

# Climate Change Adaptation Framework

Manual



April 1, 2010

**Note:** The Climate Change Adaptation Framework was developed for Alberta Sustainable Resource Development. The Framework and the adaptation preparedness activities described in this Manual can be modified and applied by any organization for the purposes of conducting vulnerability and risk assessments and identifying adaptation options.

# Executive Summary

Changes in the climate will affect regional and local environments over the coming decades. There are many indications that some changes are already occurring such as shifting vegetation ranges and increasing frequency of extreme weather events. Organizations need to start preparing for climate change and adapt to the economic and ecological consequence impacts. At the same time they should identify and take advantage of potential opportunities. This is the underlying concept of climate change adaptation.

The ***Climate Change Adaptation Framework Manual*** (the 'Adaptation Manual') is intended to help organizations address climate change risks in a comprehensive and consistent manner. It integrates the key elements for robust climate change adaptation: integration with strategic planning, standardized processes, continuity and stakeholder involvement. The users of this manual can be any individual or group responsible for managing or understanding climate change adaptation risks; and may include elected or senior officials, division leaders, or technical staff.

The Adaptation Manual accompanies the ***Climate Change Adaptation Framework***, an evidence-based decision support tool that provides a consistent yet flexible approach to understanding where an organization may be vulnerable to climate change impacts, analyze the risks to achieving objectives and identifying options to adapt and building organizational capacity to respond. The Adaptation Framework can be modified for any enterprise risks as it is based on broadly recognized standards for risk management.

Climate change may threaten an organization's ability to achieve its strategic objectives. Development of climate change adaptation plans should therefore be integrated with strategic planning and Enterprise Risk Management (ERM) processes. The Adaptation Manual provides guidance in this integration.

The complexity of the impacts and the responses required to address climate change adaptation, requires input from a diverse group of members across an organization. The Adaptation Manual recommends developing an 'Adaptation Management Team' (AMT) to coordinate understanding, assessment and response to climate change impacts. The AMT can operate on two-levels, facilitated by an identified Adaptation Coordinator. A senior-level team, or Strategic Planning Team, will provide the broad organizational vantage point and guidance for completing the activities in the Adaptation Framework. The Technical Team is the working-level team that conducts assessments and identifies adaptation options, among other activities. The Adaptation Coordinator acts as liaison between the Strategic Planning Team and the Technical Team, facilitating the specific application of the Adaptation Framework, in addition to other activities as required.

The Climate Change Adaptation Framework is a robust, risk-based approach that can be adopted to enable the identification of adaptation responses that perform well across a range of plausible futures. The tool follows a straightforward process including:

- identifying the scope of the assessment and communicating expectations to all team members involved;
- conducting activities to identify organizational vulnerabilities;
- prioritizing risks; and,
- identifying a suite of potential adaptation options.

The development of an adaptation strategy is closely connected to this process, but it is out of the scope of the Adaptation Framework and the Adaptation Manual. The concluding section to the Manual, 'next steps', provides a high-level overview of how the framework links to the strategic planning process.

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# I. Introduction

## Purpose

Changes in the climate will affect regional and local environments for decades and centuries to come. There are many indications that changes are already occurring such as shifting vegetation ranges and increasing frequency of extreme weather events. Climate change will consequently affect the way organizations<sup>1</sup> and public decision-makers plan and implement land, resource and infrastructure management strategies.

Organizations need to start preparing today for the impacts of climate change and adapt appropriately to deal with economic and ecological impacts, as well as take advantage of any potential opportunities. This is the underlying concept of climate change adaptation.

The key elements for robust climate change adaptation planning are integration with strategic planning, standardized processes, continuity and stakeholder involvement. These key elements are evident throughout the **Climate Change Adaptation Framework** (the 'Adaptation Framework') and this companion document, the 'Adaptation Manual'. The Adaptation Framework provides an evidence-based decision-support tool that integrates climate change risks into existing Enterprise Risk Management systems and strategic planning approaches to assist decision makers to identify the appropriate responses to changes in climate.

This guidance document was developed to provide clear, straightforward instructions for initiating and completing the adaptation planning process using the Adaptation Framework. The manual itself is adaptable and can be modified for any purpose or organization as the Adaptation Framework is based on broadly recognized standards for risk management. The activities can be readily integrated into organizations' existing enterprise risk management processes to identify and assess any enterprise risks.

## Structure

The Adaptation Manual is organized into the following sections:

- Climate Change Adaptation Risk Management
- The Adaptation Management Team
- The Climate Change Adaptation Framework - Overview
- Adaptation Framework Steps
  - Step1: Scope and Preparation
  - Step 2: Vulnerability Assessment
  - Step 3: Risk Assessment
  - Step 4: Adaptation Options
- Next Steps: Prioritizing Options and Developing the Strategy

The concluding "Next Steps" section provides an overview of how the outputs from the Adaptation Framework process can be integrated into an organization's strategic planning process.

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<sup>1</sup> The term 'organization' is used in this manual to refer to public sector agencies, companies, non-profit organizations and other associations. The process and approach for climate change adaptation risk management is similar for all organizations with some minor differences in how the assessments are conducted including scale and scope as well as types of risks addressed.

Figure 1 provides a document map to orient the reader. Small map icons are provided in each main section depicting the location of the section in relation to the entire document.

Information boxes, tables and charts are also provided to help elaborate on certain topics and themes. These are offered as examples and ideas, and are intended to stimulate thinking about risk management and adaptation planning, and how these concepts can be applied by an organization.

Templates are provided throughout the framework steps and activities, and are populated with illustrative examples only. A glossary and resources are included in [Appendix A](#) and [Appendix B](#) for more information.

This document should be updated and adapted over time to changing circumstances and as new information becomes available.

## Scope

This Adaptation Manual is designed to guide organizations through a process of understanding sensitivities and existing adaptive capacity, which are used to assess vulnerabilities and help to prioritize key climate change risks according to their likelihood of occurrence and magnitude of their impacts. This will enable decision makers to identify appropriate adaptation responses. The following sections of this document provide step-by-step guidance and specific instructions for applying the Climate Change Adaptation Framework, including:

- how to complete an organizational vulnerability assessment;
- how to complete a risk assessment; and,
- how to identify potential adaptation options.

The users of this manual can be any individual or group responsible for managing or understanding climate change adaptation risks, for example:

- Elected or senior officials who want to ensure that their organization is adequately identifying and treating climate change risks, coordinated with other enterprise risks;
- Department leaders who need to understand the nature of how climate change risks could impact the achievement of objectives; and,
- Division, regional or branch leaders and staff who are interested in understanding specific risks and adaptation responses related to their operations, programs and activities.

The processes and activities in this manual are provided as a guideline only and may not be appropriate or feasible for every circumstance. Activities, steps and resources referenced may need to be modified to suit the needs of the organization.

This manual is not intended to identify options to mitigate climate change, such as reducing greenhouse gas emissions.

**Figure 1: Document Map**



## II. Climate Change Adaptation Risk Management



### What is climate change adaptation?

Carbon dioxide and other greenhouse gases remain in the atmosphere for decades or centuries after release, meaning that emissions today will continue to affect the climate in the future. Even with aggressive emissions reduction (or, mitigation) approaches, increasing global mean temperatures, precipitation variability and extreme weather events such as more frequent droughts or floods are projected to occur over the next century. This will create challenges for strategic planning because organizations cannot rely on historical climate data to project future activities and risks, in addition to the increasing uncertainty and complexity in how society and ecosystems will respond to a changing climate. Organizational preparedness and planning will be important in order to lessen the effects of these changes on organizational objectives and strategies.

In the context of an organization, adaptation refers to processes, actions and strategies that allow the organizational system to cope with, manage, and adjust to changing climatic conditions such that risks are responded to and opportunities are captured.<sup>2</sup> Figure 2 illustrates some leading practices for climate change adaptation management.

Figure 2: Leading Adaptation Practices

<b>Build Adaptive Capacity</b>	Establish systems for data collection and monitoring, evaluation processes, awareness-raising initiatives, and policies to encourage, support and require individuals to incorporate climate change risks and adaptation into decision-making.
<b>Embed Climate Change into Planning</b>	Integrate consideration of the potential impacts of climate change into departmental policies, plans and programs. Conduct participatory climate risk and vulnerability assessments. Incorporate climate change risks into ERM process and strategic planning exercises.
<b>Identify 'Win-Win' Opportunities</b>	Identify a suite of potential adaptation options. Evaluate the options based on the costs and benefits relative to 'doing nothing'. Identify and deploy activities that reduce risks across a spectrum of potential climate change conditions.
<b>Monitor and Re-assess</b>	Monitor performance routinely; seek out new data and emerging climate science, and re-assess strategies and actions. Integrate scientific and local knowledge and perspectives.

<sup>2</sup> Smit, B. and J.Wandel. 2006. Adaptation, adaptive capacity and vulnerability. Global Environmental Change 16, 282-292.  
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Adaptation operates at two levels<sup>3</sup>:

1. **Building adaptive capacity:** organizations can deploy technology, processes, information and resources that create conditions for adaptation (e.g., training, policy development, etc.).
2. **Deliver adaptation options:** organizations can initiate activities that reduce vulnerabilities to climate change or exploit opportunities (e.g., invest in infrastructure, design market-based conservation tools, etc.).

Coordinated, risk-based approaches to direct investments and resources towards priority risks and vulnerable organizational aspects can limit costly disruptions and safeguard economic and social well-being.

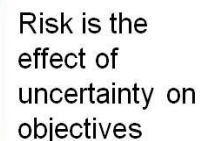
## What is risk management?

All organizations face internal and external factors that produce uncertainty which presents both risks and opportunities. Risk management for an organization, or 'Enterprise Risk Management' (ERM), is an integrated tool to enable decision-makers to effectively address uncertainty and respond appropriately to risks and potential opportunities.<sup>4</sup>

ERM is a multistep process to identify, analyze and assess risk; develop mitigation and contingency plans; monitor risks; and, report on risk responses and contingency plans. It can be applied at any time, at any level of an organization, by any function or working team, and can be specific to policy, programs, activities and functions of the organization.

