resilience and sustainability. It provides an overview and identifies the information sources that have informed this Plan.

Section Two explores the existing types of vulnerabilities and stresses in the Region that will test the Region's resilience. Vulnerabilities and stresses are examined alongside long-term trends for the Region and what these could mean if we do not adopt a different path.

Section Three provides an overview of the strategies proposed in the *Sustainability and Resilience Plan* that could be pursued to increase sustainability in Canada's National Region. It then identifies how these strategies may create additional vulnerabilities or concerns.

Section Four presents a series of prevention and mitigation strategies that the City of Ottawa and its partners could implement to better address the long-term vulnerabilities identified in Sections 2 and 3, and further enhance the Region's resilience.

Section Five discusses how the Plan will be implemented by the City of Ottawa.

1.5 Information Sources and Limitations

This Plan supports implementation of the *Sustainability and Resilience Plan*, a plan which directly addresses themes that local government and the NCC are able to influence:

- Buildings and Energy Supply;
- Land Use;
- Mobility;
- Water and Wastewater Infrastructure;
- Solid Waste and Recycling;
- Natural Systems;
- Social Development;
- Culture and Identity;
- Food and Agriculture; and
- Economy.

³ Tobin, G.A. "Sustainability and community resilience: the holy grail of hazards planning?": *Environmental Hazards* 1 (1999) 13|25

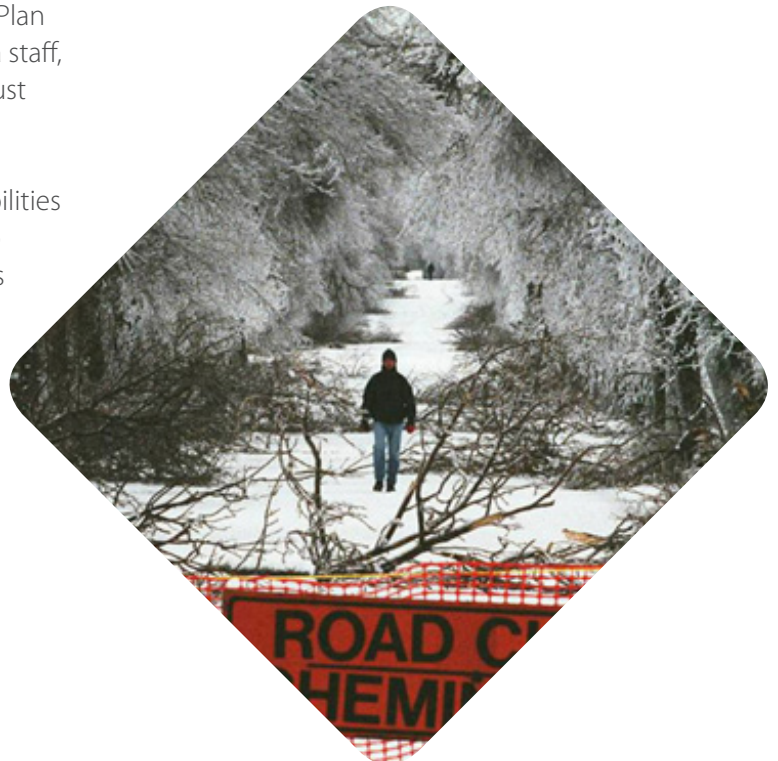
Section 2, which describes potential vulnerabilities of the Region, has been informed by a series of papers entitled *Forces Shaping the Future* which describe the big picture forces of change affecting the Region, including:

- Demographic Change;
- Sudden Shocks;
- Technology;
- Economy and Globalisation; and
- Climate Change.

It also builds upon the results of the short-term Vulnerability Analysis completed in 2010/11 by the City of Ottawa Security and Emergency Management. This included the outputs from a workshop held on July 7, 2010 with experts from the Region that described how the various forces could manifest locally.

The strategies recommended in Section 4 of this Plan were informed by discussions with City of Ottawa staff, as well as the outputs of a workshop held in August 2011 with project Partners and other experts.

The next chapter examines the risks and vulnerabilities that the Region may encounter in the medium to long-term. It is important to note that the analysis of vulnerabilities presented in Section 2 does not represent a prediction or forecast of the future; rather, it identifies potential areas of vulnerability based on current understanding of forces that could affect the Region.





2 Risks & Vulnerabilities

2.1 Forces of Change Influencing the World in Which We Live

There are a number of forces at work that may affect the environmental, social, cultural and economic conditions in which we live over the next fifty years or more. These forces include:

Economic change – The 2008 financial crisis, slow economic recovery and more recent US and European debt crises have demonstrated how interconnected and vulnerable the global economy and financial system can be. This poses an on-going risk for all cities and regions. As Canada’s most significant trading partner, slow economic recovery in the US continues to pose a risk for the economy of Canada’s Capital Region.

In addition, a growing population and increasing resource scarcity—particularly around fossil fuels, food and water—will create increasing levels of vulnerability.

Technological change – The development and application of new innovative, technologies has the potential to continue to create economic

advantages and significant environmental benefits for the Region such as improved energy efficiency, improved connectivity and to aid diverse populations to participate in public discourse. However, some technologies may also exacerbate vulnerabilities. For example, the many electronic gadgets we now use have increased the plug loads (energy use) in many homes, increasing our dependence on energy supplies.

Technological change could also lead to completely new technologies that may yield unintended consequences and challenges society will need to address.

Demographic change – The ongoing shift towards an unprecedentedly large population of seniors is one of the greatest demographic changes occurring in Western industrialized countries. This is predicted to place larger burdens on the Canada Pension Plan and Health Care system. In addition, declining birth rates in Western countries like Canada⁴ may result in a

⁴ Not only do we have an aging population but our birth rate is declining. The rate required to maintain the current Canadian population level is 2.1 births per woman while the actual fertility rate in Canada lies at approximately 1.5 births per woman. In Ottawa the birth rate has been dropping over the past two decades. From 2000-2002 it was about 1.43 births per woman.

smaller labour pool and the need to increase levels of immigration, particularly from Asia, Latin America and Africa, where populations are relatively young.

Sudden shocks – In addition to the vulnerabilities described above, an increasingly interdependent world has created greater vulnerability to “sudden shocks,” or unforeseen events that potentially have significant consequences (e.g. floods, ice storms, resource scarcity).

Climate change – A changing climate may significantly alter weather patterns, increasing the likelihood of severe storms, floods and heat waves.

These forces are described in detail within the series of papers entitled *Forces Shaping the Future*.

2.2 Current Trends

Different communities are more or less vulnerable to the forces of change described above. The level of vulnerability will depend on geographic and historical factors, decisions about land use and infrastructure investments, community capacity and preparedness and the level of emergency planning to date. This section provides an overview of some key trends that will affect the level of future vulnerability in the Region.

Land Use, Growth Management and Urban Form

While multi-unit housing starts have increased in recent years, the Region has seen strong demand for single-detached houses, averaging 44% of starts in Gatineau and 48% of starts in Ottawa over the last 25 years⁵. While the amount of intensification (development in existing areas) is increasing, many new dwellings continue to be built at the urban periphery and in rural areas. This pattern of development pushes the boundaries of urban areas further into the countryside, resulting in longer commute times, a loss of agricultural land, and loss of woodlands and wetlands. This directly impacts

ecosystems and regional food security. The increase in impervious areas means that rainfall runs off more quickly, placing greater stress on infrastructure and potentially exacerbating flooding risks. Large areas of pavement and other heat-absorbing materials also increase the temperature in cities, resulting in increased energy consumption, human health problems, and loss of water quality as heated stormwater flows into stormwater ponds and ultimately into creeks and rivers. This pattern of growth can also result in higher municipal costs for roads, transit, water and sewer services and other municipal services, and higher taxes and fees for residents. Low density growth at the periphery and in rural areas is more expensive to service than growth within areas close to the urban core. Given current infrastructure investment gaps, adding a disproportionate amount of infrastructure per new household only serves to exacerbate this challenge in the future.

The shape, density and design of our communities will have a strong bearing on our dependence on energy. It will be a major factor in determining the scale of GHG emissions in the Region from energy use in housing to transportation. Similarly, while mixed-use and compact neighbourhoods promote ‘walkability,’ poorly designed and single use neighbourhoods are related to automobile dependency and more sedentary lifestyles and related health problems.

