Climate Change Adaptation Capacity in Ontario Conservation Authorities:

A Case Study Evaluation

by

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ABSTRACT

In Canada, anticipated climate changes including an increased frequency of hot temperature extremes and intense precipitation events, are projected to affect surface water and groundwater resources with respect to water quality and water quantity. At the watershed scale, examples of these effects include changes to water flows and water availability, runoff and evaporation patterns, and dissolved oxygen and phosphorus concentrations, with potentially negative implications. In Ontario, Conservation Authorities (CAs) play an important role in managing and protecting water resources at the watershed scale, through collaboration with the municipal and provincial governments, stakeholders and community members. The projected effects of climate change on water resources will be felt at the watershed scale and will have an impact on existing activities within CAs. Research suggests that current management practices may not be sufficient to adapt to climate change effects. Therefore, CAs should be involved in climate change adaptation. This research evaluated what capacity Ontario CAs currently have for climate change adaptation, through a case-study comparison of two CAs – the North Bay-Mattawa Conservation Authority (NBMCA) and Credit Valley Conservation (CVC). An evaluative framework with indicators of capacity in three environments – the institutional environment (i.e., presence and quality of institutional arrangements), the organizational environment (i.e., organizational resources and organizational dynamics) and the action environment (i.e., community and political support), was developed through a literature review. The evaluative framework was used to assess CA capacity for climate change adaptation through information obtained from open-ended, semi-structured key informant interviews with CA employees, a review of documentation and direct observation. The results of the evaluation revealed that the capacity for climate change adaptation varied considerably between the NBMCA and CVC, particularly in the organizational environment. CVC had strong capacity in terms of resources availability and had already begun to adapt to climate change in its watershed management activities. The NBMCA was challenged with respect to resources availability and had not yet begun to adapt to climate change. Overall, this

research highlighted the importance of developing partnerships, communicating, and sharing resources and expertise with other organizations and the local community.

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DEDICATION

To Mom, Dad, Krista and Jessica. Thank you for your love, support and humour. I will remember you when I am in Hollywood.

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CHAPTER ONE

INTRODUCTION

> *Throughout the 10,000 year history of human civilization, weather patterns have remained relatively constant. Though floods, droughts, storms and other extreme weather events have always been a reality, they have been rare occurrences interrupting long periods of calm - sudden outbursts of violence marring a gentle rhythm. Now, because of human induced climate change, that gentle rhythm is breaking up* (David Suzuki Foundation 2007).

1.1 Problem Context

Despite considerable debate, there is now consensus within the scientific community that global warming is occurring (IPCC 2007). Projected changes include an increased frequency of hot temperature extremes and intense precipitation events (IPCC 2007). In Canada, climate change is projected to affect the availability of groundwater resources, surface water flows and water quality, runoff and evaporation patterns, and dissolved oxygen and phosphorus concentrations (Government of Canada 2004). Increased demand for water resources in the agricultural, municipal and industrial sectors due to warmer temperatures could add to the challenges that climate change may present for water availability (IPCC 2007).

For water resource managers, the effects of climate change present challenges that current practices do not consider. Research suggests that current management practices may not be adequate to cope with climate change and variability (IPCC 2008). Existing management approaches rely on past hydrological data to predict future conditions, which may no longer be reliable. This suggests that it is necessary to consider future projections of climate change on hydrological conditions. However, the uncertainty surrounding the future effects of climate change and the reliability of projections will require that water managers make decisions for the future in the face of this uncertainty (IPCC 2008). Research suggests that water managers should adopt a scenario-based

approach, which presents its own set of challenges due to limited data availability and the variability of results from different climate change scenarios (IPCC 2008). Despite these challenges, it is imperative that adaptation actions be taken by water managers, industries, stakeholders and governments. They can begin to do so through no regrets options such as water-use efficiency and water demand management.

Given that a considerable body of literature and scientific research emphasizes that adaptation to climate change is imperative, the question of whether water management organizations have the capacity to do so comes to bear:

> Examples of adaptive behaviour influenced exclusively or predominantly by projections of climate change and its effects on water resources are largely absent from the literature. A key prerequisite for sustainability in North America is 'mainstreaming' climate issues into decision making (IPCC 2008, pg. 104).

For this research, the question of capacity for climate change adaptation is addressed to water resource management agencies in Ontario, and more specifically, at the watershed scale in Conservation Authorities (CAs). From here on in, a watershed refers to "an area of land that is drained by a river and its tributaries into a particular body of water such as a pond, lake or ocean" (CO N.D, pg. 1). CAs have key responsibilities relating to the protection and management of water resources on a watershed basis and should be involved in climate change adaptation. As watershed-based organizations, CAs collaborate at the local level with municipal governments, stakeholders and community members. CAs work to conserve natural resources, conduct research aimed at protecting the quality and quantity of water resources, and take measures to control and prevent floods and droughts. These organizations should be involved in climate change adaptation because the effects of climate change are being experienced or are projected to have an effect at the watershed scale through changes to water quality, water quantity, and flood patterns and, therefore, will have an impact on existing CA activities.

This research does not attempt to describe the scientific evidence and understanding behind climate change in detail. Nor does it attempt to consider or describe all of the pro-

jected effects of climate change on the physical, social and economic environments. This research assumes that climate change is occurring and attempts to evaluate what capacity Ontario Conservation Authorities, as watershed management organizations, currently have to adapt to climate change effects. Thus, for this research climate change adaptation represents both the capacity of an organization to take specific actions to adapt to the effects of climate change, as well as its capacity to maintain its existing programs in the face of climate change.