Risk may be defined as the effect of uncertainty on objectives. Broadly speaking there are two overarching categories of risk:

1. **Risk to achieving objectives:** A risk that a policy, program or project will not achieve the intended objective.
2. **Unintended Consequences:** A risk that, while the objective is achieved, the deployed policy, program or project has an unintended positive or negative consequence, either for the organization or for external stakeholders or ecosystem.<sup>5</sup>



Risk is the effect of uncertainty on objectives

ERM addresses all risks types including, for example, financial, operational, reputational and strategic risks, across business units and functions within an enterprise. A risk-based approach to decision-making can provide a number of benefits, including:

- Establishing a reliable basis for decision-making and strategy development;
- Improving the organization's ability to identify, escalate, address and manage issues at the appropriate scale;
- Providing a standardized, systematic and timely approach which contributes to efficiency and consistent, comparable results;
- Avoiding the consideration of risks in organizational "silos"; and
- Providing assurance for senior leaders that issues are managed appropriately and cost effectively across the organization, and increases the likelihood of achieving organizational objectives.<sup>6</sup>

## Why enterprise risk management for climate change?

Climate change presents an additional uncertainty for decision-makers to address; but what is known is that impacts will be experienced across environmental, social and economic systems. The extent, magnitude and

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<sup>3</sup> Willows, R. and R. Connell. Eds. 2003. Climate Adaptation: Risk, uncertainty and decision-making. UKCIP Technical Report.

<sup>4</sup> International Standard Organization. 2010. ISO 13000: Risk Management – Principles and Guidelines. International Standard Organization.

<sup>5</sup> Sustainable Resource Development. Personal communication, February 19, 2010.



direction of changes for a local area and specific region may be little understood but changes are occurring now, and will continue to have far reaching implications for the future.

Imperfect and fragmented information about changing climate conditions should not be a barrier to taking action. A robust, risk-based approach can be adopted to enable the identification of responses that perform well across a range of plausible futures.

### **What are the anticipated climate change impacts for Alberta?<sup>7</sup>**

A considerable body of scientific research is accumulating which describes the potential risks - economic, environmental, and social – associated with an altered climate system. Recent trends and future projections suggest the following examples of climate change impacts for Alberta.<sup>8</sup>

- Increase in average temperatures and extreme weather events (e.g., drought).
- Reduction in water quality and quantity resulting from lower summer stream flows, decreasing precipitation, falling lake levels, retreating glaciers and increasing surface water deficits.
- Reduction in wildlife and fish habitat as climate variability shifts historical ranges.
- Reduction in soil moisture resulting in diminished forest and agricultural productivity.

Climate change will affect the ability of ecosystems to function. Ecosystem services (ES) are the benefits people obtain from ecosystems including “provisioning” services such as food and water; “regulating” services such as flood and climate control; “supporting” services such as soil formation and nutrient cycling; and “cultural” services such as recreational, spiritual, religious and other nonmaterial benefits.<sup>9</sup> This ecological infrastructure provides goods and services that are essential for vibrant economies and communities. Infrastructure development, natural resource extraction and climate change have the potential to impact ecosystems, altering their ability to continue to supply these services at the level desired by society. Organizations can deploy activities that restore and strengthen ecosystem services and their ability to support adaptation responses such as flood protection.

Vibrant economies and communities are not only dependent on ecosystem services, but also the socio-economic sectors that provide jobs, education, health care and other services. Socio-economic sectors are the relationships that influence how an organization can respond to enterprise risks and deliver on strategic objectives under changing economic, environmental and social conditions.

Organizations can use the concepts of ecosystem services and socio-economic sectors (ES-SES) to provide categories for understanding, assessing and developing strategic adaptation investments within the organization’s sphere of influence. This approach can help decision-makers target strategies and actions at building resiliency, not only in their organizations, but also healthy functioning ecosystems, which socio-economic sectors are ultimately dependent upon. Sustaining productive ecosystem services is a key adaptation strategy as it can offer cost-effective solutions with synergistic benefits.

### **How does an organization integrate adaptation in existing Enterprise Risk Management (ERM) and strategic planning processes?**

Generically, strategic planning involves identifying objectives, setting goals, understanding trends and issues, identifying and prioritizing alternatives, allocating resources, and deploying the most appropriate tactical responses to achieve the objectives. Strategy development activities can be strengthened with a more comprehensive understanding and analysis of risks. Robust ERM offers a tool to holistically analyze and respond

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<sup>7</sup> The full suite of climate change impacts projected for Alberta is beyond the scope of this Adaptation Manual. Additional resources are provided in Appendix B.

<sup>8</sup> Sauchyn, D. and S. Kulshreshtha. 2008. Chapter 7: Prairies, *in* From Impacts to Adaptation: Canada in a Changing Climate 2007, edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush. Government of Canada.

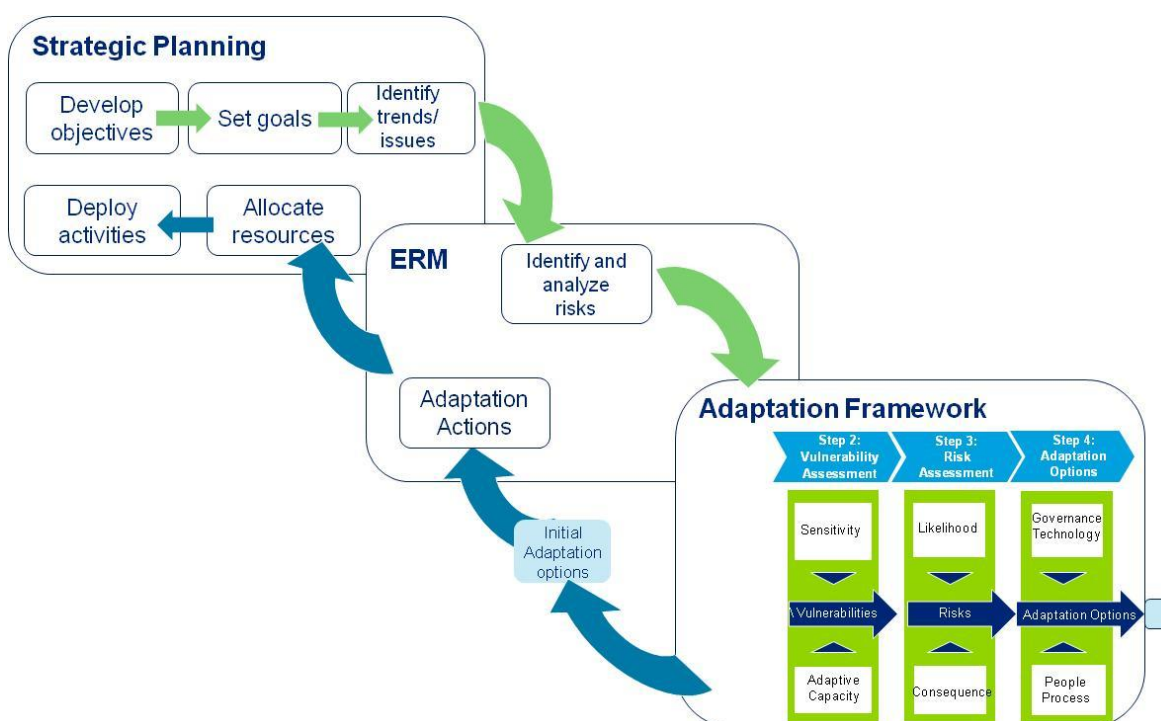
<sup>9</sup> Daily, G.C. Ed. 1997a. Nature’s Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, DC; and, Millennium Ecosystem Assessment Board. 2005. “Living Beyond Our Means: Natural Assets and Human Well-Being.” Geneva, Switzerland: The United Nations Environment Program.

to a suite of enterprise risks, including climate change, and allows an organization to respond to those risks strategically.

Climate change is one of many risks that requires integration into an Enterprise Risk Management system, so that it can be measured and addressed in proportion to other organizational risks. Organizations that have an existing risk management system will likely find the integration of the Adaptation Framework, and climate change impacts and risks specifically, relatively straightforward as the activities are an extension of existing skills, practices and capabilities.

The Adaptation Framework was developed according to leading practices for risk management including the ISO 31000 Risk Management standard. The preparation activities and assessment processes are well suited to fit into an organization's existing risk management and strategic planning methodologies. Figure 3 illustrates the relationship between strategic planning, ERM and the Adaptation Framework.

**Figure 3: Climate Change Adaptation Framework within Strategic Planning and ERM Functions**



The strategic planning process establishes the objectives; ERM evaluates the risks and potential responses; and, the Adaptation Framework is a component within ERM that provides a tool to analyze the adaptive capacity of an organization to respond effectively, prioritize the risks and identify potential adaptation options. The outputs from the Adaptation Framework activities serve as inputs to the organization's strategic planning processes and can be evaluated against other organization priorities because of the use of a standardized, consistent approach to evaluating risks and determining the correct responses, regardless of the enterprise risk under evaluation.

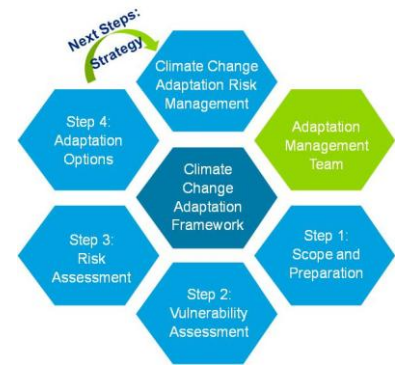
### III. The Adaptation Management Team

#### The team

Climate change impacts will affect an organization at different times with differing magnitudes of severity depending on the change to a climate variable in a region (e.g., temperature). The complexity of the impacts, and the strategic responses required to direct investment appropriately, require input from a diverse group of members across an organization.

The development of an 'Adaptation Management Team' (AMT) is recommended. This multi-stakeholder internal team can be tasked with the primary responsibility for understanding, analyzing and developing the organization's plans to respond to climate change impacts. The AMT can be made up of individuals representing different functions and levels within the organization. Organizational adaptation planning and a specific application of the Adaptation Framework should be organized with clearly defined expectations for all participants in order to foster commitment and empowerment to achieve the objectives that will be established. Roles and responsibilities for all participating members should be clearly defined.

As envisioned, the AMT is responsible to review and document climate change impacts and current responses that are used to identify potential organizational vulnerabilities which could result in the inability to achieve organizational objectives. This team will assess these vulnerabilities to determine which represent priority risks, and will then identify options for adaptation.



