



**PLANNING RESOURCE GUIDE**

# Climate Change Adaptation through Land Use Planning





The new Provincial Planning regulation continues to promote sound land use planning and express the provincial interest in the sustainable development of land, resources and infrastructure. There are, however, some new ideas and provisions that are significantly different than the old Provincial Land Use Policies.

One new idea found in the new regulation is climate change adaptation through land use planning. Manitoba is interested in building communities that are sustainable and resilient to a changing climate. Therefore the new regulation include provisions to encourage communities to anticipate and plan for the impacts of climate change and to implement adaptation strategies through various planning documents and processes.

To help understand this idea and how it can apply at the local level, Manitoba Local Government has prepared this planning resource guide, which outlines how to use information about Manitoba vulnerability and risk to inform land use planning and ensure that communities will be adaptable to the most likely effects of climate change.

The guide is mainly intended for a planning audience, such as planning staff from municipalities and planning districts, consultants and provincial staff involved with land use planning. However, it is anticipated the topic will also appeal to a wider audience.

# INTRODUCTION

The global climate fluctuates naturally, but recently, climate change has been occurring much more rapidly than normal. Even a change of just a couple of degrees will have huge impacts on a global scale.

Climate change has different effects from one part of the world to the next. In Manitoba,<sup>1</sup> some of the current and anticipated effects identified by Manitoba Conservation include:

- increased water scarcity and greater variability of water supply
- Increased potential for severe drought, extreme rainfall and other severe weather events, such as tornadoes and hail storms
- thinning ice making the seal hunt difficult for polar bears, which is critical to bears' survival
- increased intensity and severity of fires and insect outbreaks in the boreal forest
- reduced duration and reliability of winter roads

The costs of handling these changes are significant, but may be even higher if governments and communities are not prepared.

Climate change **adaptation** means adjustment in natural or human systems in response to actual or expected climate change effects, which moderates harm or exploits beneficial opportunities. By contrast, **mitigation** is intervention or policies to reduce the emissions or enhance the sinks of greenhouse gases (GHGs) which contribute to climate change.<sup>2</sup> A robust approach which incorporates both adaptation and mitigation is most effective in addressing climate change.

The Province of Manitoba is taking action to adapt to climate change with *Beyond Kyoto*, which outlines adaptation actions to be put in place by 2012. An integral part of Manitoba's climate change plan is participation in the Prairie Regional Adaptation Collaborative (PRAC) with Natural Resources Canada and the governments of Alberta and Saskatchewan. The PRAC seeks to achieve targeted policy and planning outcomes that will facilitate better adaptation to the effects of climate change. Manitoba's involvement in the PRAC helps to fulfill commitments made in *Beyond Kyoto*.

Adaptation to climate change may bring benefits to Manitoba communities such as regeneration of urban areas and improved environmental management. New communities designed to cope with future, not historical, climates will use anticipated changes to their advantage.

<sup>1</sup> See the Canadian Environmental Assessment Agency for more information on climate change effects on the prairies: <http://www.ceaa.gc.ca/default.asp?lang=En&n=9699932C-1&toc=show&offset=13#a5>

<sup>2</sup> Both Definitions: UNFCCC

Local governments can also evolve to better adapt to climate change. Adaptation is, by nature, a local response to a global issue because activities must be tailored to the particular vulnerabilities of the locality. By anticipating certain changes that are likely to happen in the municipality over others, municipalities can prepare for those changes and reduce vulnerability to the most likely risks, such as drought or flooding, while at the same time maximizing beneficial opportunities associated with these changes, such as developing new products.

This anticipatory response to climate change adaptation is different from reactive planning measures, such as enforcing building codes, moving homes, or offering compensation or subsidies. Such responses can result in higher long-term costs and be less effective than anticipatory adaptation.

An anticipatory approach can be achieved through sound land use planning. Planning for climate change takes a long-term view and incorporates a degree of uncertainty, but essentially, it is just good planning.

For an overview on climate change adaptation and municipalities, visit the ICLEI Canada Web site, which has many useful resources.

[www.iclei.org](http://www.iclei.org)

## VULNERABILITY AND RISK ASSESSMENT

The first step to climate change adaptation is to assess vulnerability and risk. Any planning authority can undertake this and use the information to help guide land use planning.

### What?

**Risk** is deviation from what is expected, a combination of the likelihood of an event and its consequences. It also represents the source of danger, harm or loss, and the possibility of suffering these effects. **Vulnerability** reflects the degree of susceptibility to this danger, harm or loss. An assessment of risk and vulnerability can be helpful in directing and balancing effort and costs associated with any action to adapt to climate change.

1. Forecast the possible impacts of a changing climate on the region: This generally entails using climate models. Because the climate is changing, using past climate data will not provide an accurate prediction of how the climate will look in future. Climate models will predict a region's future climate and ways that the region may be affected. Once anticipated changes are assessed, determine what some of the impacts of those changes might be, for example, increased flooding or drought.

Environment Canada has information on climate models at: <http://www.ec.gc.ca>.

