



**Mainstreaming the Risk-Based
Management of Climate Change Im-
pacts in Canada:**

Which Guidance is Needed?

Submitted to
Natural Resources Canada

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0 EXECUTIVE SUMMARY

0.1 Introduction

This paper reports on the findings of a study intended to determine the need for and inform the eventual scope and focus of a Canadian “climate change (adaptation) risk management solution” (or CCRMS). While clearly an array of actions are required in order support the “mainstreaming” of climate change adaptation, it has been suggested that an important step in this direction could be the establishment of nationally-accredited guidance providing direction with respect to the screening, identification, assessment, evaluation and management of climate change-related risks. The assertion is that broadly-accepted guidance in these areas could do a significant amount to: create consistent understanding across a range of sectors about what the impacts of climate change might be and where to access critical and dependable information and tools relating to this question; establish principles of good practice with respect to climate-related impact, vulnerability and risk assessment and management; and, clarify the need for and character of further guidance with respect to particular issues or highly sector-specific challenges. It has been further suggested that broad dissemination of authoritative CCRM guidance might best be accomplished by pairing it with existing management system standards.

CSA Standards and its partners set out to answer the following question: *“Is there a need for a CCRMS and, if so, what should its defining characteristics be?”* This question was disaggregated into four supporting lines of inquiry as follows:

- a) How are actors within a range of climate-sensitive sectors currently accounting for the risks posed to their organizations by the changing climate?
- b) How well have existing climate change risk management instruments worked? Have they been broadly implemented and have they led to the timely and rational inclusion of climate variability- and climate change-related risks in the decision making of their intended audiences? Why, why not and what might be learned as a result?
- c) What are the main considerations with respect to formally aligning a CCRMS with management systems and related standards?
- d) What are the most fundamental challenges to the design of a CCRMS?

0.2 Methods

Answers to the above questions were pursued through two means. First, thirty-four (34) semi-

structured interviews were conducted with a range of key informants, including: the developers of (a sub-set of) existing CCRM instruments; users of the same (sub-set of) CCRM instruments; representatives from or familiar with a range of climate-sensitive economic sectors; and, management systems experts. In order to help triangulate, complement and, as necessary, challenge findings from the survey-based research, the study team also conducted a review of the literature, mainly in the areas of: organizational learning, organizational change, climate and climate change information and decision making, and barriers to and drivers of climate change adaptation in organizations.

In addition to addressing our main research questions, the study team compiled by way of its survey- and literature-based research a list of criteria reflective of the diverse array of CCRM support needs expressed by potential CCRM instrument users. These criteria were then applied against each of the CCRM instruments targeted by the current study (see Appendix 2 for criteria and Appendix 3 for a summary table) in order to gauge the extent to which current demands are being met.

0.3 Findings

The study's main findings are reported according to four sets (i.-iv. below) of prominent themes that emerged through our review of the interview transcripts. A final set of findings (v. below) conveys guidance provided by respondents specifically in relation to the scope and character of an eventual CCRMS.

i) The first set of themes relates to the strengths of existing CCRM instruments:

Theme #1: Most respondents felt that existing instruments have been successful in supporting the identification and *preliminary* assessment of climate change-related risks

Theme #2: Most respondents felt that existing instruments provide sufficient guidance to allow for the *identification* (but not the assessment) of potential adaptation options

Theme #3: The developers and users of existing instruments are generally enthusiastic about the role these instruments have played in enabling better communication between “organizational silos” (especially in municipalities)

ii) The second set of themes relates to limitations with respect to existing CCRM instruments:

Theme #4: Existing instruments are generally viewed as lacking adequate authority in order to support the rationalization of significant adaptation action

Theme #5: Most existing instruments are widely viewed as providing too little of “the technical guidance required for rigorous assessments that could lead to adaptations,” especially in the areas of: evaluation, ranking and prioritization of climate change-related risks; characterization and communica-

tion of uncertainties; comparison of adaptation options; and means for triggering the re-assessment of key climate change-related risks.

Theme #6: Few instruments were viewed as having capitalized upon the respective strengths of both “hazards-based” (model-driven, top-down) and “vulnerability-based” (experience-driven, bottom-up) impacts and adaptation assessment methodologies

Theme #7: Existing tools are considered to be poorly-adapted for senior-level decision makers (i.e., lacking in risk-communication components)

Theme #8: The “up-take” of guidance contained in existing instruments could be enhanced by tailoring them to particular sectors

iii) The third set of themes relates to institutional barriers to addressing climate change-related risks in organizational decision-making:

Theme #9: Leaders across a range of climate-sensitive sectors appear to lag in their awareness or *willingness to evaluate the significance* of climate change-related risks

Theme #10: The issue of legal liability can impede decision-makers’ explicit recognition of climate impact-related risks (linked to theme #9 above)

Theme #11: Planning horizons appear too short to prompt the consideration of climate change impact-related risks

Theme #12: There may be a shortage of professionals qualified to competently assist with climate change-related risk management

Theme #13: There is a perceived lack of “authoritative” atmospheric and climate change-related information

Theme #14: To the extent that risks relating to the changing climate do appear on corporate risk registers, they are often lumped together and established as a separate climate change line item

Theme #15: Current fundamental weaknesses in the implementation of risk management systems could affect the utility of these systems for addressing new areas of risk

iv) The fourth set of themes relates to the role of management systems and related standards in the delivery of climate change risk management guidance:

Theme #16: Since the main tenets of management system standards define a rational process of decision-making of relevance to all types of organizations, they also provide a relevant framework for CCRM guidance

Theme #17: The establishment of a link between CCRM guidance and standardized management systems was supported by the majority of non-municipal respondents.

Theme #18: Some respondents warned against relying too exclusively on management system standards for the delivery of CCRM guidance, both because of perceived incompatibilities with local governments' decision-making structures and because of questions regarding the appropriateness of applying management system standards to policy-level decision making.

Theme #19: Most respondents interested in management system-based approaches to the delivery of CCRM guidance expressed a preference for "augmenting standards" as opposed to the development of a new management system

Theme #20: Enterprise risk management system standards were identified as the preferred set of standards to augment with CCRM guidance

v) Specific guidance on the character and scope of a CCRMS

Interviewees for the study provided specific input regarding the potential character and scope of a CCRMS. Consistent with many of the themes above, nearly two thirds of respondents suggested that a CCRMS must be either a formal or quite formal document, with a level or accreditation or authority that ensures users of its "pedigree", and the general public, shareholders and others that it will be used (i.e. that it establishes a reasonable level of practice with respect to the consideration of climate change-related risks in climate-sensitive sectors and undertakings).

As implied in the themes above, CCRM instrument users tended to request a CCRMS that is expansive in scope and purpose, ranging from awareness-generation, to decision-support frameworks, to formal quantitative decision-support tools. Some suggested that as such it must include "standard" as well as "guideline" elements. Some specific scope-relevant issues raised by respondents included:

- The potential for tailoring elements of the guidance to specific sectors, pieces of organizations, or user groups;
- The provision of guidance on a risk category / hazard / causal event basis;
- The provision of guidance on a region-by-region basis;
- Linkages to databases of, e.g., hazards, historical impacts, etc.

Such breadth is clearly both an opportunity and a challenge for the developers of these instruments.

0.4 Discussion & Analysis

Critical elements of the paper's discussion and analysis include:

i) General

Findings from the interviews as well as the literature suggest that despite the ballooning of academic and political (e.g., UNFCCC) interest in the impacts of the changing climate, few organizations, whether private or public, have demonstrated significant capacity to evaluate, prioritize and manage climate change-related risks and opportunities. The overriding message from respondents familiar with a range of private sector players in Canada is that many sectors and individual companies do not appear to treat climate change-related risks with the same rigor as they do other risks, including those relating to the “static” climate. Furthermore, major players in a number of climate-sensitive sectors have yet to openly assess the potential significance of climate change at all, despite arguably having in place the risk management systems required in order to frame the analysis. While municipal respondents suggested that the issue of CCRM is increasingly a concern in their jurisdictions, few if any Canadian municipalities have conducted much more than preliminary, screening-level assessments of climate change-related risks. At the same time, certain companies and economic sectors, and certain municipalities, are clearly beginning to lead the way, and certain CCRM instruments are beginning to gain limited acceptance among small audiences.

In many cases the challenges or barriers to CCRM are shared across organizational types and sectors. Any number of these shared (e.g., public and private sector) barriers to CCRM could persist over time if not proactively addressed, a fact that strongly supports the idea of a CCRMS. Among these barriers are: the perceived lack of *authoritative* CCRM instruments (theme #4) and *authoritative* or *accessible* atmospheric and climate change information (theme #13); the perceived lack of technical information required in order to proceed to the choice and implementation of actual adaptations (theme #5); and, a perceived lack of precedent with respect to key modes of adaptation, in the form of, e.g., case studies highlighting examples of successful adaptation (theme #8).

At the same time, a number of findings point to fundamental analytical capacity and institutional constraints among certain stakeholders that may transcend all risk management behaviour and, as such, throw into question the ability of a CCRMS to have its desired effect. For example, any number of municipal respondents gave CCRM instruments credit for “breaking down organizational silos” among, for example, departments. While this is clearly a useful thing for an instrument to do, the fact that risk management processes within these particular organizations do not already serve such a role may be a warning sign with respect to institutional readiness for CCRM. Somewhat analogously, on

the private sector side, it is not clear that a CCRMS would be able by *itself* to overcome fundamental limitations in decision making capacity relating to issues such as, for example, long-term planning horizons, given that many other elements, apart from modifications in climate statistics, would need to be included in far-future planning scenarios (e.g., the effect of projected urban development on the permeability and hence flood-prone nature of watersheds over time).

ii) Key audiences for a CCRMS

Consensus appeared to emerge that differentiated approaches to the delivery of a CCRMS may be required, along private and public sector lines, but also, just as fundamentally, according to levels of risk-maturity. The arguments are as follows:

- The general level of maturity of the target organizations with respect to risk management, and the risk-based treatment of climate-related outcomes, varies considerably, with the least risk-mature organizations likely situated in the small-to-medium sized municipal and small enterprise categories, and the most risk-mature organizations likely situated in the medium-to-large enterprise categories (and perhaps large municipal and upper orders of government).
- The list of demands made by economic sector representatives and large city respondents with respect to further “technical guidance” suggests the need to gauge the size of the eventual user community that has, or could quickly move well beyond awareness-raising, screening and adaptation option identification, and that expresses a willingness to engage in formal quantitative investment or policy analysis. This user community is not adequately served by the broader set of existing introductory tools, and yet may be the most important user community if they represent some of society’s largest adaptation investment decisions.
- It remains a considerable challenge to write a single standard (or related instrument) that is simultaneously and equally useful for both governmental and private roles in risk management, and somehow compatible with both the terminology of private management and public policy. In the absence of perfect balance in the framing of the standard, the lesser-served audience may inevitably detect that it is more useful for one group than the other and feel compelled to find another tool.

iii) Role for management system standards

For medium to large-sized corporations, the augmentation of enterprise risk management (ERM) systems with CCRM guidance may be the most desirable path forward, though here the question will be how best to remain “ERM agnostic,” since not all corporations conduct their ERM in accordance with the same standard.

Meanwhile, a significant portion of respondents suggested that linking a CCRMS to management system

standards could make it inaccessible or irrelevant to small enterprises and many municipalities. Furthermore, with respect to the public sector, there is not at this time consensus that standardized management systems are applicable in governments' sovereign (policy) decision-making capacities. While these may work well for those aspects of operating an organization where public and private sector organizations are quite similar, they are far less applicable to the public sector role of managing risks borne by others.

0.5 Conclusions and Recommended Next Steps

Conclusions

A broad range of organizational types and economic sectors in Canada would benefit from formalized guidance with respect to the identification, assessment, evaluation and management of climate change-related risks. Input received from interviewees as well as from the majority of Expert Meeting participants underscored the need on the part of private as well as public sector organizations for authoritative guidance, widely accepted by technical experts, regulators, investors, the general public and, hence, sectoral decision-makers.

However, considering the diversity of climate change-related risk management needs and interests, it may well be unreasonable to suggest a single CCRMS will suffice.

The first conclusion is that *more than one CCRMS should be developed* over time, using a process or processes accepted as reliable and authoritative by the broadest possible array of stakeholders, and reflecting among their fundamental content- and design-related considerations the following factors:

- “Risk maturity” level of the audience (see section 4.4.1 for background)
- Extent to which the audience applies risk-based approaches in the management of *existing* climate variability (see Section 4.4.3 for background)
- Whether the audience is a private or public sector organization (see 4.3 and 4.4.2 for background)
- Extent to which the audience is familiar with management system standards (see Section 4.3 for background)

The second conclusion is that significant effort should be focused on the development of guidance in support of quantitative, risk-based adaptation investment and policy analysis. While guidance relating to the identification and *preliminary* analysis of climate change-induced risks is widely available, little exists in the way of authoritative guidance for activities related to the *quantitative* evaluation, ranking and prioritization of said risks.

The third conclusion is that future CCRMSs should, where and as appropriate, incorporate or refer-

ence existing, well-tested tools, especially those developed for the assessment of particular types of climate-induced vulnerability (e.g., engineering aspects).

The fourth conclusion is that future CCRMSs should include, in addition to their normative elements, seamless access to: climate information sources; case studies of processes used by organizations to make decisions regarding climate change adaptation.

Recommended next steps

There are two principle next steps that can be recommended at this time.

i. Augment with CCRM guidance ERM standards for a subset of prominent economic sectors

An effort should be made to *engage a subset of risk mature, climate sensitive sectors in a process focused on the development of a CCRM standard that augments existing ERM systems*. Consideration should be given to engaging those corporate sectors whose activities are of greatest consequence to the public good, such as private sector players directly involved in the planning, development or operation of critical infrastructure. Chapter 7 of this paper lays out a provisional outline for an augmenting standard and suggests a potential structure and composition of a committee that could be tasked with the development of the standard.

ii. Produce a consensus-based, CCRM product specifically for municipalities

Given the limited application of management system (and especially enterprise risk management) standards by Canadian municipalities, and considering the requests from among municipal stakeholders for CCRM guidance of an authoritative nature, consideration should be given to the establishment of a parallel process to the one recommended above for the development of a consensus-based product specifically for municipalities.

1 INTRODUCTION

1.1 The Paper

This paper synthesizes and reports on the findings of a study intended to discern the need for and inform the eventual scope and focus of a Canadian “climate change (adaptation) risk management solution” (from now on, CCRMS)¹. As well, the study was undertaken in order to determine whether and how the development of a Canadian CCRMS by a nationally-accredited organization might advance the goal of “mainstreaming” the rational consideration of climate variability- and climate change-related risks into the planning and operations of the fullest possible array of user groups.

The scoping process was led by CSA Standards. The full Project Team included CSA Standards, the Toronto and Region Conservation Authority (TRCA), York University, and a consultant from the risk services sector. Financial support for the exercise was provided by Natural Resources Canada and TRCA. Significant in-kind contributions came from York University as well as an Expert Review Panel that provided input on a draft version of the paper (*list of participants forthcoming*).

The rest of the paper proceeds as follows:

- The remainder of Section 1 articulates the need for the paper and presents its goal and objectives.
- Section 2 describes the methodology used in conducting the study.
- Section 3 communicates the main findings of the study.
- Section 4 addresses the study’s main research questions through a synthesis of the findings.
- Section 5 presents the study’s conclusions.
- Section 6 makes a series of recommendations regarding next steps.

1.2 Need for the Paper

Many decisions that we make as individuals, governments, businesses and civil society organizations include assumptions about, or explicitly factor in considerations related to the climate in which we live, recreate, build, conduct commerce, and govern (Burton I, et al 2002; McCarthy et al., 2001). While humans have demonstrated a significant capacity to adapt to the climates in which we live (Morss et al, 2005; Fuessel et al 2004), in other respects we have become perhaps less adaptable, as modern day solutions, economies and development patterns lead in some cases to the establishment of sys-

1 This could, but need not necessarily be comprised of, e.g., a central standard and an associated set of risk- and sector-specific protocols.

tems that are either difficult and/or extremely costly to adjust, replace or do away with (Burton and Lim, 2005; IRG, 2006). Similarly, in too many cases, despite the fact that we may have the knowledge (e.g., on the changing climate) and the technical know-how (to adapt and prepare for climate change), we may choose to do nothing (Slovic, 2000; Adger et al, 2007).

The climate is changing. Yet as decision makers, we tend to continue to assume a static climate. In some cases this may be immaterial but in other cases it could prove catastrophic in terms of human and environmental health (Patz, 2005; Arctic Council, 2005), financial and economic costs (Stern 2007), or social and cultural outcomes (Adger 1999).

As noted in the book *Informing Decisions in a Changing Climate* (NRC 2009, p.20), “Because climate change is moving the environment beyond human experience and doing so at a rapid and accelerating rate, there is an urgency to informing...adaptation planning...at all levels of social organization, and in both the public and private sectors. Because few organizations are currently equipped to manage these challenges, new efforts will be required to help them obtain such capabilities.”

How then do we help ensure that as organizations strive in a more general sense to manage risks and identify and capitalize on opportunities, they are equipped to factor in, where and as relevant, the potential materiality of climate variability and change, and use the appropriate amount of effort and tools in doing so?

While clearly an array of actions are required in order support the “mainstreaming” of climate change adaptation, *it has been suggested that an important step in this direction could be the establishment of nationally-accredited guidance providing direction with respect to the screening, identification, assessment and management of climate variability- and climate change-related risks.* The assertion is that broadly accepted guidance in these areas could do a significant amount to:

- a) create consistent understanding across a range of sectors about what the impacts of climate change might be and where to access critical and dependable information and tools relating to this question;
- b) establish principles of good practice with respect to climate-related impact, vulnerability and risk assessment and management; and,
- c) clarify the need for and character of further guidance with respect to particular issues or highly sector-specific challenges.

Along these lines, CSA and its partners have suggested considering the development of a national “climate change risk management solution” (CCRMS) that aligns to the extent possible and relevant with existing means of organizational planning and strategic and operational risk management. One notion is to use internationally-accepted management systems and associated (ISO and counterpart Canadian) standards as vehicles for the delivery of the climate change risk management guidance.

1.3 Goal & Objective of the Study

1.3.1 Goal

The goal of the scoping exercise was to answer the following question: “*Is there a need for a CCRMS and, if so, what should its defining characteristics be?*”

1.3.2 Objective

The main objective of the scoping exercise was to address the following lines of inquiry:

- a. How are actors within a range of climate-sensitive sectors currently accounting for the risks posed to their organizations by the changing climate?
- b. How well have existing climate change risk management instruments worked? Have they been broadly implemented and have they led to the timely and rational inclusion of climate variability- and climate change-related risks in the decision making of their intended audiences? Why, why not and what might be learned as a result?
- c. What are the main considerations with respect to formally aligning a CCRMS with management systems and related standards?
- d. What are the most fundamental challenges to the design of a CCRMS?

2 METHODOLOGY

2.1 Overview

In order to address the main lines of inquiry identified under Section 1.3.2 above, the following steps were taken:

Identification and review of documents and literature in the following areas:

- instruments intended to support the assessment and management of climate variability- and climate change-related risks (what we will from now on call, “climate change risk management (CCRM) instruments”);
- management system standards, as well as peer-reviewed and grey literature addressing their application and outcomes;
- peer-reviewed literature addressing organizational learning, organizational change, and the drivers of and barriers to climate change adaptation within organizations.

Conduct of semi-structured interviews:

- with the developers and users of a small sub-set of existing climate change risk management instruments, in order to: a) elicit feedback with respect to the approach, assumptions and utility of each instrument; and, b) identify opportunities for improvement;
- with representatives from or familiar with a range of climate-sensitive economic sectors, in order to: a) gauge current approaches to the identification, characterization and management of climate variability- and climate change-related risks and opportunities within sectors; b) determine the need for further guidance in these areas; and, c) assess the degree to which such guidance should be accredited / formalized; and,
- with management system experts

Establish and apply “mainstreaming criteria” against the *majority* of documents comprising the above-mentioned sub-set of targeted CCRM instruments;

Synthesis of results from the above steps in order to address the study's main lines of inquiry (Section 1.3.2), and suggest whether or not there is a need for a CCRMS, and what its scope and character might be.

Each of these steps is elaborated upon briefly below.

2.2 Review of documents and literature

Our review of key documents and the literature was focused in three main areas, as follows.

2.2.1 *Climate change risk management instruments*

We reviewed documents in this area in order to:

- Identify, describe and categorize instruments geared towards the assessment and management of climate variability- and climate change-related risks; and,
- Select a sub-set of these instruments for assessment through: a) interviews with key stakeholders; and, b) the application of a set of proposed “mainstreaming” criteria.

2.2.2 *Management system standards, related documents and literature*

We reviewed management system standards and supporting guidance in the areas of: risk management; emergency management and business continuity; quality management; environmental management; and, corporate social responsibility.

We also reviewed literature (peer-reviewed and grey) addressing the application and outcomes of management system standards and supporting guidance:

- across different levels of decision-making within organizations;
- across types of organizations (e.g., public vs. private); and,
- with respect to the consideration of emerging risks.

2.2.3 *Additional literature*

We reviewed literature addressing organizational learning, organizational change, climate information and decision-making, and the drivers of and barriers to climate change adaptation within organizations in order to triangulate and challenge our findings based on the increasingly broad reporting of experiences in the literature.

2.3 Interviews

The main methodological component of the study was a set of semi-structured interviews conducted with a range of key informants. Our motivation for taking this approach was twofold. First, the litera-

ture addressing the climate change-related information needs of specific user groups, especially in the private sector, can be remarkably thin (NRC 2009). Second, while the number of instruments in support of activities related to the management of climate change-related risks is increasing, assessments of the efficacy of these instruments, and the experiences of their users, have yet to be well documented in the literature.

2.3.1 General means of selecting respondents

There is always the risk that a researcher’s preconceived notion of a topic can bias the selection of respondents where survey techniques are concerned (Taylor and Bogden 1998, p. 92). There are, however, several approaches for mitigating this. For example, instead of identifying all respondents from the outset, the researcher can begin with a small number of respondents and allow their insights to guide the selection of additional knowledgeable people, a technique commonly known as “snowballing”. At the same time, Taylor and Bogdan (1998, p.92) advise that snowballing can tend to limit the diversity of respondents, as like-minded people identify like-minded people and so on. “Theoretical sampling” is proposed as a technique for countering this tendency. Once early interviews have informed the development of a preliminary framework of understanding (or “theoretical framework”), further interviewees are chosen for their ability to provide insights into those elements of the framework which have yet to be well fleshed-out or tested. “Snowballing” and “theoretical sampling” were both used in the selection of respondents for the current study.