**Figure 4: Adaptation Management Team**



The AMT operates on two-levels, facilitated by an identified Adaptation Coordinator. A senior-level team, or Strategic Planning Team, provides the broad-organizational vantage point and guidance; the Technical Team is the working level action team; and, the Adaptation Coordinator acts as liaison between the Strategic Planning Team and the Technical Team. Figure 4 is illustrative of an adaptation management organizational model. Descriptions of each team are provided below (see Figure 5).

The Strategic Planning Team could be responsible for climate change, in addition to other enterprise risks to the organization. To facilitate integration of climate change risks within ERM, it would be possible to create additional technical teams responsible to identify vulnerabilities, assess risks and identify mitigation options specific to other enterprise risks as defined by the Strategic Planning Team.

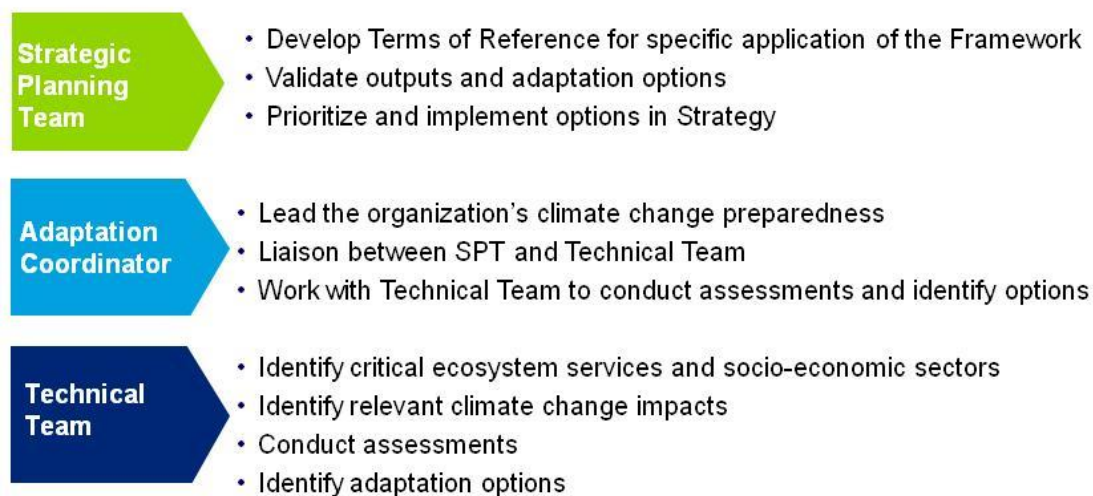
Both the Strategic Planning Team and the Technical Team will be supported by the Adaptation Coordinator. This individual will be responsible for assembling and coordinating the Technical Team, and will have authority to advise on organizational adaptation planning and activities

At each step in the Adaptation Framework process it will be important to reflect on whether the appropriate individuals, technical capabilities and resources are involved. For example, a preparation activity in the Adaptation Framework involves identifying a 'master-list' of ecosystem services and socio-economic sectors which will be used to identify climate change impacts. This 'master-list' could be developed by the organization, or additional external expertise could be identified to provide the information. Additional assistance (e.g., scientists, engineers, etc.) for some of the activities may be also required, and should be identified and included for a pre-defined objective and period of time.

## Roles and responsibilities

All members of the Adaptation Management Team will have specific roles and responsibilities in regards to the overall management of adaptation for the organization, as well as for a specific application of the Adaptation Framework. Figure 5 provides an overview of the potential roles and responsibilities that each member and team can provide. In addition, the Adaptation Framework Terms of Reference (see Step 1) can also provide a format to clearly articulate the expectations and activities of each AMT member.

**Figure 5: Adaptation Management Team Roles**



## IV. Climate Change Adaptation Framework - Overview



### The Climate Change Adaptation Framework

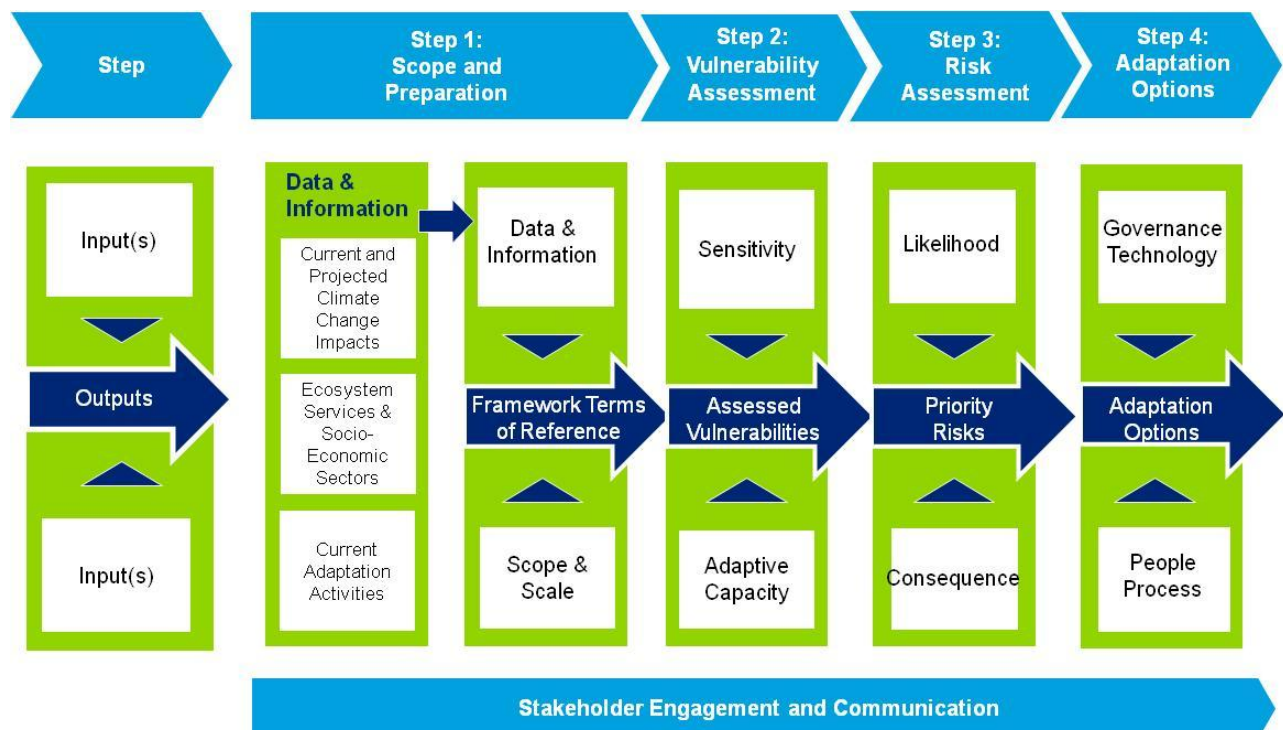
Alberta Sustainable Resource Development (SRD) commissioned a project (completed in 2008) to develop a tool that would enhance the department's understanding of how climate change could impact SRD's ability to achieve strategic objectives, as well as identify a suite of adaptation options.

The Climate Change Adaptation Framework (the Adaptation Framework), depicted in Figure 6 below, is considered an integrated approach, where scientific research and 'best available professional judgement' are used to identify potential adaptation options to myriad climate impacts.

The Adaptation Framework is based on ERM, and as such, provides a standardized approach to identify and evaluate climate impacts relevant for an organization. The approach and activities provide an easily accessible, qualitative methodology to evaluate organizational vulnerabilities and analyze risks in order to identify potential adaptation responses. It is a tool intended to assist in building organizational resilience and adaptive capacity to deliver strategies, policies and programs that reduce the impacts of climate change on socio-economic and biophysical systems with strategic investments.

The Adaptation Framework follows a straightforward process from identifying the scope of the assessment and communicating expectations to all team members involved, conducting activities to identify organizational vulnerabilities, through to prioritizing risks and identifying potential adaptation options. The outputs of the Adaptation Framework can be used to develop a climate change adaptation strategy, or incorporate into broader organizational strategic planning initiatives. The concluding section of the Manual, 'next steps' provides a high-level overview of the links to the strategic planning process.

**Figure 6: Climate Change Adaptation Framework**



The steps in the Adaptation Framework are described in the following sections. Each section outlines activities, information, and stakeholder involvement that will produce deliverables to be used in the subsequent steps. Each section is organized into the following categories:

- Purpose of the step
- Outcomes and expected results
- Activities and resources

As climate change impacts can have far-reaching implications for organizations, coordination with other government agencies, socio-economic sectors, research and learning institutions, and community-based organizations can be critical for identifying solutions and building adaptive capacity and resilience in communities and the region. The Adaptation Management Team may identify other individuals to involve throughout the process, at critical steps or for single activities over a pre-determined time period.

The Strategic Planning Team and the Adaptation Coordinator may, for example, work with other organizations to develop integrated and coordinate responses. The Technical Team can build the organization's network with academic and non-governmental communities in order to share research, knowledge, technology, tools and lessons learned from on-the-ground adaptation activities. Members of the Adaptation Management Team can use the relationships developed to solicit expertise during a number of activities outlined in the Adaptation Framework.

In addition to stakeholder involvement, routine documentation of the process, information identified, and rationales for ranking vulnerabilities and risks will be critical to ensure there is adequate supporting documentation for senior leaders and other members of the AMT to understand the sources of information and how decisions were determined. This documentation can provide consistency year-on-year and transparency through-out the process. The Adaptation Coordinator can play a key role in this aspect of the process and coordinate documentation and retention of information compiled and outputs completed.



# Step 1: Scope and Preparation

## Purpose of the step

This step establishes the context for the specific application of the framework, including guidance for identifying vulnerabilities and analyzing risks, compiling the necessary information to complete the vulnerability and risk assessments in addition to identifying appropriate adaptation responses.

Activities to establish the scope and scale of the specific application of the Adaptation Framework, and the compilation of key information can enable a common view of the process and allow for the activities to be completed efficiently, to be repeatable and for the outputs to be communicated clearly to stakeholders.



