

A Guide for Incorporating Adaptation to Climate Change into Land-Use Planning



Prepared by:
CEF Consultants Ltd.
CBCL Limited



Table of Contents

WHO IS THIS GUIDE FOR?	1
WHAT DOES THE GUIDE PROVIDE?	1
Who Are The Authors?	1
WHAT IS CLIMATE CHANGE?	2
Where Can You Find Climate Change Information?	2
What Climate Impacts Will Occur?	3
Risk and Vulnerability	5
About the Costs.....	6
MITIGATION AND ADAPTATION	6
IS YOUR PLAN CLIMATE PROOF?	7
Document the Existing Situation	7
Evaluating the Vision Statement.....	9
Consultation	10
Identify Goals and Objectives	10
Develop Policies	11
Develop Spatial Relationships	14
Implement Policies	15
Monitoring and Evaluation of Effectiveness.....	16
Administer MPS and LUP.....	17
CONCLUSION	17
REFERENCES	18



A Guide for Incorporating Adaptation to Climate Change into Land-Use Planning

WHO IS THIS GUIDE FOR?

This guide is intended to help land use planners incorporate adaptation to climate change within municipal planning strategies, and beyond planning of communities, to fiscal management of their municipality through risk management. The guide should also be particularly beneficial to members of planning advisory committees, financial planners, engineers, and administrators within municipal governments.

WHAT DOES THE GUIDE PROVIDE?

The guide is intended to provide about 6 months experience of working with climate change issues as they relate to adaptation. Guidance is provided on key issues, describing the pros and cons of different approaches – in some cases the right decision can differ between types or sizes of municipalities. Overall, the guide focuses on the following:

1. What is the difference between mitigation and adaptation – should they be tied together or kept separate?
2. What kind of impacts can occur as a result of climate change?
3. Is adaptation primarily about protecting investments in physical infrastructure?
4. How does adaptation to climate change relate to land use planning?
5. What should a climate change plan look like - how does it differ from a traditional land-use plan?
6. How does a land-use plan link to the other business and services provided by a municipality?

Who Are The Authors?

Norval Collins, MCIP, President of CEF Consultants Ltd. in Halifax, Nova Scotia, has been a consulting environmental planner and biologist for 30 years. Norval was a founding member of ClimAdapt in 2001, and author of a guide for incorporating climate change into environmental impact assessment.



Gordon Smith has over 15 years of consulting experience in planning and environmental design. He works with CBCL Limited in Halifax, serving their offices throughout Atlantic Canada and he is the company's representative to the ClimAdapt network.

J. Brett Allen is an Environmental Planner with CEF Consultants Ltd. in Halifax, Nova Scotia.

WHAT IS CLIMATE CHANGE?

Climate Change refers to both the general warming of our climate, and the increased variability of extreme events associated with this change. The increased variability means that, while the average temperature may be increasing, sometimes temperatures may be colder than usual, as well as hotter. Extreme events include wind, storms, and precipitation. In coastal areas, sea level rise and storm surges can combine to create a major threat to infrastructure. Depending on the issue, increased variability in extreme events may be of more concern than the slow but steady increase in average temperatures.

One of the key obstacles to adapting to climate change is the lack of understanding regarding its short and long-term implications. This understanding requires a sound scientific basis. The Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), was established in 1988 to evaluate the potential risk for human induced global climate change. In 2001, the IPCC released its Third Assessment Report. This report incorporated the latest scientific information, emphasizing the complex interrelationships that exist between the foundations underlying climate change, including climatic, environmental, political, economic, institutional, societal, and technological processes (IPCC 2001). It is this very complexity, interrelated nature, and far reaching implications that make addressing climate change issues so difficult, particularly for long term planning scenarios.

According to the IPCC, adaptation and mitigation strategies to climate change must involve 'locally based, technically and institutionally competent, and politically supported leadership'. However, these initiatives must also be based within the context of other socioeconomic and environmental changes that occur but are not necessarily related to climate change. Therefore, in consideration of these factors, it is important for decision makers, stakeholders, planners, and the general public, to work together in order to reduce the potential risks and maximize the possible benefits (gains) of climate change on the community and regional level, while respecting current international commitments and agreements.

Where Can You Find Climate Change Information?

In Canada, Environment Canada provides meteorological service and will generally help municipalities understand the local realities of climate change. Remember resources are



limited, but increasing emphasis is being placed on providing the needed information to other levels of government.

For example, the Meteorological Service of Canada has created a website to provide assistance to Ontario municipalities in atmospheric hazard identification and risk assessment for naturally occurring events. Background information is provided to help evaluate multiple parameters (www.hazards.ca).

What Climate Impacts Will Occur?