2.3.2 Profile of the respondents

i. Four general categories of respondent

A total of thirty-four (34) semi-structured interviews were conducted for this study, with respondents apportioned across four general categories as follows:

Developers of existing instruments	Users of existing instruments	Economic sector representatives	Management system experts and others
Eight (8) interviewees with respect to seven CCRM instruments	Eleven (11) interviewees with respect to seven different instruments	Eleven (11) interviewees from three sectors	Four (4) management system experts, one (1) emergency management expert, one (1) water systems expert, and one (1) hospital system administrator

Respondents whose backgrounds made them suitable for two or more of the above-listed categories were generally asked to select a specific perspective from which to speak. Some respondents none-

theless provided the study team with input from a number of different perspectives.

ii. Developers and users of CCRM instruments

Respondents of the “developer” and “user” descriptions were selected based upon their respective links to one or more of seven (7) targeted CCRM instruments. The distribution of respondents across the seven instruments was as follows:

	Bruce & Egener Guide	ICLEI Guide	Australia Guide	Chicago Guide	UK-CIP Guide, Adaptation Wizard & Tools	Moser Guide (vulnerability-based protocol)	PIEVC
Developer	2	1	1	1	2	1	1
User	4	1	1	1	1		3

The first five of these seven instruments were later assessed against a set of “mainstreaming criteria,” as per the process described under section 2.2.4 below. The basic rationale for the selection of this targeted set of CCRM instruments is also provided under section 2.2.4. Appendix 4 provides bibliographic information for each of these guides.

iii. Representatives from three (3) major economic sectors

As already noted, the current study set out to solicit perspectives from respondents across the broadest possible range of climate-sensitive “economic sectors.” The final mix of sectors was based in part upon assessments of previous studies (e.g., we considered sectors which NRCan (2007) identified as being climate-sensitive). But the mix was also necessarily based upon such practical considerations as the accessibility of respondents.

Economic sector respondents were distributed across four categories as follows:

Energy Utilities	Telecommunications	Risk Services
Three (3) respondents across two companies	Two (2) respondents across two companies	Six (6) respondents across six companies

Most energy utility and telecommunications respondents were targeted or recommended for interviews because of the prominent risk management-related positions they hold within their respective companies. Others were identified based either upon their familiarity with the issue of impacts and

adaptation or because of their affiliation with relevant CSA Standards committees (accessibility).

Representatives from the risk services sector were targeted for interviews because these individuals are well-positioned to speak to the status of climate change risk management across a range of economic sectors.

iv. Public, private and academic affiliations

The four main categories of respondent (see “i” above) can be classified according to their public, private, or academic affiliations, as follows:

	Public	Private	Academic
Instrument developers	1	4	2
Instrument users	10	1	
Economic sector representatives		12	
Management system experts and others	1	4	2

The disproportionate number of public sector “instrument users” reflects the fact that the majority of CCRM instruments have been developed with municipal, as opposed to, for example, private sector users in mind.

Of the public sector “instrument users,” three (3) are regional planning authority staff, one (1) is a provincial environment department official, and seven (7) are municipal government staff.

2.3.3 Conduct of the interviews

Most interviews were conducted by phone and generally ranged from 45 minutes to one hour in length. The interview protocol was as follows:

- establish a convenient time for the interview;
- email interview materials to the respondent (interview guide, backgrounder on the project);
- conduct the interview via three-way teleconference: two interviewers (one taking notes) and the respondent;

- transcribe and quality-check notes, and develop final transcript.

Interviews were semi-structured in nature and were conducted largely in keeping with a pre-established interview guide. Four different guides were used as follows: “instrument developers,” “instrument users,” “economic sector representatives,” “management system experts.” A copy of each guide is included under Appendix 1 of this report.

2.3.4 Analysis of the transcripts

Once all transcripts were complete, a list of emerging themes was compiled and reviewed. Coding of this list by thematic area allowed for further, more direct and rigorous analysis. Directed review of the transcripts enabled development of a more holistic understanding of the information, leading to the identification of incongruities in larger trends, and of sub-themes. Through the ordering of themes and sub-themes, preliminary findings were compiled. Preliminary findings were tested with the larger study team and then finalized.

2.4 Criteria-based Assessment of CCRM Instruments

In addition to addressing our main research questions, the study team compiled by way of its survey- and literature-based research a list of criteria reflective of the diverse array of CCRM support needs expressed by potential CCRM instrument users. These criteria (see Appendix 2) were then applied against each of the CCRM instruments targeted by the current study (see Appendix 3 for a summary table) in order to gauge the extent to which current demands are met. Guides from the following five jurisdictions were reviewed as follows:

Australia

- Climate Change Impacts & Risk Management (A guide for Business and Government), Australian Government, Department of Environment and Heritage, Australian Greenhouse Gas Office (2006).

Canada

- Adapting to Climate Change – A Risk-based Guide for Alberta Municipalities, Black, Bruce, and Egener (June 30, 2009).

USA

- Preparing for Climate Change – A Guidebook for Local, Regional, and State Governments, University of Washington and King County, in association with ICLEI (September 2007).

Chicago, USA

- Chicago Area Climate Change Quick Guide: Adapting to the Physical Impacts of Climate Change for Municipalities and Other Organizations (March 2008).

UK

- Climate Adaptation: Risk, Uncertainty and Decision-making. UKCIP Technical Report, UK Climate

Impacts Programme, DEFRA, Environment Agency (May 2003).

Bibliographic information for these guides is provided in Appendix 4 of this report.

3 FINDINGS

3.1 Existing CCRM Instruments

This section does two main things. First, it presents findings from the interviews with respect to the strengths (3.1.1) and limitations (3.1.2) of a sub-set of CCRM instruments. Second, it provides the results of a criteria-based assessment of five (5) of these instruments.

3.1.1 Interviewees' perspectives on the strengths of existing instruments

This section reports on input provided by those respondents who developed, applied or are otherwise familiar with one or more of the climate change risk management instruments introduced under section "ii" of 2.3.2 above. The input has been organized into a series of prominent themes.

Theme #1: Most respondents felt that existing instruments have been successful in supporting the identification and preliminary assessment of climate change-related risks

Nearly all respondents either experienced or familiar with one or more of the instruments identified under section 3.1.1 above reported considerable benefits associated with their application in the preliminary stages of climate change risk management. Respondents suggested that a particular strength of most existing instruments is the rational frameworks they provide for the identification of risks across a broad range of "organizational silos." Respondents also expressed that the instruments generally do a good job of enabling the assessment of risks, though most suggested that their utility in this regard has been limited to screening level assessments.

While the majority of respondents suggested that existing instruments fall short in their delivery of "key technical guidance required for the implementation of more rigorous assessments" (addressed in section 3.1.3, theme 4 below), a small group of respondents – including two instrument developers, a municipal user and a risk services provider – suggested that in many cases it is counterproductive to place significant emphasis on "overly technical issues" relating to the development, interpretation and use of forward-looking information. As one instrument developer said, "Providing significant and complex information about, for example, how to choose ensembles of climate models could distract, confuse and make things appear more difficult than they need to be. For most decisions, people only need to be provided with a reasonable range of potential future conditions." The municipal representative provided a perspective steeped in political realism, suggesting that the most realistic way to gain support for adaptation options is to demonstrate that they will begin to "pay off" in the near future. Implied was that decisions relating to the implementation of potential "win-win" options (embodying adaptation to potential future climatic conditions while also conveying an immediate benefit) should re-

quire less in the way of forward-looking information and can shoulder more in the way of climate change-related uncertainty. The risk services representative conveyed a similar opinion to that expressed by the municipal respondent, suggesting that existing climate-related vulnerabilities, together with their main (often social) drivers, should receive more of the focus and displace some of the emphasis on forward-looking information (an issue addressed under 3.1.2, theme #6 below). In sum, this small group of respondents communicated that existing instruments are closer to enabling significant adaptation decisions than others may suggest.

Another minority perspective was provided by a municipal respondent strongly familiar with the PIEVC (Public Infrastructure Engineering Vulnerability Assessment) Protocol. This respondent said that the Protocol provides nearly all of the direction required in order to build the case for significant, adaptation-based engineering interventions. Distinct from the experience of other instrument users, this respondent placed emphasis on the need for guidance relating to screening-level decisions, requesting means by which to better deduce which individual pieces of infrastructure, or infrastructure systems, should be prioritized for the application of specialized tools like the PIEVC Protocol.

Theme #2: Most respondents felt that existing instruments provide sufficient guidance to allow for the identification of potential adaptation options

The majority of respondents suggested that existing instruments do an adequate job of supporting their users in the identification of potential adaptation options, but that further in-depth guidance relating to the evaluation and ranking of options would in most cases be required in order to rationalize decisions and assist in understanding potential trade-offs. Those instruments most lauded for their utility *vis a vis* the identification of adaptation options tend to make effective use of case studies, allowing for access to, for example, electronic libraries of projects. The importance of case studies as a component of risk-based adaptation decision making is addressed in more detail under theme #8 below.

Theme #3: The developers and users of existing instruments are generally enthusiastic about the role the instruments have played in enabling better communication between “organizational silos” (especially in municipalities)

Instrument developers and users alike were generally very positive about the use of existing instruments as a means for bringing together parties from across a given organization in order to jointly identify and characterize climate change-related risks. A number of municipal sector representatives suggested that the use of such instruments had resulted in a rare level of “cross-pollination” within their organizations. These respondents tended to echo the perspective of the following municipal official, a person well-versed in the application of the Australian Guide:

“The ‘instrument’ has been fine in that it [has given] people a way of dealing with an intangible issue, but it is only as useful as the people who [come together and] apply it. It’s all about engaging with people and getting them to reflect, it’s a very interactive process...When we ran the adaptation workshops, one of the engineers remarked, ‘I have never talked with people outside my area about these issues.’ This [cross-departmental] aspect of [the exercise] is so necessary.”

At the same time, and as addressed in more detail in section 3.1.3, theme #4 below, few respondents suggested that vertical channels of communication had similarly benefitted from the application of these instruments.

An important minority perspective was provided by a risk services specialist who asserted that governments’ use of climate change risk management instruments should focus not only on bringing about collaboration (in the identification, assessment and management of risks) across the various units of their own organizations, but also on ensuring the proper level of engagement with outside constituencies. No other respondent raised this point nor spoke to the strengths and weaknesses of existing instruments in this regard.

3.1.2 Interviewees’ perspectives on limitations with respect to existing instruments

This section reports on input provided by interviewees who either developed, applied, or are otherwise familiar with one or more of the targeted CCRM instruments introduced under section 2.4 above. The input has been organized into a series of prominent themes.

Theme #4: Existing Canadian instruments are generally viewed as lacking adequate authority

The majority of instrument developers and users, as well as economic sector respondents either explicitly stated or affirmed that in order for climate change risk management instruments to be broadly referenced and applied, they must first be recognized by key government or professional accreditation authorities. “Unless the provinces bless it, it won’t be widely used,” indicated one instrument developer. A manager from a large city said, “In order for me to [recommend decisions based upon] the Bruce and Egener Guide, it needs to be mandated by the Province, so that it can become the guiding system, not just something voluntary.”

Similarly, a number of economic sector interviewees with knowledge of the instruments in question, or of other information sources available for the management of climate variability and climate change-related risks, suggested that the diversity of sources can create a degree of paralysis. As one such respondent put it, “There is no one industry blue book for [climate impacts-related risk management]...so how do we know which information to trust?” A utilities sector interviewee said that because his company is publically accountable it would “help [them] very much to be able to say [they] used an authoritative document.” Two utility sector respondents emphasized the scrutiny to which their decisions are exposed. Said one, “If people want to, they can pick [your climate change-related]

assumptions apart.”

A number of existing documents and decision-making instruments were noted by some as more credible than most, of which three were Canadian. Three private sector respondents, one from an energy utility and two others from the risk services sector, mentioned that NRCan’s 2007 report titled “From Impacts to Adaptation: Canada in a Changing Climate” (Lemmen et al 2007) had enabled the positioning (among company executives and boards of directors) of climate change impacts as potential “business issues.” However, the same respondents differentiated between the report’s authority as a “scene setting” document and its ability to actually enable significant strategic or investment decisions. Two users of the PIEVC Protocol suggested that by way of its repeated, case study-based application, the Protocol was becoming an increasingly authoritative set of documents. Finally, one regional planning authority representative mentioned the importance of the Canadian Climate Change Scenarios Network (CCCSN) site (<http://www.cccsn.ca/index-e.html>).

The UK’s Climate Impacts Program (or UK-CIP) was identified by over a quarter of all respondents as providing the most well-reputed tools anywhere, while the Australia Guide was seen by some as having credibility due to the backing it has received from the national government.

Theme #5: Most existing instruments are widely viewed as providing too little of “the technical guidance required for rigorous assessments that could lead to adaptations”

As already noted, most tool users and economic sector representatives felt that existing instruments generally provide adequate information to support preliminary assessments of climate variability and climate change-related risks across a range of organizational types. At the same time, interviewees representing or associated with large urban areas, major corporations and the risk services sector were nearly unanimous in their request for additional guidance relating to the prioritization of risks and the choice of (potentially costly) adaptation options. This particular set of respondents tended to request additional, well-vetted guidance that can be loosely grouped into the following areas.

a. Evaluation, ranking, and prioritization of climate change-related risks

Various respondents asserted that in order for certain adaptation decisions to be taken, existing, largely qualitative instruments should, if at all possible, be supplemented by more quantitative techniques. As one public sector respondent suggested, “Four qualitative categories of prioritization is not enough. How does this all get translated into, for example, dollar values, to compare results between parts of organizations, sectors, etc.?” Similarly, a large city representative indicated that “council really wants numbers, with budgetary pressures there are issues in justifying additional expenditures.” A representative from the senior level of an amalgamated city identified competition for funding across the jurisdiction as a constraint to adaptation planning, suggesting that the “need for [tools enabling]

difficult decisions and trade-offs” is clear.

A sub-set of those respondents who asked for additional guidance in relation to “evaluation, ranking and prioritization” went on to specify particular techniques or areas of practice that could be better formalized. Among them were “sensitivity analysis,” “the development, choice and use of scenarios,” “means for identifying thresholds,” and “costing mechanisms.”

b. Characterization and communication of uncertainties

Not surprisingly, the majority of all respondents identified “uncertainty” as among the most substantial barriers to the consideration of climate change impacts in organizational decision making. Most of those who identified “uncertainty” as an issue continued on to suggest that additional guidance with respect to the characterization, assessment, and communication of climate-related uncertainties is needed. As one respondent with significant experience both in Europe and North America indicated, “People seem to deal [fine] with other types of uncertainty but tend to get hung up on climate-related uncertainty.” A respondent with telecommunications industry ties suggested that at least one major telecommunications corporation in Canada sees the issue of climate change as too fraught with uncertainty to be explicitly considered. “There’s no new [forward-looking] data or information being used [by the company’s risk managers or operations staff]...[they feel that the company] first needs to better understand that recent trends are not part of a cycle... it’s challenging to address the uncertainty in the projections.” A risk sector professional familiar with the telecommunications sector identified the same issue as presenting a barrier to adaptation planning among a range of telecommunications businesses in Canada.

Part and parcel of the above discussion was a focus on scalar challenges associated with current climate model projections. Respondents from all backgrounds suggested that there is too little down-scaled data, and correlated understanding of regionally-specific impacts, in order to effectively use projections to yield plausible scenarios.

A number of risk services providers as well as one respondent from the (municipal) emergency management field suggested that there is “little good guidance on assessing [and understanding different types / origins] of uncertainty” in general and that this can lead organizations to identify hazards but then proceed to prioritize in irrational ways.

Three private sector representatives emphasized the difficulty of effectively communicating uncertainty to decision makers. “We need guidance on how best to do this,” said one. Another said, “One of the more common things I hear about is projections of a single climate variable that go off in two directions...The response in those cases is generally, ‘Come back when you know what’s happening.’” Another respondent, from the utilities sector, noted that, “until two quarters ago [risks due to the change in climate] had been kept off the corporate risk register due to the perceived uncertainties of the science...there was for example uncertainty about the event to use as the design event.” It was

the regulatory risk group at the company that was able to talk about the risks “in a succinct and compelling way and gain buy-in from the executive level.”

c. Comparison of adaptation options

As reported earlier, the developers and users of existing instruments had little negative to say about their utility as a means for fostering the initial identification of adaptation options. However, as implied through “a” and “b” above, the assessment, ranking and prioritization of options can be a different story. As one large city respondent indicated, “We absolutely need a tool to assess adaptation options.” He continued on to describe an instrument in electronic format that would allow for the integration of a diverse range of data fields in order to make direct comparisons between and among alternative climate risk mitigation measures.

The majority of respondents agreed with the following assertion (included as a “hypothesis” at the top of each interview guide), with only one tool developer suggesting the statement was perhaps not completely accurate:

Thus far, tools and protocols established in order to support climate change risk-based decision making have tended to specialize in the identification and assessment of risks but have provided limited guidance with respect to the selection, use and measurement of adaptation options and outcomes (continuous improvement).

One large city respondent suggested that in particular it would be useful to have more broadly accepted methods for conducting the economic analysis of adaptation options, “tools and examples that can bring adaptation down to a cost of living question...that allow you to do the analysis to show where win-win opportunities exist, where adaptive action can lead to short term and demonstrable savings.”

d. Means for triggering the re-assessment of key climate-related risks

A small number of respondents (3) noted as a shortcoming among existing instruments the lack of guidance with respect to the monitoring of climate conditions over time, and the use of related information to trigger the reassessment of particular climate-related risks or adaptation measures.

Theme #6: Few instruments are viewed as having capitalized upon the respective strengths of both “hazards-based” and “vulnerability-based” impacts and adaptation assessment methodologies

Before relaying the results comprising this particular theme, we first provide a brief introduction to

“hazards-based” and “vulnerability-based” approaches, concepts which while commonly used among members of the climate change impacts and adaptation community may be less well known by others.

“Hazards-based assessment” vs. “vulnerability-based assessment.”

The scholarly literature addressing the evolution of climate change impacts and adaptation studies distinguishes between “hazards-based” and “vulnerability-based” assessments² (Burton et al 2002; Klein and Fuessel 2006). Hazards-based assessments generally use a methodology comprised of the basic steps reflected in the following IPCC protocol (Parry et al 1998):

- (1) Define problem (including study area, its sectors, etc.).
- (2) Select method of assessment most appropriate to the problem
- (3) Test methods/conduct sensitivity analysis
- (4) Select and apply climate change scenarios
- (5) Assess biophysical and socio-economic impacts
- (6) Assess autonomous adjustments
- (7) Evaluate adaptation strategies

A main component of the hazards-based approach is the choice and application of climate scenarios. It has been argued that a weakness of this approach is its overreliance on forward-looking scenarios and hence its tendency to overlook the potential relevance of current impacts and vulnerability. As noted by Burton et al (2002), while hazards-based approaches have their “own internal logic and value, [they] can tend to omit or leave implicit other possible and useful steps.” For example, they may downplay the current state of potentially impacted systems, assume that adaptation responses are known, and focus on impacts rather than vulnerability.

Vulnerability-based assessments address future climate change in the context of current climate risks. They do so principally by: focusing on the social or organizational factors that determine coping or adaptive capacity; taking stock of past experiences managing climate-related risks; and, involving stakeholders from the outset (Fuessel et al 2004). Disadvantages may include greater reliance on expert judgment, limited comparability (because of the largely qualitative nature of results), and a lack of clear methodology (Fuessel et al 2006).

Given the extent to which the strengths and weaknesses of hazards- and vulnerability-based assessments have been studied and critiqued through the literature and elsewhere, it was surprising to hear from five different interviewees that, in their experience, hazards-based approaches remain dominant, and that few instruments in current use espouse a rational balance between hazards- and vulnerabil-

² The impacts and adaptation community also uses the terms “first generation” and “second generation” to differentiate between the two types of approaches.

ity-based approaches. As one respondent suggested, “There is no tool that [appropriately] allows for bottom-up³ as well as top-down⁴ approaches. We first need a process to identify and understand existing risks before going on to the future...the exercise is one of determining how the risk will change and what that means about the adequacy or inadequacy of our capacity to address it.” This was echoed by a respondent with both European and Northern American experience. “No tool that I know of,” said this respondent “does a good job of it. King Country (the ICLEI Guide, see Section 3.1.1 above) has tried, but in my opinion it doesn’t work very well.” Another respondent, highly experienced as a risk consultant, and especially in the climate change field, felt strongly that “people tend to jump much too quickly to the forward-looking stuff.”

Theme #7: Existing tools are not well adapted for senior-level decision makers

Various instrument user and economic sector respondents highlighted as a main challenge the use of existing instruments with decision-makers up and down their organizational structures. These respondents suggested that in order to make most existing instruments accessible to higher level decision makers, significant interpretation and facilitation is needed. Municipal and economic sector respondents alike suggested that senior executives, councillors and boards of directors require instrument versions better geared to the clear communication of potential climate change-related risks and trade-offs. As one large city respondent put it, “you need a ‘light version’ and then the ability to ratchet down to conduct more in-depth analyses.” Respondents familiar with the PIEVC Engineering Vulnerability Protocol (see section 3.1.1) suggested that it would be particularly well-complemented by guidance enabling a “fuller picture” of an organizations’ climate change-related risks. One suggested that while the Protocol is relevant to people at a variety of levels in an organization, “depending on the audience it requires some additional work.”

Most respondents suggested that a distinctly tiered approach (with clear screening-level decision points) would be required in order to rationally and systematically link climate change risk-related considerations across all levels of organizational decision making, and that electronic media may be the only reasonable means for doing so.

Theme #8: The “up-take” of guidance contained in existing instruments could be enhanced by tailoring information to particular sectors

Two representatives from the energy utility sector made direct reference to the potential for sector specific tools. As one put it, in order for senior decision-makers to take climate change-related risks

³ Bottom-up is the same as “vulnerability-based”

⁴ Top-down is the same as “hazards-based”

seriously, and to entertain major commitments to adaptation, “[they] need to be able see [their business] in the guidance that is provided.” The same interviewee said, “If there were a utilities guideline for climate impacts and adaptation that would be a Godsend.”

Other respondents were less direct in suggesting the importance of sector-specific guidance but did imply the utility of “see[ing] your [business] in the guidance”; the majority of respondents emphasized the importance of case studies, with most suggesting that examples of successful adaptation would be of greatest use, since many adaptation options may well be sector-specific. Along these lines, a representative from the PIEVC Committee noted that they are considering “starting to set up a tool where people can search case studies from other municipalities for similar types of infrastructure.”

Two management system experts suggested that municipalities and other levels of government may require their own guidance, an issue that is further addressed under section 3.3 below.

The idea of particularizing atmospheric and climate information on a sector-by-sector basis is roundly supported in the literature (Tribbia et al 2008; Moser et al 2008; NRC 2009), where the point has often been made that information must be tailored to fit the often very specific requirements of the given user community, and, that information may not be trusted (or used) unless the particular user community has had a hand to play in its development (Moser 2008).