## Outcomes and expected results

Upon completing this step, the following outcomes are delivered:

- Adaptation Framework Terms of Reference for the specific application of the Adaptation Framework.
- A master-list and short-list of ecosystem services and socio-economic sectors dependent on or impacted by the organization required for the specific application of the Adaptation Framework.
- A compendium of the organization's current adaptation activities.
- Two summary tables: 1) describing the latest climate change research; and, 2) climate change impacts affecting short-listed ecosystem services and socio-economic sectors.

## Activities and resources

The four main questions to answer in this step are:

- 1) What ecosystem services and socio-economic sectors are reliant on, influenced by or dependent on the organization's strategies, policies and programs?
- 2) What strategies, policies and programs is the organization currently undertaking to adapt to climate change?
- 3) What are the projected climate change impacts that could affect the ES-SES related to the organizational strategy and objectives?
- 4) What is the scope of the current assessment?

Two specific preparation activities can be conducted and documented on an annual or biannual basis: 1) the master-list of ES-SES; and, 2) the compendium of the organization's current adaptation activities. These two sources of information could be prepared by the Adaptation Management Team (AMT) or other identified resource, then update as required as new information is available.

Each question below is further refined with descriptions of the specific activities, AMT members identified and resources to complete Step 1. The activities can occur concurrently. There is considerable flexibility with the roles and responsibilities to conduct the activities through-out the Adaptation Framework steps. An important consideration is to ensure that the right individuals are tasked with the relevant activities. The activities below can also be modified as required.

**Question #1: Determine which ES-SES are relevant to the organization. What ecosystem services and socio-economic sectors are reliant on, influenced by or dependent on the organizations' strategies, policies and programs?**

Climate change will alter the quality, timing and quantity of ecosystem services, as well as the resilience of communities and economic sectors. Ecosystem services and socio-economic sectors (ES-SES) are the categories recommended to identify climate change impacts and analyze the risks because they underpin key relationships that help organizations thrive under changing economic, environmental and social conditions.

The concept of ES-SES can refer to any ecosystem service, resource, management area, activity or other area of interest that is directly related to the organization's mandate and objectives, and could be affected by climate change (e.g., specific environmental values like water quality, supply chain partners, etc.). This information will provide categories for understanding, assessing and developing strategic adaptation investments within the organization's sphere of influence.

The Technical Team, supported by the Adaptation Coordinator, is responsible for the following activities:

1.1 The development of a master-list of ES-SES is a key preparation activity that involves identifying all of the critical ecosystem services and socio-economic sectors that an organization's decisions (i.e., strategies, programs, etc.) depend upon or impact. The Technical Team, supported by other members of the AMT and other identified stakeholders (e.g., scientists) will develop a master-list of the ES-SES that fall directly within the organization's responsibility and mandate. This list is flexible and adaptable to the needs of the organization.

The Technical Team can develop the master-list through desk-top research and by soliciting the information from a range of sources including government agencies, companies, academic associations, non-governmental groups or industry associations. The Technical Team can also identify if there is an existing ecosystem services inventory that may have already been conducted for a province or region.

In circumstances where the information is not readily available, the Technical Team can use research conducted by the Millennium Ecosystem Assessment and the World Resources Institute which have identified the list of ecosystem services (ES) for every ecosystem type.<sup>10 11</sup> Using this baseline information the Technical Team can systematically consider, for each ES, whether the organization's decisions impact or depend on the function of that service. For example, a public sector organization responsible for public land management makes decisions that influence animal grazing, the provision of freshwater and the regulation of climate.

The identification of key socio-economic sectors can be determined by applying professional judgement and validating the information with the Strategic Planning Team. The socio-economic sectors should be directly related economic activities or social institutions related to the organization's mandate. For example, SES could include the public health sector as whole or specific contractors that conduct work on behalf of the organization.

While some organizations may choose to conduct in-depth analysis at this stage, a cursory examination and compilation of ES-SES is sufficient for this adaptation assessment. In other circumstances, other agencies

**Examples of Ecosystem Services**

- Crops and food
- Freshwater
- Climate regulation
- Medicinal plants
- Pollination
- Nutrient cycling
- Soil formation
- Pest regulation
- Bio-chemicals
- Fuel
- Timber
- Fibre
- Flood control
- Cultural value

**Examples of Socio-economic Sectors**

- Public health
- Forestry
- Agriculture
- Energy
- Education

<sup>10</sup> Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Current State and Trends, Volume 1. R. Hasan, R. Scholes, and N. Ash (eds.). Island Press

<sup>11</sup> Ranganathan, J., C. Rauphepp-Hearne, N. Lucas, F. Irwin, M. Zurek, K. Bennet, N. Ash, and P. West. 2008. Ecosystem Services: A Guide for Decision-makers. World Resources Institute.



(e.g., a government department responsible for environmental protection) may have already conducted a similar analysis and identified ecosystem services in the region that can be used here.

- 1.2 Based on the master-list developed in 1.1, the Technical Team will need to develop a short-list of ES-SES by pre-screening and identifying the key ecosystem services and sectors that are relevant to the specific application of the framework. The short-list could be prioritized by examining which ES-SES are already experiencing climate change impacts or other stressors. Tailoring the assessment to a smaller number of ES-SES will make the process more concise and manageable. The Adaptation Coordinator can present an initial short-list to the Strategic Planning Team for review and validation according to the required scope of the specific application of the Adaptation Framework.

## **Question #2: What policies and programs is the organization currently undertaking to adapt to climate change?**

A current state assessment is common practice in strategic planning exercises. The purpose of creating a compendium of the organization's current adaptation activities is to understand what policies, programs and activities are already resourced and in place to respond to climate change impacts. The development of a compendium of current adaptation activities should be completed prior to initiating a specific application of the Adaptation Framework.

- 2.1 The Adaptation Coordinator, working with other resources as required, will complete an inventory of existing policies and programs already in place to manage adaptation to answer the question, "What is the organization currently doing to address climate change adaptation?" The inventory could include activities that are not explicitly labelled 'adaptation' but that have implications for climate change impacts.

Sources of information could include annual budgets, strategic plans, business plans and engagement with operational staff. This information will assist with evaluating the adaptive capacity of the organization and pre-screening for the assessment.

The following table, with examples provided, illustrates a template that can be used to create a compendium of current adaptation activities. It can be organized according to the four categories of organizational capabilities that are used in Step 4 to identify potential adaptation options. Once completed initially, the document would only require updating on an annual basis.

**Table 1: Compendium of Current Adaptation Activities – Sample Template**

Capabilities	Adaptation Activities - Examples
Governance	New license restrictions for areas identified for future climate stress; national organizations coordinating adaptation responses; and, internal multi-department working teams conducting research.
People	Adequate training for staff to conduct adaptation risk assessments; webinars and workshops; integration of climate change adaptation into job descriptions and performance metrics; and, communities of practice.
Technology	Routine monitoring and repair of biodiversity monitoring systems; models and simulators; and quantitative research on assisted species migration.
Process	Approval process for public land access aligned with risk management for climate impacts; field trials for invasive species more adapted to the changing climate conditions; and new environmental management standards and guidelines.

**Question #3: What are the projected climate changes impacts that could affect the short-listed ES-SES identified in Question 1 above?**

In order to evaluate the risks associated with climate impacts, the Technical Team requires information about the climatic conditions in the region or province that may change in the future. This preparation step is valuable to document the latest research on climate changes and potential impacts in order to support future decision-making and communicating the results to a wider audience. Credible and complete information on climate change impacts can help the Adaptation Management Team to build and maintain support for ongoing application of the Adaptation Framework and increase buy-in for the deployment of adaptation activities.

3.1 The Technical Team, supported by the Adaptation Coordinator, will answer the question, “what are the projected climate change impacts?” by collecting, summarizing and appraising information regarding existing and projected climate change impacts. This activity could be coupled with an organization’s existing trends analysis, external and internal factors process, etc. (i.e., environmental scan).

The information can be drawn from a diverse array of sources such as journal articles, academic research and conferences. The Technical Team should collect multiple sources for projected impacts to provide a cross-section of information. Use of a single source should be avoided.

Regardless of the level of information available, the ‘confidence rating’ should be recorded. To provide confidence in the assessment of outputs in later steps, the Technical Team should record the source of the data and assign a qualitative confidence rating as well as, brief comments explaining the decision. The following table can provide a guide to compiling the data:

**Table 2: Projected Impacts Table – Sample Template**

Geographic area	Climate variable	Projected change (+/-)	Expected change and timing	Expected seasonal changes	Confidence rating	Source
Drylands	Temperature	Increase	+0.03°C to 3.2°C by 2020	Warmer in summer months.	High confidence	IPCC
Eastern slopes	Precipitation	Decrease	Unknown	More in late autumn than historical data	Moderate confidence	IPCC
Province	Extreme events	Unknown	Unknown	Unknown	N/A	Workshop with experts

Climate change models can provide one valuable source of information. When using climate change models record the following<sup>12</sup>:

- Publication author, date and year;
- Climate model used (e.g. Canadian Regional Climate Model, Fourth Generation Coupled Climate Model);
- Greenhouse gas emission scenario used;
- Timeframe for the future projection (e.g., 2025) and the baseline timeframe (e.g., 1980-1989 average climate data); and,
- The geographical area for the projection (e.g., Prairie region).

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<sup>12</sup> Based on recommendations from the Climate Impacts Group at the University of Washington and ICLEI (see Snover, *et al.* 2007).

This information is valuable to help understand the projected impacts and the assumptions the modelling results are based on. For example, the projected concentrations of greenhouse gas in the atmosphere will have significant implications for projecting impacts and climate scenarios. No one on the team needs to be an expert on climate modeling, but it is important for team members to understand how the data and assumptions influence the projections and scenarios.

As the Adaptation Framework is a qualitative approach to pre-screen for vulnerabilities and risks, more detailed research (e.g., modeling, scenarios, etc.) is not required.