Transportation and Mobility

Although the Region’s investment in transit and transit ridership has been strong, automobiles remain the dominant means of transportation, accounting for 71% of all trips in a 24-hour period in 2005⁶. This makes Canada’s Capital Region vulnerable to obesity-related health impacts, air pollution and



5 City of Ottawa. Planning and Growth Management Department. 2009 Annual Development Report. September, 2010. http://www.ottawa.ca/city_services/statistics/dev_report/pdf/adr_2009_en.pdf

6 City of Ottawa. Transportation Master Plan. 2008. Section 2.3 Current Travel Patterns and Trends summarizes the 2005 Origin-Destination survey of travel within Canada’s Capital Region. http://www.ottawa.ca/city_hall/master_plans/tmp/index_en.html

higher energy prices. As fuel prices increase, vehicle use may become more unaffordable and increase both household and business costs. Rising obesity rates and diseases associated with sedentary lifestyles have been linked with urban form and the reliance on automobiles. Respiratory diseases such as asthma have also been linked to the air pollution resulting from high rates of automobile use.

Buildings and Energy

Buildings and activities within them account for an estimated three-quarters of the energy consumption in the Region, with transportation accounting for the balance. Existing buildings will account for most building energy consumption and emissions in Ottawa over the next half century. Energy retrofits can improve performance of these buildings by up to one third using existing and available technology and construction measures.

Quebec is fortunate to have a reliable source of clean hydro-electric power which makes it less susceptible than Ontario to fossil fuel energy price fluctuations. Through its *Green Energy Act*, Ontario is endeavouring to reduce its reliance on fossil fuels. However, renewable energy and nuclear power also have vulnerabilities that need to be addressed.

Energy Costs

Continued increases in energy consumption make the Region's businesses and households vulnerable to energy price volatility. Energy and emissions modeling has shown that if current trends continue, household energy spending on local travel and home heating and cooling in the Region could increase from \$2,800/year in 2008 to over \$4,000 in 2040. Total energy spending in the Region could increase from \$2 billion annually in 2007 to over \$5 billion by 2040 unless energy consumption is reduced through greater building efficiency, increased use of public transit, and other measures.⁷

⁷ Refer to the *Energy and Emissions Plan*, 2012 for more detail.

Materials and Waste

Recycling and solid waste management have steadily improved and the Region now diverts almost 40% of residential waste through re-use, recycling and waste to energy conversion. However, the total amount of residential waste is increasing and 60% of residential waste still ends up in landfills. Further, residential waste is only 30% – 40% of the total waste produced in the Region, with the larger share produced by the industrial, commercial and institutional sectors and which is regulated at the provincial level.

Water and Wastewater

Water treatment and distribution and wastewater collection and treatment systems are a key part of the Region's critical infrastructure. As such, these systems directly affect our ability to manage risks and vulnerabilities. In Ottawa, risk prevention and mitigation has been one of the key considerations for the design of our infrastructure systems. Risks to the water and wastewater system include:

- Higher intensity of storm events and rapid melting of ice/snow that can lead to flooding of urban areas and overflow of combined sewers;
- Failure of major water or sewer lines due to earthquake, accidental rupture;
- Contamination of the water supply system through acts of terrorism/vandalism or accidental leakage of hazardous materials;
- Increased operational costs due to higher priced energy; and
- Sustained Region or city-wide power failure.

During the last 15 years, significant changes to the Ontario Plumbing Code, as well as various municipal initiatives have had a sizable impact on reducing water requirements in Ottawa. As a result, the average daily flow in the Ottawa system is now similar to levels in the 1980s in spite of population growth. Residential water consumption is higher in Gatineau than in Ottawa, since a flat rate is charged throughout Quebec. Generally, water consumption is lower when water is metered.

The changing climate is expected to alter water flow patterns, ground and surface water levels and affect water supplies, sometimes in unpredictable ways. Diminishing surface water and groundwater supplies coupled with increasing demands for these resources may challenge all aspects of water resource management. The volume of wastewater generated, the infrastructure and energy needed to manage it, and the effect it has on rivers and streams when it is treated and discharged is directly related to water consumption.

Economy

The local economy continues to be predominantly dependent on the federal government and, to a lesser extent, the technology sector.

Like most metropolitan regions, the health of the Region's local economy is strongly tied to the economic health of our major trading partners, especially the United States. The Region will continue to be vulnerable to global economic downturns.

There is also a risk that the Region will lose out on the competition for talent (including general labour and knowledge workers) to the so-called BRIC⁸ countries where greater opportunities may be perceived by some potential immigrants and companies looking for opportunities.

Natural Systems

Natural systems of forests, wetlands and watercourses have been and continue to be disrupted by:

- Urban and rural development;
- Road construction;
- Air pollution from a growing number of vehicles;
- Chemical and physical alteration of wetlands and water bodies;
- Subsequent loss of aquatic habitat;
- Invasive species; and
- Agricultural practices that may affect water quality in rural areas.

Together, these losses are a threat to biodiversity and the overall health of the Region's ecosystems.

Recreational use also negatively impacts the ecological function of natural areas. With a population of almost 1.2 million nearby, Gatineau Park receives over 1.7 million visits per year, placing significant pressure on its natural processes. User numbers are also high in the Greenbelt and NCC's urban lands— areas surrounded by all types of land uses (residential, commercial, recreational and institutional).

Food and Agriculture

Conventional food production is high in energy and chemical inputs, although sustainable practices continue to evolve and are increasingly affordable for farmers and consumers alike. Much of the crop in the Region is exported and the Region continues to import much of its food. Unless agricultural land is protected from urban and rural development, there is a risk of becoming more and more reliant on food imports, increasing the Region's vulnerability to food price shortages and increases. Additionally, energy price increases would also increase food prices, affecting affordability and adding to the Region's vulnerability.

A growing world population and impacts to crop production such as floods or droughts around the world may also impact food prices in the Region, making it increasingly difficult for many families to afford a healthy diet.



8 BRIC - Brazil, Russia, India, and China.

2.3 Vulnerabilities Based on Current Trends

If current trends continue, the challenges of the 21st Century could create or exacerbate a number of vulnerabilities in the Region. This sub-section examines those vulnerabilities.

EXISTING VULNERABILITIES

The City of Ottawa has undertaken a Vulnerability Analysis⁹ focusing on shorter-term vulnerabilities. Although not the direct focus of this paper, many of these vulnerabilities will over time interact with the longer-term challenges, so it is important to be aware of them.



There are 7 areas of general concern ranked as follows:

1. **Earthquake:** A seismic event resulting in structural collapse, natural gas leak and/or structural fire.
2. **Critical Infrastructure Failure:** A failure which includes assets such as water, sewer, telecom, electricity, IT or natural gas.
3. **Summer Storm:** A weather related storm caused by a tornado/wind storm, wild fire, flooding, thunder/lightning storm, hail storm or heat wave/drought.
4. **Hazardous Material:** Harm caused by the release of dangerous goods including toxic chemical release/spill, flammable liquid release/spill or radiological dissemination.
5. **Winter Storm:** A weather related storm caused by a heavy snow fall, cold wave or ice storm.
6. **Terrorism / Public Safety:** An act of coercion that involves an explosion, bomb threat, suspicious package, airplane crash, mass casualty situation or a demonstration/riot.

⁹ The City undertook a vulnerability analysis in 2003, which was subsequently updated in 2010/12. The results of this analysis are presented under separate cover.

7. **Public Health:** A health related event caused by a communicable disease outbreak, food poisoning, water contamination or atmospheric contamination.

These vulnerabilities are associated with both natural and human events. The City of Ottawa and other organizations in the Region have made investments which have reduced the levels of these and other vulnerabilities. However, future challenges may require increasing levels of investment or changes in the way cities are planned and designed in order to minimize the associated vulnerabilities.

ANTICIPATED VULNERABILITIES

This section outlines some of the vulnerabilities we can anticipate in the Region:

Vulnerabilities related to Economic Change

There are a number of macro-level factors that create vulnerability for the Canadian economy and, as a consequence, for Canada's Capital Region.¹⁰ These include a strong reliance on the U.S. economy as a trading and investment partner (at a time when China, India, Brazil and other emerging economies are growing) and a high reliance on natural resources to fuel Canadian Gross Domestic Product (GDP) growth. Associated vulnerabilities could include:

- **Resource scarcity** – Many experts have been discussing the “peak oil” phenomenon, wherein the levels of fossil fuels available to sustain global energy demand are diminishing. Similarly, population growth and increased economic affluence in many countries has led to higher levels of consumption of materials overall. Meat consumption is increasing, placing greater pressure on grain production and increased pressure on food prices. Resource scarcity may lead to additional vulnerabilities, such as:

¹⁰ A Risk workshop conducted with experts in various fields in June 2010 identified a number vulnerabilities including those in this section