Many of the challenges, constraints, and consequences of climate change fall under three broad categories: the natural environment, infrastructure, and health and safety. These climate change scenarios create particular opportunities and constraints for land use and human development. Examples of climate change impacts are provided in the following table adapted from the UK Climate Impacts Programme web site's Resources section (UKCIP, 2005a; UKCIP, 2005b; UKCIP, 2005c; UKCIP, 2005d; UKCIP, 2005e).

Natural Environment	
Potential Impacts	Examples of Adaptation Responses
Higher risk of flooding/erosion of susceptible developments in floodplains or coastal margins	Ensure planning takes account of future trends in flooding and coastal erosion. Consider range of options for flood and coastal management, including promoting appropriate and sustainable defenses and locating new development away from areas of highest risk. Accelerate investment in existing rolling programs of coastal and river flood defenses to protect existing development in flood prone areas against increased risks from climate change. Undertake planning on a watershed basis with requisite inter-agency cooperation.
Increased risk of subsidence as soils shrink in hotter drier summers	Plan for preventative and remedial maintenance of existing housing stock and infrastructure
Temperature increases affect living space environment	Use thermal properties of materials to improve cooling and retrofit energy efficient air conditioning
Change in ecosystem stability resulting in loss or change of habitat or species	Improve protection and management of existing designated areas and engage voluntary organizations for help. Reduce non-climatic stresses
Loss of ability to attenuate existing or future impacts	Ensure policy builds on the natural dynamics of ecosystems and incorporates buffer zones in designated areas and incorporate opportunities

Natural Environment	
Potential Impacts	Examples of Adaptation Responses
	to facilitated colonization in agri-environment schemes, flood protection schemes and coastal planning.

Infrastructure	
Potential Impacts	Examples of Adaptation Responses
Increased risk of disruption due to flooding, high winds, heavier snowfalls or other extreme weather events	<p>Plan to flood-proof or re-site infrastructure and plan routes to minimize disruption. Assess overhead versus underground systems including comparative risk analysis of factors such as damage from wind and subsidence.</p> <p>Zone landscape around these facilities to minimize flood risks on the infrastructure and the adverse impacts from, for example, run-off.</p> <p>Reduce expected economic lifetimes</p>
Increased temperature causing service disruption and heat stress to traveling public	Avoid exposed places and provide shade or cooled waiting areas
Renewable sources of energy are likely to play an increasing role in future energy provision.	Leave space for these to be developed

Health and Safety	
Potential Impacts	Examples of Adaptation Responses
Higher risk of skin cancer / sun burn due to hotter summers and increased outdoor recreation	Consider ways to increase awareness of dangers of exposure. Provide more shade in public recreational areas
Heat stress to the old, poor and vulnerable communities and people likely to increase	Ensure adequate shade and cooling available. Provide areas of refuge. Improve the preparedness and awareness of society.
Loss of power in high rises has implications for seniors relying on infrastructure, such as elevators for movement to upper floor homes and refrigeration for food storage. They will not be able to escape heat nor will they be able to walk up and down from the upper floors every day to get food.	Consider height restrictions, provide areas of refuge.
EMO facilities could be cut off from areas of need during a natural disaster	Carefully locate new EMO facilities away from medium and high-risk flood areas but without affecting response times. Institute a program of relocation for poorly located existing facilities. Where high-risk areas cannot be avoided facilities need to be designed and constructed to ensure emergency services can be operational in all circumstances. Development of improved contingency responses would also assist in reducing risk.
Dispersal of pollutants, in air, soil and water may be modified	Carefully locate facilities such as waste disposal sites. Re-assess contaminated land or other "brownfield" sites may need to be reassessed for the potential future remobilization of pollutants

Risk and Vulnerability

Potential impacts of climate change on the natural environment, infrastructure, and health and safety can be assessed based upon factors governing risk and vulnerability. **Risk** can be simply described as deviation from the expected. However, risk 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. Due to the uncertainty and variability associated with climate change scenarios, risk and vulnerability assessments can be helpful to direct and balance effort and costs associated with any action. Further guidance on risk-assessment based approaches is provided in the Canadian Standards Association publication CAN/CSA-Q634-M91 *Risk Analysis Requirements and Guidelines* (CSA 1991) and in CAN/CSA-Q850-97 *Risk Management: Guidelines for Decision Makers* (CSA 1997).

About the Costs

The direct costs of land use planning that incorporate adaptation and build in flexibility for climate impacts will be insignificant in comparison to the social or physical costs of doing nothing. Climate related planning is generally only a greater emphasis on good planning, which could bring other benefits such as regeneration of urban areas and improved environmental management. Direct costs of adaptation that will be incurred relate to broadening and coordinating planning processes and educating and raising awareness of decision makers at all levels about how to build climate flexibility into plans.