3.1.3 *Criteria-based assessment of CCRM instruments*

Instruments geared towards the management of climate variability- and climate change-related risks were identified (see Appendix 4) and assessed. The results of the criteria-based assessment can be found in Appendix 3. The guides were reviewed against the set of criteria outlined in Appendix 2.

In general, while all the guides use the same foundational core of risk identification, assessment, and management, the most comprehensive guide with supporting tools is the UK CIP. This guide addresses the issue of uncertainty in great detail and how to manage uncertainty when making decisions about managing the risks related to climate change. “The guide also provides users with insights into how best to use various scenario and projection data. In terms of mainstreaming advice, the Australian guide addressed mainstreaming by suggesting integration with existing enterprise risk management practices as well as other activities such as the annual planning cycles such as strategic planning. None of the guides identified opportunities to integrate climate change risk management with management systems (e.g., environmental management, quality management, etc.).

3.2 Institutional Barriers to Addressing Climate Change-Related Risks

Section 3.1 above conveyed findings relating mainly to interviewees’ experience of specific CCRM

instruments. The current section conveys interviewees' perspectives relating to broader "institutional" barriers to the evaluation and treatment of climate change-related risks. Many of the barriers covered under the (8) thematic groupings below may be addressed at least in part through the development of better-accepted and more accessible CCRM guidance and tools. Some, however, will clearly require other types of intervention as well, for example, changes in laws, regulations or government policy.

Theme #9: Leaders across a range of climate-sensitive economic sectors appear to lag in their awareness or willingness to evaluate the significance of climate change-related risks

There was general agreement among private sector interviewees that risks associated with the impacts of a changing climate have yet to garner the meaningful attention of business leaders across many of Canada's climate-sensitive sectors. Respondents from the risk services sector, whose expertise spans the oil and gas, mining, energy utilities, telecommunications, and manufacturing industries, provided the greatest amount of input in this regard. Their shared view was that private sector clients seldom show interest in the assessment of climate change impact-related risks. As one such respondent communicated, "My North American clients don't really consider [climate change-related impacts] as a business issue." Another felt that the issue of impacts and adaptation may actually be on the brink of receiving significantly more attention, but that while "[p]eople recognize it as an area of emerging risk, they are loathe to talk about it because they have done so little to understand or address it."

A non-risk services sector respondent with experience in the UK suggested that even in that jurisdiction, where government now requires of certain sectors the assessment, integration and reporting of climate change impact-related risks (DEFRA 2009), "capacity is [still] lacking at the levels where decisions are taken...[the UK CIP] has largely been working with mid-level people in organizations' environment departments and I'm not sure this is the right place to focus."

An assessment of the literature tends to bear out the message received from economic sector respondents with respect to the slow up-take of CCRM among private sector players. CERES in the United States, for example, has conducted over the years a series of studies surveying companies across a broad range of sectors (Knobloch et al 2010). While economic sectors have become precipitously more aware of and proactive with respect to "carbon risks," one side of the climate change risk portfolio, corporations' annual reporting with respect to the changing climate and associated risks has demonstrated a much slower evolution.

Recent Canadian work supports the assertion that the leadership of certain climate-sensitive Cana-

dian sectors has not moved significantly towards the serious consideration of climate change impact-related risks. NRCan's 2007 Report "From Impacts to Adaptation: Canada in a Changing Climate" (Lemmen et al 2007) lists a range of adaptation actions which have been either considered or implemented by Canadian stakeholders. Remarkably few stem from initiatives undertaken by Canada's most prominent economic sectors. Meanwhile, a recent study based on surveys with the Canadian mining sector convincingly demonstrates that while operational level employees think adaptation options are an increasingly important issue to consider, executive-level interviewees expressed much less concern about the changing climate, related risks and opportunities (Pearce et al, 2009).

At the same time, while in the minority, certain private sector players are showing leadership on the issue of impacts and adaptation. For example, a recent study commissioned of CSA Standards by Environment Canada suggested that while capacity for the assessment of climate change-related factors may vary considerably across electricity transmission utilities in Canada, some utilities have long been involved in and remain committed to significant work in the area (Sparling et al., 2009). Meanwhile, a transmission sector respondent interviewed for the present study noted that the Vice President of his organization is strongly committed to "establishing [our company] as a leader" in the area of impacts and adaptation.

Another sector that has been proactive in some respects is the insurance industry. Through groups like the Institute of Catastrophic Loss Reduction (ICLR), the insurance sector in Canada supports research on key adaptation measures as well as policy mechanisms for better facilitating their implementation. So far, much of ICLR's work has focused on impacts and adaptation issues of a municipal, rather than private sector,⁶ nature.

Theme #10: The issue of legal liability can impede decision-makers' explicit recognition of climate impact-related risks

Two risk services providers, one utility sector representative and a municipal respondent each touched upon the issue of legal liability, suggesting that the explicit recognition of climate change-related risks – through, for example, inclusions on corporate risk registers – "raises the bar" with respect to their management, and, hence, increases the likelihood of lawsuits in the event of unmitigated damage. Implied was that certain private and public sector players may be steering clear of the rigorous assessment of climate change-related risks in order to avoid elevating their "duty of care."

Theme #11: Planning horizons may be too short to prompt the consideration of climate change impact-related risks

Various respondents identified conventional planning horizons as encumbering the integration into

⁶ Apart from the building industry, with whom ICLR has done a considerable amount of work.

decision-making of climate change impact-related risks. Private sector respondents tended to relay experiences in keeping with the following statement, made by a utilities sector interviewee: “Because people haven’t been able to agree on the scope of the risk, including when things may become an issue, the risk just gets pushed off the ledger...folks tend to model risk on a one year time horizon for management, though we also model five year enterprise risk.”

Public sector respondents provided a mix of perspectives on the issue. Respondents from regional planning authorities seemed relatively optimistic about the ability to overcome planning horizon issues, citing planning exercises in their jurisdictions on the scale of 30 to 100 years. A provincial level respondent, meanwhile, said, “We mostly look [out as far as] the 3-5 year planning horizon...[We] recognize that when dealing with climate change [we] need to look at the longer term [but] we’re still learning how to do that.”

Theme #12: There may be a shortage of professionals qualified to competently assist with climate change-related risk management

One respondent with a significant track record in the area of vulnerability assessment emphasized that the pool of consultants with credentials to support organizations in the management of climate change-related risks is worryingly small. In particular, the respondent noted the importance of social science techniques and aptitudes for the conduct of vulnerability assessments, and the fact that many consultants are trained in fields geared towards the assessment of the purely biophysical aspects of impacts, vulnerability and risk.

Theme #13: There is a perceived lack of “authoritative” or “accessible” atmospheric and climate change-related information

Fully in keeping with their views regarding the non-“authoritative” nature of CCRM instruments in particular (see 3.1.4, theme #1 above), respondents from the risk services, telecommunications, and electricity sectors noted that, in general, more should be done to confirm for and make accessible to users the most comprehensive and authoritative atmospheric and climate change-related information sources. As one risk services respondent indicated, “My clients would really like one source to go to so they don’t have to review and vet scenarios and make their own decisions. They want an authoritative source...[L]ots of clients are saying the information isn’t available or isn’t reliable...a really credible list would be of great value...to the corporate risk manager.” Similarly, a utilities sector representative said, “We need more...and better information than is out there right now...a hub that provides as much of the basic information on impacts would be very useful.”

In order to illustrate one type of “authoritative information” that may increasingly be in demand, a respondent from the risk services sector noted a request for a set of “sea level-rise projections” made of

the State of California by the construction industry in that jurisdiction. The industry believes it will be better positioned to withstand public scrutiny, and protect itself against potential law suites in the future, if its coastal developments are planned according to state-sanctioned projections. As a large city respondent suggested, “this sort of information needs to come from a place with a lot of credibility, accountability and trust.” Again, this is a theme roundly echoed in the literature (Tribbia et al 2008; Moser 2008; NRC 2009).

Theme #14: To the extent that risks relating to the changing climate do appear on corporate registers, they are often erroneously established as “a separate ‘climate change’ line item”

As already noted under theme #1 above, respondents from the risk services sector said that in most cases their clients have yet to begin addressing in an explicit fashion risks stemming from or accentuated by the changing climate. In a related vein, one risk services provider suggested that even where corporations have begun to acknowledge such risks, these risks most often become orphans on the corporate risk register. While ideally risks relating to the changing climate would be considered together with financial, regulatory and other mainstream concerns, they instead tend to be lumped together and established as “a separate ‘climate change’ line item.” This approach may adversely affect not only the level of attention paid and analysis directed towards impacts and adaptation issues, but also, in a correlative fashion, is likely to limit the inclusion of such factors in key, risk-based planning processes. As a utilities sector respondent suggested, climate change-related considerations “should be inserted into the strategic planning and capital budgeting and allocation processes” of climate-sensitive companies.

Theme #15: Current weaknesses in the implementation of risk management systems could fundamentally affect the utility of these systems as means for addressing new areas of risk

The final theme in this section relates to a more generalized concern expressed explicitly by one risk services provider, then echoed through the input of another respondent with a risk services background. These respondents indicated because a significant number of organizations currently conduct poor risk management, turning to existing risk management systems in order to address challenges posed by the changing climate could prove, at least in some cases, problematic.

As the risk services provider put it, “The most difficult situation is where [a corporation has] an ineffective [enterprise risk management] framework. What if it does [risk management] very badly? It might be useful to recognize this challenge. Where this is the case, it might be best just to pick two early win options for adaptation rather than trying to work on all fronts.”

When asked for examples of how risk management is currently going wrong, the same respondent indicated that “clients [tend to] focus a lot more time on the identification of risks rather than on analysis and treatment.” With respect to climate change in particular, as well as risk governance in general, another example was provided:

I find companies who have an existing [enterprise risk management] program and an existing corporate risk management committee and then they set up a separate climate risk management committee...and the climate issues are often dealt with in an ad hoc fashion...this is a governance issue...the need for capital asset replacement will be assessed and a determination made and only then is climate change considered...This amounts to the project manager being asked to simply tick the box...he will likely be asked to do a cost/benefit analysis that downplays the climate change element. This points to the importance of having someone other than the project advocate make the assessment...This is not a fault of the existing tools but rather of how [enterprise risk management] is being implemented.

An alternative slant on this issue was provided by an Australian respondent speaking from his experience as a CCRM instrument developer as well as a risk services provider more generally. He suggested that in Australia the issue of climate change risk management has significantly raised the profile of risk management in general. “Most local governments had risk management strategies [all along],” said the respondent. “[These strategies] had been marginalized...[but now] we see increased uptake as the result of climate change.”

3.3 The Role of Management Systems and Related Standards in the Delivery of Climate Change Risk Management Guidance

All respondents were asked to provide input on the potential role of management systems and related standards with respect to the mainstreaming of CCRM within organizations. Specific questions asked of interviewees can be found within the interview guides corresponding to each of the respondent categories (Appendix 1). One guide was tailored specifically for use with management system experts.

The current section reports on responses provided by the interviewees, as well as upon a number of findings from the literature. All findings are organized under a series of prominent themes.

Theme #16: Since the main tenets of management system standards define a rational process of decision-making of relevance to all types of organizations, they also provide a relevant framework for CCRM guidance

The literature defines management systems as, for example, “formal structures of rules and resources that managers adopt to establish organizational routines and help achieve corporate...goals” (p.62, Coglianese et al, 2001). Management systems aim primarily to ensure that organizations have a structured approach for establishing objectives, planning for the achievement of those objectives, and measuring and assessing results. Underlying the use of management systems is the tacit assumption

that there is value in any organization adopting a formal framework for decision-making and action, as opposed to using entirely informal and ad hoc processes (Davis 2009).

A respondent with significant academic as well as practical knowledge noted that management systems are essentially ubiquitous among organizations:

Wherever you have organizations, you have management systems...All organizations have management systems but may not know it. Management systems are pervasive...[some] are informal and [some are] formal...[The most formal systems are] based on standards, where there is a conscious effort by those in the organization to develop a systematic approach to managing particular aspects of products and services.

While certain respondents voiced reservations about relying too exclusively on management system standards for the delivery of CCRM guidance (addressed under theme #18 below), there was general agreement that the main tenets of these standards – namely the “plan, do, check, act” sequence – comprise in a general sense the basic touchstones of rational organizational behaviour. In other words, respondents suggested that there is a fundamental logic in, at the very least, seeking to reflect the main elements of management system standards in the development of CCRM guidance.

Theme #17: The establishment of a link between CCRM guidance and standardized management systems was supported by the majority of non-municipal respondents

Nearly all private sector respondents and over half of all instrument developers expressed support for establishing a link between CCRM guidance and standardized management systems. On the other hand, among respondents with municipal backgrounds, nearly half expressed reservations about this approach (see theme #18 below).

Those who backed a link between CCRM guidance and standardized management systems expressed a variety of views about what the character of this “link” could be (see theme #19 below for detailed findings).

Two respondents with ties to the UK reported that the impacts and adaptation community in that country has decided that management system standards may be the best vehicle for spurring the rational consideration of climate change-related risks by a broader array of private sector actors. A respondent from the British Standards Institute (BSI) reported that his organization is currently advising the UK-CIP on the development of a guide describing the use of ISO 14001 (environmental management), ISO 31000 (enterprise risk management), and the UK’s own domestic business continuity standard in order to address risks relating to the changing climate.

Economic sector respondents confirmed that most large, and many mid-sized, corporations in Canada either certify to or otherwise employ standardized management systems of a variety of descriptions,

with environmental (ISO 14001), quality (ISO 9001), business continuity, and enterprise risk management principle among them. Unfortunately, without conducting an exhaustive survey of businesses and governments across Canada, it is impossible to report with any degree of precision just how many organizations use each of the major management systems. The only official numbers for Canada are for those organizations certified to one or more of the ISO standards for which certification is available, namely ISO 14001 and ISO 9001. And yet, it is commonly known that far more organizations use formalized management systems without pursuing actual certification (Boehmer per comm, 2009).

The following numbers are available for Canada:

- As of 2002, ISO 14001-certified Canadian organizations numbered 1,062 (ISO 2002), a number that is thought to have nearly doubled since then (per comm. Kahayrullina, 2009);
- During 2008-2009, CSA distributed 679 copies of its new emergency management and business continuity standard, Z1600;
- From 2005-2009, 620 copies of Q850, Canada's national risk management standard were sold.

With respect to the public sector, Davis (2009) reported that ISO 14001-based environmental management systems have been "identified as a growing trend in the public sector for close to a decade," while Leetham and McLeod (2004) reported that 26 Canadian cities were known to have some sort of active environmental management system.

Theme #18: Some respondents warned against relying too exclusively on management system standards for the delivery of climate change risk management guidance

Nearly half of all municipal respondents and two management system experts warned against relying too exclusively on management system standards for the delivery of CCRM guidance. A risk manager from the utilities sector also provided input that leaves room for reflection. While the caveats provided by this group of interviewees ranged in character, the prevailing concern was that certain types of organizations would be inadequately served or, in the worst case, "cut out of the equation" through an over-reliance on management system standards.

Municipal representatives in this group were mainly concerned about Canadian municipalities' current lack of familiarity with management system standards, suggesting that CCRM guidance linked directly to existing standards may, as a result, be perceived as irrelevant by local authorities. The second concern, voiced by just one municipal respondent, related to the cost of certification. This particular response suggests a lack of awareness regarding the nature of certification and, perhaps, management system standards more generally, since the standards may be used independently of certification.

One management system expert echoed to a degree the same concern voiced by municipal respondents above, suggesting that while it would make sense to link CCRM guidance to existing management systems where private sector users are concerned, a separate instrument should be considered with respect to the municipal sector.

A second management system expert suggested that aligning CCRM guidance too closely with management system standards could conceivably affect its relevance both for governments (local as well as regional) and for small and medium sized enterprises. With respect to governments, the respondent noted that while some public sector organizations in Canada do use, e.g., environmental management system (EMS) standards, the application of EMS standards has thus far been limited to individual facilities. One reason, suggested this respondent, “Is that there is currently no agreement as to whether these formal standards are appropriate for use in policy making, for government decisions in their sovereign role as governments.” When asked to elaborate further upon this assertion, the respondent clarified that the issue relates largely to “a general difficulty in getting public interest groups to the table in order to [have an equal voice in] setting and improving the standards.”

The same management system expert noted that while “formalized management systems are pervasive in medium and large organizations in the private and public sector, they are not prevalent in small and micro organizations, a large segment of the business community.” Among the factors constraining the use of formalized management systems among small and micro organizations are: assumptions within the standards regarding a level of formality not found in small organizations; and, assumptions regarding the presence of clear and discrete roles, responsibilities and procedures, characteristics that do not prevail in many small organizations.

Finally, a senior-level risk manager from the utilities sector provided input that suggested a potential draw-back of the management system approach. This respondent suggested that while his company has moved to include risks relating to the changing climate on their risk register, the issue has not yet “filtered down” to, for example, “the systems-design level people.” While the respondent himself did not raise this as a concern per se, one might ask whether other means for providing CCRM guidance would better prompt the technical and professional disciplines to begin accounting for climate change-related considerations. What vehicle, for example, would best establish new CCRM guidance as something that triggers professional obligations?

Theme #19: Most respondents interested in management system-based approaches expressed a preference for “augmenting standards” as opposed to the development of a new management system

Karapetrovic et al (2006:11) have observed that, “the universe of international management system standards is now populated by dozens, if not hundreds of documents containing criteria and guidance alike, and is continually expanding from its ‘big bang’ twenty years ago when the original ISO 9000 models saw the light of day.” A sense of management system fatigue was communicated to one ex-

tent or another by the majority of respondents familiar with formalized management systems. Most suggested that management system-based guidance should therefore come in the form of an “augmenting standard”, as opposed to a new management system.

Two minority opinions were expressed by a UK standards-development expert and a Canadian risk services provider. The UK respondent said that, “[While at the moment] it would be difficult to convince people that there is a need for a new [management system] standard, if [CCRM guidance] works well as an add-on to existing standards, if it is taken up and found to be of use, then more formal steps could be taken down the line.” Meanwhile, the risk services sector representative posited that “while you don’t want to do a standard that is simply repackaging other standards, there may at the same time be some value in making [CCRM guidance] more identifiable.” Implied was that a new management system standard could be worth considering.

Theme #20: Though most respondents familiar with management systems agreed in principle that a “CCRM augmenting standard” could be rationally linked to any number of formalized management systems, enterprise risk management systems and related standards were most touted in this regard

Not all respondents expressed a view with respect to the types of management systems that should be prioritized for CCRM augmentation. However, the majority of economic sector interviewees and one management system expert expressed strong support for establishing formal relationships between enterprise risk management systems and CCRM guidance. These respondents generally said that most other management system families remain too narrowly focused in order to prompt the consideration of climate change-related risks across all elements and functions of an organization. It was noted, for example, that the ISO 14001 family of standards is seldom, if ever, used in order to support organization-wide planning and assessments, since its application is typically focused at the level of single facilities. The same group of respondents argued that, by design, enterprise risk management systems and related standards allow for a much broader assessment of organizational risks and opportunities. As one risk services provider said, “If you don’t make [CCRM] part of ERM, you will miss out on its importance and its relevance to all of the potentially-impacted areas of the business.”

Of those respondents who backed the augmentation of enterprise risk management systems, two suggested caveats. A risk services interviewee said that it would be important for any CCRM guidance to “remain ERM agnostic”. “We find,” said the respondent, “that clients want to be able to continue to use the framework they are familiar with; if you do a new standard, it should not favour one ERM system over another...people use [a range] of approaches.” The second caveat was provided by a utilities sector representative who was concerned that “ERM frameworks” can tend to focus “more on the business risk side and not on the technical side.”

3.4 Final Guidance Regarding the Character and Scope of a CCRMS

Towards the end of each interview, respondents were asked to make specific recommendations regarding the character and scope of an eventual climate change risk management solution (CCRMS). Input provided by the respondents generally fell within the following three areas – “level of formality,” “scope,” “mode of delivery,” – each of which is reported upon in turn below.

3.4.1 Level of formality

As reported under sections 3.1.2 and 3.2 above, the majority of respondents perceived a lack of authoritative guidance and information as impeding the conduct of risk-based adaptation decision-making across a range of organizations and sectors. This perception was to some extent but not entirely reflected in respondents’ views regarding the level of formality required of a CCRMS.

Seven respondents from across the instrument developer (2), user (2), private sector (2), and management system expert (1) categories said that a high level of formality would be beneficial. Four of these respondents said that the guidance should be sufficiently formal so as to be cited in legislation. Various respondents provided opinions akin to the following regional planning authority response: “Not a formal standard but perhaps a guideline that is supported by the federal and provincial governments, so that there is some incentive to follow it and be consistent...A guideline with solid buy-in and back-up.”

Seven respondents provided no explicit opinion on the issue.

3.4.2 Scope

The majority of respondents suggested that an integrated pair of instruments should be considered, the first comprising a general, risk-based protocol (or guidance with respect to the use of existing management systems) with a focus on climate-variability and climate change-related factors, the second comprising a set of “implementation”-related tools. Two respondents characterized this need by saying that the scope should include both “standard” (i.e., risk protocol) and “guideline” (i.e., implementation) elements. A number of other respondents framed the issue similarly to the following respondent: “Have something at the operational level so they know what’s required for implementation; and something for the executive team so they understand the importance [of the issues].” Another respondent suggested that the job of a national CCRMS should be to “bring together in one place all of the best existing instruments,” having noted the PIEVC Protocol and the Egener and Bruce Guideline. On a slightly different note, a risk services provider suggested that the issue of scope should include within its gambit the “hazards-based” (top-down) versus “vulnerability-based” (bottom-up) question. “The first layer of guidance,” said this respondent, “has to be, ‘What can you get with top down vs. bottom up approaches?’”

Other scope-relevant issues, each of which was raised by one or more of the respondents, included:

- The potential for tailoring elements of the guidance to specific sectors, pieces of organizations, or

user groups (e.g., public versus private sector);

- The provision of guidance on a risk category or causal event basis;
- The provision of guidance on a region-by-region basis;
- Linkages to databases of, e.g., hazards, historical impacts, etc.

3.4.3 Mode of delivery

Web-based solutions were emphasized by nearly all respondents as the only plausible approach to providing both a central, risk-based, decision-making protocol as well as a host of implementation-related tools. A number of respondents suggested that web-based approaches would make it much simpler to present guidance in a tiered fashion, allowing users to choose between, for example, screening-level approaches and more in-depth assessments. One risk services provider may have put it best:

It goes without saying that what is needed is a web-based, multi-layered approach. Using the web will be the only practical way of doing it. The UK Adaptation Wizard approach [would be a good one to model it on]. Have a central 'hub' that connects users with all the required instruments. This would allow for a tiered risk assessment...with the central [document(s)] not go[ing] much further than screening...