- 3.2 Projected changes to climate variables will produce impacts on ecosystems and socio-economic activities related to the organization's objectives. The Technical Team will use the outputs from Activity 3.1 to identify and describe the projected climate change impacts on the short-listed ES-SES (as determined in Activity 1.2) to answer the question, "what are the projected impacts to the short-listed ES-SES? The following table provides an illustration and a format to complete the activity:

**Table 3: Project Climate Impacts on ES-SES – Sample Template**

Ecosystem service or socio-economic sector	Projected climate change impacts
Timber	Invasive species
	Reduced bio-productivity
	Increasing frequency and duration of forest fires
Agriculture	Increased demand for irrigated water due to reduce summer precipitation
	Increasing pests
	Reduced summer surface water
Soil fertility	Soil moisture reduced below bio-productive levels
	Prolonged drought conditions leading to erosion
	Loss of soil stability

#### Question #4: What is the scope of the current assessment?

The Strategic Planning Team (SPT) will be responsible for providing the strategic guidance for the specific application of the Adaptation Framework, and for supporting the Technical Team and the Adaptation Coordinator, through the process to complete the activities. The SPT will answer the following scope questions and document the information in the 'Framework Terms of Reference' document (see [Appendix C](#)). The Framework Terms of Reference documents and communicates the purpose and scope of the activities, the stakeholders for involvement, resources and time allocated, and reporting and status update requirements.

The Strategic Planning Team will complete the following activities:

- 4.1 Document the request that initiated the assessment. What is the main driver(s) for conducting the vulnerability and risk assessment? (e.g., annual strategic planning exercise, abrupt or unexpected change in an ecosystem service, etc.).
- 4.2 Clarify the objectives and expectations of the assessment. What is the SPT trying to achieve by using the Adaptation Framework and what is the desired outcome? (e.g., senior level understanding of high-risk areas to focus policy development and research, a concrete list of the top three (3) organizational vulnerabilities and responses to address them, etc.). Included in this activity is the establishment of expectations for outcomes (e.g., number of adaptation options) and milestones (e.g., three months with bi-weekly status updates).

4.3 Determine who should participate: Who should be on the Technical Team? Which other resources should be involved in the process? (e.g., colleagues from a different department, external experts, etc.).

4.4 Define the boundaries within each of the categories below. What is the scale of the assessment?

- Geographical (e.g., province, natural region)
- Organizational (e.g., entire department, divisions, etc.)
- Operational (e.g., programs, policies, etc.)
- Time horizon for climate impacts (e.g., five, ten, twenty-five years, etc.)
- Time-line for adaption activities (e.g., options identified for 1-3 years budget cycle)



The Adaptation Framework is scalable to any level of an organization. Refined assessments at a smaller scale can occur within the broad organizational assessment. The Strategic Planning Team and Adaptation Coordinator will need to consider how to integrate disparate assessments however, and this can prove challenging. The SPT and Adaptation Coordinator will need to plan ahead to consider the process for integration to ensure all aspects of the organization are assessed consistently and gaps are avoided. An integrated approach involving all of the necessary individuals from across the organization is recommended in order to capture and analyze vulnerabilities and risks appropriately.

The following table provides two examples of scope for specific applications of the Adaptation Framework.

**Table 4: Two Scope Examples**

Driver	Objective(s) of assessment	Timeline and milestones	Participants	Boundaries/ Scale
Annual department plan – need to identify adaptation options to include	Identify the top 5 priority climate change risks and potential treatment options for the next fiscal year	Deadline 06/2010 4-6 weeks total  Bi-weekly status reports to STP	Technical Team only for Vulnerability Assessment  Engage with three academics (specified here) for the risk assessment activities	Regions where the organization operates. All organizational divisions and activities. Climate change impacts - 10 years Adaptation options – 20 recommended options over 10 years
Provincial adaptation strategy input – the organization has been asked to provide adaptation options into a provincial strategy	Identify the top 10 priority risks and potential treatment options for the next five years	Deadline Spring 2011 8 months Biweekly status reports to STP and provincial coordinators	Technical Team with cross-ministry consultation	Province-wide Entire organization Multiple assessments based on Land-use Framework regions Climate change impacts - 20 years Adaptation options – 15 recommended options over 5 years

The scope of the assessment and the scale of applying the Application Framework will need to be tailored to the needs of the organization for each specific application. In some circumstances the Strategic Planning Team will indicate that a broad, organization-wide assessment is required to provide inputs into department strategic

planning. In other circumstances, the Adaptation Framework can be applied to smaller, more refined scales such as a specific natural region, program or policy, or one or two economic sectors.

The Strategic Planning Team can also provide project management guidance and specify a project timeline for completion of the specific application of the Adaptation Framework. Milestones and status updates should be established in order to monitor progress. The Framework Terms of Reference is intended to provide a strong foundation for future steps, to validate resource and time requirements, and ensure all stakeholders adequately understand expectations.

### **Scope and Preparation Validation**

The final activity in Step 1 involves validating the scope components (i.e., Framework Terms of Reference) and all of the information compiled with the members of the AMT. This can be completed through one or several team meetings coordinated by the Adaptation Coordinator. The session should allow AMT members to walk-through the outputs of each activity, and then discuss modifications or potential changes. This activity can ensure that all AMT members understand the expectations for the process, the scope of the assessment, the time commitment expected, and the outcomes to be achieved.

## Step 2: Vulnerability Assessment

### Purpose of the step

The purpose of the vulnerability assessment is to evaluate how susceptible an organization is to climate change, and identify areas on which to focus adaptation efforts. The International Panel on Climate Change (IPCC) defines vulnerability as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes”.

In the context of the Climate Change Adaptation Framework, the vulnerability assessment considers the sensitivity of ES-SES to changes in climate variables such as temperature and precipitation, and the existing adaptive capacity of an organization to respond to this sensitivity, in order to arrive at an assessment of vulnerability. This is a qualitative assessment and assigns a value of high, moderate and low organizational vulnerability for each impact.

Specific ecosystem services or socio-economic systems that are experiencing existing stress, or could potentially be impacted in the future from climate change, should be considered sensitive. This, coupled with areas where an organization lacks capabilities (e.g., policies, programs, etc) indicates vulnerability.



### Outcomes and expected results

Upon completing this step, the following outcomes are delivered:

- An evaluation of ES-SES sensitivities to climate change impacts.
- An evaluation of the organization’s adaptive capabilities to respond to climate change impacts.
- A list of ranked organizational vulnerabilities.

### Activities and resources

The main question to answer in this step is: “where is our organization vulnerable to changes in climate?” The vulnerability assessment is a three-step process unto itself:

1. Determine the degree of sensitivity to climate change. What is the degree to which the identified ES-SESs are sensitive to climate change?
2. Evaluate the adaptive capacity of the organization. What is the adaptive capacity of the organization to address existing and potential climate change impacts?
3. Analyze and prioritize organizational vulnerabilities. What is the vulnerability based on sensitivity and adaptive capacity?

The Technical Team will use the outputs from Step 1 to conduct these activities. The vulnerability ranking is a qualitative exercise based on best available professional knowledge from the Technical Team and any additional stakeholders. A workshop or other collaborative format is a suitable forum to conduct the activities in the vulnerability assessment.

### Question #1: What is the degree to which the identified ES-SSES are sensitive to climate change?

The Technical Team will use the Framework Terms of Reference document, in addition to the projected climate change impacts on ES-SSES and compendium of current adaptation activities, developed in Step 1 to qualitatively assess the degree to which identified ES-SSES are sensitive to climate change impacts.

If changing climate conditions will significantly affect ES-SSES related to the organization's mandate, then those systems are considered to be sensitive. The Technical Team can conduct a qualitative assessment to determine the degree of sensitivity by asking:

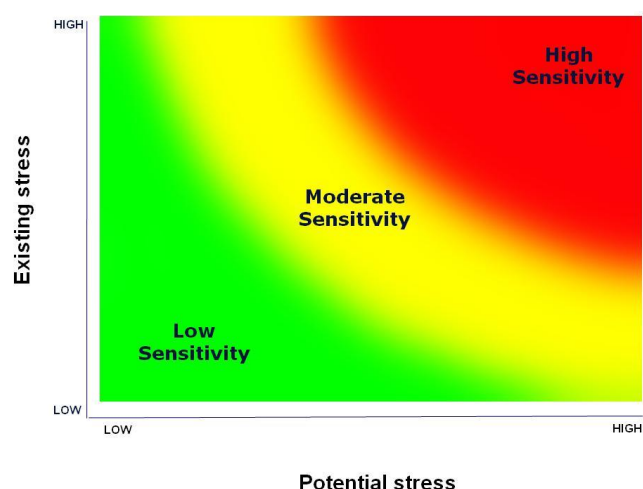
- Is the ES-SSES subject to existing stress due to climate change or other external stress factors (e.g., excessive consumption, market conditions, etc.)?
- Is the ES-SSES subject to potential stress as a result of climate change?

Systems already experiencing stress are more likely to experience adverse effects from changing climate conditions. The Technical Team can use their professional judgment to consider other factors that could influence the sensitivity of a system including projected demand for resources due to market conditions, urban pressures, as well as ecological thresholds and coping ranges for certain species.

Figure 6 provides a sensitivity matrix to determine the sensitivity of an ES-SSES to climate change impacts and other stress factors. Determine the degree of sensitivity and document the rationale for the selection in the table provided. Table 5 provides an illustrative sample.

The qualitative ranking of the degree of sensitivity from existing and potential stress is used as one input into the vulnerability assessment below. The Technical Team should also consider documenting additional sources of information to inform the Strategic Planning Team about how the ranking was determined.

**Figure 6: Sensitivity matrix**



**Table 5: Sensitivity Analysis - Sample Template**

ES-SSES	Existing Stress	Degree of sensitivity from existing stress (H/M/L)	Potential Stress	Degree of sensitivity from potential stress (H/M/L)	Degree of Sensitivity (H/M/L)
Timber	Economic issues in the timber industry (e.g., mill closures)	Moderate	Pine beetle, forest fires, low soil moisture, etc.	High	<b>High</b>
Livestock	Some areas experiencing declining water availability.	Moderate	Increasing growing regions leading to improved outputs.	Low	<b>Low</b>
Water	High. Declining water quality and availability in most regions.	High	Current quality and quantity issues further exacerbated by climate change.	High	<b>High</b>



## Question #2: What is the adaptive capacity of the organization to address existing and potential climate change impacts?

Adaptive capacity describes the ability of an organization to accommodate and respond to changes in climate. If an organization is able to respond and adapt to changes to related ecosystems or socio-economic sectors with minimum disruption or incurred costs, it is considered to have high adaptive capacity.