MITIGATION AND ADAPTATION

Mitigation deals with reducing greenhouse gas emissions that contribute to climate change; adaptation deals with response to changing conditions resulting from climate change. Mitigation will not stop climate change because it is already occurring and the degree of reduction proposed under the Kyoto Protocol is only enough to cause a slight slowing in the rate of change. Mitigation is a response in a global context, whereas adaptation is a local response to deal directly with climate change impacts in your community. This guide does not deal specifically with mitigation, but discusses how mitigation and adaptation are related and the pros and cons of linking them.

Adaptation can be reactive or anticipatory. In the planning context, the emphasis is on reducing costs by taking appropriate corrective action to reduce exposure to risk. Being reactive usually means replacing things damaged as a result of storms, and hopefully changing the design to minimize the costs next time around. But adaptation differs from mitigation in many other important ways. Adaptation involves discussion of risks, uncertainty, and substantial costs with indirect benefits to accrue down the road as a result of reduced exposure to risk. Adaptation can be a difficult sell at the political and public level, compared to mitigation, which can usually be sold as a feel-good program with costs tailored to fit. Adaptation is almost always a difficult sell until an extreme event hits, then a window of opportunity opens for a relatively short period of time until other priorities again take priority.

Adaptation also differs from mitigation in that it is not addressed as a single program. Adaptation is something that needs to be incorporated in business as usual^o—integrated throughout the activities and responsibilities of an agency. Even more importantly, it is a shared response that requires all levels of government to work cooperatively together for the best result. In relation to land-use planning, adaptation must be considered at all stages of a plan from developing a vision to specific implementation tools. Since mitigation can generally be implemented as a stand-alone specific program, adaptation requires a substantially different mindset. Adaptation is almost always viewed as similar to mitigation because it is simply another face of climate change, but it is critical to understand that an adequate adaptation response is entirely unlike what might have been done for mitigation.



Some people have suggested that mitigation and adaptation be linked, to help people understand how the two responses to climate change are related, and that both are important. The benefits or problems associated with linking the two responses will differ between municipalities and different parts of the country. Generally speaking, it is critical that managers understand why adaptation and mitigation are fundamentally different from each other. The natural reaction is to think they should fit in a similar mould, and the sooner the mistake is communicated, the sooner an adaptation response can be initiated.

Guideline: Don't link adaptation and mitigation before thoroughly evaluating the pros and cons in your climate change response.

IS YOUR PLAN CLIMATE PROOF?

This guide is intended to help you specifically evaluate your land-use master plan and determine where change is required and the direction and magnitude of effort required. While many of the required responses can be accommodated within existing planning processes, one cannot rely on the direct application of what has been done elsewhere because climate change impacts will vary significantly from place to place.

The guide is based on a generic model of the planning process as illustrated in Figure 1.

The steps outlined in the remainder of this guide following the outline presented here. It is important to note that planning, although a comprehensive process, is quite sequential in production. Each major step during plan develop tends to go through a separate review and approval process, whether it be with a municipal council or a larger public consultation process. This increases the importance of incorporating appropriate review at each stage to identify the essential concerns to avoid surprising roadblocks later in the process.

Document the Existing Situation

In documenting the existing situation, you need to establish the climate change context in your municipality. You want to understand what impacts climate change has or may have in your area, what are people's perceptions about climate change, what information sources exist to help you and which of your community's assets are most at risk. You should also coordinate with the local emergency response coordinators to ensure they are aware of what you are doing and obtain input.