Only one existing instrument was noted as making solid use of web-based approaches; the UK CIP's Adaptation Wizard was identified by the majority of all respondents as the model to aim for in this respect. Of potential interest were a number of specific examples for how existing instruments could better harness web-based vehicles. Speaking specifically about the PIEVC Protocol, one respondent suggested that there should be a way to move from spreadsheets to "interactive worksheets." Where the Egener and Bruce instrument is concerned, a number of respondents suggested that it could evolve to include on-line means for working through and comparing adaptation options, for example.

4 DISCUSSION & ANALYSIS

The current section draws upon the interview-based findings, as well as upon the literature and feedback from the Experts Meeting, in order to address the four lines of inquiry set out in Section 1.3.2 of the paper.

4.1 How do actors across a range of climate-sensitive sectors currently account for risks posed to their organizations by the changing climate?

Findings from the interviews as well as the literature (e.g., Lemmen et al 2007; Pearce et al 2009; Tribbia et al 2008; Adger et al 2007; Young et al 2009; Spalding, K.S. 2010) suggest that despite significant academic and political (e.g., UNFCCC) interest in the societal, environmental and economic impacts of the changing climate, few organizations, whether private or public, have demonstrated significant capacity to evaluate, prioritize and manage climate change-related risks and opportunities. While in many cases, the challenges or barriers in this regard appear to be shared across organizational types and sectors, in other cases they may be more particular to, e.g., public versus private sector organizations. The remainder of this section first discusses findings related to the status of CCRM in public sector organizations (principally municipalities). It then turns to private sector-related findings in this regard.

i. Municipal sector

While municipal respondents suggested that the issue of CCRM is increasingly a concern in their jurisdictions, few if any Canadian municipalities have conducted much more than preliminary, screening-level assessments of climate change-related risks. To some extent this is clearly a reflection of the fact that it remains “early days” for climate change adaptation as an area of municipal focus. However, as reported under sections 3.1.2 and 3.1.3, municipal respondents touched upon issues that, without attention, could persist over time as barriers to the maturation of CCRM within their organizations. Among such barriers are: the perceived lack of authoritative atmospheric and climate change-related information (theme #13); the perceived lack of technical information required in order to proceed to the prioritization, choice and implementation of actual adaptations (theme #5); and, a perceived lack of precedent with respect to key modes of adaptation, in the form of, e.g., case studies highlighting examples of successful adaptation (theme #8). Each of these barriers could in and of itself support an argument for establishing CCRM guidance that is accredited and that extends beyond the screening stage of CCRM, in order to address, for example, means for characterizing and weighing the importance of uncertainties, or for costing alternative adaptation-related options.

Yet a number of findings point to fundamental analytical capacity and institutional constraints that may, at least among some municipalities, transcend all risk management behaviour and, as such,

throw into question the ability of a CCRMS to have its desired effect within this sector. Consider, for example, those respondents who gave CCRM instruments credit for “breaking down organizational silos” among municipal departments (themes #1 and #3 above). While this is clearly a useful thing for an instrument to do, the fact that risk management processes within these particular organizations do not already serve such a role may be a warning sign with respect to institutional readiness for CCRM. Existing risks, including those associated with a stationary climate, are themselves likely poorly managed if mechanisms for assessing cross-organizational risks are in short supply, or at least ineffective, to start with. In this case, would it do any good to layer on risk-based guidance relating to the effects of a changing climate?

Two potential counterpoints to the above concern were provided by a number of different respondents. First, various respondents emphasized the importance of encouraging vulnerability-based approaches (as reported under themes #1 and #6), focusing not so much on the management of temporally distant or gradually emerging risks (potentially trickier to assess) but rather on the “here and now” of recent experience and those factors which affect vulnerability (sensitivity, exposure and adaptive capacity). Arguably, addressing climate- (change) related risks in this way could help circumvent what may otherwise seem an unrealistic option of feeding largely forward-looking (climate change) information into what may be admittedly immature risk-based decision making processes. An approach that focuses on existing risks first (and thereby provides a foundation for vulnerability-based approaches to CCRM), might have the primary benefit of “mainstreaming” risk management for climate-sensitive public and private outcomes (perhaps under the climate change banner, where useful), with the side benefit of “mainstreaming” adaptation to climate change as a key aspect of the process.

A second counterpoint was provided by the Australian respondent who suggested that the issue of climate change (impacts) has in and of itself prompted the reinvigoration of risk management practices among many Australian municipalities. Could this dynamic develop in Canada as well?⁷

ii. Private sector

As noted in the findings, the overriding message from respondents familiar with a range of private sector players in Canada is that many sectors and individual companies do not appear to treat climate change-related risks with the same rigor as they do other risks, including those relating to the “static” climate. Furthermore, major players in a number of climate-sensitive sectors have yet to openly assess the potential significance of climate change at all, despite arguably having in place the risk management systems required in order to frame the analysis. In many respects, barriers to private sector engagement with CCRM appear to parallel those described by respondents addressing municipal

⁷ In Australia, the policy driver has been a series of extremely high impact, climate-related disasters, of which the spate of fire over the last few years have received the greatest profile.

contexts. Barriers of relevance to an eventual CCRMS include: the perceived lack of authoritative atmospheric and climate change-related information (theme #13); the perceived lack of technical information required in order to proceed to the choice and implementation of actual adaptations (theme #5); a perceived lack of precedent with respect to key modes of adaptation, in the form of, e.g., case studies highlighting examples of successful adaptation (theme #8); and, a lack of support for communicating the outputs and assumptions of CCRM approaches to senior-level management (theme #7).

A number of barriers identified over the course of the study were mentioned either exclusively with respect to private sector companies, or with an overriding emphasis in this area. For example, while a range of respondents suggested that case studies would be important illustrative tools, private sector respondents were decidedly more intent than others on the importance of having senior-level executives “see themselves” (their sector) in the CCRM guidance. These respondents stopped short of downplaying the utility of “generic guidance,” but did suggest that such guidance alone would go only so far in generating buy-in within their sector (see theme #8).

Another private sector-dominated theme (whether rightly or wrongly) was the issue of liability. As noted under theme #10, executive-level decision-makers may be reticent to raise climate change risk-related issues until they feel they know how to “reasonably” address them, and can be legally protected with respect to their actions in this regard. One impact of creating a standard, authoritative CCRMS could be to elevate the standard of awareness and consideration required in order to meet one’s duty of care as a fiduciary operating in a climate-sensitive sector. At present, apart from where assessing and reporting are directly mandated (for example, in the federal environmental assessment process), it is not clear what a senior manager can be excused for not having done, since there is no baseline level of consideration of climate change sensitivity that one could be considered to have fallen short of. In this case, a CCRMS could provide both a carrot (something to be used) and a stick (something one could be accused of not using) in moving from fleeting awareness to active consideration.

Planning horizons (theme #11) and the misuse of existing risk management frameworks (theme #15) were the other two CCRM-related barriers identified primarily with respect to private sector players. Both are important to the extent that they may underscore fundamental analytical capacity and institutional barriers that transcend all risk management behaviour. For example, it is not clear that a CCRMS would be able to overcome fundamental limitations in decision making capacity relating to long-term planning horizons, given that many other elements, apart from modifications in climate statistics, would need to be included in future planning scenarios (e.g., the effect of projected urban development on the permeability and hence flood-prone nature of watersheds over time).

4.2 How well have existing climate change risk management-related instruments worked?

As can be deduced from Section 4.1 above, while in most cases CCRM instruments have been able

to support awareness-raising and screening-level CCRM assessments, where Canadian organizations are concerned, existing instruments have been much less influential in the development of analyses capable of justifying climate change-driven (i.e., adaptation) decisions. The principle reasons for this are detailed under section 3.1.2 of the findings. Rather than addressing these points once again, the current section instead speaks to two observations that require further emphasis with respect to the efficacy of existing instruments.

First, it is important to point out that currently, in Canada, there are no private sector-specific CCRM instruments. Existing Canadian CCRM instruments either explicitly or implicitly target municipalities. In keeping with this, interviewees made no mention of CCRM instruments, whether Canadian or otherwise, being used by Canadian corporations. In the UK, where adaptation instruments for the private sector have been developed, government officials remain dissatisfied with their uptake. The UK CIP has therefore embarked upon the development of guidance for the use of management systems in the treatment of climate change-related risks.

Second, the list of demands made by economic sector representatives and large city respondents with respect to further “technical guidance” (see theme #5 above) suggests the need to gauge the size of the eventual user community that has, or could quickly move well beyond awareness-raising, screening and adaptation option identification, and that expresses a willingness to engage in formal quantitative investment or policy analysis. This user community is not adequately served by the broader set of existing introductory tools, and yet may be the most important user community if they represent some of society’s largest adaptation investment decisions. It would be unfortunate to “mainstream” only to increase the number of organizations having these same needs (for quantitative investment or policy analysis tools) while not serving those who already face complicated near-term, climate-influenced investment decisions.

4.3 What are the main considerations with respect to the use of management systems and related standards in the delivery of CCRM guidance?

There appear to be three principle considerations with respect to the use of management systems and related standards in the delivery of CCRM guidance.

i) Compatibility with audience

As indicated in Section 3.3 above, the majority of economic sector respondents felt that the formal association of CCRM guidance with existing management system standards would be an effective means for reaching certain user groups, principally medium-to-large sized corporations, but eventually large cities (see, e.g., Davis 2009) and higher orders of government as well. At the same time, a significant number of municipal respondents and two management system experts suggested that linking a CCRMS to management system standards could make it inaccessible or irrelevant to small enter-

prises and many municipalities.

Unfortunately, it is difficult to gauge in a precise way, without significant further study, the number of organizations, private and public alike, that have adopted formalized management systems and may therefore be most open to entertaining the use of associated CCRM guidance. It is therefore also unclear just what portion of organizations currently familiar with formalized management systems are in the public sector.

With respect to the public sector, there is not at this time consensus that standardized management systems are applicable in governments' sovereign (policy) decision-making capacities. While these may work well for those aspects of operating an organization where public and private sector organizations are quite similar, they may be less applicable to the public sector role of *managing risks borne by others*. An additional consideration is that even were agreement to exist that existing management system standards are directly applicable to public sector organizations in their policy role, it remains a considerable challenge to write a single standard (or related instrument) that is simultaneously and equally useful for both governmental and private roles in risk management, and somehow compatible with both the terminology of private management and public policy. In the absence of perfect balance in the framing of the standard, the lesser-served audience may inevitably detect that it is more useful for one group than the other and feel compelled to find another tool. In this sense, the CCRMS may need to be sector-specific, in this case *public versus private*.

ii) Potential for organization-wide impact

This study set out to examine the potential utility, for the mainstreaming of CCRM guidance, of management systems and related standards, in general. There was no strong, preconceived notion with respect to which among the various management systems and standards would be most suitable for "augmentation" by a CCRMS nor, for that matter, whether the more suitable approach would be to develop an entirely new family of (CCRM) standards.

Where the augmentation of existing standards is concerned, feedback from the interviews (see themes #17-20) strongly suggests that enterprise risk management (ERM) standards may be the most highly-favoured and likely best vehicles to target. The principle or at least most convincing argument for the use of enterprise risk management systems is that ERM systems, more than others, are designed to "cut across" all aspects of an organizations planning and operations.

And yet while ERM standards received the greatest vote of confidence, given the increasing trend among large corporations towards the integration of all management systems (citation forthcoming), coupling CCRM guidance with any of the most prominent systems (e.g., environmental management, emergency management and business continuity, of risk management) might ultimately serve the same purpose. Depending upon the eventual sector-based differentiation of a CCRMS, it may also be worthwhile differentiating with respect to the management system standard targeted for augmenta-

tion.

iii) “Visibility” of new (CCRM) guidance

While certainly not the majority perspective, two respondents, including a seasoned risk services provider did suggest a potential benefit of establishing a CCRMS as its own family of standards, the argument being that (merely) augmenting existing standards may garner too little attention for the issue of impacts and adaptation. The issue of “visibility” also ran beneath the surface of input provided by many respondents as they addressed, for example, the “accessibility” and “authoritative nature” of currently available information. The upshot: Which approach or approaches will best differentiate reliable, peer-reviewed CCRM guidance from information that may be less-well vetted, while also complementing, and not over-complicating, existing organizational management processes?

4.4 What are the most fundamental challenges to the design of an effective CCRMS?

The design of an effective Climate Change Risk Management Solution (CCRMS) must take due consideration of challenges stemming from three main issues, each of which is discussed in turn below.

4.4.1 *The diverse range of risk maturity levels among organizations*

Organizations within the potential audience for the CCRMS may demonstrate an extremely broad range of risk maturity levels, which will render them either more or less ready to take on climate change-related advice:

- a) There will be organizations within the potential audience of this CCRMS that have a very low level of maturity with respect to the concepts and standard practices of risk management.
- b) There will be organizations within the potential audience of this CCRMS that have a very low level of maturity in dealing with existing static climate-related risks and the decisions required, independent of climate change.
- c) Some organizations may need to build internal support, or “make the case that this is worth thinking about,” before they can contemplate risk management; they may want a tool that helps them, starting at this very early point.
- d) Many decisions currently made in the domain of climate-sensitive outcomes (static or changing) are not risk-based. By “not risk-based,” we mean there is no explicit measurement of risk that is driven by climatic hazards, or estimates of risk reduction that would result from available options. Decisions are made (including status quo), but without the explicit application of risk esti-

mates.

- e) Many of the most important adaptations may be capital-intensive, or “expensive” in some other way (land use restrictions, insurance, regulations) and will require a strong, often quantified, argument in favour of such investments or restrictions, particularly where there is considerable competition for investments and strong competing rationales against restrictive policies or regulations.

These realities constitute a considerable threat to the success of any narrow product, and a significant challenge for a broadly defined one. If broadly defined to serve all of the audiences above, the solution will be simultaneously introducing three new concepts to at least some audiences: the organization-wide application of a risk management process; a risk-based approach to managing climate-sensitive outcomes (climate change aside); and, the specific attributes of the incremental hazard of climate change. In addition, the broadest solution would provide tools for internal awareness-raising all the way through to facilitating selection of analytical tools for quantified option analysis under uncertainty.

This same challenge can be understood from the other extreme, in a positive light, by describing an organization which:

- f) has an entirely risk-based approach to managing the risks associated with climatic conditions in the static climate scenario, including coping with the uncertainties (product or service demand forecasts, population projections, economic forecasts, flood risk as affected by changes in regional land use, etc.) that exist independent of climate change;
- g) has the capacity to make informed choices among decision options using decision-analytic techniques that consider costs, uncertainties in the present and the future, and explicitly estimate the amount of risk reduction that will result from the options under consideration;
- h) has experience with supporting senior decision-makers where important protective or adaptive decisions are made to avoid adverse outcomes that would be expected relatively far into the future;
- i) has mature methods for assessing and comparing risks across the organization, so that climate-affected outcomes can be compared with other risks being faced by the organization or its stakeholders; and,
- j) has mature methods of communicating about uncertainty, risk and the basis for risk-based decisions.

For such an organization (temporarily setting aside the *uncertainty* associated with climate change

scenarios), it would be relatively straight forward to integrate the range of forecasted changes in climate variables, together with their relative likelihoods, into their existing risk-based investment or policy model, much like they would any other incremental source of imperfect information which impacts their assumptions about the future. Returning to the specific question of climate change, in the case of this organization, the fact that climate change impacts have considerable uncertainty is really only a matter of degree rather than a novel challenge. In this case, therefore, *the role for a CCRMS-like solution would be to package what is known and unknown in the science of climate change into an authoritative and informative input into an already robust and rational process.*

The two extremes posed above suggest that the users of the potential CCRMS span the continuum from the more rudimentary decision-making environment, where each of the former challenges are present, to the mature, “risk-ready” organization, where each of the latter positive attributes are present.

The fact that a CCRM solution may need to choose a particular audience, or somehow straddle this continuum is made apparent by considering the set of tools listed under Section 2.4 of this paper:

- k) In some cases the tool is apparently introducing the organization to risk management for the first time, including basic definitions, rationales for risk-based decision making, and so on, as is the case with the Egener and Bruce guide.
- l) In the case of the Australian guide, the broad spectrum of potential users is explicitly acknowledged; the document suggests that the user may either already be embedded in an enterprise risk management system, or that, at the opposite extreme, the guide may enable the first purposeful application of risk management principles within the interested organization.
- m) The UK CIP Technical Report (guide) encourages organizations to choose from among and adopt a diverse array of complex risk assessment and decision-analytic techniques. While this implies an audience that has yet to embrace risk-based or decision-analytic approaches for dealing even with static climate risks, it at the same time presumes that such tools will nonetheless be considered with respect to the specific risk of climate change.
- n) In yet another case, the tool attempts to assist users at the very early stages, with an entirely new program; the ICLEI report includes advice on “building support” and “building a team” among 14 chapters of which only two address climate change vulnerability and risk assessment.

4.4.2 Private sector & public sector decision-making environments may differ remarkably

While the needs of public and private sector players may be sufficiently similar to warrant a ‘common

toolkit' for certain phases of risk management (e.g., risk identification and awareness raising), formal decision-support relating to significant decisions or investments, or to significant disclosures of risk, could require a more differentiated approach.

The majority of interviewees as well as participants at the December 2009 Experts Workshop were in agreement that private and public sector needs may be sufficiently different to warrant separate solutions. While these solutions could conceivably be integrated or related at some later point, the core effort to develop the solutions would be distinct, and responsive to the diverse interests.

To an extent, advocacy with respect to the separation of private and public needs reflected the fact that the point along the risk maturity continuum at which a user organization finds itself may be most closely related to the (economic) sector in which it resides. This situation may create a useful opportunity for providing both sector-specific tools and tools that match the risk maturity of the sector itself, as well as the specifics of its decision support needs. This point was made clear by several interviewees and workshop participants with significant private-sector experience in risk management.

4.4.3 Climate-sensitive risks vs. climate-change-sensitive risks

Should the CCRMS aim to support the evaluation of *all* climate-sensitive risks or solely climate *change*-sensitive risks? This question is intricately linked to the issue of hazard-oriented vs. vulnerability-oriented approaches to risk assessment. A number of arguments can be offered in defense of either approach, though each must be seriously scrutinized with respect to key assumptions.

Pro-climate-change-only:

- o) It could be argued that sufficient capacity already exists to address the stationary climate (i.e., risks associated with the variability of climate-driven factors absent climate change). This implies that it would be inefficient to address both climate risk and climate change risk, since the former is well known and well managed.
- p) One might also argue that it is necessary to tie current activities to climate change-related funding, initiatives, or interest, in order to capitalize on otherwise scarce resources.
- q) The emergence of quasi-legal obligations (public liabilities, securities-related disclosure requirements, etc.) specifically related to climate change might also justify a focus on this narrower slice of risk management.

Pro-all-climate:

- r) One might argue that in a number of important ways, insufficient attention has been paid to risks arising from climatic variability in general, regardless of climate change. If this is true, then the notion of a climate-change-related risk management approach, in the absence of an all-climate

risk management approach, may be suspect. Only limited evidence has been gathered with respect to the quality, among sectors, of current “all-climate” risk management, though it is clear that a certain level of risk control is in place in a range of sectors. One could set about to determine the extent to which these practices are indeed “risk-based” as opposed to relying on tacit expert knowledge.

- s) To the extent that a climate change-only approach may under-emphasize *present* levels of vulnerability to climate-related factors, any number of ‘no-regrets’ adaptation solutions (i.e. those capable of delivering immediate co-benefits) may be passed over. The “net present value” of mitigated losses accruing for the first time 50 years from now will be extremely limited, even under modest social discount rates or requirements for internal rates of return. The delivery of co-benefits in the short-to-medium term can result in significantly more favorable value propositions in this regard.

5 CONCLUSIONS & RECOMMENDED NEXT STEPS

This final section of the paper does two things. First, it answers the question, “Is there a need for a CCRMS and, if so, what should its defining characteristics be?” It does so by way of four main conclusions (5.1). Second, it recommends next steps for the development and diffusion of formalized CCRM guidance (5.2).

5.1 Conclusions

The paper’s findings (Chapter 3) together with its discussion and analysis (Chapter 4) make clear that a broad range of organizational types and economic sectors in Canada would benefit from formalized guidance with respect to the identification, assessment, evaluation and management of climate change-related risks. Input received from interviewees as well as from the majority of Expert Meeting participants underscored the need on the part of private as well as public sector organizations for authoritative guidance, widely accepted by technical experts, regulators, investors, the general public and, hence, sectoral decision-makers.

However, considering the diversity of climate change-related risk management needs and interests conveyed over the course of the interview process and Experts Meeting, it would be unreasonable to suggest that a single CCRMS will suffice.

The first conclusion therefore is that *more than one CCRMS should be developed* over time, using a process or processes accepted as reliable and authoritative by the broadest possible array of stakeholders, and reflecting among their fundamental content- and design-related considerations the following factors:

- “Risk maturity” level of the audience (see section 4.4.1 for background)

The CCRMS for risk mature audiences should focus on incorporating into *existing* risk management frameworks and practices methods for assessing, evaluating and managing climate change-related risks. Risk mature audiences, many of whom may be faced with among the largest of our society’s adaptation investment decisions, and most of whom have, nonetheless, yet to factor climate change into their decision making practices, are poorly served by the current, broad set of largely introductory CCRM tools.

Conversely, a CCRMS(s) for less risk-mature audiences will be required, by definition, to begin with ‘first principles,’ will lack the option of integrating with existing risk management frameworks (i.e., will be ‘stand-alone’ in nature), and may elect for the time being to introduce less in the way of quantitative methodologies.

- Extent to which the audience applies risk-based approaches in the management of *existing*

climate variability (see Section 4.4.3 for background)

Risk mature, climate-sensitive sectors should by definition demonstrate a strong ability to understand and address risks associated with the variability of climate-driven factors *absent climate change*. A CCRMS targeting such audiences should, therefore, focus most particularly on the assessment, evaluation and management of climate *change*-driven factors. And yet, even “risk mature” organizations may lag in their management of at least certain risk factors, including those of a weather- or climate-driven description. It may therefore be useful for many if not most organizations to receive guidance on vulnerability- as well as hazards-based CCRM (see theme #6, Section 3.1.2 for background). Optimally, the balance struck with respect to guidance for each of these approaches will match the demands of the audience.

- Whether the audience is a private or public sector organization (see 4.3 and 4.4.2 for background)

It remains a considerable challenge to write a risk management standard (or related instrument) that is simultaneously and equally useful for both governmental and private roles in risk management, and somehow compatible with both the terminology of private management and public policy. Furthermore, there is not at this time consensus that standardized management systems are applicable in governments’ sovereign (policy) decision-making capacities. While such systems may work well for those aspects of operating an organization where public and private sector organizations are quite similar, they may be less applicable to the public sector role of *managing risks borne by others*.