- » *Crime – petty crime and organized crime* – Dramatic decreases in the availability of essential resources may lead to increased crime levels. This could include petty crime, particularly crimes of opportunity, as well as organized crime. As with any economy suffering from resource scarcity, black market activity through organized crime could become acute;
- » *Malnutrition, health issues* – Higher food prices may increase the risk of malnutrition and obesity, as households may be forced to make less nutritious but more affordable food choices. This may subsequently increase the possibility of health-related impacts and emergencies; and
- » *Rising fuel costs* – Rising fuel costs could increase the cost of living. A continued reliance on the personal automobile will make this impact more acute.
- **Rising Gap Between Rich and Poor** – Inequality within societies results in more social problems among those in the lower socio-economic groupings.¹¹ According to a special advisor at the International Monetary Fund speaking at 2011's World Economic Forum in Switzerland, the increase in inequality is the most serious challenge facing the world. The Conference Board of Canada's report released September 2011 indicates that the gap between rich and poor in Canada has been rising at a faster rate than in the U.S. since the mid-1990's, although the U.S.' actual gap is larger.
- **Health Impacts** – Downturns in the global economy may result in reduced incomes for retirees and reduced employment within the labour force. Reduced incomes and lower rates of employment—especially employment that includes health and other benefits—reduces full access to health care and other benefits such as maternity leave and disability insurance. These losses can adversely affect quality of life and life expectancy.
- **Shifts in Work-Tenure** – The rise of temporary, part time and contract work, across many employment sectors, may lead to periods of unemployment and work uncertainty including those in the public sector as well as some highly-skilled workers. Together with the absence of health and other benefits this could have implications for quality of life.
- **Energy Expenditures** – The future could see increased spending on household energy use for transportation and home heating and cooling as fuel prices rise. An analysis performed for *Choosing our Future* found that average household energy spending in the Region could increase from \$2,800/year to more than \$4,000/year by 2040.¹²
- **Municipal Expenditures** – Continued low-density growth at the periphery and in rural areas is more expensive to service than growth within existing areas close to the urban core. Public infrastructure projects such as roads, sewers and transit may be funded through increases to individual property taxes, with these services crowding spending on health, social, and cultural services.
- **Unemployment** – A sudden change in economic conditions could create high levels of unemployment, particularly if the federal government remains the primary sector of employment in the Region. Long-term and ongoing cuts to federal programs without parallel efforts to diversify the local economy may create high levels of local unemployment with a number of social and related consequences, including increased crime and loss of opportunity for young people. Larger numbers of people may choose to leave the Region for work elsewhere, with potential impacts on community cohesion and housing prices.

¹¹ *Spirit Level – Why Equality is Better for Everyone*; Richard Wilkinson and Kate Pickett, Penguin Books, 2010, p.18

¹² These figures account only for expenditures per unit of energy (such as a litre of fuel or a gigajoule of gasoline) used for residential and commercial buildings and transportation. Fixed costs (monthly service charges) and areas outside which are largely outside of municipal influence, such as industrial and aviation energy are not considered. More information can be found in the *Regional Energy and Emission Plan* (2011).

- **Social Tension / Labour Conflicts** – Economic downturns may also create social tensions locally as economic prospects become scarcer. Labour negotiations may become more challenging as organizations struggle through the downturn. If income distribution becomes more polarized, then the risk of social tension may increase.

Vulnerabilities related to Technological Change

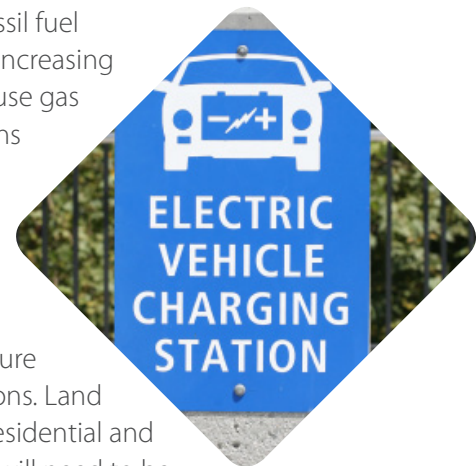
While new forms of technology have the potential to create new efficiencies, they also have the potential to create vulnerabilities. Some of these vulnerabilities include:

- **Isolation** – Social isolation because of an unhealthy immersion in technology has already become an issue in many communities. The potential exists for this to increase as technological advances change the way people communicate and interact with each other. Increased isolation may have adverse impacts on social cohesion as well as negative effects on mental health.¹³
- **Obesity and other health problems** – Similarly, technology could increase the risk of obesity and other health problems. This could be exacerbated by the amount of time people spend in vehicles commuting and the decreased level of, and access to, green spaces.
- **New forms of crime** – New technologies could be used to perpetrate old crimes with a modern twist, such as new forms of fraud or identity theft.
- **Loss of opportunities for local business** – An increase in demand for online retailing may reduce the business opportunities available for local retailers and small businesses unless they too have online sites.
- **Employment** – manufacturing industries and large institutions may be under threat as new

technologies replace large-scale operations with smaller scale and multi-purpose technologies.

On the upside, technology has the potential to alleviate some of the challenges of the future. For example, an increase in telecommuting can reduce the traffic burden on roads. Other opportunities in technology include:

- **Advancements in Transit Technology** –
 - » *Smart Card technology and Automatic Fare Collection (AFC) systems* on OC Transpo's bus and Bus Rapid Transit (BRT) system will streamline fare collection and payment systems making transit travel more convenient for passengers. It would also facilitate route planning which in turn would lead to more efficient use of vehicles and reduced fuel use.
 - » *Transit Signal Priority (TSP)* allows buses to travel through signalised intersections with reduced or no delay and has been implemented at a number of intersections in Ottawa. The direct short-term impact of TSP is reduced travel time and improved schedule adherence, and the long-term impact of TSP is reduced transit operating and capital costs, increased transit ridership and transit modal share. The ultimate results are fewer car trips and greenhouse gas (GHG) emissions.
- **Electric Cars** – Fossil fuel shortages and an increasing focus on greenhouse gas emission reductions will likely increase the demand for electric vehicles (EVs). These vehicles require specific infrastructure like charging stations. Land use planning for residential and commercial areas will need to be coordinated with local electric utilities, to ensure



13 In his book *Bowling Alone: America's Declining Social Capital* (1995). Author Robert Putnam links the decline of social capital to the isolating tendencies of technology such as television, internet and virtual reality.

that local distribution capacity is sufficient to accommodate the cumulative demand of these charging stations. The transition to vehicles using alternative power presents an opportunity to grow and attract workers that specialize in EV technology and smart charging stations.

- **Car-Sharing** – The growth of car-sharing in the Region may also have implications for land-use and the frequency and length of individual vehicle trips. Car-sharing encourages individuals to use cars only when they need to, therefore promoting active transportation and public transit as the modes of choice.
- **Car size** – As more and more people select smaller cars, it may offer opportunities to make better use of existing infrastructure like park & ride lots.
- **Miniaturization** – The creation of ever-smaller scales for mechanical, optical and electronic products, may have implications for activities that were once seen as “non-urban”. For example, recycling processing activities can now take place anywhere in the urban centre, and miniaturization can make some industrial activities compatible with a variety of other land uses. This provides opportunities to mix land-uses in smaller areas, and create a more compact and sustainable city that is less reliant on fossil fuels. Design of urban space may be altered as design approaches integrate water and energy and other technologies could push the boundaries of traditional design of urban fabric and architecture.
- **Electricity Mix** – The changes in energy production could lead to a greater mix of energy to sustain the Region’s activity meaning more resilience to fuel price changes. Changes in the distribution of alternative power such as wind and solar will materialize with electricity grids that act as a storage device for locally produced energy. Homes can generate power and sell excess power to the grid, and take power back from the grid when local supply is not meeting demands. This system is associated with smart metering technology and requires support by regional energy suppliers such as Hydro One.

- **Civil Society** – New communications technology creates the opportunity to reach more people and the ability for more people to participate in discussions and have input in decision making providing opportunities to those who might otherwise not have a voice.

Vulnerabilities related to Demographic Change

Demographic changes are occurring whereby Western industrialized countries are facing aging populations and a declining birth rate. In addition, to make up for some of the shortfall created by retiring baby-boomers, levels of immigration, particularly from Asia, Latin America and Africa – where populations are relatively younger—are expected to increase. This swell in immigration will significantly alter the demographic composition of urban areas and could bring issues of housing, employment and public servicing further to the forefront of public policy development. Beyond this are concerns that geopolitical tensions and resource scarcity in various parts of the world may lead to an increase in refugees to the Region. A growing population that is older and more diverse has the potential to create and/or exacerbate the vulnerabilities in the following areas:



- **Increased demand on health services** – The aging of the population may create an increase in the demand for health care services, including emergency care. However, the main drivers of increasing demands on the health care sector are changing and costly technologies, as well as greater utilization of testing and other services.
- **Transit and built infrastructure** – The growing population in the Region will result in more pressure on roads and transit and the aging population will demand greater accessibility of built infrastructure (sidewalks, parks, transit shops and public facilities). Seniors will need

more transit, shops and services that are closer to where they live.