In order to assign a qualitative ranking to the degree of organizational adaptive capacity, the Technical Team can complete the following activities:

- Populate the template (see Table 6) with the short-listed ES-SES, climate change impacts and the current adaptation activities that are addressing the impacts.
- For each climate change impact, consider the determinants of adaptive capacity (see Figure 7) and evaluate, using professional judgment and group discussion, the degree to which the organization can adapt to the impact.
- Assign a qualitative ranking of high, moderate or low.

The Technical Team should document all sources of information to inform the Strategic Planning Team about how the ranking was determined. The qualitative ranking of the degree of organizational adaptive capacity is used as the second input into the vulnerability assessment below.

**Figure 7: Determinants of adaptive capacity<sup>13</sup>**

Determinant	Definition	Considerations
Economic resources	An organization's capital resources, assets, financial means and current economic conditions.	Access to financial resources to respond? To what degree with limited financial means affect the ability to adapt?
Technology	An organization's current application of technology and the potential to develop or use technology at all levels of the organization.	Does the technology exist and is it applied? Does the organization have the ability to develop and apply new technology?
Skills and information	An organization's recognition of the necessity to adapt, and the knowledge and capacity available to assess best options and respond.	Does the organization have sufficient skills and information? Is there awareness of the necessity to adapt and a commitment to develop the right skills?
Infrastructure	The built infrastructure, including facilities and services that facilitate the organization's contribution to economic and community development.	Does the organization need to upgrade or build infrastructure? Is existing infrastructure in advantageous geographic areas?
Institutions	An organization's structure and mechanisms created to coordinate social networks and deliver on a purpose; this also includes sub-structures within the organization.	Does the organization have the existing internal institutions (and social relationships) to respond? Are there strategic partnerships to harness?
Equity	The ability to govern the access to resources and information equitably within the organization.	Does the organization equitably distribute resources within the organization? Could the organization be forced to compete with other organizations for resources?

<sup>13</sup> Based on: Smit B. and O. Pilifosova. 2001. Adaptation to climate change in the context of sustainable development and equity. *In Climate change 2001: impacts, adaptation, and vulnerability*. J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken, and K.S. White (editors). Intergovernmental Panel on Climate Change, Cambridge University Press, New York, N.Y. pp. 876–912



Table 6 provides a sample template to document the results. Additional information can also be provided in the template.

**Table 6: Adaptive Capacity Analysis - sample template**

ES-SES	Climate change impacts	Current Adaptation Response	Adaptive capacity (H/M/L)
Timber	Pine beetle	Extensive programs to combat pine beetle, multiple staff involved, focus on research and operations.	<b>High</b>
	Declining bio-productivity	Focus on pine beetle; limited resources to deal with other climate change impacts (e.g., biodiversity).	<b>Low</b>
Agriculture (food)	Shifting vegetation patterns	No specific programs on rangeland management and climate change.	<b>Low</b>
	Reduced surface water	Working with other departments to coordinate activities on public land management related to water.	<b>Moderate</b>
Water quality	Increasing spring run off	Working with other departments to support provincial water management strategy.	<b>Moderate</b>
	Declining ground and surface water	No specific water management activities planned.	<b>Low</b>

### Question #3: What is the probability of vulnerability based on sensitivity and adaptive capacity?

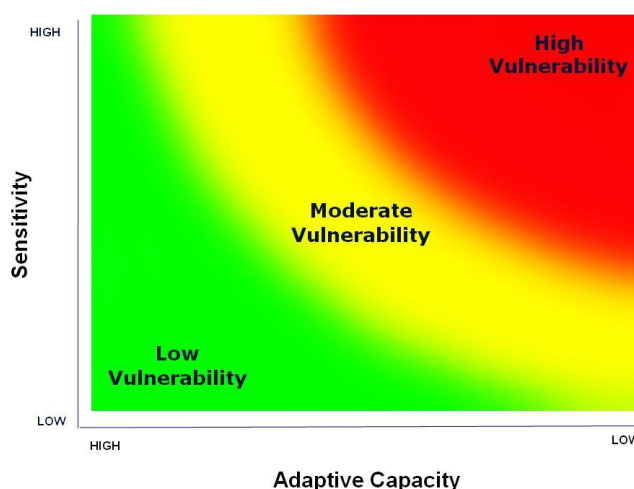
The third and final activity in the vulnerability assessment step is to combine the results from the sensitivity analysis and the adaptive capacity analysis above to determine the degree of vulnerability to specific change climate impacts on key ES-SES. It is a qualitative estimation of potential gaps in the organization's current activities that could prevent the achievement of objectives.

The Technical Team can use Figure 8 as an illustrative guide to work collaboratively to determine the vulnerability ranking for each ES-SES climate change impact.

**Figure 8: Vulnerability matrix**

For consideration to complete this step:

- A climate change impact on an ES-SES that is already highly sensitive but the organization already has the existing or planned capacity to address would result in a moderate vulnerability.
- A climate change impact on an ES-SES that has low sensitivity but the organization has no response could also be considered a moderate vulnerability.
- A climate change impact on an ES-SES that is critical for meeting objectives, and where there is no current organizational response, represents a high vulnerability.



All vulnerabilities, regardless of ranking, will be used to conduct the risk assessment process to ensure there are no gaps, nor potential for cumulative risks. Table 7 provides a sample template to document the results. The Technical Team should document all information used, to inform the Strategic Planning Team how the ranking was determined.

**Table 7: Vulnerability Assessment - Sample Template**

ES-SES	Existing and potential impacts	Degree of sensitivity	Adaptive capacity (H/M/L)	Vulnerability (H/M/L)
Timber	Pine beetle	High	High	<b>Moderate</b>
	Increasing forest fires	High	Low	<b>High</b>
Agriculture	Declining rangeland health	Moderate	Low	<b>Moderate</b>
	Water scarcity	High	Moderate	<b>High</b>
Water	Scarcity	High	Moderate	<b>High</b>
	Poor quality	High	Low	<b>High</b>

The Technical Team and Adaptation Coordinator can validate the results of the assessment with the Strategic Planning Team and/or communicate the results to keep them informed throughout the process.

### **Vulnerability Assessment Validation**

The final activity in Step 2 involves validating the results of the sensitivity analysis, adaptive capacity analysis and vulnerability assessment. This can be completed through one or several team meetings coordinated by the Adaptation Coordinator as determined in the Framework Terms of Reference (i.e., a project management milestone). The session should allow AMT members to walk-through the outputs of each activity, and then discuss modifications or potential changes. This activity can ensure that all AMT members understand the scope of the assessment and the outcomes achieved.

## Step 3: Risk Assessment

### Purpose of the step

A risk assessment helps an organization to determine how climate change (or other internal or external factors) could affect the ability to achieve outcomes. This step can assist decision-makers to understand where to focus adaptation investments and priorities. Decisions made in this step are qualitative and involve a consideration of the likelihood and consequence associated with the impacts.



### Outcomes and expected results

Upon completing this step, the following outcomes are delivered:

- A completed risk analysis.
- A prioritized list of risks to use as input for identifying adaptation options.

### Activities and resources

The main question to answer in this step is: “what are the key risks to be addressed?” This step will be quite familiar to most organizations as it involves the basic risk assessment processes of determining the likelihood of a risk occurring and the potential consequence that could occur if the risk materialized.

The Adaptation Coordinator and Technical Team will be responsible for completing this step.

### Question 1: What are the key risks to be addressed?

Use the following information collected in Step 1 and Step 2 to conduct the risk assessment:

- Current and projected climate change impacts
- Ecosystem services and socio-economic sectors (ES-SES)
- Vulnerability assessment results

The risk assessment is a qualitative exercise based on best available professional knowledge from the Technical Team and additional stakeholders as identified using information compiled in previous activities. A workshop or other collaborative format is a suitable forum to conduct the activities in the risk assessment. In addition, additional individuals could be engaged (e.g., Strategic Planning Team) to discuss the potential for risks with a broader perspective of the organization.

This step requires the Technical Team to evaluate each climate change impact, and determine the risk rating based on the impacts’ potential likelihood and consequence. An organization can use existing risk assessment definitions for likelihood and consequence, modified for the specific application to climate change adaptation (e.g., longer time horizon for likelihood). In circumstances where an organization does not have risk assessment definitions, the Strategic Planning Team, working with the Technical Team and Adaptation Coordinator will need to develop a comparative rating system for likelihood and consequence. Figure 9 provides an illustrative sample for comparing the potential consequence

For each impact, the Technical Team will need to complete the following activities:

1. Determine the consequence of each climate change impact. Consequence is the outcome of an event that can affect the ability of the organization to meet objectives.
2. Determine the consequence risk rating. Provide numerical value under the consequence categories.
3. Determine the likelihood: rare, unlikely, possible, likely or almost certain. Likelihood is the chance of something happening.

**Figure 9: Sample Risk Assessment Matrix**

Sample Consequence Categories					
Risk Rating	Strategic	Financial	Operational	Environment & Safety	Public Perception
<b>Insignificant (1)</b>	No impact on strategy.	Less than \$99,000	No impact on execution of plans.	No impact on human health and safety, or environmental quality.	Limited impact on public image. No media coverage.
<b>Minor (2)</b>	Minor change in strategic direction.	\$100K - \$249K	Minor impact on execution of plans.	Minor injury or illness. Minor impact to environmental quality, easily rectified.	Some impact on public image. Local media coverage for a short period.
<b>Reasonable (3)</b>	Multiple changes to strategic direction.	\$250K - \$749K	Moderate impact on execution of plans.	Lost time injury or illness. Moderate environmental impact with limited long-term quality effects.	Moderate impact on public image. Regional or national media coverage for a limited period.
<b>Major (4)</b>	Substantive revision to strategy required.	\$750K - \$1.5M	Substantive impact on execution of plans.	Permanent damage caused by injury or illness. Impact to environmental quality exceeds 25 years to restore.	Substantive impact on public image. Regional or national media coverage for a long time period.
<b>Severe (5)</b>	Complete change to strategy and organizational objectives.	More than \$1.5M	Critical implications for execution of plans.	Fatality. Catastrophic impact to environmental quality requires more than 100 years to restore.	Severe impact to public image. Extended national coverage and/or international media coverage.

The likelihood is assessed for each risk and quantified according to the organization's likelihood scale. An illustrative likelihood scale is shown in Figure 10. Note that the time horizon on the likelihood scale will need to match the time horizon for analyzing climate change impacts and/or the scope of the assessment.