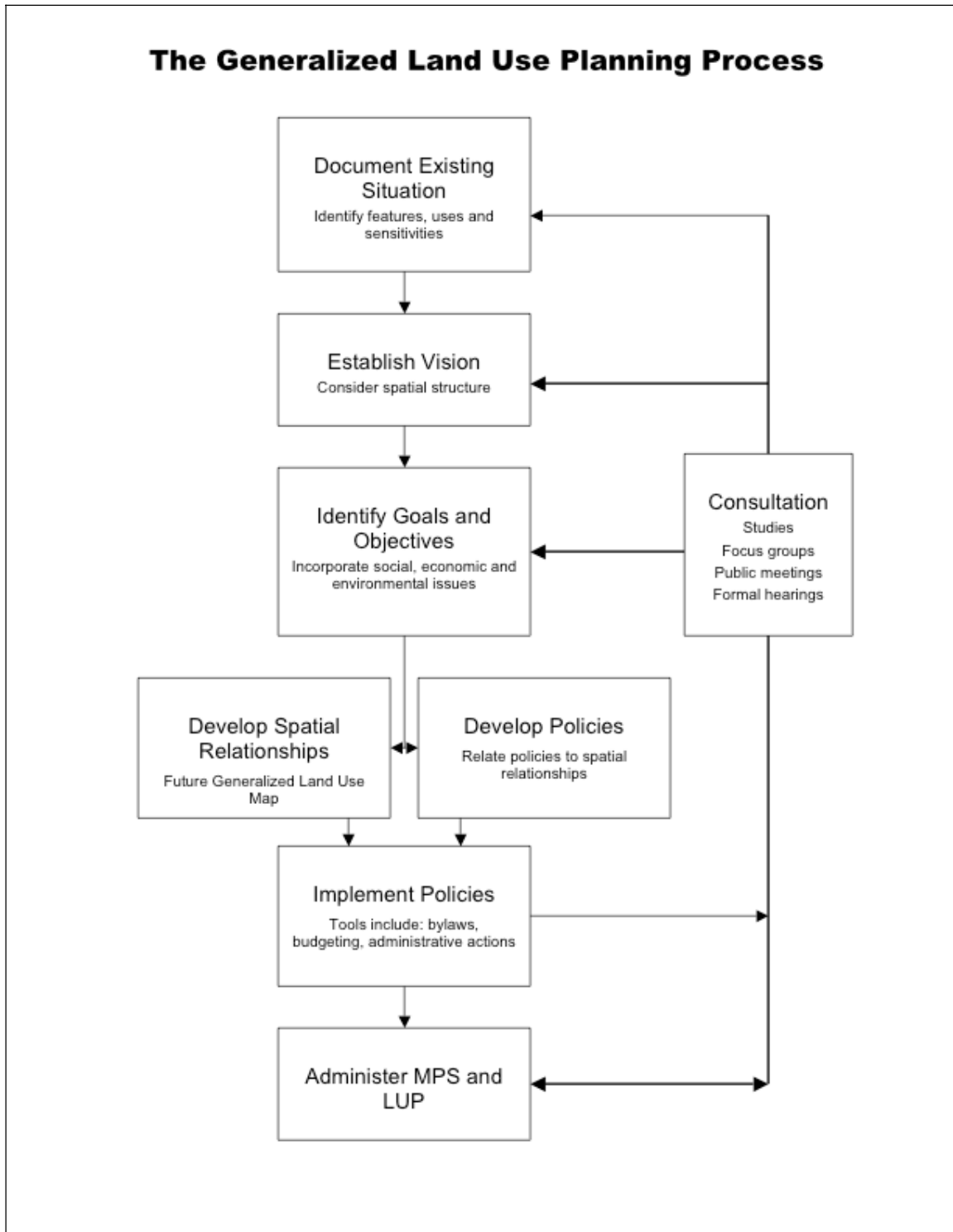


Figure 1: A Generalized Diagram of the Land-Use Planning Process

Guideline: As you begin the process of incorporating climate change considerations into your land use plans, you should undertake the following activities:

- 1. Identify any climate change related problems that have occurred to date;**
- 2. Identify perceptions regarding the risks of climate change within your organization;**
- 3. Discuss resources for analysis of climate change data within your municipality and with climatologists at Environment Canada;**
- 4. Review issues with emergency response coordinators to ensure they are aware of what you are doing, and**
- 5. Identify key vulnerabilities if the information is available.**

Answers to these questions should provide an initial familiarity with the situation that helps identify resources that will be of value as you proceed to examine your response to climate change in more detail.

Evaluating the Vision Statement

The vision statement for your municipality may sound like motherhood and apple pie, but it is critical to evaluate how the overall vision for your municipality might be affected say 50 years into the future by climate change. The key questions for evaluating the degree to which the vision is climate change proof are:

1. Will the pillars that support the financial and social viability of your municipality remain strong enough to support the vision?
2. Are the key elements of the vision especially vulnerable to climate change?

The evaluation at this stage should be relatively straightforward. For example, if a large portion of your municipality is dependent on marine shipping, then it is reasonable to look at existing assessments that deal with shipping to evaluate the risk to this source of financial stability. As a guideline, the top six economic sectors supporting your community should be examined to determine if major issues likely affect the vision statement. If obvious weaknesses are identified, it may be important to re-evaluate the vision statement in light of these risks.

Similarly, the vision statement might specify particular elements that are potential at risk directly. Again, if this is the case, the vision statement should either change its emphasis, or be reworded to include specific mention of the risks from climate change.

Guideline: Check the foundations that support your community to ensure the vision is reasonable given the reality of climate change.

Consultation

Consultation is generally carried out at multiple stages of plan development. The type or quantity of consultation will probably not vary much with consideration of climate change. However, care should be taken to identify especially vulnerable groups to make sure they have been adequately included. It will also be important to ensure residents are made aware of potential climate change impacts and how they could impact on overall planning as well as individual properties.

When it comes to consider financial implications of climate change, it is essential to evaluate the distribution of costs and benefits. A shift in the traditional distribution of who pays and who benefits can occur. For example, the risk of building in flood prone areas will no doubt increase with climate change, but the question of who carried the risk and who must pay for flood protection improvements to protect existing properties is not always clear.