- Extent to which the audience is familiar with management system standards (see Section 4.3 for background)

It will be necessary to consider alternative modes of delivery for future CCRMSs. For large private sector organizations, the augmentation of existing enterprise risk management standards with CCRM advice or requirements will likely yield the best results. For small corporations and most municipalities, the augmentation of existing management system standards will not be an appropriate mode of delivery.

The second conclusion is that significant effort should be focused on the development of guidance in support of quantitative, risk-based adaptation investment and policy analysis. While guidance relating to the identification and *preliminary* analysis of climate change-induced risks is widely available, little exists in the way of authoritative guidance for activities related to the *quantitative* evaluation, ranking and prioritization of said risks. Specific areas of interest in this regard might include: the development and use of scenarios; sensitivity analysis; definition of thresholds; and, costing mechanisms.

Accompanying this conclusion, it is also worth mentioning that there is still no “consensus” on the degree to which the current suite of more basic tools are useful nor, therefore, which are the best to use. Furthermore, at least a certain degree of consistency needs to be established with respect to how, for example, Canadian municipalities are using these tools and the climate information required for their application.

The third conclusion is that future CCRMSs should, where and as appropriate, incorporate or reference existing, well-tested tools, especially those developed for the assessment of particular types of climate-induced vulnerability (e.g., engineering aspects).

The fourth conclusion is that future CCRMSs should include, in addition to their normative elements, seamless access to the following types of information:

- 1) Atmospheric data, climate projections, statistics and such information regarding uncertainty in this data as is necessary to support risk assessment applications (see theme 13, Section 3.2 for background)
- 2) Case studies of processes used by organizations to make decisions regarding climate change adaptation (see theme 8, Section 3.1.2; theme 13, Section 3.2 for background).

5.2 Recommended Next Steps

There are two principle next steps that can be recommended at this time.

1) Augment with CCRM guidance ERM standards for a subset of prominent economic sectors

The majority of medium-to-large private sector organizations in Canada use enterprise risk management approaches in accordance with a small number of internationally recognized ERM standards. An effort should be made to *engage a subset of risk mature, climate sensitive sectors in a process focused on the development of a CCRM standard that augments existing ERM systems*. Consideration should be given to engaging those corporate sectors whose activities are of greatest consequence to the public good, such as private sector players directly involved in the planning, development or operation of critical infrastructure.

This augmenting standard should draw significantly upon already existing protocols and tools. Furthermore, it should develop or consolidate more detailed guidance with respect to those areas of quantitative analysis identified earlier on in this paper (e.g., development and use of scenarios; sensitivity analysis; definition of thresholds; and, costing mechanisms). Chapter 7 of this paper lays out a provisional outline for an augmenting standard and suggests a potential structure and composition of a committee that could be tasked with the development of the standard.

2) Produce a consensus-based, CCRM product specifically for municipalities

Given the limited application of management system (and especially enterprise risk management) standards by Canadian municipalities, and considering the requests from among municipal stakeholders for CCRM guidance of an authoritative nature, consideration should be given to the establishment of a parallel process to the one recommended above for the development of a consensus-based product specifically for municipalities. This municipal CCRMS should draw upon the best of existing, municipally-oriented CCRM guidance, begin with ‘first principles’ of risk management, but include where and as appropriate links to more detailed guidance in support of specific quantitative analytical techniques.

6 CCRMS: ANNOTATED TABLE OF CONTENTS AND PROPOSED COMMITTEE STRUCTURE

A) ANNOTATED TABLE OF CONTENTS

Forward

This section of the Standard will indicate:

- why climate change factors should be addressed as part of an organization’s overall risk management strategy;
- why uncertainties stemming from the changing climate are not altogether dissimilar to uncertainties resulting from other factors influencing organizations’ planning and operations;
- Etc.

Introduction

This section will indicate:

- why the CCRMG was developed;
- the basic premise behind its design (as an augmenting standard);
- how each section of the CCRMS maps to related sections in existing enterprise risk management standards and frameworks.

1. Scope

This section of the CCRMS will address the purpose and intended application of the Standard. Among

other things, it will:

- suggest that the Standard is meant to “augment” (be applied in conjunction with) existing enterprise risk management (ERM) standards and frameworks;
- suggest that the Standard is applicable to all climate-sensitive sectors;
- list specific topic areas included in the Standard;
- list specific topic areas excluded from the Standard;
- indicate that because climate change science and related techniques continue to rapidly evolve, updated information should be used where and as possible; and,
- indicate where updates to information contained in the Standard can be located.

2. Terms and Definitions

This section of the CCRMS will introduce terms relevant to the use and application of the Standard and provide definitions mostly from the impacts and adaptation lexicon. Users will be referred to existing ERM standards for relevant risk management terms and definitions.

3. Principles

This section will outline the general principles guiding application of the Standard. These principles may include:

- Transparency (e.g., disclosure of sufficient and appropriate climate change risk-related information to allow stakeholders to make decisions with reasonable confidence)
- Conservativeness (e.g., use conservative assumptions, values and procedures....)
- Due diligence
- Continual improvement
- Stakeholder involvement

4. General requirements

This section of the CCRMS will speak to requirements for the implementation and integration of climate change risk management within existing organizational ERM frameworks and processes. General categories in relation to which requirements will be addressed include:

- Executive commitment
- Understanding the organization and its external and internal contexts
- Accountability
- Integration into organizational processes
- Identification of resources (e.g., climate experts plus key sources of climate information) and stakeholders;
- Communication and reporting.

5. Risk Assessment

This section of the CCRMS **will map directly to the corresponding elements of existing ERM guidelines** but will provide considerations and guidance with respect to methods relating specifically to the effects of climate change. Main elements of the ‘risk assessment’ portion of the CCRMS may include:

5.1 Definition of Risk Criteria

- Timeframe(s) for the assessment
- Definition of the “exposure unit” / object of the assessment
- How to treat combined risks
- Etc.

5.2 Risk Identification

- Use of historical climate-related information
 - o “Vulnerability-based approach”
- Use of scenarios-based information
 - o “Hazards-based approach”
 - Development of scenarios
 - Validation and choice of scenarios
 - Strengths and limitations of the approach
- Use of climate trends information
 - o Development of climate trends
 - o Validation of trends
 - o Strengths and weaknesses of the information
- Combining historical, scenarios and trends-based information
 - o Methods and rules of thumb

5.3 Risk Analysis

- Estimating the *consequences* of specified climate-related outcomes (from 5.2)
 - o Use of historical, scenarios and trends-based climate information
 - o Main methods, best practice, and challenges
- Estimating the *probability* of specified climate-related outcomes
 - o Use of historical, scenarios and trends-based climate information
 - o Main methods, best practice, and challenges
- Evaluating uncertainties:
 - o Identifying origins of uncertainty in climate-related information
 - Measurement errors
 - GHG emission scenarios
 - Modeling uncertainty: model choice and structure; input values; parameters

- Climate responses, including potential for indeterminacy; stochastic events; non-linear relationships
- Variability in the response of physical and social system components
- Defining areas of *unquantifiable* uncertainty
- Quantifying areas of reasonably quantifiable uncertainty
 - E.g., sensitivity analysis

NOTE: This portion of the Standard will also bring attention to a series of annexes intended to provide additional guidance with respect to:

- specific analytical and statistical techniques;
- sector-specific issues;
- particular hazard types;
- case studies.

6. Risk Evaluation

This portion of the Standard will address the weighing and communication of climate change-related risks, providing direction in the following areas:

6.1 Communicating uncertainty:

- Guidance with respect to conceptual models for characterizing uncertainty, and their application with respect to climate change-related factors;
- Guidance with respect to terminology and modes of communication.

6.2 Prioritizing risks

- Techniques for the weighing of risks
 - Focusing specifically on the significance of climate change-related uncertainty in this regard

7. Risk Treatment

7.1 Understanding risk tolerance (in consideration of the various public and private stakeholders)

7.2 Selecting risk treatment / adaptation options:

- Techniques for assessing adaptation options may include but not be limited to:
 - Adaptation cost curves
 - Cost-effectiveness analysis
 - Multi-attribute trade-off analysis

7.3 Evaluation of residual risks

7.4 Implementation of risk treatment options

7.5 Monitoring, Review, and Continuous Improvement

B) DRAFT COMMITTEE VOTING MATRIX – DESCRIPTION OF INTEREST CATEGORIES

Matrix Overview

The voting matrix will be constructed to ensure balanced representation, and so that no single interest group dominates. Minimums and maximums for each category will also be established

Matrix Categories and Descriptions

Category	Recommended Minimum	Recommended Maximum
Industry Sector Risk Managers	6	8
Regulatory / Policy / Under-Writer	7	9
General Interest	5	7
(Risk Consultant)	TBD	TBD

Proposed Membership Category Descriptions

Members shall represent the following categories on the basis of their predominant interest, with consideration being given to representation from a full range of related sub-categories as well.

1. Industry Sector Risk Manager Interest - This category includes those who predominantly own, operate, or maintain corporate entities, or those who act as their representatives. Examples of specific sectors include but are not limited to: Energy; Mining & Minerals; Agriculture & Forestry; Logistics & Supply Chain management; Construction & Facilities.

2. Regulatory / Policy / Underwriter Interest - This category includes those who predominantly regulate, set policy, or underwrite risks and hazards. This includes among others, representatives from the Federal and Provincial/Territorial governments; municipal government, as well as private sector underwriting interests.

3. General Interest: This category includes those who are not predominantly associated with any of the above categories. This category may include representatives with scientific interests, engineering, planning, finance, management, legal or health. It may include members of the public, organizations representing the public interest, or professional organizations that do not meet the criteria of other interest categories.

4. (Optional category, to be used only if necessary) Consultant Interest - This category includes those who are predominantly involved with the supply of advisory services to corporations. This may include professional firms such as lawyers, accountants, actuaries, engineers, health care providers, financial advisors, or similar professions.

Additional considerations:

- I. Regional representation, stemming from Canada's diverse geography such as coastal regions, inland regions, and northern regions.
- II. Representation, within interest categories should include small to medium size corporations, as well as larger organizations.

Associate Members

This category will be comprised of other interested experts or organizations who make significant technical contributions to the work, but who do not formally vote.

7 PROJECT PARTNERS

7.1 Natural Resources Canada – Climate Change Impacts and Adaptation

Since 1998, Natural Resources Canada's Climate Change Impacts & Adaptation Division has funded more than 300 impacts and adaptation research projects.

These projects emphasized local decision-maker participation to facilitate the uptake of new data and information on climate change impacts and adaptation. However, while these projects have done much to increase knowledge of both impacts and our ability to adapt to them, it is not feasible to conduct detailed research projects at every location in Canada for all issues of concern. Building on the research knowledge and experience, the Division recognizes the importance of acting now to effectively respond to climate-related risks and opportunities.

Thus, the Climate Change Impacts and Adaptation Division encompasses two main activities:

1. **The Regional Adaptation Collaboratives (RACs) Program** – This program will provide a mechanism for collaboration between different levels of government, private sector entities, and community organizations on complex adaptation issues that address federal, sectoral, or regional priorities. The objective of this initiative is to equip decision-makers with the information and advice that they need to make policy, operational, and management changes that respond to regional opportunities and threats from a changing climate.
2. **Tools for adaptation** – This program will develop adaptation tools to support decision-making on whether and how to adapt to a changing climate. An adaptation tool is a method that guides non-climate change experts through a series of analytical steps to examine the implications of climate impacts on their policies, plans, and operations; and determine appropriate response options. There is a need to make climate change information relevant and useful to potential users from a variety of different sectors. An efficient way to meet this need is to develop tools tailored to meet user needs⁸.

7.2 Toronto and Region Conservation Authority

Toronto and Region Conservation (TRCA) works with its partners to ensure The Living City is built on a natural foundation of healthy rivers and shorelines, greenspace and biodiversity, and sustainable communities. Approved by the TRCA Board in April 2008, the TRCA Action Plan, *Meeting the Challenge of Climate Change: Toronto and Region Conservation Authority*, provides formal direction to the Authority to work with partners and all levels of government towards a coordinated regional climate effort.

⁸ http://adaptation.nrcan.gc.ca/whaquo_e.php

The TRCA has significant expertise in the development of mitigation and adaptation programs, particularly in hydrological and ecological issues. It also has the potential to draw on the larger range of expertise at other Ontario conservation authorities. The TRCA's Strategic Plan, *Moving Toward the Living City*, focuses on recognizing and integrating climate change as a critical component in achieving the objectives and goals of a healthy, sustainable urban region extending into the 22nd century. Over the past decade, the TRCA has worked at bringing together stakeholders from governments and other agencies to stay updated on climate impacts and share information on new programs and strategies that deal with mitigation and adaptation.

7.3 York University – Faculty of Environmental Studies

Innovative research is at the heart of the Faculty of Environmental Studies (FES). Our inception in 1968 as Canada's first faculty of environmental studies launched a new kind of scholarship committed to interdisciplinary research with practical applications.

FES comprises of researchers from a wide array of disciplines: community indigenous arts, cultural studies, ecological economics, environmental education, food and agriculture, social forestry, human ecology, geography, environmental engineering, medical anthropology, marine biology, oceanography, political science, physics, sociology, urban planning, zoology, among others⁹.

⁹ <http://www.yorku.ca/fes/research/>

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9 APPENDICES

Appendix 1 - Interview Guides

A. INTERVIEW GUIDE FOR INSTRUMENT DEVELOPERS

Background Questions

- a) What is your role within your organization?
- b) Please describe your involvement with producing the guide or tool.

II. Questions Relating to Existing Decision-Making Tools & Management Systems

II.1 “How does your instrument support the regular and effective consideration of climate change-related risks by the organization or sector for which it was intended?”

- a) What are the main strengths and weaknesses of your instrument?
- b) What factors have contributed to its successful implementation?
- c) Is your tool pertinent to all levels of decision making within an organization (e.g., from operations up to senior level management)?
- d) Does your tool prompt consideration of climate and climate change-related risks across “the full range of scales” (e.g., spatial - local, regional, national, and / or temporal)?
- e) Does your tool utilize accepted risk management approaches that are broadly applicable to multiple sectors?
- f) How does your tool address decision-making in the context of the uncertainty and limitations inherent in projecting a future climate?
- g) How does your tool support the consideration of information of a forward-looking nature?
- h) Are there any particular barriers with respect to the application of your tool (e.g., lack of detailed information and guidance on how to use and select climate models, detailed information on how to manage issues of data quality and uncertainty)?
- i) Does your tool leverage existing (business) processes to better manage climate-related risks?
- j) Does your tool incorporate feedback processes to monitor the effectiveness of climate-related decision making, modify approaches if necessary and incorporate new information as it becomes available?
- k) What other tools are you familiar with that we should look into?

II.2 Existing tools and protocols range in their ability to integrate with organizational management systems and processes (Hypothesis #3). Are there any particular barriers to the use of existing management systems for the treatment of climate change-related risks?

- a) How widely used are management systems within the organizations or sectors with which you are familiar? And what levels of decision-making do they inform?
- b) What factors may limit the use of management systems and related standards within organiza-

tions?

III. Questions Relating to the Eventual Approach and Architecture of the CCRMS

III.1 What form and content can be suggested at this time assuming that the CCRMS were to be developed?

- a) How might its final format and level of formality affect the extent to which organizations use it (to factor into their planning and operations risks and opportunities related to climate variability and change)?
- b) Would guidance based on the adaptation of established management systems and standards be accepted and used?
- c) Do you have advice related to mode of delivery?

III.2 Are there any other factors that we should consider if we decided to develop a future CCRMS

B. INTERVIEW GUIDE for Sector Representatives

Background Questions

- a) What is your role within your organization?
- b) How long have you been in your current position? With your current organization? With your current sector?
- c) Do you have responsibilities that relate specifically to climate risk?

II. Interview Questions

II.1 What type of guidance is most needed by your sector / organization when it comes to the identification and management of risks related to climate variability and climate change?

- a) Is climate change a concern for your organization/sector/industry, why or why not?
 - i. i)How is risk viewed within your sector or organizations in terms of time spans? Short-term, long-term? 3-5 years or 10-30 year outlook?
 - ii. II) Are weather and climate-related events of significance to: operations? Supply chains? Health and safety? Other?
 - iii. Has any new weather or climate-related issues affected your planning or operations over recent years?

II.2 What tools, instruments or guidelines are you familiar with that might be of assistance to your efforts to manage climate change-related risks?

- a) What are the most notable strengths and weaknesses of the tool you are familiar with / have used?
- b) How does the tool address decision-making in the context of the uncertainty inherent in projecting a future climate? How specific is its guidance in this regard?
- c) Does the tool utilize accepted risk management approaches that are broadly applicable to multiple sectors?
- d) Is the tool pertinent to all levels of decision making within your organization (e.g., from operations up senior level management)?
- e) Are there any particular barriers with respect to the application of the tool (e.g., lack of detailed information and guidance on how to use and select climate models, detailed information on how to manage issues of data quality and uncertainty)?
- f) Does the tool leverage existing (business) processes to better manage climate-related risks?
- g) Are you familiar with other tools that we should look into?

II.3 Existing tools and protocols range in their ability to integrate with organizational management systems and processes (Hypothesis #3). Would it be advisable to structure climate change (adaptation) risk management guidance so as to integrate with or directly complement / point to existing management systems and standards?

- a) How widely used are management systems (e.g., business continuity, emergency, environmental) within your organization or sector?
- b) Might there be any particular barriers to the use of existing management systems for the treatment of climate change-related risks?

II.4 Should CSA develop a climate change risk management standard or guidance document?

- a) What should its focus and scope be?
- b) How might the final format and level of formality of a standard or guideline in this area affect the extent to which organizations use it?
- c) Do you have advice related to the document's eventual mode of delivery (e.g., web-based)?
- d) Are there any other factors that we should consider if we decided to develop a future CCRMS?

C. INTERVIEW GUIDE for INSTRUMENT USERS

I. Background Questions

- a) What is your role within the organization?
- b) How long have you been in your current position? With your current organization? With your current sector?
- c) Do you have responsibilities that relate specifically to climate risk?

II. Interview Questions

II.1 What type of guidance is most needed by your sector / organization when it comes to the identification and management of risks related to climate variability and climate change?

- a) How is risk viewed within your sector or organizations in terms of time spans? Short-term, long-term? 3-5 years or 10-30 year outlook?
- b) Are weather and climate-related events of significance to: operations? Supply chains? Health and safety? Other?
- c) Has any new weather or climate-related issues affected your planning or operations over recent years?

II.2 What tools, instruments or guidelines are you familiar with that might be of assistance to your efforts to manage climate change-related risks?

- a) What are the most notable strengths and weaknesses of the tool you are familiar with / have used?
 - b) How does the tool address decision-making in the context of the uncertainty inherent in projecting a future climate? How specific is its guidance in this regard?
- b) Does the tool utilize accepted risk management approaches that are broadly applicable to multiple sectors?
- c) Is the tool pertinent to all levels of decision making within your organization (e.g., from operations up to senior level management)?
- d) Are there any particular barriers with respect to the application of the tool (e.g., lack of detailed information and guidance on how to use and select climate models, detailed information on how to manage issues of data quality and uncertainty)?
- e) Does the tool leverage existing (business) processes to better manage climate-related risks?
- f) Does the tool incorporate feedback processes to monitor the effectiveness of climate-related decision making, modify decisions if necessary and incorporate new information as it becomes available?
- g) Are you familiar with other tools that we should look into?

II.3 Existing tools and protocols range in their ability to integrate with organizational management systems and processes (Hypothesis #3). Would it be advisable to structure climate change (adaptation) risk management guidance so as to integrate with or directly complement / point to existing management systems and standards?

- a) How widely used are management systems (e.g., business continuity, emergency, environmental) within your organization or sector?
- b) Might there be any particular barriers to the use of existing management systems for the treatment of climate change-related risks?

II.4 Should CSA develop a climate change risk management standard or guidance document?

- a) What should its focus and scope be?
- b) How might the final format and level of formality of a standard or guideline in this area affect the extent to which organizations use it?
- c) Do you have advice related to the document's eventual mode of delivery (e.g., web-based)?
- d) Are there any other factors that we should consider if we decided to develop a future CCRMS?

D. INTERVIEW GUIDE FOR MANAGEMENT SYSTEM EXPERTS

I. Background Questions

- a) What role(s) do you play within your organization?
- b) How long have you been in your current position? Organization? Sector?
- c) Are you involved with the development or use of management systems, or research relating to their development and use?

II. Interview Questions

- a) How widely used are management systems (business continuity, emergency, environmental, quality, and corporate social responsibility) within the sectors with which you are most familiar, and which levels of decision-making do they inform?
- b) Are there any particular sectors in which management system standards are either not used or poorly accepted?
- c) Are there any particular barriers to the use of existing management systems for the identification and / or management of “emerging” risks? The identification and/or management of risks stemming from the impacts of climate change?
- d) Which factors most limit the use of management systems and related standards within organizations?
- e) How should the CCRMG reflect the approach and/or structure of existing management standards?
- f) Will a CCRMG based on the adaptation of established management standards and systems limit its acceptance and use if it is determined that a number of sectors and organizations do not use these standards and systems?
- g) What might be learned from “sector applications” or other approaches to clarifying the use of existing management systems with respect to either a specific sector or a specific area of risk?
- h) What degree of formality (guideline vs. standard) will be required in order for the CCRMG to be widely used / taken seriously?

Appendix 2 - Mainstreaming Criteria

Assessment Area #1: Guidance that Enables Integration with Existing Decision Making Processes?

Main criterion 1: The “tool” provides guidance in keeping with existing management system protocols

Supporting criterion 1: With respect to the general structure of management systems

Supporting criterion 2: Through reference to existing systems or standards

Main criterion 2: The “tool” provides guidance on engaging key internal and external players

Supporting criterion 1: With respect to stakeholder identification

Supporting criterion 2: With respect to the sharing of information / communication

Main criterion 3: The “tool” provides guidance on the identification of opportunities in addition to risks

Assessment Area #2: Guidance on Technical Considerations?