**Figure 10: Sample Likelihood Scale**

Rare (1)	Unlikely (2)	Possible (3)	Likely (4)	Almost Certain (5)
Very low probability that this risk will occur in the next <b>X</b> years.	Less than 50% chance that this risk will occur in the next <b>X</b> years.	50/50 chance that this risk will occur in the next <b>X</b> years.	More likely than not that this risk will occur in the next <b>X</b> years.	Very high probability this risk will occur in the next <b>X</b> years.

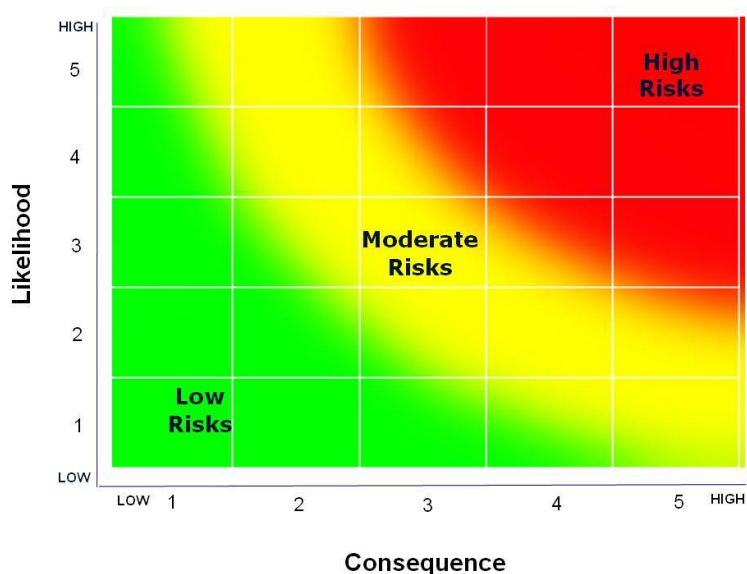
Table 8 provides a sample risk analysis template to record the process and results. The outputs from this step will be used to identify adaptation options. The steps to complete the risk assessment are as follows:

- 1) Populate the table with results from the vulnerability assessment completed in Step 2.
- 2) Using the risk assessment criteria above (Figure 9), determine the severity of the climate change impact using a risk rating (numerical value) for each impact category (i.e., operation, strategic, etc.). Populate the numerical value in the 'consequences' column.
- 3) Determine the potential likelihood of the climate change impact using the likelihood scale provided in Figure 10 above.
- 4) Assign a qualitative classification of the risk by discussing the estimated vulnerability of the organization combined with the potential severity and likelihood.

An organization with an existing ERM system will have a method to conduct the risk calculation. If the organization does not have an existing approach, one method is to sum the total value from the 'severity' columns and divide the by the number of consequence categories to generate one the single risk number. Caution should be exercised in applying this approach as the changes in consequence might not be linear. Practitioners should use judgement in assigning the single risk number.

The Risk Matrix (Figure 11) can be used to assign the risk classification based on likelihood and consequence. The AMT should discuss the final risk classifications of all the risks and force rank the risks based on professional judgement and group discussion to arrive at a final prioritized list.

**Figure 11: Sample Risk Matrix**



**Table 8: Risk assessment – sample template**

ES- SES	Climate change impacts	Risk Analysis						Likelihood	Risk Ranking (H/M/L)
		Vulnerability Assessment	Consequence						
			S	F	O	P	PC		
Timber	Pine beetle	Moderate	3	4	4	3	4	Almost certain (5)	High
Agriculture	Declining rangeland health	Moderate	1	1	2	2	2	Possible (3)	Low
Water	Scarcity	High	5	3	4	4	5	Almost certain (5)	High

Some of the risks that are classified as “low” may be safe to ignore. However, they may pose significant challenges to the organization cumulatively, and over time these risks may become more severe; therefore, low risk climate change impacts should not be ignored completely.

The climate change impacts that relate to multiple departments or multiple jurisdictions may pose similar risks to each department or jurisdiction. In these cases, sharing the risk may be an effective management option. However, the danger in “sharing” a risk in a poorly coordinated manner is that no department or jurisdiction manages the risk effectively. Therefore, coordination between business areas, other departments and other jurisdictions is critical.

### **Risk Assessment Validation**

At this stage, the Technical Team and the Adaptation Coordinator can validate the results of the risk analysis with the Strategic Planning Team. The AMT can determine whether to proceed with identifying adaptation options for all of the risks, or for only a selection of the high priority risks.

## Step 4: Adaptation Options

### Purpose of the step

The purpose of this step is to identify a wide range of potential adaptation options that are appropriate under current and future climate conditions. The outcomes from this step will provide a toolkit of ways to achieve objectives by enabling the identification of policies, programs, projects, research, technologies or any other options. Adaptation options can be identified and deployed individually to address a single issue, or in combination to address multiple impacts and at different scales.

Early adaptation increases adaptive capacity while reducing vulnerabilities and demonstrates effective risk management. The organization can determine where to focus adaptation option identification. For example, some organizations may choose to focus initially on the risks considered “high” and on systems already experiencing climatic variability and disturbance.



### Outcomes and expected results

Upon completing this step, the following outcomes are delivered:

- An initial list of adaptation options, organized according to organizational capabilities.

### Activities and resources

The main question to answer in this step is: “what are the potential adaptation options that reduce the organization’s vulnerability and potentially provide new benefits?”

The Technical Team, working with the Adaptation Coordinator and other stakeholders identified for this stage, can use a range of tools and techniques to identify adaptation options; for example, conducting focus groups, hosting or attending workshops, conducting research to compile a jurisdictional review of options, brainstorming with the team and policy review exercises.

**Individual adaptation initiatives are a good start, but an integrated and risk based strategic approach is most effective**

Building adaptive capacity is fundamentally linked to identifying and executing adaptation options. Ways to build adaptive capacity include: research, scoping studies, climate scenarios and modeling, regional studies, data collection, monitoring, partnerships and cooperative ventures, network development, organizational learning, and education and awareness-raising.

The Technical Team and Adaptation Coordinator can use a ‘capabilities approach’ to identify and document options and provide a wide range of potential risk treatment solutions. An organization’s capabilities for adaptation depend on four critical areas: governance, people, technology, and process.

The Technical Team will use the outputs from the risk assessment process, as validated with the Strategic Planning Team to develop adaptation options. The following organizational capabilities are provided as a reference point so that a broad spectrum of techniques and tools are considered.



### Description and examples of organizational capabilities:

**Governance:** management, policies and processes to direct the activities of the organization. This could include policy, resource decisions, and facilitation of cross organization relationships. Specific examples include: licensing and approvals on surface land, compliance strategies, quotas or regulatory limits on disturbance or access, etc.

**People:** Everyone in an organization is responsible for managing risks. Organizations can identify adaptation options that improve the capacity and capabilities of the individuals within the organization, and also look beyond the organization to external stakeholders as well. Specific examples include: training, recruitment and retention strategies, updated job descriptions and performance management.

**Technology:** refers to the application of science to adapt to the environment. This could include a variety of high and low tech options available for assessing and addressing climate change risks. Specific examples include climate modeling software, GIS, field equipment, monitoring equipment, and infrastructure.

**Process:** Processes describe how work is done in an organization. Processes for climate change adaptation include: develop and deploy strategies, identify and assess risks, respond to risks, design and test measures, monitor and re-evaluate progress, and sustain and continuously improve. Cooperation between business units and departments will be a critical component of the adaptation process. Specific examples include: research, development of indicators for successful adaptation, procedures to incorporate climate change risks into the Environmental Scanning process, and routine evaluation procedures to assess indicators. Table 9 provides a sample table illustrating potential adaptation options.

**Table 9 Adaptation Options - Sample Template**

High Risk Impacts	Organizational capabilities	Adaptation options <sup>14</sup>
Increasing forest fires	Governance	Policy for fire management
	People	Community training for fast fire response
	Technology	GIS systems to track and provide alerts for lightning
	Process	New procedures for fire response
Shifting vegetation and grazing zones	Governance	Staff training and awareness activities
	People	Involve ranching community in land use planning
	Technology	GIS to identify more appropriate grazing areas
	Process	New standards to shifting allowable range areas

Key challenges to address when identifying adaptation options are to:

- balance the risk of timing adaptation activities so the response is not launched too early or too late, and,
- balance the potential benefits and opportunities with the likelihood and magnitude of the climate change impacts.

Numerous jurisdictions are grappling with the same challenges and so a look beyond the organizational and geographic regions, to other organizations' adaptation responses could identify some 'out of the box' options. Australia, for example, recently released (2010) their adaptation position paper and strategy. Figure 12 provides an overview of their key strategy for adapting to a water constrained future.

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<sup>14</sup> Multiple options for each capabilities category can be identified.



**Figure 12: Australia's Adaptation Response to Water Scarcity**

Australian Adaptation
<p>The National government is investing \$12.9 billion the 'Water for the Future' program that focuses on four national priorities:</p> <ul style="list-style-type: none"><li>• Taking action on climate change</li><li>• Using water wisely</li><li>• Securing national water supplies</li><li>• Supporting healthy rivers and wetlands</li></ul> <p>The program will implement a number of projects to help Australians adapt to a future with less water. Examples of initiatives include:</p> <ul style="list-style-type: none"><li>• development of new and enhancement of existing water markets;</li><li>• development of new, science-based limits on water use; and,</li><li>• investing in alternative urban water supplies and water saving initiatives.</li></ul> <p>Source: Adapting to Climate Change In Australia, 2010</p>

#### **Adaptation Options Validation**

The final activity in Step 4 involves validating the initial list of recommend adaptation options with the Strategic Planning Team. This can be completed through one or several team meetings coordinated by the Adaptation Coordinator as determined in the Framework Terms of Reference (i.e., a project management milestone). The Technical Team can present the list of potential options and work with the other members of the AMT to determine the most appropriate adaptation responses to recommend for further development.

## V. Next Steps: Prioritizing Options and Developing the Strategy



The Climate Change Adaptation Framework is one component in the overarching climate change management approach which involves identifying and analyzing risks, developing and implementing a response strategy, and monitoring and communicating the results of progress.