Guideline: Make sure those most vulnerable to climate change or the costs incurred from climate change are appropriately consulted.

Identify Goals and Objectives

Plans generally have multiple goals, each with related objectives. Together they determine what criteria should be used to develop specific policy and help direct planning and development priorities. The following questions may be beneficial in determining what criteria should be considered. Do the goals and objectives:

- integrate social, economic, and environmental issues?
- incorporate climate predictions and implications?
- consider pertinent legislation and other policies?
- predict changes in human behaviour?

Criteria can provide reasonable bounds for policy development by focusing effort and ensuring that the associated costs and benefits are not distributed unfairly amongst individuals, stakeholders, and government.

Some goals of a plan deal with environmental aspects of the community, such as green space, environmental protection and recreation. These environmental aspects may seem more obviously connected with climate change, but other connections may be less obvious. At this stage it is important to identify the kinds of information you need to determine the links to climate change. The goal or objective is vulnerable if you can postulate a realistic scenario where the risk is unacceptable.



Other goals of a plan deal with social aspects of the community. Some demographic groups, for example, the elderly, can be particularly vulnerable to conditions resulting from climate change, particularly increased summer temperatures. If electricity fails in a high-rise development when temperatures are extremely high, little can be done and mortality can result.

Guideline: Vulnerability of goals and objectives should be evaluated using realistic scenarios to identify unacceptable risks to extreme events.

Develop Policies

Policies that either consider or incorporate climate change have been slow to develop. Generally, the lack of policy development has been due to either limited awareness or ambivalence towards climate change issues. Although the potential outcomes of climate change effects can be reasonably evaluated, continued uncertainty surrounding long-term climate change scenarios can obscure the relevance and importance of related issues to land use planning. This unpredictability can lead to reluctance on the part of planners, decision makers, and other stakeholders to promote long-term policy development.

However, the formulation of climate change policy and improvements to successfully deal with future climate change issues will provide additional resilience to the planning process by reducing overall vulnerability and risk to any extreme event, not necessarily only those that are climate change related. It is important to act now and through the plan review process improve the ability to forecast potential local climate change impacts and develop responses specific to your community.

Guideline: Try to anticipate rather than respond. Begin developing appropriate climate change policy now to improve ability and capacity to deal with future climate change scenarios.

Climate change policies should not stand by themselves. Climate change can be integrated with broader policy measures that support the protection and sustainability of the natural environment, the built environment including infrastructure, and human health. More specific examples include policies that govern coastal zone management, environmental impact assessments, disaster management, economic instruments, building codes, and environmental management plans (Khan 2001).

Guideline: Integrate climate change policies with other policies that support similar planning goals and objectives.

Care should be taken to avoid implementing policies that constrain or limit future options to respond to variable climate change scenarios. Given the uncertainty associated with current climate change impact predictions, it would be wise to maintain a toolkit of responses to maintain flexibility of response rather than to commit entirely to one course of action that you may not be able to modify as circumstances change.



Guideline: Be aware of enacting short-term policies that may constrain future response options.

There are numerous examples of climate change policies that support adaptive planning strategies. These include:

- no new development within xx metres of shorelines;
- no new development with the xx year floodplains;
- no new development that would increase water demand over the current planned capacity;
- no new development on steep slopes over xx%, and
- no new development in areas prone to coastal surges without an approved emergency evacuation plan.

You will note that these climate change policies are not really different than many of the existing policies applied in planning documents already. What will be different is the extent of the areas to which they may be applied. While ultimately, adaptation to climate change should be seamlessly integrated into policies and plans as a matter of course, initially it may be necessary to create specific climate change policies to develop awareness and address specific issues in a conscious manner.

The following steps have been established to help guide the development of a climate change policy within the planning process and are intentionally similar to those of the Land Use Planning process (see Figure 2).

Determine Scope of Policy

Effective climate change policies should provide a framework that can enable planners to make appropriate recommendations pertaining to climate change and its potential implications for land use planning. In this respect, climate change policy should consider the municipal vision statement as an overall guide. For example, if the municipal vision statement encourages sustainable livelihoods or biodiversity preservation, policy should consider the possible implications of climate change could on the pillars that support these visions.

The scope will identify the problem(s) that the policy is intended to address, which will determine what actions are required (CAG 2004). Scope should also consider time frame, whether it is short, medium, or long term. Time frame helps to determine what resources may be required to institute and sustain the policy for extended periods. Longer time-periods may require more adaptive policies that can incorporate new science and respond to changing conditions.