Main Criterion 1: The “tool” includes a screening protocol to assist in determining the degree to which climate variability and climate change-related risk analysis is required in the first place

Supporting criterion 1: With respect to the need for additional analysis

Supporting criterion 2: With respect to the level and type (e.g., quantitative vs qualitative) of additional analysis

Supporting criterion 3: With respect to a tiered approach to conducting the additional analysis

Supporting criterion 4: With respect to the availability and location of information for further analysis

Supporting criterion 5: With respect to the issue of uncertainty

Supporting criterion 6: With respect to the question of enterprise vs societal risk

Main criterion 2: The “tool” provides guidance with respect to the selection of climate projections / scenarios

Supporting criterion 1: With respect to how to choose among existing ensembles

Supporting criterion 2: With respect to whether a new ensemble is required

Supporting criterion 3: With respect to how to establish new ensembles

Supporting criterion 4: With respect to locating key information

Supporting criterion 5: With respect to the issue of uncertainty

Supporting criterion 6: With respect to the question of enterprise vs societal risk

Main criterion 3: Does the “tool” provide guidance with respect to the use and interpretation of projections / scenarios?

Supporting criterion 1: With respect to the assessment of model and ensemble outputs

Supporting criterion 2: With respect to the interpretation of model and ensemble outputs

Supporting criterion 3: With respect to the issue of uncertainty

Supporting criterion 4: With respect to locating key information

Assessment Area #3: Guidance on Adaptation Options & Monitoring?

Main Criterion 1: Tool provides guidance related to the choice of adaptation options

Supporting criterion 1: With respect to the development of capacity

Supporting criterion 2: With respect to the identification of adaptation options

Supporting criterion 3: With respect to the weighing of options

Supporting criterion 4: With respect to the issue of “uncertainty”

Supporting criterion 5: Through the use of worked examples and case studies

Main Criterion 2: Tool includes guidance related to the monitoring and review of adaptations and/or conditions that could prompt reconsideration of the need for adaptation options

Appendix 3 - Tool Evaluation Matrix

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Assessment Area #1: Guidance that Enables Integration with Existing Decision Making Processes?					
Main criterion 1: The “tool” provides guidance in keeping with existing management system protocols	<p>No. Guidance is forthcoming in 2009. Instead, the guide is consistent with widely accepted risk management processes:</p> <p>Stage 1: identify problem and objectives Stage 2: Establish decision-making criteria Stage 3: Assess risk Stage 4: Identify options Stage 5: Appraise options Stage 6: Make decision Stage 7: Implement decision Stage 8: Monitor, evaluate, and review</p>	<p>Partially No links are made to how to integrated climate change risk management with existing management systems. However guidance is provided on how to integrate climate change risk management with existing risk and planning processes.</p>	<p>No. No links are made to how to integrated climate change risk management with existing management systems.</p>	<p>No. No links are made to how to integrated climate change risk management with existing management systems.</p>	<p>No. No links are made to how to integrated climate change risk management with existing management systems.</p>

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 1: With respect to the general structure of management systems	No. Guidance is forthcoming in 2009.	No.	No.	No.	YES
Supporting criterion 2: Through reference to existing systems or standards	No. Guidance is forthcoming in 2009.	No.	No.	No.	Yes. The guide references the Canadian National Standard CAN/CSA Q850-01 "Risk Management Guidelines for Decision-makers".
Main criterion 2: The "tool" provides guidance on engaging key internal and external players	Yes. The guide provides a listing of tools and techniques to engage stakeholders (e.g., brainstorming, consultation, focus groups)	Yes. The concept of multi-stakeholder workshops to identify and assess the risks is proposed.	Yes. The guide recommends various methods to engage and receive input and participation from external and internal stakeholders. For example: - the establishment of External Advisory Boards to with membership from across jurisdictions, sectors, and disciplines), - the establishment of an internal team from each department or division - public engagement and communications to inform and seek input from the community.	Yes.	Yes. The guide strongly emphasizes on going communication with stakeholders and those affected by the potential risk.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egener (Alberta Guide)
Supporting criterion 2: With respect to stakeholder identification	Yes. The guide acknowledged that there are different levels and types of decision-making and which includes the identification and input of stakeholders.	Yes. The guide provides guidance on stakeholder identification and provides examples of potential stakeholder groups.	Partially. The guide instructs users to identify and understand the audience for climate risk management outreach activities. It provides general advice that the following key groups should be considered: the public sector, private sector, not for profit, and media.	Yes.	Partially. The guide does not articulate how to identify stakeholder groups, however it requires users to consult with key people or groups that might be affected or concerned in order to conduct a stakeholder analysis of their risk perceptions.
Supporting criterion 3: With respect to the sharing of information / communication	Yes. The guide states that on going communication with decision makers and stakeholders is necessary.	Yes. The guide states that communication and consultation are key components of any risk management process.	Yes. The guide advises users on key messages to communicate to stakeholders and also advises that that it is important to share the learning gained from the preparedness planning as well as the results of preparedness plans.	Yes. The guide encourages the evaluation of adaptation implementation plans through multi-departmental work group processes that also include other expert stakeholders.	Yes. The guide strongly emphasizes on going communication with stakeholders and those affected by the potential risk.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Main criterion 3: The "tool" provides guidance on the identification of opportunities in addition to risks	<p>Yes.</p> <p>The "Wizard" portion of the guide states that delivering adaptation actions involves taking practical actions to either reduce vulnerability to climate risks, or to exploit positive opportunities. DAA can include:</p> <ul style="list-style-type: none"> Accepting the impacts, and bearing the losses that result from those risks Off-setting losses by sharing or spreading the risks or losses Avoiding or reducing one's exposure to, climate risks Exploit new opportunities <p>In addition, the UK CIP Guide for Business Planning ("A Changing Climate for Business") provides guidance on business threats and opportunities (to markets, finance, logistics, premises, people, processes) that could arise from climate change.</p>	<p>No.</p> <p>The guide does not discuss the potential for the identification of opportunities.</p>	<p>Yes.</p> <p>The guide acknowledges that when planning for climate change decision-makers need to make decisions in the face of uncertainty.</p> <p>The guide recommends the implementation of "no regrets", "low regrets", or "win-win" actions.</p>	<p>Yes.</p> <p>The guide identifies opportunities to enhance current practices in order to adapt. For example:</p> <ul style="list-style-type: none"> - the preservation of native species and identifying new plants - enhanced urban forest management - enhanced urban wetland management - enhanced agricultural practices 	<p>No.</p>
Assessment Area #2: Guidance on Technical Considerations?					

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Main Criterion 1: The “tool” includes a screening protocol to assist in determining the degree to which climate variability and climate change-related risk analysis is required in the first place	<p>Yes.</p> <p>Stage 1 of the Framework: "Identify problem and objectives" requires the tool user to conduct a preliminary assessment to determine the degree to which climate variability and climate change-related risk analysis is required in the first place by recommending that tool users consider the following types of initial questions:</p> <p>1) Where does the need to make the decision come from? What are the main drivers behind the decision? What beneficial objectives are intended?</p> <p>2) Is the problem explicitly one of managing present-day climate or adapting to future climate change?</p> <p>3) If the main driver is not related to climate or climate change, is climate change believed to be a factor in the problem? If so, how important is climate change believed to be, relative to other factors?</p> <p>4) Is the decision expected to provide benefits in the long-term (> 10 years) or have other long-term conse-</p>	<p>Partially.</p> <p>There is no screening protocol per se. However, the guide recommends that an initial risk assessment (through a multi-stakeholder workshop process) be conducted in order to understand potential impacts to an organization. The guide notes that some identified risks may require more detailed analysis before the need for treatment or the nature of appropriate treatment measures can be determined. Key considerations should include the uncertainty in the likelihood of the occurrence, and the sensitivity of particular risks to changes in climate variables.</p>	<p>Yes.</p> <p>The guide instructs users to begin by:</p> <ul style="list-style-type: none"> - collecting information on a few key climate variables such as temperature and precipitation; - collecting information about the range of climate change that the local community could experience; and - understanding and logging the certainty of the information collected. 	<p>No.</p> <p>The tool itself does not include a screening protocol. The City of Chicago undertook a separate projections and impact study to understand the potential risks to the City. As such it is generally understood and accepted that the City will be impacted by climatic change.</p>	<p>Yes.</p> <p>A preliminary analysis is recommended to determine if further analysis of the potential risk is required.</p>

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egener (Alberta Guide)
	<p>quences? Describe what they are, the likely time period, and to whom they may be important. Decisions with long-term consequences are likely to be more sensitive to climate change.</p>				

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 1: With respect to the need for additional analysis	Yes. Stage 3 of the Framework: "Assess Risk (tiered)" provides guidance on the types of questions that need to be answered in order to determine if additional analysis is warranted in light of the Tier 1 Risk Screening Assessment.	Yes. The guide notes that some identified risks may require more detailed analysis before the need for treatment or the nature of appropriate treatment measures can be determined. Key considerations should include the uncertainty in the likelihood of the occurrence, and the sensitivity of particular risks to changes in climate variables.	Yes. Following a preliminary assessment / screening of the potential impacts of climate change, the guide requires that a climate change vulnerability assessment be conducted. This consists of: - a sensitivity analysis for the systems associated with the identified planning areas; - an evaluation of the adaptive capacity of the systems associated with each of the planning areas; - an assessment of how vulnerable the systems in the planning areas are to the effects of climate change	No. The tool itself does not include a screening protocol. The City of Chicago undertook a separate projections and impact study to understand the potential risks to the City. As such it is generally understood and accepted that the City will be impacted by climatic change.	Yes. Following the preliminary analysis, should stakeholders determine that further analysis is required, Step 3 of the guide provides guidance on risk estimation. This step is where further consideration is given to the probability and consequences of the event.
Supporting criterion 2: With respect to the level and type (e.g., quantitative vs qualitative) of additional analysis	Yes. Stage 3 of the Framework provides guidance on how to determine and select the most appropriate quantitative and qualitative risk assessment tools and techniques.	No. The guide is primarily focused on qualitative risk assessment, but recommends a more detailed analysis if required.	Partially. Guidance is provided on key considerations for conducting a sensitivity and vulnerability analysis. The guidance provided for both is qualitative in nature. There is no guidance on conducting quantitative assessments.	Yes. The guide uses a combination of quantitative and qualitative scoring system for determining the magnitude of the consequence and likelihood of the impacts in the risk assessment.	No. The guide is primarily focused on qualitative risk assessment.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 3: With respect to a tiered approach to conducting the additional analysis	Yes. Stage 3 of the Framework: "Assess Risk (tiered)" provides guidance on a 3 tiered approach (Tier 1 - Risk Screening, Tier 2 - Qualitative, and Generic Quantitative Assessment, and Tier 3 - Specific Quantitative Assessment) to risk assessments depending on the level of decision-making (i.e., policy, program, or project), the level of understanding the tool user has about how climate change will affect his / her decision, and whether a climate adaptation decision is being made.	Partially The guide notes that some identified risks may require more detailed analysis before the need for treatment or the nature of appropriate treatment measures can be determined. Key considerations should include the uncertainty in the likelihood of the occurrence, and the sensitivity of particular risks to changes in climate variables. The Guide provides high-level guidance on how to consider sensitivity and uncertainty.	Yes. The guide recommends the following tiered approach: - conduct an initial assessment (scoping of the climate change impacts); - conduct a climate change vulnerability assessment; and - conduct a climate change risk assessment;	Partially. While the guide does not suggest a tiered approach to conducting additional analysis, a tiered approach was taken in the Chicago projections and potential impacts study.	Yes. The guide provides a tiered approach to conducting the additional analysis.
Supporting criterion 4: With respect to the availability and location of information for further analysis	Yes. Users are pointed to UKCIP Scenario data. In addition other sources of information include: BACLIAT. Oxfordshire (ClimateWise) The BRAIN (searchable database) The Climate	Yes. The guide points users to IPCC and the Australian Commonwealth Scientific and Research Organization (CSIRO) for information in scenarios, uncertainty, and probabilities.	Partially. The guide provides information on key information sources such as 2000 US National Assessment and NOAA and directs users to NAST 2000, IPCC, UK CIP.	Yes. The guide directs users to the www.chicagoclimatereaction.org for climate projections and impacts data.	No. The guide provides projection data in the Annex, but does not provide advice about where to go for additional information.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 5: With respect to the issue of uncertainty	Yes. The guide provides guidance on the relationship between risk, uncertainty, and confidence. The guide provides information on classifying types of uncertainty in the context of climate change risk assessment (e.g., environmental uncertainty, data uncertainty, knowledge uncertainty, model uncertainty).	Partially. The guide refers users to the IPCC (2001) estimates of confidence in projected changes to extreme events and other climate variables.	Yes.	Partially. While the guide does not address the issue of uncertainty, the projections and impacts document provides guidance on how uncertainty was managed. The document differentiates between two types of uncertainty: Social and Economic Uncertainty, and Scientific Uncertainty. To address scientific uncertainty the researchers used several different climate models. Social and economic uncertainty was addressed by examining the changes expected under a higher and lower emission scenario.	No. The guide does not provide advice on how to manage issues of uncertainty.
Supporting criterion 6: With respect to the question of enterprise vs societal risk	No. Guidance is not provided with respect to balancing enterprise risk with societal risks. The focus is primarily on the achieving the objectives of the enterprise.	No. Guidance is not provided with respect to balancing enterprise risk with societal risks. The focus is primarily on the achieving the objectives of the enterprise.	Yes. The guide focused on climate change risk management for local authorities. In this regard, the guideline balances risks to municipal infrastructure / assets with the risks to communities.	Partially. While the guide does not explicitly broach the issue of enterprise vs societal risk, the risks to health were assessed in addition to physical environmental risks.	No. Guidance is not provided with respect to balancing enterprise risk with societal risks.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Main criterion 2: The “tool” provides guidance with respect to the selection of climate projections / scenarios	Yes. The guide provides guidance on selecting and using suitable climate scenarios.	No.	No.	No. The tool mentions the outputs of the scenarios, but does not provide advice about the how to select projections and scenarios.	No.
Supporting criterion 1: With respect to how to choose among existing ensembles	Yes. Advice on when to use various types of scenarios is provided. For example advice is provided on when to use the following types of scenarios: the output of climate models, simple incremental scenarios, and climate analogues (e.g., based on the decisions that need to be made and time horizons).	No.	No.	No.	No.
Supporting criterion 2: With respect to whether a new ensemble is required	No. The guidance does not provide advice regarding circumstances where new ensembles may be required. However advice is provided on various down-scaling techniques to allow climate scenarios to be developed at more detailed time and space resolutions.	No.	No.	No.	No.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egener (Alberta Guide)
Supporting criterion 3: With respect to how to establish new ensembles	Yes. Guidance is provided on various downscaling techniques to allow climate scenarios to be developed at more detailed time and space resolutions (e.g., dynamical downscaling, weather generators, weather typing, statistical / regression-based downscaling).	No.	No.	No.	No.
Supporting criterion 4: With respect to locating key information	Yes. Guidance is provided on climate scenarios and where to locate key information (e.g., UK CIP 02, UK CIP 09, and IPCC).	Yes. Information on where to find key information is provided. The Guide directs users to the Australian Government Greenhouse Gas Office website.	Partially. The guide provides information on key information sources such as 2000 US National Assessment and NOAA and directs users to NAST 2000, IPCC, UK CIP.		No.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 5: With respect to the issue of uncertainty	Yes. The guide addresses uncertainty in climate change scenarios based on the output of Global Climate Models (GCMs) and Regional Climate Models (RCMs).	Partially. The guide refers users to IPCC (2001) for estimates of uncertainty related to projected changes to extreme events and other climate variables.	No.	Partially. While the guide does not address the issue of uncertainty, the projections and impacts document provides guidance on how uncertainty was managed. The document differentiates between two types of uncertainty: Social and Economic Uncertainty, and Scientific Uncertainty. To address scientific uncertainty the researchers used several different climate models. Social and economic uncertainty was addressed by examining the changes expected under a higher and lower emission scenario.	No. The guide does not provide advice on how to manage issues of uncertainty.
- Supporting criterion 6: With respect to the question of enterprise vs societal risk	No. Guidance is not provided with respect to balancing enterprise risk with societal risks. However there are 4 UK CIP socio-economic scenarios.	Partially. The guide indirectly addresses the question of enterprise vs societal risk in Table 2 where examples of climate change impacts are provided.	Yes. The guide focused on climate change risk management for local authorities. In this regard, the guideline balances risks to municipal infrastructure / assets with the risks to communities.	Yes. The guide focused on climate change risk management for local authorities. In this regard, the guideline balances risks to municipal infrastructure / assets with the risks to communities.	No. Guidance is not provided with respect to balancing enterprise risk with societal risks.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Main criterion 3: Does the “tool” provide guidance with respect to the use and interpretation of projections / scenarios?	Partially. Guidance is provided on the use of projections and scenarios in terms of when to use various types of scenarios. For example advice is provided on when to use the following types of scenarios: the output of climate models, simple incremental scenarios, and climate analogues (e.g., based on the decisions that need to be made and time horizons). There is no guidance on the interpretation of projections / scenarios.	No.	No.	No.	No.
Supporting criterion 1: With respect to the assessment of model and ensemble outputs	Yes. Guidance is provided on how to choose suitable climate scenarios in risk assessment and decision-making.	No.	No.	No.	No.
Supporting criterion 2: With respect to the interpretation of model and ensemble outputs	Yes. Guidance is provided on how to interpret scenarios in terms of: Magnitude and direction Statistical characteristics Averaging and sampling periods and scales Joint probability events, etc.	No.	No.	No.	No.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 3: With respect to the issue of uncertainty	Yes. The guide addresses uncertainty. The guide suggests that flexible, or adaptive, management can be an effective way of making decisions in the face of uncertainty.	Partially. The guide refers users to IPCC (2001) for estimates of uncertainty related to projected changes to extreme events and other climate variables.	Yes.	Partially. While the guide does not address the issue of uncertainty, the projections and impacts document provides guidance on how uncertainty was managed. The document differentiates between two types of uncertainty: Social and Economic Uncertainty, and Scientific Uncertainty. To address scientific uncertainty the researchers used several different climate models. Social and economic uncertainty was addressed by examining the changes expected under a higher and lower emission scenario.	No. The guide does not provide advice on how to manage issues of uncertainty.
Supporting criterion 4: With respect to locating key information	Yes. Guidance is provided on the character of climate scenarios and where to locate key information (e.g., UK CIP 02, UK CIP 09, and IPCC).	Yes. Information on where to find key information is provided. The Guide directs users to the Australian Government Greenhouse Gas Office website.	Partially. The guide provides information on key information sources such as 2000 US National Assessment and NOAA and directs users to NAST 2000, IPCC, UK CIP.	Yes. The guide refers users to the "Projections and Potential Impacts" document.	No.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Assessment Area #3: Guidance on Adaptation Options & Monitoring?					
Main Criterion 1: Tool provides guidance related to the choice of adaptation options	Partially. The guide does not provide guidance about the selection of potential adaptation options, but does provide guidance on key adaptation considerations such as maladaptation, over-adaptation, under-adaptation, and the precautionary approach.	Yes. The guide provides guidance on assessing treatment options (e.g., cost-benefit, cost-effectiveness, financial analysis, general equilibrium, multi-criteria decision analysis)	Yes. The guide provides users with example adaptation / preparedness actions the guide recommends the development of a "preparedness plan" which may include activities such as: - modifying policies, practices, and procedures; - increasing adaptive capacity and reducing vulnerability to climate change; - Building new or upgrading existing infrastructure; - Improving community awareness and preparedness; and - Partnership building with other communities and agencies.	Yes. Adaptation options can be assessed against the following strategies: Reduce vulnerability to extreme heat events Reduce vulnerability to extreme precipitation Reduce vulnerability of buildings, infrastructure, and equipment to extreme climate conditions Reduce vulnerability to ecosystem degradation.	Yes. The guide provides advice on how to identify adaptation options and provides examples.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 1: With respect to the development of capacity	<p>Yes. The guide offers guidance in Building Adaptive Capacity (BAC). BAC activities include: Gathering and sharing information (undertaking research, collecting and monitoring data, and raising awareness through education and training initiatives); Creating a supportive institutional framework (changing standards, legislation, and best practice guidance, and developing appropriate policies, plans and strategies); Creating supportive social structures (changing internal organizational systems, developing personnel, or other, resources to deliver the adaptation actions, and working in partnership).</p>	<p>Yes. The guide provides advice on the development of adaptive capacity. Key elements include: access to good information, effective monitoring to detect change that are occurring, flexibility and resources.</p>	<p>Partially. The guide recommends a tiered approach to adaptation planning and implementation which takes into account adaptive capacity: - Tier 1 actions are those that can and will be implemented in the present planning process; - Tier 2 actions are those actions that could be implemented now or in the near future but require additional information, resources, or authorities; and - Tier 3 activities are those actions that are not suitable candidates at this time.</p>	<p>Yes.</p>	<p>No.</p>
Supporting criterion 2: With respect to the identification of adaptation options	<p>Yes. The UKCIP Adaptation Wizard assists with the identification and evaluation of adaptation options.</p>	<p>No.</p>	<p>Yes. The guide recommends the establishment of preparedness goals to help guide the identification and selection of adaptation / preparedness activities.</p>	<p>Yes. Examples of adaptation options for various types of impacts are provided.</p>	<p>Yes. The guide provides advice on how to identify adaptation options and provides examples.</p>

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 3: With respect to the weighing of options	Yes. The UK CIP Wizard supports the weighing and evaluation of adaptation options.	Yes. The guide provides guidance on assessing / weighing treatment options (e.g., cost-benefit, cost-effectiveness, financial analysis, general equilibrium, multi-criteria decision analysis)	Yes. The guide provides users with example criteria to help assess adaptation options. Criteria consist of: <ul style="list-style-type: none"> - alignment of action with preparedness goals; - cost vs benefit; - determining the robustness of the action under a range of climate change scenarios - how flexible is the action - timeframe for the implementation of the action - is the action equitable - the action should not make impacts worse in other others / communities 	Yes. Adaptation options can be weighed against the following strategies: <ul style="list-style-type: none"> Reduce vulnerability to extreme heat events Reduce vulnerability to extreme precipitation Reduce vulnerability of buildings, infrastructure, and equipment to extreme climate conditions Reduce vulnerability to ecosystem degradation. 	Yes. The guide provides direction on how to weigh and assess different adaptation options based on: <ul style="list-style-type: none"> - the implementation timeframe - estimated cost - effectiveness level - the acceptability of the option.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 4: With respect to the issue of "uncertainty"	Yes. The guide addresses decision-making with climate change uncertainty.	Partially. The guide refers users to IPCC (2001) for estimates of uncertainty related to projected changes to extreme events and other climate variables.	Yes. The guide acknowledges that when planning for climate change decision-makers need to make decisions in the face of uncertainty. The guide recommends the implementation of "no regrets", "low regrets", or "win-win" actions. The guide also recommends quantitative modelling of different climate change scenarios and applying downscaling techniques.	Partially. While the guide does not address the issue of uncertainty, the projections and impacts document provides guidance on how uncertainty was managed. The document differentiates between two types of uncertainty: Social and Economic Uncertainty, and Scientific Uncertainty. To address scientific uncertainty the researchers used several different climate models. Social and economic uncertainty was addressed by examining the changes expected under a higher and lower emission scenario.	No.