- **Social tension** – An increase in immigration could intensify social tension, particularly if accompanied by an economic downturn. The increasing diversity in the Region may also lead to the need to increase culturally appropriate services and the number of languages in which municipal services are provided, beyond English and French.
- **Capacity to attract and retain immigrants** – As of 2011, 100% of Ottawa's net labour force growth needs to come from immigration due to our declining birth rates. Recent evidence is that Ottawa's rate of attraction and retention of immigrants is decreasing due to successful offers from other municipalities and provinces to attract and retain them.
- **Housing shortages / increased housing demand** – The emphasis on preference for single dwellings combined with population growth from new Canadians to the Region may put upward pressure on housing demand and prices. The potential exists for some members of the local population to be unable to afford adequate housing (a growing issue already). It may be necessary to provide a greater mix of affordable, rental and supportive housing in the downtown core and strategically support the diversification of housing type and tenure both inside the Greenbelt and suburban locations.
- **Skills shortages for age-friendly services** – An increase in the aging population may require age-friendly services and facilities for which skilled labour may be scarce. This might include care-givers, age-friendly buildings, parks and similar services.
- **Provision of family and senior friendly services** – The Region will be challenged to provide new services and facilities to meet the needs of an aging population while also serving the needs of young families and other increasingly culturally diverse households (such as clinics, cultural facilities, playgrounds and

other family-friendly recreational facilities) as the population increases.

- **Public works infrastructure** – Existing public works infrastructure including sewage, drinking water and electrical supply may experience significant operating pressures in terms of meeting the needs of a growing, aging and diverse population increase in urban areas. Potential areas to explore could include the adoption of new servicing technologies, distribution procedures and consumption bylaws to encourage reduced consumption.

Vulnerabilities related to Sudden Shocks

Sudden shock types of events, sometimes referred to as "black swan" events, could be natural or human-caused. The Region's ability to absorb and recover from these sudden shocks will be affected by our level of preparedness, adaptive capacity, existing systems, and structures. Sudden shock events could include:

- **Natural disasters** – Earthquakes, forest fires, landslides and other natural disasters could affect the Region. The Region is susceptible to earthquakes as it is in close proximity to a fault line. New buildings are designed to current seismic event/earthquake standards with different safety standards assigned to buildings that are required to function post-disasters such as hospitals, fire stations, etc. For existing buildings there is no requirement to upgrade to the new 2006 seismic standards and thus these buildings would be susceptible to undetermined degree of damage. Key is the fact that the pre-2006 building stock may or may not collapse or suffer damage depending on the seismic event/ earthquake as these have many redundancies built into them, however these have not been



purposely designed for high magnitude events at the extreme for the Region, whereas the new buildings are designed to withstand events of the magnitude identified specifically for this region. These disasters could result in a number of significant disruptions including power, infrastructure (roads, bridges, sewers, etc) and telecommunications.

- **Terrorism** – The Region’s designation as the nation’s capital may increase its vulnerability to a variety of types of terrorism, potentially linked to many of the world’s major conflicts. There are a number of attractive terrorist targets in the Region including government buildings and facilities and foreign embassies. Similarly, visits by foreign dignitaries could also attract terrorist activity.
- **Pandemics** – Health pandemics are an increasing concern as evidenced by SARS, H1N1, and the recent e-coli outbreak in Europe.
- **Highly Centralized Systems** – Dependence on highly centralized energy systems such as natural gas, petroleum products and electricity presents important challenges should any one of these system elements to fail. These systems are intimately connected and could cause widespread shock to a Region. Another ice-storm could cause electricity systems to fail, which in turn could cause gas pumps and home heating to stop working. Our increasing reliance on technology could make these types of shocks more severe and widespread.

Vulnerabilities related to a Changing Climate

Climate uncertainty may significantly alter weather patterns and create conditions that would challenge the Region’s resilience. Such as:

- **Storms** – A changing climate may increase the probability of severe storms and related extreme weather events including ice storms, hurricanes. These and other types of events may result in short-term, dramatic levels of precipitation that may cause disruption and damage to infrastructure, and increase the probability of other hazards (e.g. floods, fires).

For instance, intense winter storms in the Region are expected to be 8% – 15% more frequent.¹⁴ Some of the Region’s older homes may be more susceptible to weather damage. Similarly, the standards to which newer homes and developments are built will need to continue to evolve as weather patterns change.

- **Floods** – Increased storms could create higher risks of flooding in the Region. However, the present estimates for increased risk of flooding are inconclusive.¹⁵ There is some evidence that a changing climate will reduce flood risks owing to warmer winters and more dispersed snow melt, while others believe the potential for heavy storms would increase the level of risk. Current flood risk information on the Ottawa River Basin is based on studies completed in 1984 and may require updating. Nonetheless, potential for flooding remains if adequate redundancy is not built into building codes, developments and infrastructures in ways that can account for flooding. On a smaller scale, attention will become more focused on storm-water management systems that manage high rainfall events, and systems like bioswales and cisterns could become important elements in the urban landscape.
- **Droughts** – Increased droughts could create the need for greater water rationing, affect farming and erode quality of life. In addition, drought in many parts of the world may put upward pressure on food prices. Droughts would also impact the water levels in rivers and lakes, in which case recreational activities such



¹⁴ James Bruce, Climate Change Information for Adaptation, See <http://www.iclr.org/climateextremesbruce.html>

¹⁵ Interview with Bruce Reid, Rideau Valley Conservation Authority, April 2011. Mr. Reid states that many river basins in the Region should be reviewed.

as swimming, fishing and boating would also be affected.

- **Heat waves** – Average temperatures in the Region are expected to increase 2.5 to 4 degrees Celsius by 2050.¹⁶ Heat waves may become common, which would increase the need for emergency management services, particularly people who are frail, the very young and the very old, may be less equipped to cope with the effects of heat waves. This could also lead to greater summer energy use.
- **Urban heat island** – The creation of an urban heat island is also a potential vulnerability whereby the built-up area becomes significantly hotter than its surroundings, as the materials used in urban development tend to retain heat at a much higher level than natural landscapes. Adverse health effects and high energy usage (for air conditioning) and poor air quality are implications of the heat island effect.
- **Peaks of migration** – The Region might experience peaks of migration given its abundant supply of clean fresh water and air.

Section 3 discusses how the sustainability path could address some of these vulnerabilities, and identifies where its implementation could create additional vulnerabilities that will need to be addressed.

¹⁶ Op. Cit. Bruce, p. 36.

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3 The Sustainability Path

3.1 Resilience in Canada's Capital Region

The Partners have a significant degree of influence over the level of vulnerability in the Region, since there are a number of choices or “levers” that can be applied to reduce the level of vulnerability. Some of these levers are short-term emergency management responses. Others (the focus of this Plan) are longer term responses. Vulnerabilities may be reduced by modifying approaches to land use and development patterns, water management, building design and construction, transportation, social development and natural systems. Through the work completed within the *Choosing our Future* initiative, the Region has identified a number of strategies that could put it on a more resilient and sustainable path. These are presented in the *Sustainability and Resilience Plan*.

Around the world and in Canada's Capital Region (CCR), significant thinking, innovation and piloting has occurred to promote more sustainable ways of organizing activities at the local level. Indeed, many practices that have been tested and/or fully applied elsewhere in North America may be applicable in the Region.

The initiative is addressing both sustainability and resilience therefore, it is important to understand the relationship between the two. Sustainability is commonly understood to mean maintaining prosperity and quality of life for all while not undermining the opportunities for future generations— e.g. generating wealth through economic development should not permanently diminish natural systems (fish, forests, energy, soils, water, air quality, climate, and other systems) to the point where they cannot support future generations. Nor should it put social, physical or mental health at risk or diminish cultural pursuits and expression.

In general, a sustainable community is more likely to be a resilient community; by reducing its reliance on diminishing natural resources, a community can reduce its impact on natural systems and also reduce its vulnerability to resource shortages. However, there are cases where sustainability and resilience might work against each other. For example, increased use of new communications technology, while replacing the need for many workers to travel to workplaces and providing efficient ways for groups to share information, increases our vulnerability to the effects of any widespread or prolonged failure in the communications system. This is why the

initiative is simultaneously looking at the concepts of sustainability and resilience.

This section provides an overview of the sustainability path, and a review of how such a path could reduce the Region's vulnerabilities. It assesses these sustainability measures to understand how they can deliver greater resilience against the vulnerabilities described in the previous section. Some of the measures envisioned as part of the sustainability path for the Region could also create risks, challenges or trade-offs of their own, and these are identified in this section.

3.2 The Sustainability Path

The *Sustainability and Resilience Plan for Canada's Capital Region*, a companion document to this Plan, describes a new path of sustainability that the Region could take. This section outlines this sustainability path. It describes ways in which the Region could alter current trends and exert influence over vulnerabilities.