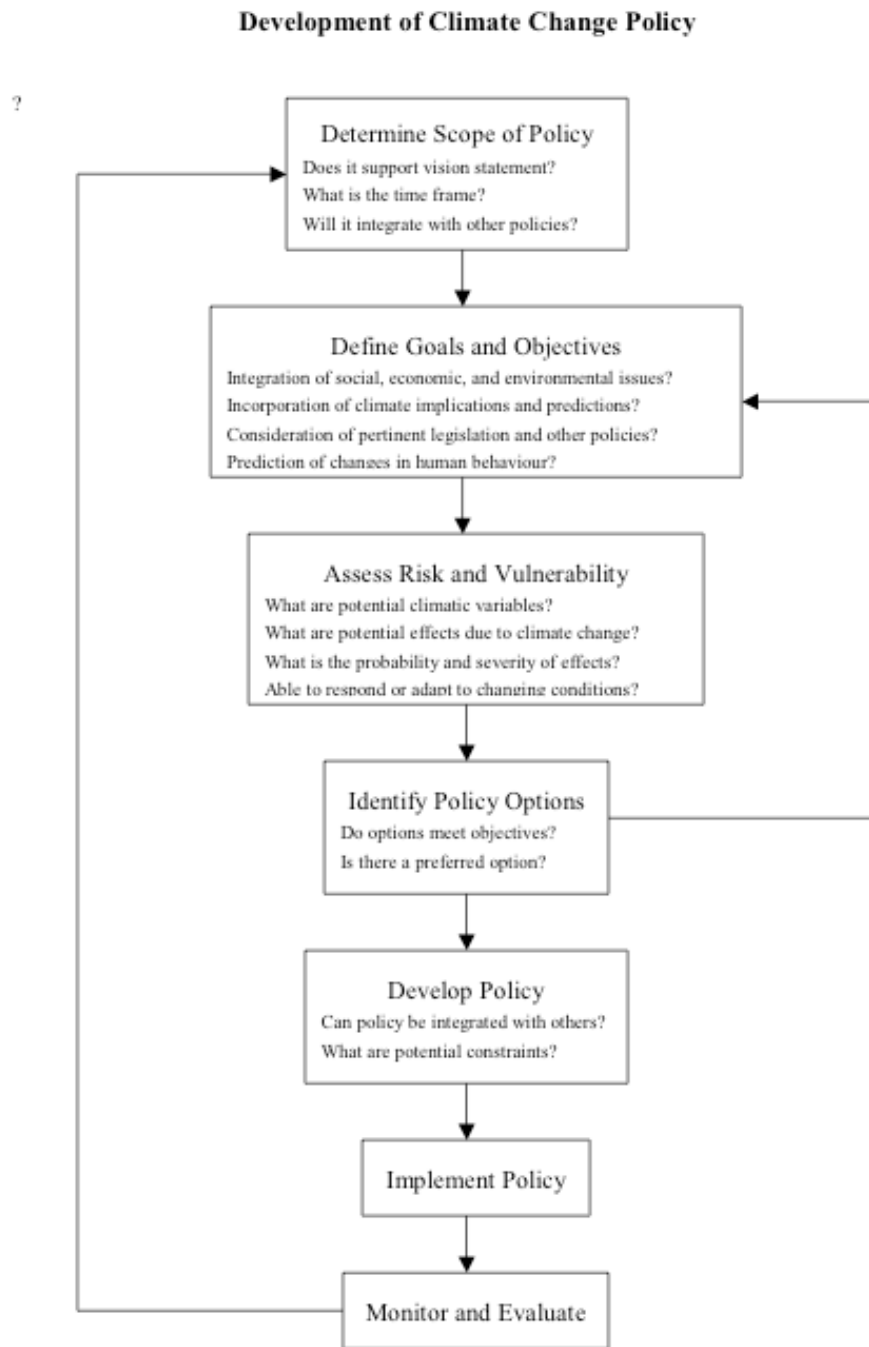


Figure 2: Development of Climate Change Policy

Guideline: Consider climate change policy in terms of short, medium, and long-term framework supporting the municipal planning vision.

Risk and Vulnerability Assessment

Planners should recognize and anticipate the effects of climate change to better plan for different climate change scenarios. Risk and vulnerability assessments can address some of the uncertainty surrounding future climate change by focusing policy goals and objectives. Policy and action priorities can be established by considering factors such as potential climate change effects and implications, overall costs, time frame, and intent.

Determining potential climatic variables is an important component of the assessment. For example, coastal communities may have different planning priorities than inland communities when considering climate change effects such as sea level rise. Potential effects, including the probability of occurrence, severity, and its implications, should also be considered.

Guideline: Conduct a risk and vulnerability assessment to determine priorities and focus policy goals and objectives.

Identify Policy Options

The unpredictability of future climate change requires a variety of policy options that can respond to different scenarios. Possible options might range from doing nothing to doing a lot. Some policies, such as those governing water management, may be of benefit regardless of future climate scenarios. Other policies, such as adaptable building design, may have higher benefits depending upon the extent and nature of potential climate change (CAG 2004). Policies that deal directly with climate change issues, such as sea level rise, may incorporate retreat, accommodation, or direct action responses.