Anticipated climate impacts can be inferred via the 2007 National Assessment Prairie Chapter [www.parc.ca](http://www.parc.ca)

2. Determine the risks associated with the likely impacts and the level of vulnerability to those risks: Assess the vulnerability of the natural environment, infrastructure, and health and safety of citizens to weather-related events. This will determine the degree of damage or loss that may occur when severe weather strikes. Examine the resilience of existing systems and the capacity to be able to handle changes by asking the following questions:

- Can the service area currently accommodate existing weather patterns and changes in climate? For example, has the storm water system been able to handle flash floods?
- Are there any barriers to the service area's ability to accommodate changes in climate?
- Is the service area already strained in ways that will limit its ability to accommodate future changes in climate?

Remember that not all changes will be risks; some are also opportunities. For example, the potential to develop a new product or service may arise out of a warmer climate, such as growing new crops.

3. Apply the information learned to land use planning: Knowing the changes most likely to come, the risks (and opportunities) associated with them, and local vulnerabilities, apply this information to land use planning processes. What changes are needed, if any? See the 'How' section for ideas on ways to do this.

### Why?

Conducting a vulnerability and risk assessment contributes to decision making and policy development by providing a basis for establishing priorities. The vulnerability and risk assessment help to:

- determine opportunities to facilitate the development of new services and products
- enhance reputation with stakeholders
- protect community investments
- reduce risks to human health
- reduce insurance costs
- improve quality of life

The cost of incorporating vulnerability and risk into land use planning is insignificant in comparison to the costs of doing nothing. Direct costs of adaptation that will be incurred relate to broadening and coordinating planning processes and raising awareness of decision makers at all levels about how to build climate flexibility into plans.

For information on assessing vulnerability and risk, please see *Adapting to Climate Change: An Introduction for Canadian Municipalities*, which can be ordered on-line through Natural Resources Canada.

See: [www.adaptation.nrcan.gc.ca/](http://www.adaptation.nrcan.gc.ca/)

## How?

Climate change adaptation is something to consider at all stages of planning, from the long-term vision of the community to specific implementation tools. Use the information from the vulnerability and risk assessment to guide the long-term direction of the community to prepare for change, even uncertainty.

There are many ways to incorporate the information learned from the vulnerability and risk assessment into land use planning to adapt to the most likely effects of climate change in the region. Embed information from the vulnerability and risk assessment into all steps of the existing planning process: establishing a vision, setting goals, developing and implementing policies, consultation and review. The development plan, secondary plans, zoning by-law and subdivision approval process can be used to help facilitate this. Community consultation and integration with other climate change adaptation activities are also ways for a community to adapt to climate change.

## 1. DEVELOPMENT PLAN, SECONDARY PLAN, ZONING BY-LAW

Look at the vulnerability and risk assessment: what are the most likely risks, and where is the community most vulnerable? The following are ways in which the development plan, secondary plans or zoning by-law can be used as tools to help prepare for a variety of potential risks to Manitoba municipalities.

### Flooding:

- Include policy statements in the **development plan** to indicate a commitment to minimizing the effects of flooding by considering a range of options for flood management, such as promoting appropriate sustainable defences and locating new development away from areas of highest risk.
- Ensure planning takes account of future trends in flooding. Use geographic information systems (GIS) and climate models to guide development away from flood prone areas. Designate these areas in the **development plan** for agricultural or recreational uses rather than residential or commercial.
- Use the **zoning by-law** to re-site infrastructure and routes so that disruption during flooding is minimized.

The City of Steinbach has design criteria for drainage: [http://www.steinbach.ca/city\\_services/infrastructure/drainage/](http://www.steinbach.ca/city_services/infrastructure/drainage/)

Adaptation options are influenced by geographical location and the scale of development

### **Drainage and snow clearance as a result of extreme weather events:**

- Use the **secondary plan** as a tool to ensure proper drainage. A secondary plan can include drainage requirements for a planning area, covering many lots.
- Use the **zoning by-law** to ensure that there is adequate greenspace in existing and new developments. This is a natural way to ease drainage and also offers space to pile cleared snow.

### **Drought:**

- As soils dry out in hotter, drier summers, they shrink. This contributes to the wear and tear of foundations, putting housing stock and infrastructure at risk. Use a soil survey to inform the **development plan** when deciding on land use designations so that future development is directed to areas where soils are most appropriate for buildings and other infrastructure.
- Certain types of agriculture may not be appropriate in drought-prone areas because additional irrigation will be needed. Ensure agricultural designations in the **development plan** take changing soil conditions into account, again using a soil survey.
- In some cases, rural residential development will not be appropriate because it is not possible to dig wells. This may lead to a demand for the construction of new water lines, which will add to a municipality's infrastructure burden. For this reason, consider using development plan policy to direct development to existing settlement centres where appropriate infrastructure exists, or can be more easily and sustainably serviced.

Further information on soil surveys relating to land use can be found here:  
<http://www.gov.mb.ca/agriculture/soilwater/soilsurvey/fss02s00.html>

### **Increased forest fires or intensity of fires:**

- Fire will have a major impact on land use development, particularly residential and cottage development. Consider including policies in the **development plan** to address this risk. For example, keep residential development to one side of a road when at the periphery of a forest, and take advantage of natural firebreaks such as rivers.