Social Development

The path to sustainability includes addressing key social issues including poverty, housing, social equity, health, safety, quality of life and the quality of social relationships. It includes looking at social determinants of health and how they work together to support or detract from social development. A focus on improving social determinants of health for the population can be a strong opportunity for a more preventative approach to many problems currently faced in the Region. This could involve encouraging physical activity through improved cycling and pedestrian infrastructure, or community gardens to improve nutrition. It would also involve improving social inclusion and engagement,



actively encouraging residents, regardless of background, ability and status, to get involved in their community. This could help isolated or marginalized residents become healthier, more active members of society.

Using a more community-based approach to service delivery that recognizes the benefits of leadership at the neighbourhood level, linked to broader plans and resources, would lead to greater efficiency and learning potential. This would involve a wider range of actors with different expertise, thereby linking various programs that address a range of issues. This flexible response to evolving needs would be mirrored in the physical environment as well, involving elements such as senior-appropriate and culturally-appropriate buildings, and public spaces that be adapted to different uses such as temporary street closures for events and festivals.

Culture

The sustainability path also emphasizes the role of culture. This encompasses support for arts and heritage as well as a shared set of values through which we can address the day-to-day choices we make, and our relationships with other people and with nature. A strong consideration of culture will mean designing and building places that support collaboration between different sectors, creating new ideas and information. These creative hubs would involve co-locating a mix of assets, with investments, institutions, and creative practitioners. Our cities and neighbourhoods would foster a sense of place and belonging, using locally inspired infrastructure, landscaping, signage and building character guidelines. Public art and the built environment would be used to strengthen connections between people and place, providing opportunities for recreation and visual delight.



Culture reaches beyond the tangible into elements such as partnerships and participation. Encouraging involvement in civic life requires building capacity of different groups. No one group or level of government can successfully promote and encourage the expression of our cultural identity. Leadership must include the many stakeholders including all levels of government and groups in society including non-profit and for-profit artistic and cultural groups, as well as the educational and business sectors.

Land Use, Growth Management and Urban Form

The sustainability path includes a more compact urban region. Urban growth would be focused largely within the existing urban containment boundaries. There would be a higher proportion of multi-unit dwellings (townhomes, apartments) and much of the growth would occur through intensification of existing areas, especially along major corridors and in designated mixed-use centres. Much of this urban growth would occur as transit-oriented development (TOD) —i.e. high density, mixed-use development that serves diverse populations within walking distance of transit stations. Through careful land use planning and urban design, the Region would become much more transit-oriented, with a large number of rapid transit stations serving new mid-rise neighbourhoods. These new neighbourhoods would include a variety of housing types and sizes assuring availability for people with different incomes, as well as daily shopping needs and local services and hence would be more walkable and convenient for residents and employees who work there. A compact urban region would decrease dependence on the automobile and hence increase its resiliency to increases in fuel price or resource scarcity.



This more compact pattern of development would preserve more agricultural land and natural green space as new neighbourhoods were developed. Large natural areas would be conserved and damaged areas would be restored. Invasive species would be carefully controlled to minimize their impact on natural ecosystems.

Transportation and Mobility

The sustainability path would place greater emphasis on an expansion of the public transportation system, especially rapid transit such as LRT, and transport networks would be tightly integrated with the high-density nodes described above. Active transportation (walking, cycling and other human powered modes) would be facilitated and promoted as a healthy mode of travel. As an example, the number and quality of cycling and walking paths, and the quality of the pedestrian environment would be increased through high quality urban design.



Urban streets would be designed as “complete streets” that could accommodate and balance multiple modes of transportation as well as public art, generous landscaping and places to sit and reflect. In some cases, road infrastructure would be re-purposed or downsized to accommodate the growing demand for active transportation modes and public open spaces. In addition, commercial parking lots and Park&Ride lots could be used on weekends for markets.

Personal automobiles and delivery vehicles would continue to be an important part of the transportation system. However, a transition to electric vehicles would be accelerated through the provision of the required infrastructure (public charging stations) and possible incentives such as preferred parking for low emission vehicles.

Overall, the many improvements to the transportation and mobility system would help address congestion and reduce the higher energy consumption, emissions and wasted time associated with it.

Buildings and Energy Supply

New buildings would gradually become more compact and energy efficient through collaboration among the building industry, municipalities and energy providers. Programs would result in the rapid retrofitting of the existing building stock to achieve significant energy efficiency improvements and reduced operating costs.

District energy systems in the central area and mixed-use centres would be expanded as the Federal Government redeveloped Tunney's Pasture and other sites into mixed-use centres. Alternative energy systems (e.g. energy from waste) would supplement conventional power generation.

Materials and Waste

More intensive recycling, composting and re-use efforts could result in 70% (or more) of waste being diverted from landfills. In some cases, "cradle to cradle" approaches to waste management would be introduced so that waste would be re-purposed and never become waste in the first place.

Economic Development

Through continued efforts to maintain and improve quality of life, the Region would attract a growing number of businesses in the sustainability sector and "green jobs," creating a more diverse local economy. At the same time, existing businesses would be expanded, become more energy efficient and be located in areas with good transit, pedestrian and cycling access.

Natural Systems

Large forests and wetlands and their abundance of biodiversity would be preserved as part of an interconnected system of public lands and privately-owned lands maintained through careful stewardship.

In central and suburban neighbourhoods, attention would be paid to landscaping and native plants that support biodiversity in urban parks and streets, landscaping around commercial and institutional buildings, along stream corridors and in and around stormwater management ponds.

People in the Region would be more aware of the potential impact of their lifestyle on ecosystems and natural resources elsewhere in the world and try to make responsible consumer decisions.

Food and agriculture

There would be an increased level of local farming, and greater emphasis on sustainable approaches to local food production. Value added processing of local food stuffs would also be encouraged, with governments developing local food procurement policies.

Much of the food would no longer have to travel great distances, thereby reducing GHG emissions and mitigating the changing climate, as well as reducing the cost of food since the cost of delivery over great distances would be reduced.

Water and Wastewater

Water quality would improve throughout the urban area as government and conservation authorities succeed in their efforts to manage urban development and to incorporate green infrastructure (e.g. constructed wetlands, permeable pavements in parks and parking lots). This would be supplemented by the efforts of homeowners and building managers to manage storm water on their properties.



Potable water conservation efforts would reduce both municipal operating costs and household costs. The above efforts combined with the upgrading and continued improvement of water and wastewater technology would also contribute to energy savings.

3.3 How the Sustainability Path Addresses Vulnerabilities

This section identifies how implementation of the sustainability path can address a number of the identified vulnerabilities and enhance the Region's resilience. **Table 1** identifies risk prevention, preparedness and mitigation strategies embedded in the sustainability path. It also describes the vulnerabilities these measures address, and identifies any additional vulnerabilities or challenges that may not be addressed by implementation of the sustainability path.

Overview of Vulnerabilities Addressed by the Sustainability Path

Table 1 provides an overview of key elements of the sustainability path (by lever) and the types of vulnerabilities that they address. This table demonstrates that elements of the sustainability path will:

- Enhance the Region's resilience to the effects of extreme weather events (through practices such as suitable risk assessment, improved water management and conservation, and protection of natural systems and their functions);
- Reduce effects on the more vulnerable populations through focus on prevention, social inclusion, and equitable access to integrated social services;
- Promote healthy lifestyles and a more active population by creating convenient, safe walking and cycling infrastructure, mixed-use communities, and access to protected natural systems;
- Improve response to natural disasters through greater densification, ensuring more of the

population is situated within proximity to hospitals and emergency services;

- Reduce the impact of high energy prices on residents and businesses and reduce greenhouse gas emissions through use of renewable energy, introduction of energy efficiency measures, and greater densification;
- Increase resilience to food scarcity and create opportunities for local business through local food production and promotion, and
- Support new sustainable business sectors (such as renewable energy, local food production), creating new opportunities for local business and employees.

Overview of Vulnerabilities Potentially Created by the Sustainability Path

Table 1 also identifies other potential vulnerabilities or concerns that could be introduced or exacerbated through implementation of the sustainability path. Early awareness and identification of these possible effects will enable the Region to anticipate and respond to these potential vulnerabilities through preventive and mitigation strategies (as discussed in Section 4). Potential vulnerabilities include:

- **The shift to more compact development might lead to an** increase of housing prices if adequate attention is not paid to facilitating the development of adequate supply of new housing in existing areas;
- **Greater requirements for evacuation and emergency management planning** due to increased densification. This could also require a change in delivery models for emergency management, particularly fire, police and paramedics due to potential increase in response times and communication issues arising from higher density;
- **Increase in the concentrated demand for water and wastewater treatment** due to higher / denser population. Older communities could be at risk since their infrastructure may be inadequate for higher volumes associated with greater densification and severe weather events;

- **Increased local food prices** as demand for local food increases; and
- **Increased vulnerability to transport network shutdowns** (because of greater use of public transit) due to, for example, extreme weather events, sudden shocks, or terrorist attack.