Specific or preferred policy options may not be obvious. If the policy option cannot meet the defined objectives and goals, further analysis may be required. This may require revisiting goals and objectives defined earlier in the process. Deciding upon specific or preferred options generally determines what resources (financial, material, and/or knowledge) will be required to support the enacted policies.

Guideline: Develop policy options that can respond to variable scenarios.

Develop Spatial Relationships

Land capability, suitability, and the feasibility of different development alternatives are analyzed to determine appropriate spatial relationships that form the basis of the



generalized future land use maps. These maps can be developed at the regional, municipal, or site-specific scales.

Changes in vulnerability may necessitate changes in existing or proposed land use patterns. Activities such as agricultural or tourism may become more difficult to pursue. The provision of buffers and the protection of natural areas that can act as storm abatement and attenuation areas may become more important. Inter-jurisdictional planning and coordination may become more important. There may be a need to create detailed plans for specifically vulnerable areas. Climate will be more dynamic and there will be a need to review spatial relationships more often and be prepared to make changes based on new information as it becomes available.

Guideline: Consider the potential impact of extreme events and possible longer term changes in environmental conditions as one of the bases upon which the land use plan is created.

Guideline: In addition to changes within your municipal unit, look beyond your boundaries for potential impacts that could affect the plans you create.

Guideline: Keep on top of data related to climate change in your area, for example, sea level rise, hydrographic and flooding data, etc., and be prepared to make changes to your generalized future land use maps based on the incorporation of that information during your plan reviews.

Implement Policies

Planning policy is implemented through tools such as zoning by-laws, regulations, the budget process, and incentives. While impacts occurring outside municipal boundaries are often considered in planning documents, the aspect becomes more critical as a result of potential climate change impacts and improved liaison with bordering and influencing jurisdictions becomes more important.

While some of the changes to implementation tools may be implemented immediately through administrative adjustments, others will require modifications to legal instruments such as by-laws and regulations, and will have to follow the plan amendment process. For example, changes to the boundary of a land-use zone or general setbacks from watercourses will necessitate changes to planning documents and will require consideration and consultative efforts on the part of municipal staffs and councils, while requesting additional information on stormwater management plans from a developer may not be as onerous.

Implementation actions requiring substantial effort by the municipality will require consideration in the budgeting and human resource allocation process. With the variable



level of effort required to implement different changes within an environment of limited resources, it will be important to prioritize efforts based on urgency of the required change and the resources needed to implement the change.

Once decisions are made on what actions are required, it will be important to monitor progress toward implementation. However, climate change is not a static event and monitoring will be required to ensure that plans and implementation activities respond to altered circumstances and improved projections.

Guideline: Determine required amendments to zoning plans and by-laws to reflect climate change impacts. Determine budgeting and human resource allocations required to implement the required amendments.

Guideline: Determine if additional information on the consideration of climate change adaptation is required from developers as part of the application process, for example, improved stormwater management plans that consider extreme events.

Guideline: Liaise with other municipal units and jurisdictions to be aware of what impact their efforts may have on your municipality and to coordinate efforts to manage both incoming and outgoing impacts.

Monitoring and Evaluation of Effectiveness

Monitoring should focus on changes in spatial relationship, such as flood zones, that result from climate change.

Although coordinating climate change policy with existing land use planning policies and strategies is essential, the current effectiveness of these policies should first be evaluated as to their suitability for long-term planning responses.

Understanding and evaluating planning options is a key to improving overall adaptability. Inclusion of measures that can provide checks and balances to inform planners and decision makers whether the policy is effective, and if not, allow for implementation of suitable adaptation measures, is beneficial.

The evaluative process can be performed in either an iterative or circular manner. The iterative process permits refinements of policy scope, risk assessment mechanisms, options, and decision-making criteria (CAG 2004). Circular processes permit continual reevaluation as policies are revisited and reviewed regularly as new knowledge is gained and climatic conditions become more certain.

Guideline: Periodic reviews of climate change projections for your area should be incorporated into the plan review process to ensure plan adapts to changing environment.

Administer MPS and LUP

The effectiveness of a climate change plan is dependent on its initiatives being carried out in the future. Regardless of how good the plan may be, its effective communication is the key to its continued success.

Communication on climate change is essential for both municipal councils and the public. Future councils must continue to support the initiatives to reduce exposure to risks in the face of constant demands for short-term priorities. At the same time, the public must understand and support the expenditures council approves. In the short term it will take considerable effort to sell adaptation to reduce future risks, but continued good communication will need to be maintained to sell appropriate responses over the long term.