Assessment Criteria	UK CIP (2003)	Australia	ICLEI	City of Chicago	Bruce & Egner (Alberta Guide)
Supporting criterion 5: Through the use of worked examples and case studies	Yes. The UK CIP provides case studies to demonstrate how each section of the guide and scenarios can be applied.	No.	Yes. At various points in the guide, examples of how the risk activity or issue was approached by different local authorities were provided. For example, case study was provided on establishing climate change preparedness teams, assessing vulnerability to sea level rise, a questionnaire used by King County for the preliminary assessment of climate change impacts and adaptation barriers, etc.	Yes. An example risk assessment is provided (Table 3.1)	Yes. A worked example and case study are provided.
Main Criterion 2: Tool includes guidance related to the monitoring and review of adaptations and/or conditions that could prompt reconsideration of the need for adaptation options	Yes. The guide provides guidance on the monitoring, evaluation, and review of decisions. The process is iterative.	Yes. The risk management process is iterative.	Yes. Chapter 12 of the guide is focused on measuring progress and updating the plan. Advice is provided on ways to measure progress and review initial assumptions that the plans were based on. The guide also recommends updating plans once new information has been collected based on the review of plans and assumptions.	Yes. The risk management process is iterative.	Yes. The guide demonstrates a continuous improvement approach which includes review, monitoring and a repeat of the risk management process as needed.

Appendix 4 - Bibliographic Information for CCRM Guides Reviewed

Australian Greenhouse Office, 2006. Climate Change Impacts & Risk Management: A Guide for Business and Government. Department of Climate Change and Energy Efficiency. Australia.

Black, R., Bruce, J. and Egener, M., 2009. Adapting to Climate Change – A Risk-based Guide for Alberta Municipalities. Natural Resources Canada. Ottawa.

ICLEI, 2007. Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments. King County, Washington.

City of Chicago, 2008. Chicago Area Climate Change Quick Guide: Adapting to the Physical Impacts of Climate Change for Municipalities and Other Organizations.

UKCIP, 2003. Climate Adaptation: Risk, Uncertainty and Decision-making. Oxford, United Kingdom.

Appendix 5: Expert Advisory Group Meeting Minutes

Location: Canadian Standards Association, 178 Rexdale Blvd., Toronto, Ontario, M9W 1R3

Conference Room 1

Date: December 3rd, 2009, 8:30 AM to 4:00 PM

Teleconference: 416-343-2658 / 1-866-440-8939 conference id: 6736178#

1. Meeting Objectives:

- To validate and provide additional input to the key conclusions that have been drawn in the Draft Climate Change Risk Management Scoping Paper; and
- To provide input and advice on any additional work that may need to be considered in order to substantiate and provide a clear path forward for the development of a national climate change risk management solution.

2. Opening and Welcome:

- M. Mortimer, Program Manager of the Built Environment Infrastructure program at CSA Standards opened the meeting and welcomed meeting participants.
 - Refer to Appendix 6 for the list of meeting participants.
 - M. Mortimer acknowledged the project partners (NRCan, TRCA, and York University), provided an introduction to CSA, CSA's consensus-based standards development process, as well as background & context for the climate change risk management study. The hypotheses for the study consisted of the need to:
 - Establish generally-accepted means for addressing organizational risks related to the changing climate (i.e., *authoritative guidance*)
 - Provide direction with respect to the integration of CC adaptation into existing modes of planning and operations
 - Clarify how a range of specific & increasingly robust protocols (e.g., engineering vulnerability) fit within broader, organization-wide CC (adaptation) risk management
 - E. Sparling, Project Manager, CSA Standards, and lead author of the study reviewed the key findings from the study:
 - There are broad-ranging demands with respect to what a CCRMS should address
 - An organization's general level of risk maturity will fundamentally shape the type of CCRM guidance that it requires, as well as the mechanisms best suited to delivering this guidance
-

- Management systems and related standards (especially in the area of ERM) should be harnessed for the delivery of CCRM-related guidance to a broad range of mostly private sector organizations
- Many (especially smaller) municipalities may be best served by a CCRMS particular to the municipal setting.
- User communities that express a willingness to formally engage in quantitative investment or policy analysis are not adequately served by the majority of existing CCRM tools, and yet may represent society's largest adaptation investment decisions.
- Vulnerability-based approaches should be better supported, and a CCRMS could play a role in this regard.

3. Discussion & Feedback:

- Meeting participants were asked to discuss and provide feedback on the following 3 discussion questions:
 - i. Are there findings from your perspective that are particularly important?
 - ii. What do the findings suggest about the need for and character of a CCRMS?
 - iii. What if anything should be the role of management systems in the delivery of CCRM guidance?

Discussion Question 1: Are there findings from your perspective that are particularly important?

- The following points were raised by some meeting participants regarding Question #1:

General Comments

- Found the document extremely helpful. For years I've been trying to move the City of Toronto to appreciate Climate Risk Management. Developed a document called Ahead of the Storm. City of Toronto not working in tandem with emergency management. Considering trying out the concept of ERM – but have no authority to roll out ERM across the City
- Uncomfortable about this CSA process. We think that the problem is simple – this process is making it too complicated. We've been adapting to climate change for centuries. Not difficult to do. We took the CSA Q850 and augmented and have engaged 100 of communities and they are baffled by this – but it's really simple. Concerned we are making this unnecessarily complicated. We developed guidance for the public sector, but it also applies to private sector.
- I think the CSA process has a lot to recommend it. CSA's structure and process represents a robust model if you get the right people involved.
- NRCan: The purpose is to look at the landscape and prove what is needed. Study does not take into account what's going on with Environment Canada.
- There is an expectation for authoritative tools. Where we go still needs to be decided.
- TCRA's interest is that we had identified a lack of leadership and consistency in taking this on. Cities have no idea what to do – there is a lack of definitive guidance and standardization of tools and approaches and there is a lot of concern around uncertainty in climate solutions and projections.
- How can cities define the tools they use now? We are very supportive of CSA's process.

Comments related to public vs. private sector

- Private sector risk management needs to be driven through disclosure in annual reports, MD&A driven by the OSC need to pick up and create some pull for private sector – need authoritative scenarios.
- ERM in private sector provides an economic advantage. At the municipal level –societal vs. economic risk?
- public vs. private – public sector thinking is different from private sector thinking.
- Not clear if the potential user audience for such a document has been defined and whether it's homogenous enough for a single document would work (e.g., differences in private vs. public sector).
- Need to think about how a solution or deliverable might relate to existing approaches and documents that are out there (e.g. EMR and EMS) - whatever comes out needs to be easily integrated
- Need to think about accessibility to smaller organizations (small municipalities and enterprises).
- Public sector - Broader societal role vs. Private sector – financially focused
- Enormous opportunity on the public side – to sustain (make evergreen) a tool for municipalities.
- Provincial and municipal government roles are important – disaster management and health are two reasons why governments are paying attention
- It is gratifying that the document nailed the municipal concerns and gaps – the lack of authoritative guidance is a huge issue – there is no way for municipalities to identify which approach or process will meet federal or provincial approval.
- Re: uncertainty with respect to climate information and projections. There is very little consistency of guidance of how to interpret uncertainty and translate it into climate planning. It was interesting to note that many (small to medium) municipalities are in the same boat in terms of risk maturity.
- From the social responsibility perspective we recognize in the City of Toronto the City relies on businesses that are infrastructure providers. We acknowledged there is a need for the municipality and businesses (that own and operate infrastructure) to work together. The CSA approach would have that integrity and leadership.
- We are trying to get the private sector engaged. The study with Marsh is to determine the level of engagement of infrastructure providers. We hope to establish peer pressure. Modelling this based on NYC where they've already done this.
- Merger & Acquisition operations – issue of climate and supply chains – this train is moving a lot faster than a lot of people in the private sector are ready for.
- On the private sector side there is a new audience that is about to emerge. Clients are frustrated (Ontario Securities Commission requirements and carbon disclosure project).
- The report was fascinating to me – had no idea that there were so many instruments for doing this type of risk assessment. Very little of this is known in the private sector.
- The financial community will start asking for this from the private sector and the insurance markets will drive this for both the public and private sectors. Need consistent approaches whether it's a standard or solution.
- Private sector drivers also include: Disclosure, Duty of Care, Social Responsibility

Comments relating to the need for an integrated approach

- What I found important is the approach at the organizational level – municipalities try to put things in silos (e.g. dept of Environment e.g., who owns it) need to start looking across the whole organization.
- Support the concept of building this off on existing ERM frameworks. There are some organizations ERM very important in cross-organizational and cross risk type. On the private side – there is a lot more focus on the other aspects of risk associated with the carbon markets side. Bundle adaptation risk with climate risk.
- Need to look at integrated impacts with business strategy. Working with one provincial government – their view of adaptation risk is limited to things like storm water management. But there are also implications for demand on public assistance and migration issues, e.g.. Would that be an adaptation risk? Putting boundaries on what constitutes adaptation risk is very challenging. So I support the ERM approach.
- We may have this perception that everyone is trying to integrate this throughout their operations, but its not happening. There is a disconnect.
- From a municipal perspective adaptation and mitigation options can either complement or contradict one another and there needs to be some way to describe how those responses interact.

Comments relating to the key findings

- Re: findings on authoritative guidance: the one area where there is authoritative guidance is in the provinces of ON, AB, and BC in the emergency management area.
- The key finding was the need for authoritative guidance for both instruments and data (historical and projections). The analysis indicates that the tools that are there now can be improved upon. HIRAO (Hazard Identification Risk Assessment Ontario) only looks at historical information and there is a move to try and incorporate climate change within the HIRO. There is a disconnect currently - not getting this stuff into emergency management operations.
- The issue of carbon and climate is yesterday's news – climate adaptation and impacts to business continuity are the issue and having a standard will be key. Management systems are specific to those who have something to manage – first you have to figure out what you managing. In the private sector – once you admit that you have to assess the risk, then you have to manage it.
- Grappled with this first hand as a utility Risk Manager – had false starts - “I don't know what I'm getting myself into: Important findings include:
 - authoritative guidance
 - one source of data – or data that is most authoritative for sectors
 - needs to be ERM friendly – a lot of organizations in the private sector are fairly advanced and to introduce something for a particular universe of risks is not on – Look out and see what ERM frameworks are out there – strive to be ERM framework agnostic
 - Sector specific – having the users able to see their sector
 - Worked examples are crucial to see how guidance can be applied in that specific scenario and what do you put in your risk register for this type of thing)
 - Determining the net effect of climate change (e.g., risk and opportunities). Can' t run generation unit due to low cooling water but demand goes up and you get more \$\$ so it works out...
 - Planning horizon – planning horizon longer for infrastructure intensive industries.

- The risk horizon doesn't necessarily match the planning horizon – need risk disclosures to match. Risks are identified 1-5 years out.
- Review the ASTM document that's out for ballot.
- We've left out the mitigation side – people don't distinguish climate adaptation risk from mitigation risk. Both are connected in the private sector – think hard about including that in the document.
- ERM needs to come from Sr. level management. Same thing is true about climate change. If you come in because internal audit says we need to include climate change it's difficult – the big challenge is how to communicate this highly uncertain guidance to help senior level management understand something needs to happen.
- There has to be something that will change the market and influence those decision makers. A major outreach will be needed after we develop the standard. We do plan to go in that direction as a next step. On a provincial scale – MOE working on risk to drinking water source protection and how to integrate climate change – we should use this to see how we can use this project to integrate into DWSP
- Would like to suggest pilot projects to help move things forward.
- We need a standard that everyone can use as a benchmark, and the product can improve after that.
- The presence of the standard is vitally important as there is paralyse – there are a lot of people doing risk evaluation – need a menu to assist the common person do this and keep it simple.
- We need a standard that everyone can use as a benchmark, and the product can improve after that.
- The presence of the standard is vitally important as there is paralysis – there are a lot of people doing risk evaluation – need a menu to assist the common person do this and keep it simple.
- It would be wonderful for companies to have an authoritative document that they could pick up and implement.

Discussion Question #2: What do the findings suggest about the need for and character of a

CCRMS?

- The following points were raised by some meeting participants regarding Question #2:
 - NRCan – need to recognize that there are already tools out there – NRCan has determined that there is no one thing that people will use. They pick what they want – we have multiple tools aimed at the same group of people.
 - Recognize the private sector needs a standard.
 - If the focus is on municipalities – there is an outstanding tool that Mark (Egener) has put together and we need a CSA process to keep that going.
 - We use whatever standard that the clients want to use. There isn't currently a standard for Canadians. So either a Canadian benchmark gets established or we'll use some other thing.
 - There is no standard guidance on how to use climate and projection data (at the scale that they care about). There is a need for climate data that is relevant to climate change risk assessment and adaptation planning for different sectors and relevant to the temporal and spatial scale. With a characterization of the associated uncertainty.

- A solution needs to have in its character a way in which to frame climate change risks and vulnerabilities along with all the other risks and vulnerabilities that exist within the organization. Over-emphasize climate vulnerabilities and you may not pay sufficient attention to more immediate risks.
- It's a mistake in the private sector to split adaptation and mitigation from each other – the drive will come from disclosure obligations for public companies – in order to put substance in their disclosures (ASTM). Need a standard or document to allow for this. This should also be relevant with public and private organizations.
- A spot to go to get information about climate change would be helpful. You need someplace to go to get the data and impact information.
- Having been a practitioner and user there is a lot of good material on how to do good risk management – I would say take those as a given because some organizations have already adopted those and make sure that the system you work on is able to be integrated with that. Therefore maybe not a standard but guidelines to be used in conjunction with an ERM standard.
- It's viewed as a systematic risk – doesn't fit nicely into one risk type as we would normally define – a guideline will help you hit a number of risk types (financial, operational, etc.).
- Need to speak to the differences in how sectors view their risks and vulnerabilities from a regulatory, shareholder, stakeholder perspective.
- Address both mitigation and adaptation – this is a must have from a private sector perspective as well co-benefits in terms of adaptation and mitigation
- Sector focus –there is a lot of work to define critical infrastructure on a sectoral basis – this would be a good approach to do a critical risk assessment to have a sector by sector document. That may get us closer to a societal approach – since critical infrastructure allows us to continue on with a standard of living we have come to expect.
- That's a very relevant question based on the work we are doing on the vulnerability of infrastructure in municipal government. In the initial stages can go for a full blown assessment right off the bat – risk analysis is like peeling an onion. When does the development plan actually happen?
- There is a need for a standard to tell you how to do the risk assessment and tell you which tools to use.
- TRCA, York, and others are working on looking at pulling together people that do regional based physical modeling – to figure out what is the state of the art – what does Ontario have to do to achieve this – conducted a desk review and will be looking at some of the policy questions – all of this is based on science. The intent is to make this serve as a model for the rest of the country.
- Want to see something that provides regional data and case studies.
- No one has mentioned the tools that are needed to assist with extreme events and compounding of moderate back to back events and addressing cascading failures.

Comments relating to CSA's Potential Role

- Municipal side – this is all about adaptation – and how to manage and adapt infrastructure. Turn Mark Egner guide into a CSA standard.
- There needs to be something that is so authoritative out there that can not be ignored and that business will ignore it to its own peril. People will take the anecdotal evidence and scientific evidence and put them up without grounding. It links to disclosure requirements and Securities Level (OSC, SEC). Get the OSC to reference NRCAN or EC then it would link these pieces together.

Discussion Question #3: What if anything should be the role of management systems in the delivery of CCRM guidance?

- I'm in agreement with the sentiments with themes 16-19 that deal with management systems. Theme 20 any approach should be complementary with EMS. Regarding the question of small and medium sized enterprises – disagree with ignoring them. If you are talking about mainstreaming climate change you have think about smaller organizations and the extent to which management systems have penetrated this community. They are the mainstream of our business community. Management systems in less than 50 orgs exist informally – limited documentation, resources, multi-roles, etc. This group has to be brought on board.
- Every management system is unique to the organization. May not be effective to piggy back off exiting management systems

4. Process Review

- Meeting participants offered the following feedback related to the meeting and process that was undertaken:
 - The day was rewarding and we had an open dialogue. The background document was very good. Yet we didn't make it to a clear resolution.
 - More representation from different sectors would have been helpful (e.g., potential users of the solution)
 - Very impressed to see how public and private sector see things – process was very well done.
 - Provincial government was missing around the table today (had federal and municipal representation)
 - Loved the report – the province made 59 recommendations in a block buster report (downloadable from MOE website) well done document. Ontario Expert Panel on Climate Change adaptation.
 - Great group of people. Complemented the well written and powerful document. Circulation of the report will be very important and should be made available to decision makers who should know about the issues that are before us with respect to a lack of guidance and comprehensive suit of tools.
 - Wish the document had been issued sooner so the questions could have come out sooner so we can formulate our opinions.
 - Heard a lot here and it's been very valuable. Appreciated the insights.
 - The coordinator for the Strategic Risk Council of the Conference Board of Canada would be interested in putting the topic of Climate Risk Management on their agenda. Risk managers on the council are struggling with how to manage this type of risk. The next meeting of the Strategic Risk Council is in April 2010 in Toronto.

5. Next Steps M. Mortimer

- CSA will not proceed to any second phase until we know that what we decide to develop will be of value and will be used.

6. Closing Remarks & Meeting adjournment

- M. Mortimer thanked meeting participants for their participation on behalf of CSA and the project co-funders and collaborators.
- The meeting was adjourned at 4 PM.

Appendix 6 – December 3rd, 2009 Expert Review Meeting Attendance List

1. Birgit Isernhagen, City of Ottawa
2. Chandra Sharma, Toronto Region Conservation Authority
3. Chris Eaton
4. Dana Fountain, York University Masters Student
5. David Lapp, Engineers Canada
6. David MacLeod, City of Toronto
7. Dr. Gary Davidson, Canadian Institute of Planners
8. Gray Taylor, Bennett Jones
9. George Boire, Marsh
10. Greg Paoli, Risk Scientists International
11. John Fayhe, Golder Associates
12. Joan Klasson, Environment Canada
13. Karen Kraft-Sloan, York University
14. Marc Egnor
15. Michelle Colley, Acclimatise – (formerly of UK CIP)
16. Melissa Creede, Sapis Insight – (risk mgmt and adaptation)
17. Pam Kertland, Natural Resources Canada
18. Pat Concessi, Deloitte,
19. Paul Kovacs, Institute for Catastrophic Loss Reduction
20. Robert Tremblay, Insurance Bureau of CAnada
21. Ryan Ness, Toronto Region Conservation Authority
22. Sharon Fernandez, Environment Canada
23. Stepan Wood, York University,
24. Stewart Dutfield, York University Masters Student
25. Tarik Islam, Environment Canada

Appendix 7 – Comments from Reviewers

The following comments were provided on the draft final version of this Paper. Some are reflected in the final report but others are not:

Section	Sub-section	Commenter	Comments / Considerations
General		John Fahey, Golder Associates Ltd.	Your document is most interesting and a very important consideration for many. If the standard is proceeded with, the implications are far and wide.
4.1	ii. Private sector para 2	John Fahey, Golder Associates Ltd.	There will always be a lack of information, not enough information, scientific questions and challenges. Allowing this to be an issue will inject paralyses and distraction. Many risk management processes are completed on less than ideal information.
4.1	ii. Private sector para 4	John Fahey, Golder Associates Ltd.	There are many other indirect vehicles in place such as the OSC, or SEC that provide the reason to consider climate risks or have provided guidance on the issue. A "risk to a company" can be from any direction and any material risk must be considered. Climate is not an exception. Anything more than guidance may not allow a "one size fits all" requirement.
4.1	ii. Private sector para 5	John Fahey, Golder Associates Ltd.	Is the correct word "misuse"? Is it that the risk management frameworks are not effective platforms or allow a variety of interpretive application?
4.3	i) Compatibility with audience para 1	John Fahey, Golder Associates Ltd.	This is demonstrating the flaw for many. The guidance is a front-end analyses that is fitted into the existing business and enterprise risk system in the entity. It is not to create another management system at the back end.
4.3	i) Compatibility with audience para 2	John Fahey, Golder Associates Ltd.	I do not see the connection between those who have management systems and being most open to CCRM guidance. This appears to be a rather large leap.
4.3	i) Compatibility with audience para 3	John Fahey, Golder Associates Ltd.	The issue on the table is Climate risk exposure. Public and private are not different in the exposure potential and are inter-related in the urban fabric. You can not have 2 or more systems.
4.3	ii) Potential for organization-wide impact para 2	John Fahey, Golder Associates Ltd.	Agree. Enterprise risk, business continuity risk is the core to all of this.
	ii) Potential for organization-wide impact para 3	John Fahey, Golder Associates Ltd.	Do not complicate things by becoming detailed. or trying to be specific
4.4	4.4.1 para 1	John Fahey, Golder Associ-	This begs - who is not an audience? Given insurance and banking risk management and presence throughout all areas of

Section	Sub-section	Commenter	Comments / Considerations
		ates Ltd.	society and their focus on climate, who/what is not an audience?
4.4	4.4.1 e)	John Fahey, Golder Associates Ltd.	This in fact can make some decisions very simple. You do not locate a factory in the town, you close the factory and move.
4.4	4.4.1 pg 45 para 1	John Fahey, Golder Associates Ltd.	How often are you going to update it? What will be done with flawed or in complete science? This means the CSA will be the library for all Canada and set the benchmark.
4.4	4.4.1 pg 45 para 3	John Fahey, Golder Associates Ltd.	you can not be selective. Municipalities and companies have a wide spectrum of types of activities and assets which trying to be specific will open up issues.
4.4	4.4.2 para 2	John Fahey, Golder Associates Ltd.	This is key not to be confusing-The issue is the process of the identification of risk is common. How one assesses action or impact is an end user process. Thus solution needs may be different
5.1	para 3	John Fahey, Golder Associates Ltd.	This is a minefield of issues. Who will define risk maturity of an entity? Once you issue a standard, people use it as a benchmark and thus measuring stick for other means. How will one not aim for the lowest level of effort?
5.1	Pg 49 last para	John Fahey, Golder Associates Ltd.	This is a black hole requiring constant up-dates. In addition to at what detail is it provided?
5.2	Pg 50 para 2	John Fahey, Golder Associates Ltd.	Again-- this predetermines you are up to speed on the latest, most accurate and applicable information.
5.2	Para 4	John Fahey, Golder Associates Ltd.	I agree in part. You want to a diverse view on the topic. This way you get a balanced understanding and not a key hole view. The fact you say a sector is climate sensitive predetermines you know the answer to the risk process already or know what matters to a sector area.
5.2	Pg 50 last para	John Fahey, Golder Associates Ltd.	I say this is tricky position-- consider the scenario. I am in a town that applied a certain standard to risk evaluation. I apply another more rigorous standard. An event happens. The city is found to not have applied a method widely accepted. The town occupies and operates the ribbons and assets in between the rest of the land in a town and thus it could be argued they are in the minority of the community although responsible for ensuring the connections of the community.
General		Bob Black	<p>First an update on "<i>Adapting to Climate Change – A Risk-based Guide for Alberta Municipalities</i>, Black, Bruce, and Egener (June 30, 2009) (the Guide). The Guide has been through two subsequent iterations since the Alberta project. We have had over 70 municipal and provincial representatives attend four workshops (Edmonton, Winnipeg, Victoria and Vancouver) to review the Guide and provide input and comment to it. The latest version (the BC Guide) is operational and in fact it will be used in an upcoming climate change adaptation risk management study by Metro Vancouver. Many of the issues raised in the CSA paper have been addressed by the most recent version of the Guide, a copy of which is attached for your perusal.</p> <p>We are concerned with the possible abandonment of Q850 and</p>