Section 4 identifies key strategies to prevent and/or mitigate these additional risks.



Table 1: Relationship Between Sustainability Path and Identified Vulnerabilities

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>LAND USE, GROWTH MANAGEMENT AND URBAN FORM</p>	<ul style="list-style-type: none"> • Develop a Compact region and complete communities – Enable more compact and transit-oriented development (higher density, mixed-use and mixed income development) through land use plans, zoning and approvals process, financial incentives and public-private partnerships 	<p>Economic, Technological and Demographic change</p> <ul style="list-style-type: none"> • Promote healthy active living as citizens will have access to a greater number of amenities without the use of cars • Ensure more of the population is closer to hospitals and emergency services <p>Climate change</p> <ul style="list-style-type: none"> • Suitable risk assessment and improved water management will decrease the effects of extreme weather events, floods and heat waves <p>Affordability</p> <ul style="list-style-type: none"> • A more compact urban form will reduce costs associated with municipal infrastructure and services, household travel and energy use 	<p>Strategies could:</p> <ul style="list-style-type: none"> • Reduce housing affordability if adequate attention is not paid to facilitating new housing supply through infill, intensification and redevelopment • Require change in delivery models for emergency management, particularly fire, police and paramedics due to potential increase in response times and communication issues arising from higher density and complex mixed-use buildings • Create greater requirements for evacuation and emergency management planning due to increased densification

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>WATER, STORM WATER AND WASTEWATER INFRASTRUCTURE</p>	<ul style="list-style-type: none"> • Water conservation – Encourage water conservation and the adoption of conservation measures through incentives, awareness, building and policy and regulatory measures • Best practice urban stormwater management – Promote development practices that reduce stormwater runoff through approvals process, including: promotion of stormwater collection and reuse systems; addition of soil depth for new developments to increase water absorption during rain events; and improving and upgrading stormwater and sewer systems to prevent sewage releases. • Integrated resource recovery – Identify opportunities for the reuse of non-potable water, such as grey water and the harvesting of waste heat • Community awareness – Reduce agricultural run-off through enhanced education and promoting sound management techniques 	<p>Affordability</p> <ul style="list-style-type: none"> • Using less water decreases the amount of energy used to treat water and wastewater and consequently reduces energy expenditures. Using less water defers or eliminates the need for capital cost expenditures or infrastructure upgrades • Integrated Resource Recovery can capture value from waste heat and resources in the waste stream <p>Climate change</p> <ul style="list-style-type: none"> • Conserving water and restricting use can decrease the effects of droughts and extreme events (rainfall) 	<p>None Identified</p>

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>BUILDINGS & ENERGY SYSTEMS</p>	<ul style="list-style-type: none"> • Energy efficient buildings – Encourage energy efficient improvements in new buildings through education, approvals process and incentives • Building retrofits – Enable residential and commercial building retrofits through education, training and financial incentives • Renewable energy – Encourage adoption of building-scale renewable energy sources through permitting processes, rezoning applications and sustainability checklists and expand large-scale renewable electricity sources • District energy systems – Promote development of district energy systems in appropriate locations through partnerships 	<p>Economic change</p> <ul style="list-style-type: none"> • A move towards energy efficiency and the use of renewable energy sources creates opportunities for local business and employees working in the energy and green building fields • Energy efficiency measures and building design will decrease utility bills for the businesses that use them <p>Affordability</p> <ul style="list-style-type: none"> • Energy efficiency and greater use of renewable energy sources will decrease the building life cycle cost burden created by high energy prices • While there are often slightly higher capital costs associated with energy efficient buildings and renewable energy systems, the reduced energy costs to heat and cool the buildings will save households and businesses money over the medium to long-term especially as we see energy price increases. 	<p>Strategies could:</p> <ul style="list-style-type: none"> • Create higher housing prices where upgrades, retrofits or leading technology has been incorporated and creates a higher value with buyers. This may be offset over time by lower operating costs.

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>NATURAL SYSTEMS</p>	<ul style="list-style-type: none"> • Connectivity – Improve connectivity of large natural areas through land use planning, development controls, strategic acquisitions and partnerships and stewardship activities with landowners. • Protection – Encourage protection, restoration and development of small-scale habitats in urban and suburban areas through awareness building with landowners, approvals process with developers and through strategies on public land • Invasive species management – Manage invasive species through management programs, public education and regulation 	<p>Technological change</p> <ul style="list-style-type: none"> • Protecting and connecting natural systems and habitats increases opportunity for recreational activities that can counteract the sedentary lifestyles associated with overuse of some communications technologies <p>Climate change</p> <ul style="list-style-type: none"> • Protection of natural habitats in urban and suburban environments can decrease the effect of storms and heat waves (e.g., by providing tree cover and shade) <p>Affordability</p> <ul style="list-style-type: none"> • Natural systems provide valuable natural services such as filtration of water and flood control. Protecting them can help us avoid some costly infrastructure investments. 	<ul style="list-style-type: none"> • Natural systems are affected by sudden shocks of climate instability resulting in tourist attraction events being negatively affected (e.g. potential cancellation of Winterlude, reduced ski and skate season due to warmer winters)

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>FOOD AND FARMING</p>	<ul style="list-style-type: none"> • Protection – Protect agricultural land through land use plans and regulation, partnership with the province, and financial incentives • Local food – Advance the local food economy by establishing local food procurement policies for the Cities and the NCC (including defining what is meant by 'local') • Alternative practices – Encourage agricultural practices that rely less on fuel and chemical inputs • Public space – Allocate public land for community gardens • Awareness – Promote awareness of local food, agricultural land and healthy eating 	<p>Economic change</p> <ul style="list-style-type: none"> • Local food production can increase resilience to food scarcity and create opportunities for local business • Alternative practices that rely less on fuel and chemical inputs increase resilience to energy and chemical price fluctuations <p>Technological change</p> <ul style="list-style-type: none"> • Growing food in community gardens or purchasing local food at farmers markets increases connectivity with local farmers and other citizens and counteracts the isolating tendency of some communication technologies <p>Demographic change</p> <ul style="list-style-type: none"> • Awareness building and greater opportunities to produce, eat or celebrate local food increases the potential for building cohesion between ethnic groups <p>Climate Change</p> <ul style="list-style-type: none"> • Strengthening local food systems may provide greater resilience to the impacts of a changing climate on world agriculture. <p>Affordability</p> <ul style="list-style-type: none"> • Strengthening local food systems could provide some resilience to global food price increases. Those who participate in local production and processing can reduce their food expenditures which represent about 12% of average household expenditures 	<ul style="list-style-type: none"> • Shifting ecozones due to changing climate could increase potential threat of invasive species and may change precipitation patterns and climate events such as flooding, heavy rains, and winds. Agriculture could be severely affected by these changes

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<p>MOBILITY</p>	<ul style="list-style-type: none"> • Public transportation – Continue to expand the public transportation system, including expanding rapid transit system • Active transportation – Facilitate and promote active transportation (walking, cycling and other human powered modes) by increasing the number and quality of pathways and linking existing and new pathways and improving safety and comfort of the urban environment for these uses • Complete streets – Design and retrofit streets to develop “complete streets” that accommodate and balance multiple modes of transportation • Electric vehicles – Encourage transition to electric vehicles by providing required infrastructure (public charging stations) and incentives such as preferred parking for low emission vehicles 	<p>Economic change/ Affordability</p> <ul style="list-style-type: none"> • Shifting to transportation systems that require less fossil fuel decreases the impact of rising fuel prices on households and businesses <p>Technological change</p> <ul style="list-style-type: none"> • Facilitating and promoting active transportation contributes to healthy lifestyles and may counteract some of the negative impacts of technology <p>Demographic change</p> <ul style="list-style-type: none"> • Public transportation increases mobility options for aging or low-income populations <p>Climate change</p> <ul style="list-style-type: none"> • Reducing dependency on fossil fuel transportation decreases GHG emissions 	<p>Increased use of public transit could:</p> <ul style="list-style-type: none"> • Increase exposure of members of the population to pandemics • Increase vulnerability to transport network shutdowns due to extreme weather events created, or through terrorist attack

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>MATERIALS AND SOLID WASTE</p>	<ul style="list-style-type: none"> • Waste diversion – Encourage waste diversion through examination of barriers to using current programs and targeted public awareness • Product stewardship – Take a more active role in product stewardship and waste reduction through partnerships and education, and by helping to shift the mind-set of residents and businesses to using less • Waste reduction – Continue to investigate other opportunities to reduce waste generation, such as supporting re-use stores and materials exchanges 	<p>Economic change</p> <ul style="list-style-type: none"> • Waste diversion and reduction creates efficiencies, better resource allocation and local business opportunities <p>Demographic change</p> <ul style="list-style-type: none"> • While demographics would suggest the volume of solid waste will increase (along with associated landfill/incineration requirements), a greater focus on reduction and diversion will result in a consistent or decreased volume of waste over time 	<p>None identified</p>