### **Loss or change of habitat or species:**

- Work with the conservation district to designate parts of the region for habitat protection and improvement in the **development plan**. The CD will be able to identify the best areas in the region for this purpose.

### **Limited access to emergency services during extreme weather events:**

- In the **zoning by-law**, locate emergency facilities away from areas at risk of flooding, and institute a program for the relocation of facilities that are or will be at risk. Consider including policies in the development plan to ensure accessibility to emergency services for the citizens of the region at all times.

### **Modified dispersal of pollutants in air, soil and water:**

- In the **zoning by-law**, locate facilities such as waste disposal sites away from commercial, residential and recreational land uses so that pollutants will not interfere with activities related to those land uses. Check contaminated land, or other brownfield sites, which may need to be reassessed for potential future pollutants.

## **2. SUBDIVISION APPROVAL PROCESS**

The subdivision approval process is another tool already in place that can be used to help adapt to the potential risks of climate change in Manitoba municipalities.

### **Drainage and snow clearance as a result of extreme weather events:**

- Require that improved storm water management plans take extreme weather events into consideration. This could include enforcing water retention for all subdivisions to ensure the post-development storm water run-off levels will be equal to the pre-development levels.
- Require that surface coverage of lots is limited and ample greenspace is provided in all subdivisions of five lots or more. This will ensure adequate drainage and provide space for piling snow.
- Encourage the construction of retention ponds in new subdivisions, including dry retention ponds.
- Put into place pre- and post-development run-off values for various types of developments to help generate awareness and provide a measurable value against which various proposals can be evaluated.

### **Increased forest fires or intensity of fires:**

- Require new subdivisions to assess fire risk. If the risk is high, ensure that adequate escape routes and fire services are provided.

### **Limited access to emergency services during extreme weather events:**

- Where development in high-risk areas cannot be avoided, use the *Subdivision Regulation* to apply design guidelines to ensure emergency service facilities are constructed to be operational under all circumstances.



### 3. COMMUNITY CONSULTATION

To better ensure adaptation to the effects of climate change, consult with community members. Use existing processes and requirements for public input as opportunities to: raise public awareness of climate change adaptation; inform the public of the implications of climate change on residents and property; solicit community input, and; update developers, builders and other citizens of the standards and procedures in place, and the reasons why.

Vulnerable groups and those likely to be at-risk, such as farmers whose fields are susceptible to flooding, may be able to contribute their knowledge to better inform planning documents. Take advantage of these local sources of knowledge to improve the planning process so that climate change adaptation is incorporated. For example:

- Winter road usability in northern Manitoba depends on frozen soil. As the climate warms, winter road use is likely to be reduced due to melting permafrost. Build in an adaptation scheme for reduced winter road usability into the visioning and planning process when undergoing a development plan review.
- Engage voluntary organizations to assist in determining ways to handle loss or change of habitat or species, and to improve protection and management of areas currently designated as protected.

### 4. OTHER CLIMATE CHANGE ADAPTATION ACTIVITIES

Integrating land use planning with other planning activities in a coordinated effort to address climate change adaptation ensures that resources are strategically aligned to maximize benefits. Below is a list of ways to improve planning for climate change adaptation that will complement land use planning:

- Maintain consistency between emergency planning, integrated watershed management planning, financial plans and budgets, and the development plan.
- Work with emergency measures organizations in the planning process to develop improved contingency responses in cases where emergency services are cut off during an extreme weather event.
- Work in conjunction with other planning authorities in the conservation district to plan as part of a watershed to ensure future water resources are planned for. Integrate watershed management plans with the development plan.
- Combine infrastructure functions to maximize their use. For example, combining roads with swales will improve storm water management and drainage more efficiently.

- Drought and flooding will cause changes to the amount of surface water. An improved drainage plan that encourages or requires the use of retention ponds is a useful implementation tool. A series of retention ponds will:
  - retain water and maintain its distribution throughout a region during drought conditions
  - reduce the peak volume of water downstream during rain events
  - retain excess run-off then slowly release it, reducing peak volume downstream during rain events
  - reduce the risk of storm sewer overflow during rain events
  - help to refresh aquifers
  - provide wildlife habitat and staging areas for water fowl

Portage la Prairie Water Resources Infrastructure Assessment – As part of a Canada-wide vulnerability assessment of municipal infrastructure across Canada, this pilot project assessed the applicability of an engineering protocol developed by the Public Infrastructure Engineering Vulnerability Committee (PIEVC). The protocol was assessed on the waterworks system of the City of Portage la Prairie. The Executive Summary includes contents of what a comprehensive vulnerability assessment entails.

[www.pievc.ca](http://www.pievc.ca)

Still Creek Integrated Stormwater Management Plan – The Still Creek watershed is an urbanized watershed with a high population that is susceptible to disruptive flooding during heavy rain events. Municipalities in the watershed, as well as regulatory agencies, residents and the watershed community, collaborated to develop this plan. [www.metrovancouver.org/](http://www.metrovancouver.org/)