Section	Sub-section	Commenter	Comments / Considerations
			<p>the adoption of ISO 31,000. Mark has reviewed the latter document and feels it is too strategic and general in nature and lacks the guidance that Q850 provides. If ISO 31,000 is adopted by CSA we suggest there will be a need for a Canadian-specific guidance document on how to actually use this standard. The Guide can be modified to provide this guidance for CCRM.</p> <p>As the authors and proponents of <i>Adapting to Climate Change – A Risk-based Guide for Alberta Municipalities</i>, we feel that the Guide provides sufficient guidance for most users. In those areas where there may be a perceived lack of detailed guidance this is more than offset by the focus on a simple process, easy to implement and explain. We hope that as a result of this CSA study and subsequent deliberations the Guide will continue to be an extension of CSA doctrine. In the meantime, it is being used by an every-growing number of Canadian municipalities as their CCRM process.</p> <p>I have no issues with the conclusions as listed however would suggest you want to be careful that the pursuit of the last three conclusions doesn't conflict with the first conclusion. Don't let the development of a complex CCRM process eliminate a more simple, user-friendly process that can be used by, as you refer to them, less risk-mature organizations.</p>
		Bob Black	<u>Theme 2.</u> Disagree. Section 5 of the Guide is focused on assessing potential adaption options and provides appropriate assessment templates.
		Bob Black	<u>Theme 3.</u> Concur
		Bob Black	<u>Theme 4.</u> Agreed, however we must not let this get in the way of moving ahead with CCRM. While there appears to be enthusiasm and support for CCRM activities at the federal and municipal level, provincial governments appear to be reluctant to support or even become involved with this process. Several large municipalities (Toronto and Metro Vancouver) ARE moving ahead with CCRM, despite a lack of an "approved" process. You may be putting too much emphasis on this issue.
		Bob Black	<u>Theme 5.</u> There seems to be a desire to have a CCRM process that covers the entire spectrum of the subject from strategic overview to detailed technical implementation. We think this is an unrealistic expectation. For example the Guide is designed to take the CCRM process to a certain level and then "hand it off" to the user for a more technical (and likely engineering) processes for more analysis if that is felt necessary. We have noted in our workshops that a common comment from the participants is to keep the process simple, not to make it more complicated to understand or implement.
		Bob Black	<u>Theme 6.</u> We believe the Guide address the issue from both approaches. While we tend to focus on a vulnerability-based approach our process is equally applicable to a hazard-based

Section	Sub-section	Commenter	Comments / Considerations
			evaluation.
		Bob Black	<u>Theme 7.</u> We disagree completely with this conclusion. In fact one of the basic objectives of the Guide, and the reason for the use of so many templates (in particular the Risk Evaluation Matrix in Section 4) is to provide simple and straightforward briefing tools for participants, stakeholders and senior management. In a briefing to the Environment and Energy Committee of Metro Vancouver (elected officials) in October, 2009 much use was made of the templates included in the Guide and our proposal to proceed with a CCRM using the Guide was met with unanimous approval.
		Bob Black	<u>Theme 8.</u> We have also used the Guide as the basis for a Hazard, Risk and Vulnerability Assessment for a large post-secondary institution. While there may be some requirement to fine-tune the Guide for specific requirements we found that it is fundamentally sound for different audiences.
		Bob Black	<u>Theme 9.</u> Maybe, but this is changing quickly, particularly at the municipal level. Local authorities seem to be “getting the message” about climate change adaptation. If anything, its not the “need” that is lacking, its political will and funding and support from provincial governments.
		Bob Black	<u>Theme 10.</u> Possibly, however liability is a card of convenience that can be played to delay doing just about anything. In our experience we have not found that this is a significant impediment to doing a CCRM study.
		Bob Black	<u>Theme 11.</u> While constrained planning horizons might be an issue for <u>implementing</u> the results of a CCRM they have not been an impediment to actually <u>studying</u> the issue. In our experience there appears to be a growing understanding, particularly at the municipal level, that planning timelines must be expanded to properly address climate change adaptation.
		Bob Black	<u>Theme 12.</u> If you adopt a CCRM process or standard that is so complicated or detailed that only a few anointed specialists can understand it then we would agree with this comment. However, if you keep the process simple and limit the scope of study local government administrators should be able to apply the process to their areas. This really speaks to the issue of simplicity versus totality. Applying the maxim that “best is the enemy of good enough” we feel that a simple process, such as outlined in the Guide, is of more value to a user, and more likely to be used, than a more comprehensive and technically challenging document. This has been borne out
		Bob Black	<u>Theme 13.</u> This appears to be a bit of a red-herring and in fact becomes less relevant as time moves on. There are people who seem determined to demand unrealistically detailed projections of climate change and will use the lack of this as a rea-

Section	Sub-section	Commenter	Comments / Considerations
			son to avoid addressing the issue. Our perspective, borne out by the comments of our workshop attendees, is that there is enough authoritative climate change information available to support a CCRM.
		Bob Black	<u>Theme 15</u> – maybe you could reword this theme to say “Increased interest in the implementation of risk management systems could fundamentally affect the utility of these systems as a means for addressing new areas of risk” to reflect the comments of your Australian commentator. Be more positive in your conclusions.
		Bob Black	<u>Themes 16 – 20</u> . We have no difficulty with relating CCRM to other management systems (see comment above regarding Q850 and ISO 31,000). However, our experience is that municipalities will not be driven by management systems but will only adopt those where they see a practical (and often financial) benefit or are regulated by other orders of government. To reiterate the point made under theme 12, the overriding sentiment we have received in our workshops is to keep the process simple, and easy to execute and explain.
General		David T. MacLeod, CEA, EMS(LA), Sr. Environmental Specialist, Toronto Environment Office.	<p>1) Bravo CSA! The report is very well done. NRCan has made a good investment in funding this work. CSA is to be commended for their insightful professionalism which will be helpful to many sectors and the entire Country. Hopefully other parts of the world will also benefit from this work. Hopefully the expertise and professional practice coming out of this work will also result in opportunities for CSA, consultants, academics and other professionals to apply their skills in Canada and abroad.</p> <p>2) One of the themes that I see missing is consideration of how climate change could affect government programs that are not infrastructure oriented. I am referring to "softer" social programs that help especially vulnerable persons. Examples would be programs to help homeless and low income persons, refugees and new immigrants, seniors, and public health issues. From what I can tell from benchmarking I have done amongst leading cities, this kind of consideration has been limited in the developed world.</p> <p>3) The National Roundtable for the Environment and Economy sponsored a significant legal review on the issue of liability due to inaction on climate change adaptation by organizations. The title is, "<u>Legal Liability as a Driver of and Barrier to Climate Change Adaptation in Infrastructure Projects</u>", prepared by Torys LLP, April 15, 2008. There are significant opinions in this report which would imply a duty to act by various parties. There should be stronger consideration of the implications of this report. The opinions in this paper are not necessarily those of the City of Toronto. I attach this pa-</p>

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			<p>per.</p> <p>4) Through a competitive bid process, the City of Toronto awarded a contract to Deloitte in December 2009 to conduct a project known as "Environmental Risk Assessment: First Application - Climate Change". This project has involved benchmarking and is taking into account the findings of this CSA report - which are considered very useful. The project specifies strong consideration of the Bruce and Egener methodology, with an intent to take this very helpful methodology to the next level. The Toronto project specifies a more robust electronic tool that can handle larger volumes of data and allows faster and more powerful analysis and reporting.</p> <p>Toronto's project involves development of a climate change risk assessment process and electronic tool in MS Access for use by City organizations. We are considering how the tool may have functionality of:</p> <ul style="list-style-type: none"> - Embedding of user friendly instructions and notes; - Better data security; - Easier user interfaces; - Environmental due diligence through including some components of ISO 14001; - Concepts of Enterprise Risk Management; and - Inclusion of top down (hazards based) and some bottom up (vulnerability based) analysis. <p>Once the tool, and associated train the trainer materials have been tested in two City divisions, there is a plan to request that Toronto City Council allow the tool to be shared on a wider basis, pending a requirement of no liability on the City of Toronto by possible users. The City of Toronto is listed an honorary member of the Ontario Regional Adaptation Collaborative, due to the stated intent to seek Council permission to share this process and tool with the Province of Ontario for modification and use by other municipalities.</p> <p>If further guidance beyond the Bruce and Egener methodology is considered (per section 5.2(2)), I suggest that the Toronto project outputs be considered (pending approval by Toronto City Council).</p> <p>5) The CSA document mentions the value of sector based guidance, which is very valid. I would advocate that there is also a function for some kind of guidance on regionally based activity on climate change risk assessment. The City of Toronto is planning to conduct outreach to critical infrastructure oriented companies and crown corporations to encourage them to pursue climate change risk assessment work - sharing data, information and ideas. There is critical importance to under-</p>

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			<p>standing how the failure or harm to one infrastructure type may have cascading impacts on others. This approach was already used successfully by New York City. The CSA document does make brief mention of co-operation between various sectors, but this needs to be emphasized more and should be mentioned in the document.</p> <p>6) Environment Canada is supporting a pilot project to demonstrate how better information can be obtained on the future severe weather extremes. This work is being done through a Climate Change Science Advisory Committee. One of the objectives of this work is to help develop a process that might be applied in other regions of Canada.</p> <p>7) There should be mention in the document about the critical concern over the planned Federal funding support curtailment of The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), Canada's lead agency for climate research in our universities. Without continued climate change research, it will be very difficult to provide the kind of information needed to make sound decisions on costly expenditures that support adaptation. This is an issue of national climate security and fundamental importance.</p> <p>8) There is not sufficient mention of the role of Hazard Information Risk Assessment (HIRA) and the role of emergency planning in the document. It is important to avoid duplication of effort and build upon what work emergency planners may have done regarding the planning for severe weather.</p> <p>9) Any future guidance document on CCRM should consider more than just sudden onset risks. This would include creeping, cumulative, cascading types of problems.</p> <p>10) Page 60, spelling of forth, should be fourth.</p> <p>11) Page 8 at the bottom spelling of "responds" should be "respondents".</p>
General		C. Eaton	<ol style="list-style-type: none"> 1. As per the instructions, my comments are limited to material in Section 4 (Discussion & Analysis) and Section 5 (Conclusions & Recommended Next Steps). 2. Good job preparing Sections 4 and 5 from complex and (perhaps) conflicting material from various diverse perspectives – it couldn't have been an easy task but the deliverable is great! 3. Regarding Section 4, the findings and arguments generally make sense and address the key points; a few more specific comments are provided below. 4. Regarding Section 5, in general, I agree with the main conclusions and recommended next steps; a few more

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			specific comments are provided below.
4		C. Eaton	<p>5. The split between public and private sectors (pp. 38-39) makes sense but I don't understand why the municipal "sub-sector" is addressed while the federal and provincial "sub-sectors" are excluded. Won't some federal and provincial organizations (e.g., those responsible for critical infrastructure industries) be affected by climate change and benefit from guidance?</p> <p>6. If federal and/or provincial organizations were included, the risk management maturity distinction between public and private sectors would likely be reduced (e.g., mandates by the Treasury Board Secretariat at the federal level and similar authorities at the provincial level, notably the B.C. Ministry of Finance and Alberta Ministry of Finance and Enterprise).</p> <p>7. Regarding the "issue of liability" for private sector organizations (p. 40), inaction may be more related to (rational or irrational) risk perceptions about the problem (e.g., drivers, scale, scope, timing, etc.) and ambiguity around the solution and less by liability concerns. Refer, for example, to the attached <i>Experience-Based and Description-Based Perceptions of Long-Term Risk: Why Global Warming Does Not Scare Us (Yet)</i> (2006) article by Elke Weber.</p> <p>8. Regarding the lack of "private sector-specific CCRM instruments" (p. 41), perhaps a similar argument could be made for some federal and provincial sub-sectors (e.g., those responsible for critical infrastructure industries such as crown corporations that are electric utilities).</p> <p>9. Regarding the "augmentation of existing standards" (p. 42), you might want to qualify the use of "enterprise risk management (ERM)" since many (recent) standards are not ERM standards per se but rather risk management standards that allow for the possibility of ERM (e.g., ISO 31000, CAN/CSA-ISO 31000, draft CAN/CSA-Q850, etc.).</p> <p>10. Regarding the "integration of all management systems" (p. 42), I'm not sure about this trend. I'd be interested in seeing the evidence. But, even if this trend exists, isn't a risk management standard the most logical place for a CCRM based on the subject matter alone?</p>
5		C. Eaton	<p>11. Regarding the "extent to which the audience is familiar with management system standards" (p. 49), I'm not sure the evidence supports the conclusion "For small corporations and most municipalities, the augmentation of existing management system standards will not be an appropriate mode of delivery." I think that adopting CAN/CSA-ISO 31000 (or something similar) that has been augmented for CCRM use could be viable for such organizations.</p> <p>12. Regarding the prevalence of ERM in the private sector (p. 50), you should provide evidence to support the claim that "The majority of medium-to-large private sector organizations in Canada use enterprise risk management approaches in accordance with a small number of internationally recognized ERM standards" or consider softening the claim. Refer to the attached <i>ERM: Inside and Out</i></p>

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			<p>(2005) study by The Conference Board of Canada.</p> <p>13. Similar to a point raised in 9 above, you might want to qualify the use of the term “ERM” when referencing standards (p. 50) since many (recent) standards are not ERM standards per se but rather risk management standards that allow for the possibility of ERM.</p> <p>14. You might want to specify which “internationally recognized ERM standards” (p. 50) are leading candidates for augmentation. For reference, I would support basing a CCRM on just about any leading risk management standard (e.g., ISO 31000, CAN/CSA-ISO 31000, AS/NZS 4360/HB 436, etc.) except COSO’s <i>ERM – Integrated Framework</i> (2004).</p> <p>15. Similar to several points raised above, I’m not sure why federal and provincial organizations are excluded, particularly those responsible for critical infrastructure industries. You should either add them to Sections 4 and 5 or provide some rationale for excluding them. I’d suggest either including them with the private sector organizations (preferred) or treating them in a manner quite similar to the private sector organizations, resulting in a three-tiered approach (i.e., private sector, federal and provincial sub-sector, and municipality sub-sector).</p> <p>16. While I appreciate the parsimony of the conclusions and recommended next steps in Section 5 (i.e., “solutions”), I think they could probably benefit from more direct and explicit links to the major themes from Sections 3 and 4 (i.e., “findings and issues”). A table might help.</p> <p>17. Again, generally I appreciate the parsimony of Section 5, but you might want to provide some additional details regarding implementation, including the specific deliverables (i.e., standard, guidelines, tools, etc.) and anticipated process, timing, and expertise requirements.</p>
0	0.3 Findings	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>v) Specific guidance on the character and scope of a CCRMS</p> <p>include in sector examples: water resource management include public and private sector user groups</p>
0	0.5 Conclusions and Recommended Next Steps	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	I am okay with key recommendations. It will be a good idea to include a section on how we plan to move forward with these recommendations. important to make sure we move forward with this
3	3.4.2 Scope	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>Update bullet pt as with the following additions:</p> <p>The potential for tailoring elements of the guidance to specific sectors, pieces of organizations (e.g., water management, energy production, energy transmission, etc.), or user groups (public sector or private sector);</p>

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4	4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<u>i. Municipal sector</u> update sentence to include: “Among such barriers are: the perceived lack of authoritative atmospheric and climate change-related information (theme #13); the perceived lack of technical information required in order to proceed to the <u>prioritization</u> , choice and implementation...”
4	4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<u>i. Municipal sector</u> Comment on second paragraph, last sentence: <i>“This should not be considered a key factor in determining whether public sector needs a CCRMS or not ... Hazard and Risk planning is an important issue for municipalities from a legal Liability perspective.”</i>
4	4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<u>i. Municipal sector</u> Comment on last paragraph: <i>“This is an important point – the issue of adaptation is serious enough that it shouldn’t be avoided or “dumbed-down” for the municipal sector as the previous paragraphs imply to some degree.”</i>
4	4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<u>ii. Private sector</u> Comment on first paragraph: “some examples might be useful”
4	4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<u>ii. Private sector</u> Comment on fourth paragraph, second sentence: <i>“This is true for public sector as well”</i>
4	4.2	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	Comment on last paragraph: <i>“This is an excellent point but the message is a bit vague as written – suggest some clearer wording.”</i>
4	4.4.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	Comment on bullet pt i): <i>“This seems to be close to what we might be aiming at”</i>
4	4.4.1	R. Ness & C. Sharma Toronto Region	Comment on bullet pt r): <i>“I don’t think this is relevant. I don’t remember if this ques-</i>

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		Conservation Authority (TRCA)	<i>tion/issue was part of the original scope or if this was discussed at the expert meeting. This may distract us from the goal."</i>
5	5.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>Comment on second conclusion:</p> <p><i>"I would still argue that even though this guidance is widely available, there is still no consensus on the degree to which these tools are useful and which tools are the best to use. Further, some consistency needs to be established so that, for example, all Canadian municipalities are using the same tools and using climate information and science in the same way. I would suggest this need be highlighted somewhere in the document."</i></p>
5	5.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>Update pt #1 of the fourth conclusion as follows:</p> <p>3) Atmospheric data, future climate projections, statistics and such information regarding uncertainty in this data as is necessary to support risk assessment applications (see theme 13, Section 3.2 for background)</p>
5	5.1	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>Comment on pt #2 of the fourth conclusion:</p> <p><i>"This is a good idea but perhaps a bit misleading – there has likely been insufficient time to evaluate whether any adaptation decisions by anyone to date have actually been successful. May better to word this as "Case studies of processes that have been used by organizations to make decisions regarding climate change adaptation"™"</i></p>
5	5.2	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>1) Augment with CCRM guidance ERM standards for a subset of prominent economic sectors</p> <p>Comment on second paragraph:</p> <p><i>"Not sure why the PIEVC tool was specifically singled out – many of the other tools seem to be equally useful to draw on in the development of an ERM CCRM approach."</i></p>
5	5.2	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>2) Produce a consensus-based, CCRM product specifically for municipalities</p> <p>Comment re: Egener reference:</p> <p><i>"Again, is it appropriate to single out a single approach here?"</i></p>
6	6.2	R. Ness & C. Sharma Toronto Region Conservation Authority (TRCA)	<p>Replace existing text with:</p> <p>9.1 Toronto and Region Conservation Authority</p> <p>Toronto and Region Conservation (TRCA) works with its partners to ensure The Living City is built on a natural foundation of healthy rivers and shorelines, greenspace and biodiversity, and sustainable communities. Approved by the TRCA Board in April</p>

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			<p>2008, the TRCA Action Plan, <i>Meeting the Challenge of Climate Change: Toronto and Region Conservation Authority</i>, provides formal direction to the Authority to work with partners and all levels of government towards a coordinated regional climate effort.</p> <p>The TRCA has significant expertise in the development of mitigation and adaptation programs, particularly in hydrological and ecological issues. It also has the potential to draw on the larger range of expertise at other Ontario conservation authorities. The TRCA's Strategic Plan, <i>Moving Toward the Living City</i>, focuses on recognizing and integrating climate change as a critical component in achieving the objectives and goals of a healthy, sustainable urban region extending into the 22nd century. Over the past decade, the TRCA has worked at bringing together stakeholders from governments and other agencies to stay updated on climate impacts and share information on new programs and strategies that deal with mitigation and adaptation.</p>
General		Gray E. Taylor Chair, Climate Change & Emissions Trading, Corporate Law Partner Bennett Jones LLP	<p>For clarity, I think the report should focus on adaptation risk much more rigorously. I think there is a great deal of potential for ambiguity in fact the report might well be taken to deal with "carbon" or "mitigation" risks, particularly if portions of it were quoted out of context. I think adding the letter "A." in the term CCRMS to make it "CCRAMS" would be a good idea and to also clarify that CCRM really means CCRAM and use that term consistently would be a good idea.</p> <p>I also think that the focus should be on climate change, not climate, that being the topic raised in section 4.4.3 where I am not persuaded at all by the "Pro-all-climate" points.</p> <p>Generally, I think the report tries very hard to make some sense out of a very jumbled situation. I think the comments about the wide variety of potential users is accurate and poses very significant challenges to trying to make do with a single document. Consequently, I think the idea of a family of documents or at least different documents aiming at different potential users makes good sense.</p> <p>Earlier today I sent you a copy of a press release indicating the intention of the Obama administration to move forward on a framework for dealing with adaptation to the United States. That might give an opening into which the work being contemplated here could fit and where funding might be obtained (I think that funding is an incredibly important issue with respect to Next Steps).</p>
0	0.1	Gray E. Taylor Chair, Climate	Re: CCRM Comment: "term is not defined"

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		Change & Emissions Trading,	Re: terms used: assessment, evaluation Comment: “are these terms different”? Comment: throughout document use term “climate change-related <u>adaptation risks</u> ” rather than climate change-related risks Re: use of the word “critical” in first paragraph Comment: “why this word? Do you mean important” Re: bullet point b) use of the term “climate variability” Comment: “different from climate change”
0	0.3	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: Theme #4 Comment: “support the rationalization / awkward analysis”
1	1.1	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: first sentence Comment: “as indicated this is important but easily lost” Re: second paragraph Comment: “identity of consultant from risk services sector is important”
1	1.2	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: 4 th paragraph Comment: “normal variability is part of static climate – it is climate change we are after” Re: 5 th paragraph, first sentence Add “risk assessment and management” after “adaptation” Re: 6 th paragraph, first sentence Add “or relates” after “...that aligns”
3	3.2	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: Theme #10 Comment: “hard to believe anyone thinks this”
4	4.1	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: ii) Private sector, paragraph 1, term “climate-sensitive sectors” Comment: “how to define these”?
4	4.3	Gray E. Taylor Chair, Climate Change & Emissions Trading,	Re: paragraph 2, term “economic-sector” Comment: “do you mean private sector?”