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>SOCIAL DEVELOPMENT</p>	<ul style="list-style-type: none"> • Prevention – place greater emphasis (including more funding) on prevention rather than reacting to social issues (e.g. promote active living, healthy food programs, crime prevention, and policies and programs to improve air quality) • Community-based initiatives – empower residents and community groups to define their own needs and the most effective social program delivery systems. Support the development of unique places that invoke a strong sense of community identity and pride. Examples include Ontario’s Child and Family Centres, Ottawa’s Community Health and Resource Centres, recreation programs, cultural events. Create opportunities for voluntarism • Social inclusion – help residents feel part of the community. Provide equitable access for new immigrants to services and opportunities. Examples include employment and training programs for marginalized groups that are linked to growing economic sectors, and the use of social media to increase access for those isolated due to transportation or mobility challenges • Flexible and adaptable use of space – manage land use and design housing to meet the diverse and evolving needs of different socio-economic groups and an aging population. Design housing stock to reflect the needs of a culturally diverse community. Examples include housing design that supports aging in place, secondary suites, and multi-generational homes 	<p>Demographic change</p> <ul style="list-style-type: none"> • Increased demand on health services: a focus on prevention and an increase in local empowerment and capacity would increase the ability of neighbourhoods to respond to and address both chronic and emergency issues • Skills shortages for age-friendly services • Provision of family and senior friendly services: flexible, adaptable design allows the community to change over time to address different needs of a changing population and also adapt to changing physical conditions <p>Sudden shocks and climate change</p> <ul style="list-style-type: none"> • Integration will allow various levels of government to respond in a more co-ordinated, effective manner • Rising fuel prices, the rapid spread of new viruses like H1N1, and extreme weather events like heat waves or ice storms impact vulnerable people more than others. A focus on social inclusion will reduce the risks to these vulnerable populations and improve overall resilience of the community 	<p>None identified</p>

LEVER	MITIGATION OR ADAPTIVE STRATEGIES OF THE SUSTAINABILITY PATH	VULNERABILITIES ADDRESSED BY THE SUSTAINABILITY PATH	CONCERNS AND OTHER POTENTIAL VULNERABILITIES
<p>SOCIAL DEVELOPMENT <i>Continued</i></p>	<ul style="list-style-type: none"> • Community engagement and participation – develop initiatives to increase community participation and engagement in community life and decision-making. Develop tools that harness the creativity that exists in the community, our ability to learn more from one another and increase the levels of trust in and between communities. Examples include Web 2.0 technology and social media as consultation tools, and increasing the availability of services offered in languages other than French and English • Enabling local governments – develop social programs to harness collaboration between all levels of government and focus on funding for social development. Expand the definition of “infrastructure” to include and prioritize social elements 		

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<p>CULTURE</p>	<ul style="list-style-type: none"> • Design and build creative places – collaboration between different sectors presents opportunities for the creation of new ideas and information. These creative hubs would involve co-locating a mix of assets, investments, institutions, and creative practitioners • Build cultural leadership and partnerships – foster the creation of strong cultural frameworks that rest on a variety of sectors, including culture, arts and heritage, economic development, tourism, education, and the private sector • Use public art and design of the built environment – strengthen connections between people and place, providing opportunities for recreation and visual delight. This could include tangible and intangible characteristics, such as stories linked to physical sites with the use of communications technologies • Build a sense of place and belonging – develop a shared set of values through which we can address the day-to-day choices we make, and our relationships with other people and with nature. Creating a welcoming environment for cultural and artistic expression is a key ingredient to promoting belonging. Locally inspired infrastructure, landscaping, signage and building character guidelines also add to a sense of place 	<ul style="list-style-type: none"> • Strengthening the capacity of different groups to integrate into society can assist our ability to adapt to changes of many types including <i>Demographic Change, Economic Change, Climate Change, Sudden Shocks</i> • Enhancing our connection to and understanding of natural systems can help us recognize when these natural systems are becoming fragile and perhaps make these systems more resilient • Designing and building more creative places that support collaboration and innovation can help strengthen and diversify the economy and create resilience against economic shocks and downturns in specific sectors 	<p>None identified</p>



4 Key Strategies

While the sustainability path (described in **Table 1**) addresses many of the risks and vulnerabilities that the Region may face in the coming decades, there are additional risks and vulnerabilities that it does not address. This section identifies key prevention and mitigation strategies that the City of Ottawa and its Partners can implement to reduce the likelihood or severity of longer-term risks facing the Capital Region. These strategies supplement the strategies described in the *Sustainability and Resilience Plan*.

Strategies and Actions to Enhance Resilience

The key strategies presented in **Table 2** and **Table 3** are intended to prevent and mitigate remaining risks after implementation of the sustainability path (as identified in Section 3)¹⁷. These additional measures assume implementation of the sustainability path presented in the *Sustainability and Resilience Plan*; if a different path is chosen, the associated vulnerabilities and mitigation strategies will require review and adjustment. The strategies are presented in two categories: Prevention Strategies; and Preparedness and Mitigation Strategies.

¹⁷ "Prevention" refers to the avoidance of a risk altogether whereas "mitigation" refers to reducing the impact of a risk.

Table 2: Key Risk Prevention Strategies & Actions

LEVER	KEY RISK PREVENTION STRATEGIES & ACTIONS
<p>PUBLIC HEALTH</p>	<ul style="list-style-type: none"> • Review safety and health surveillance and monitoring to determine if changes are needed to reflect increased densification, changing climatic conditions, and an aging population (e.g., for pandemics, other diseases and air pollutants) • Review the Heat Action Plan to ensure that it will be adequate to respond to more frequent and severe high temperature events, an aging population, and greater densification • Conduct outreach and education to raise awareness on prevention practices related to pandemics and spread of disease
<p>INFRASTRUCTURE PROTECTION, MAINTENANCE AND RETROFIT</p>	<ul style="list-style-type: none"> • Ensure the Critical Infrastructure Identification Study (to include water, sewer, telecom, electricity, natural gas, transportation fuel, IT) considers vulnerabilities associated with more severe weather events, a larger population, and greater densification. Ensure adequate funding for the renewal and maintenance of critical infrastructure. • Review community behaviour to understand demands and stresses on community infrastructure in order to develop tailored solutions (e.g., wastewater infrastructure) • Develop and implement Renewable Energy Systems, including an increase in solar/wind energy availability for high-density nodes to provide back-up off-grid capacity in the event of brown-out conditions • Initiate community awareness and education activities to build awareness of water use and protection, and household hazardous waste collection system • Promoting and enabling a mobile workforce (e.g. working remotely/ teleworking, mixed-use communities) that is resilient to disruptions (e.g., extreme weather events, transportation disruptions, emergencies)

Table 3: Key Preparedness and Mitigation/Adaptation Strategies

LEVER	KEY RISK PREPAREDNESS & MITIGATION/ADAPTATION STRATEGIES
BUILDING, SITE AND INFRASTRUCTURE DESIGN	<ul style="list-style-type: none"> • Through planning and approvals processes encourage smart development that: <ul style="list-style-type: none"> » Takes into consideration the ecosystem on and around the development site » Encourages development of communal facilities (e.g. rain water collection systems/ barrels) » Integrates requirements for permeable surfaces and storm water management » Encourages expansion of the urban tree canopy » Ensures new development does not occur in areas that are at high-risk for natural disasters (e.g., floods, earth quakes) through zoning, requiring suitable risk assessments and developing standards • Ensure safety and security measures are incorporated into new design and retrofits including: <ul style="list-style-type: none"> » Incorporating fire safety measures adequately in building design requirements (in line with 2012 National Fire Code) » Incorporating security considerations into transit system design
EMERGENCY SERVICES AND RESPONSE	<ul style="list-style-type: none"> • Reconfigure and test emergency services to ensure adequate response times and behaviour at each high-density node • Develop, revise and test community evacuation and emergency plans • Review emergency/crisis plans to ensure they address situations of severe fuel shortages
FOOD SECURITY	<ul style="list-style-type: none"> • Create a food security plan to manage potential for food shortages (including due to severe weather disruptions) or lack of food affordability, including: <ul style="list-style-type: none"> » Encourage diversification of locally grown crops » Study greenhouse farming to determine its potential role and whether the City should encourage businesses in this area • Launch a community awareness and education campaign to raise citizen awareness of local food and seasonal eating habits