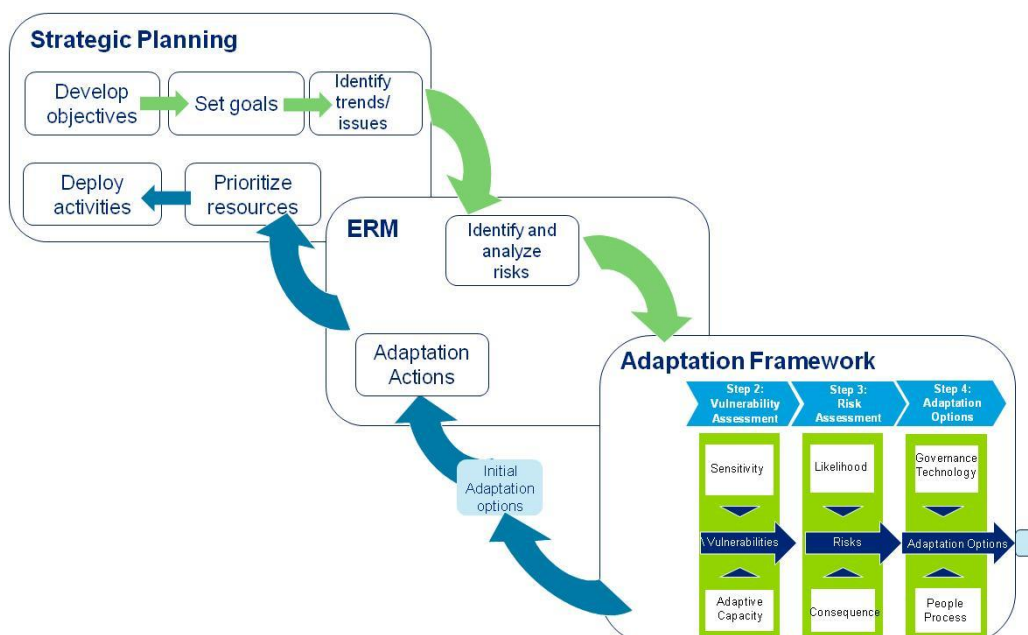
The organizational strategic planning process is one component of the climate change adaptation management approach that defines objectives, determines where to make key investment decisions and prioritizes resources. It provides a compass and map for the complex and uncertain territory of climate change, and allows an organization to measure progress against key performance indicators as articulated in business plans.

Strategic planning for climate change adaptation provides:

- Overall policy and strategic direction, to be supported by detailed business plans;
- A documented baseline for further improvements and growth;
- A vehicle for developing and testing plans prior to execution;
- Transparency for all stakeholders;
- A framework for holding employees accountable for results linked to strategic goals; and,
- A communications tool for internal and external stakeholders.

Figure 13 illustrates the connection between the strategic planning process, ERM and the Adaptation Framework. A key input into the ERM and Adaptation Framework is the E-Scan process which is used to identify trends and issues, including climate change impacts. It could also be tailored to identify and update a compendium of ecosystem services as well.

**Figure 13: Linking Strategic Planning to the Adaptation Framework**



As described above, the strategic planning process establishes the objectives for the organization, while ERM evaluates the risks and potential responses to ensure objectives can be achieved. The Adaptation Framework can be considered a component within ERM that provides a tool to analyze the adaptive capacity of an organization to respond effectively, prioritize the risks and identify potential adaptation options. The outputs from the Adaptation Framework activities serve as inputs to the organization's strategic planning processes and can be evaluated against other organization priorities because of the use of a standardized, consistent approach to evaluating risks and determining the correct responses, regardless of the enterprise risk under evaluation.

The outputs from the Adaptation Framework (i.e., the recommended adaptation options) will require further strategic evaluation and refinement to determine which activities will be developed into departmental or broader organization strategy and implementation plans. The Strategic Planning Team, in consultation with other members of AMT can determine that a select number of options are appropriate. Other options may require additional information, resources and review prior to implementation. In the ERM process, the options identified in the Adaptation Framework will be integrated with risk mitigation activities identified to address other enterprise risks, and the resulting set of options will be fed back to the strategic planning process.

## Appendix A – Glossary

**Adaptation:** Processes, actions and strategies that allow the system to cope with, manage and adjust to changing climatic conditions such that risks are mitigated and opportunities are captured.<sup>15</sup>

**Adaptive capacity:** The capability of an organization to respond to climate change impacts.

**Adaptation Coordinator:** An individual responsible for assembling and coordinating the Technical Team, and will have authority to advise on organizational adaptation planning and activities.

**Adaptation Framework:** A consistent, yet flexible approach to evaluate organization vulnerabilities and risk in order to identify strategic adaptation options.

**Adaptation Management Team:** A team representing different functions and levels within the organization, who are tasked with responsibility for climate change adaptation. This group will have primary responsibility for understanding, analyzing and developing the organization's plans to respond to climate change impacts.

**Capabilities approach:** The use of four organizational capabilities (i.e., Governance, People, Process and Technology) to inventory existing organizational activities and develop strategic responses to risks.

**Confidence Rating:** A qualitative assignment to indicate level of comfort with and confidence in the information.

**Consequence:** The outcome of an event that can affect the ability of the organization to meet objectives.

**ES-SES:** An acronym representing 'ecosystem services and socio-economic sectors'. ES-SES are categories referring to any ecosystem service, resource, management area, activity or other area of interest that is directly related to the organization's mandate and objectives, and could be affected by climate change.

**Ecosystem Services (ES):** Ecosystem services (ES) are the benefits people obtain from ecosystems including "provisioning" services (e.g., food and water); "regulating" services (e.g., flood and climate control); "supporting" services (e.g., soil formation); and "cultural" services (e.g., recreation, spiritual and other nonmaterial benefits).<sup>16</sup>

**Enterprise Risk Management:** an integrated tool to enable decision-makers to effectively address uncertainty and respond appropriately to these risks and potential opportunities.

**Likelihood:** the probability of occurrence.

**Risk:** the effect of uncertainty on objectives.

**Risk assessment:** the process of risk identification, analysis and evaluation.

**Risk management:** coordinated activities that allow an organization to identify and control events and impacts that could influence the ability of the organization to meet objectives.

**Sensitivity:** the susceptibility of a system to climate change impacts.

**Strategic Planning Team:** The senior leadership on the Adaptation Management Team responsible for climate change, in addition to other enterprise risks to the organization.

**Technical Team:** The working level action team responsible to carry out the Adaptation Framework activities.

**Vulnerability:** potential gaps in the organization's current activities to climate change impacts that could prevent the achievement of objectives.

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<sup>15</sup> Smit, B. and J.Wandel. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change* 16, 282-292.

<sup>16</sup> Daily, G.C. Ed. 1997a. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC; and, Millennium Ecosystem Assessment Board. 2005. *Living Beyond Our Means: Natural Assets and Human Well-Being*. Geneva, Switzerland: The United Nations Environment Program.

## Appendix B – References

- Barrow, E., and G. Yu. *Climate Scenarios for Alberta*. Regina: Alberta Environment and Prairie Adaptation Research Collaborative, 2005.
- Commonwealth of Australia. 2010. Adapting to Climate Change in Australia: An Australian Government Position Paper. Department of Climate Change.
- Daily, G.C. Ed. 1997. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC.
- Deloitte. "The Risk Intelligent Energy Company." *Risk Intelligence Series*, no. 7 (2007).
- IPCC (International Panel on Climate Change). 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Cambridge University Press: Cambridge, New York.
- IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for policymakers. In *Climate Change 2007: The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Solomon S., D. Qin, M. Manning, Z.Chen, M. Marquis, K.B. Averyt, M.Tignor, H.L. Miller. (Eds.). Cambridge University Press: Cambridge, New York
- International Standard. 2010. ISO 13000: Risk Management – Principles and Guidelines. International Standard Organization.
- Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Current State and Trends*, Volume 1. R. Hasan, R. Scholes, and N. Ash (eds.). Island Press.
- Millennium Ecosystem Assessment Board. 2005. "Living Beyond Our Means: Natural Assets and Human Well-Being." Geneva, Switzerland: The United Nations Environment Program
- Ranganathan, J., C. Rausepp-Hearne, N. Lucas, F. Irwin, M. Zurek, K. Bennet, N. Ash, and P. West. 2008. *Ecosystem Services: A Guide for Decision-makers*. World Resources Institute.
- Sauchyn, D., J. Byrne, N. Henderson, D. Johnson, M. Johnston, S. Keinzle, and E.Wheaton. *Alberta Vulnerability Assessment - Assessment of Biophysical Vulnerability*: Prairie Adaptation Research Collaborative, 2006.
- Smit, B. and J. Wandel. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change* 16, 282-292.
- Smit, B. , O. Pilifosova, I. Burton, B. Challenger, S. Huz, R.J.T. Klein, and G. Yohe "Adaptation to Climate Change in the Context of Sustainable Development and Equity." In *Climate Change 2001: Impacts, Adaptation and Vulnerability*, edited by James J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White: IPCC, 2001.
- Snover, A.K., L. Whitely Binder, J. Lopez, E. Willmott, J. Kay, D. Howell, and J. Simmonds. 2007. Preparing for Climate Change: A Guidebook for Local, Regional and State Governments. In association with and published by ICLEI – Local Governments for Sustainability, Oakland, CA.
- Stern, Nicholas. 2007. *The Economics of Climate Change*. Cambridge University Press.
- Willows, R. and R. Connell. Eds. 2003. *Climate Adaptation: Risk, uncertainty and decision-making*. UKCIP Technical Report.
- United Nations. 2007. Framework Convention on Climate Change. Accessed online: [www.unfccc.int](http://www.unfccc.int)

## Appendix C – Framework Terms of Reference

<b>Driver for the Specific Application of the Adaptation Framework</b>	
<b>Objective(s)</b>	
<b>Participants and stakeholders</b>	
Strategic Planning Team	
Adaptation Coordinator	
Technical Team	
Additional stakeholders for Step 2: Vulnerability Assessment	
Additional stakeholders for Step 3: Risk Assessment	
Additional stakeholders for Step 4: Adaptation Options	
<b>Scale of the Assessment</b>	
Geographical area	
Organizational scope	
Operational scope	
Climate change time horizon	
Adaptation option time horizon	
<b>Project Management</b>	
Project timeline	
Milestones	
Status update requirements	
Resource (i.e., hour) requirements	