Guideline: Both short term and long term communication strategies will be required to sell adaptation planning.

CONCLUSION

This report provides an outline in which to begin thinking about climate change adaptation responses and land uses planning. There is no one correct approach and it is important to determine the appropriate response for your community within the context of your local situation. As noted at the outset, the guide focuses on answering the following questions:

What is the difference between mitigation and adaptation – should they be tied together or kept separate?

Adaptation and mitigation are different responses to climate change. You want to be sure of the pros and cons of linking them before you do.

What kind of impacts can occur as a result of climate change?

There are a variety of physical impacts such as changing floodlines or increased storm surges, but there are also social aspects of which we must be aware.

Is adaptation primarily about protecting investments in physical infrastructure?

No, while protection of infrastructure is an important aspect, adaptation is about protecting human health and safety and improving quality of life.

How does adaptation to climate change relate to land use planning?

It doesn't change the process; it integrates into the existing process and makes good planning more important.

What should a climate change plan look like - how does it differ from a traditional land use plan?

Good planning already addresses the elements that will be impacted by climate change. What will be different is that the plan may have to take a longer term view and will have to be able to incorporate a higher level of uncertainty.

How does a land use plan link to the other business and services provided by a municipality?

The land use plan is an important document, because it helps municipalities spend money wisely over the long term. Not recognizing the importance of adaptation, and planning infrastructure and development appropriately could cost millions of dollars.

REFERENCES

Allen Consulting Group (ACG). 2005. *Climate Change Risk and Vulnerability: promoting an efficient adaptation response in Australia*. Report to the Australian Greenhouse Office, Department of the Environment and Heritage. Commonwealth of Australia.

CAG consultants. 2004. *The Planning Response to Climate Change*. Office of the Deputy Prime Minister: London. Oxford Brookes University, Oxford.

Canadian Standards Association, 1991. *Risk Management: Guideline for Decision Makers CAN/CSA-Q634-91*. Rexdale, ON, Canada.

Canadian Standards Association, 1997. *Risk Analysis Requirements and Guidelines CAN/CSA-Q850-97*. Etobicoke, ON, Canada.

Engineering and Physical Sciences Research Council (EPSRC) and UK Climate Impacts Programme (UKCIP). February 2003. *Building Knowledge for a Changing Climate. The impacts of climate change on the built environment*. Published under the UK Climate Impacts Programme, Union House, 12–16 St. Michael's Street, Oxford, UK, OX1 2DU.

Environmental Resources Management. May 2000. *Potential UK adaptation strategies for climate change*. Produced for the United Kingdom Department of the Environment, Transport and the Regions, 99DPL013.

Intergovernmental Panel on Climate Change (IPCC). 2001. *Climate change 2001: Synthesis Report, Summary for Policymakers*.

Khan, Marlon. 2001. *National Climate Change Adaptation Policy and Implementation Plan for Guyana*. Prepared for the National Ozone Action Unit of Guyana/Hydrometeorological Service. Guyana.

Pittock, Barry. 2003. *Climate Change: an Australian Guide to the Science and Potential Impacts*. Australian Greenhouse Office. Commonwealth of Australia.

UKCIP. 2005a. *Activity / Local Authorities - Service Impacts and Adaptations / Environmental services and awareness*. Retrieved 6 September 2005 from http://www.ukcip.org.uk/resources/sector/ci_sector_la.asp?sector=11&las=env

UKCIP. 2005b. *Activity / Local Authorities - Service Impacts and Adaptations / Health and social*. Retrieved 6 September 2005 from http://www.ukcip.org.uk/resources/sector/ci_sector_la.asp?sector=11&las=health

UKCIP. 2005c. *Activity / Local Authorities - Service Impacts and Adaptations / Transport and highways*. Retrieved 6 September 2005 from http://www.ukcip.org.uk/resources/sector/ci_sector_la.asp?sector=11&las=transport.

UKCIP. 2005d. *Activity / Local Authorities - Service Impacts and Adaptations / Housing and buildings*. Retrieved 6 September 2005 from http://www.ukcip.org.uk/resources/sector/ci_sector_la.asp?sector=11&las=housing

UKCIP. 2005e. *Activity / Local Authorities - Service Impacts and Adaptations / Planning*. Retrieved 6 September 2005 from http://www.ukcip.org.uk/resources/sector/ci_sector_la.asp?sector=11&las=planning

For more information contact:

Norval Collins, MCIP
CEF Consultants Ltd.
5443 Rainnie Drive
Halifax, Nova Scotia
(902) 425-4802
email: ncollins@cefconsultants.ns.ca

or Gordon Smith
CBCL Ltd.
1489 Hollis Street, The Brewery
PO Box 606
Halifax, NS B3J 2R7
(902) 421-7241
email: gordons@cbcl.ca