LEVER	KEY RISK PREPAREDNESS & MITIGATION/ADAPTATION STRATEGIES
<p>ADAPTATION PLAN FOR A CHANGING CLIMATE</p>	<ul style="list-style-type: none"> • Encourage the design and development of climate refuges or other measures that can lessen the impact of heat waves or an urban heat island effect including: <ul style="list-style-type: none"> » Alternative (lighter) coloured roofing material or alternative pavement for parking lots, » Increased urban tree canopy to provide greater shade, » Protection of green space, » Provision of drinking water, cooling centres, fountains, outdoor public pools • Develop an invasive species management plan that considers urban, agricultural and protected lands • Review key events in Canada’s Capital Region and consider altering the nature and timing of these events (e.g., Winterlude) • Consider the need for different equipment to service roads and networks given anticipated climatic changes (e.g. need for more de-icing versus snow clearing)
<p>SOCIAL SUPPORT TO VULNERABLE SECTIONS OF THE POPULATION</p>	<ul style="list-style-type: none"> • Ensure housing strategy includes measures to mitigate the impact of higher housing prices/ shortages on vulnerable sections of the population • Promote and support cultural, civic and community activities that integrate vulnerable populations into communities to enhance social cohesion • Raise community awareness and education through a campaign to promote a culture of caring for the elderly and other vulnerable groups



5 Implementing the Plan

5.1 Implementation Approach

While the *Risk Prevention and Mitigation Plan* is applicable to the entire Region, it was born out of Ontario's Emergency Management and Civil Protection Act requirement that each municipality develop an emergency program that includes four core components: mitigation/prevention, preparedness, response and recovery. For this reason, this Plan is addressed more specifically to the City of Ottawa. The identified strategies will be referred to the responsible departments for review and integration into existing plans. Where required, the responsible department will develop a new plan that incorporates these strategies (e.g. changing climate adaptation plan, food security plan).

The Plan is intended to inform short and medium term policy and program decisions. It will provide guidance and strategic direction to Official Plan, Infrastructure and Transportation Master Plans, Environmental Strategy, Human Services Plan, Arts and Heritage Plan, Emergency Management Program, Corporate Planning Framework, Corporate Risk Planning, and the Long-Range Financial Plan.

Every five years, Security and Emergency Management reviews and updates its short-term vulnerability analysis. This periodic update will help to identify the degree to which identified vulnerabilities have manifested themselves as risks within the Capital Region, and will be used to identify the need to accelerate additional preventive or mitigation measures.

5.2 Recommendations for the City of Ottawa's Emergency Management Mitigation Program

Based on the conclusions and recommendations of the updated Vulnerability Analysis and the *Risk Prevention and Mitigation Plan*, Ottawa's Emergency Management Program will develop a Mitigation Program that regularly and systematically considers hazard identification, risk assessment and consequence analysis.

The 2011 Vulnerability Analysis identified and ranked 7 areas of general concern that will be on its radar over next five years:

1. **Earthquake:** A seismic event resulting in structural collapse, natural gas leak and/or structural fire;
2. **Critical Infrastructure Failure:** A failure which includes assets such as water, sewer, telecom, electricity, IT or natural gas;
3. **Summer Storm:** A weather related storm caused by a tornado/wind storm, wild fire, flooding, thunder/lightning storm, hail storm or heat wave/drought;
4. **Hazardous Material:** Harm caused by the release of dangerous goods including toxic chemical release/spill, flammable liquid release/spill or radiological dissemination;
5. **Winter Storm:** A weather related storm caused by a heavy snow fall, cold wave or ice storm;
6. **Terrorism / Public Safety:** An act of coercion that involves an explosion, bomb threat, suspicious package, airplane crash, mass casualty situation or a demonstration/riot; and
7. **Public Health:** A health related event caused by a communicable disease outbreak, food poisoning, water contamination or atmospheric contamination.

Over the next five to thirty years, other concerns related to demographic change, climate change and resource scarcity are likely to become more important. As concluded by the Vulnerability Analysis, *while it is unclear how many of the forces of change will precisely shape the Region and the threats it will face, what is clear is that the potential for change and volatility of the types of threats Ottawa will face is incredibly high. Consequently, the City will need to be prepared for the modes of action of a wide range of threats, and will benefit from tracking and considering emerging trends as it updates its vulnerability analysis every five years.*

The above list will certainly be modified and other vulnerabilities will likely be added overtime.

Based on these short-term vulnerabilities, the Sustainability Path, and **Tables 2 and 3** (key long-term Prevention, Preparedness and Mitigation Strategies),

the City of Ottawa will develop its Mitigation Program. Key elements of the program that need short-term action will be:

- **Critical Infrastructure Identification Study** – this study will identify critical infrastructure systems including water, sewer, telecom, electricity, natural gas, transportation fuel, IT) and consider the vulnerabilities to these systems. This study should consider vulnerabilities associated with more severe weather events, a larger population, greater densification and terrorist threats. It will be important to ensure adequate funding for the renewal and maintenance of critical infrastructure;
- **Review the Heat Action Plan** to ensure that it will be adequate to respond to more frequent and severe high temperature events, an aging population, and greater densification;
- **Renewable Energy Systems** – the City will examine the potential of using decentralized renewable energy systems that can be used to supplement grid based power systems and also as emergency power supply during large power failures;
- **Emergency Services Response** – The City will continue to review and improve its emergency services response capability including plans for large scale evacuations of dense urban areas; and
- **Climate Change Adaptation Plan** – the City will develop an adaptation plan that will anticipate climate related changes and propose measures to avoid or reduce these impacts.

5.3 Cooperation

Emergency management, whether to address immediate crises, short-term vulnerabilities or long-term change requires a high level of cooperation among many different agencies in the Region. *Choosing our Future* has involved a high level of cooperation among three Partners but it is recognized that many others must be involved in effective risk management programs. Therefore, the City will continue to work with agencies involved in emergency response, emergency preparedness and planning to ensure that plans and programs are well coordinated and resources used effectively.



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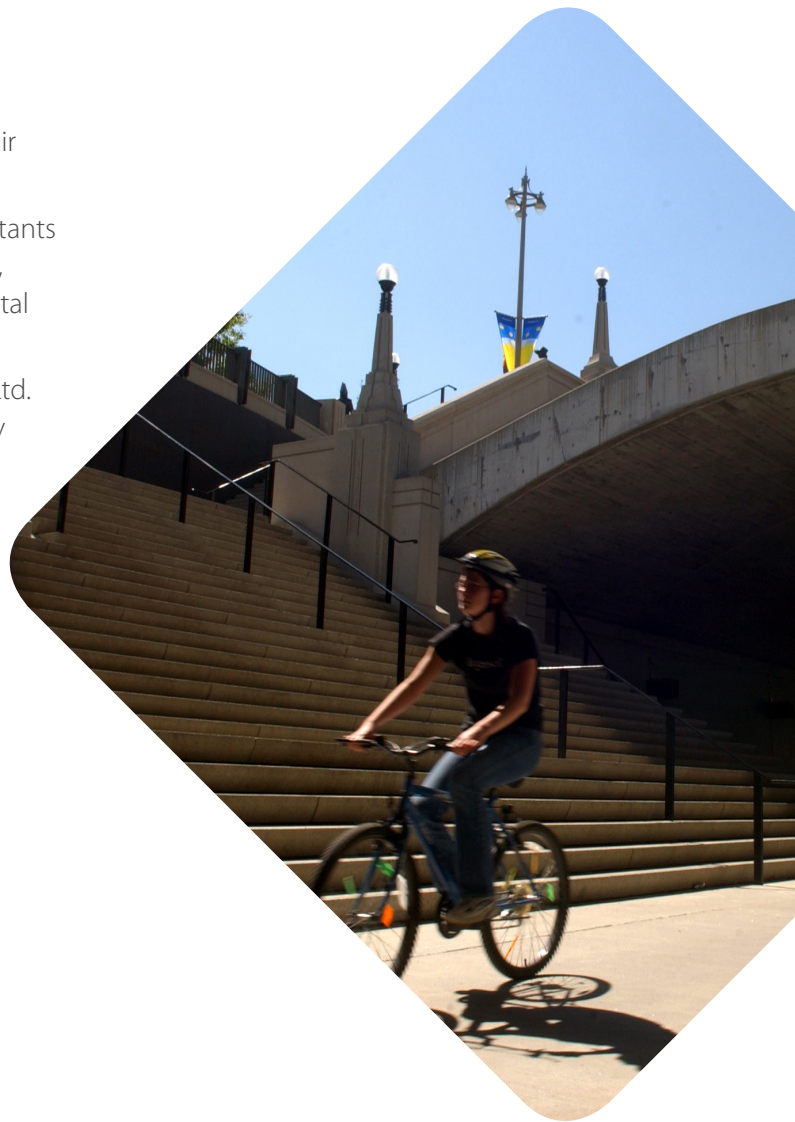
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