1.2 Research Purpose and Objectives

This research aims to answer the question: "What capacity do Ontario Conservation Authorities currently have to adapt to climate change in watershed management?" The objectives of this research are as follows:

- Objective one**:** To develop an evaluative framework for the assessment of Conservation Authority capacity for climate change adaptation;
- Objective two: To apply the evaluative framework in an assessment of the capacity of Ontario Conservation Authorities for climate change adaptation into watershed management; and,
- Objective three: To propose recommendations for improving the capacity of Ontario Conservation Authorities for climate change adaptation.

1.3 Thesis Overview

Chapter One provides the purpose and rationale for this thesis and outlines the research objectives. Chapter Two provides a review of literature pertinent to capacity, adaptive capacity and climate change, and describes the evaluative framework developed for the assessment of Conservation Authorities' capacity to integrate climate change adaptation into watershed management. Chapter Three describes the methods used for this research and Chapter Four describes the context of watershed management and climate change

adaptation in Ontario and evaluates existing institutional arrangements to assess their contribution to the capacity of Conservation Authorities (CAs). Chapter Five and Chapter Six provide descriptions and evaluations of the North Bay-Mattawa Conservation Authority (NBMCA) and Credit Valley Conservation's capacity for climate change adaptation integration, and Chapter Seven compares the capacity of the CAs, describes CAs' capacity for climate change adaptation, and offers capacity-building recommendations.

CHAPTER TWO

LITERATURE REVIEW

Climate change and variability present significant challenges at the global and local scale. Across resource sectors, communities, organizations and governments are faced with the challenge of adapting their management practices and policies to consider the projected effects of climate change. In light of observed and expected climate change, and in recognition of anticipated effects on natural and social systems, adaptation is necessary in order to cope with this change. Adaptation is defined here as an "Adjustment in natural or *human systems* in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC 2007, pg. 869). As a result, communities, organizations and governments must have the adaptive capacity required to face the uncertainty of climate change.

The purpose of the following discussion is to review the concepts of adaptive capacity and adaptation and to identify indicators of capacity in order to develop an evaluative framework to assess the adaptive capacity for climate change adaptation in watershed management in Ontario Conservation Authorities. Section 2.1 provides key definitions and conceptualizations of adaptive capacity, adaptation and related theories and concepts. Section 2.2 identifies and describes specific indicators of adaptive capacity that are used to develop an evaluative framework in Section 2.3. Section 2.3 identifies various approaches available for evaluating capacity and provides the evaluative framework that will be used to assess the capacity for climate change integration in Ontario Conservation Authorities (CAs).

2.1 Defining Adaptive Capacity and Adaptation

The concept of adaptive capacity is addressed in a range of disciplines, from environmental science and natural resource management to organizational development and public health (Berkhout *et al*. 2006; Ebi *et al*. 2006; Lenton 2002; Smit and Wandel 2006; Staber and Sydow 2002). Due to its broad use across disciplines, there are

numerous definitions and conceptualizations within academic literature. For example, Armitage (2005, pg. 703) defines adaptive capacity in the context of natural resource management as:

> a critical aspect of resource management that reflects learning and an ability to experiment and foster innovative solutions in complex social and ecological circumstances.

Grindle and Hilderbrand (1995, pg. 445) define capacity as "the ability to perform appropriate tasks effectively, efficiently and sustainably." Staber and Sydow (2002, pg. 412), in reference to organizational adaptive capacity, state:

> Adaptive capacity aims less at improving economic efficiency than improving the ability to learn, to act reflexively, and to maintain or transform social structures and processes.

In the climate change context, Smit *et al*. (2000, pg. 238) argue that adaptive capacity is "The potential or capability of a system to adapt to (to alter to better suit) climatic stimuli" and the Intergovernmental Panel on Climate Change (IPCC 2007, pg. 869) defines adaptive capacity as:

> The ability of a system to adjust to *climate change* (including *climate variability* and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Common in definitions of adaptive capacity, regardless of the context, are themes of flexibility, learning, innovation and change (Armitage 2005; Franks 1999; Georgsdottir and Getz 2004; Lemos *et al*. 2007; Naess *et al*. 2006; Tompkins and Adger 2005).

Adaptive capacity can be of significant value to individuals, communities and organizations, particularly in the face of uncertainty. Parsons (1964) explains that, when faced with uncertainty, organizations with adaptive capacity are better able to manage and cope with these uncertainties. Systems are better able to adjust to changing conditions compared to those with limited or no adaptive capacity (Smit and Wandel 2006; Staber and Sydow 2002). Recently, considerable research has addressed adaptive capacity in the context of climate change and variability at the global and local scale. For example, in 2007 the Intergovernmental Panel on Climate Change (IPCC) released their

Fourth Assessment Report entitled “Impacts, Adaptation and Vulnerability” that devotes an entire chapter to adaptation and capacity. Examples of adaptive capacity research at the local scale include community capacity to adapt to climate change impacts (Ivey *et al*. 2004), adaptation to climate change in water resource management (de Loë and Kreutzwiser 2000), and organizational adaptation to climate change impacts (Berkhout *et al*. 2006).

Adaptive capacity is of critical importance when considering climate change adaptation and efforts to reduce a system’s vulnerability to climate change impacts. The IPCC’s definition provided earlier in this discussion emphasizes that adaptation involves adjustment and change, and that systems should be flexible and able to change in response to climatic stimuli. Therefore, a community, organization or government must have adaptive capacity in order to adapt to climate change. Smit and Wandel (2006), in their review of the relationships between adaptation and adaptive capacity, explain that “the forces that influence the ability of the system to adapt are the drivers or determinants of adaptive capacity” (pg. 286) and “adaptations are manifestations of adaptive capacity” (pg. 287).

There are a range of possible climate change adaptation options for water resources. The Government of Canada (2004, pg. 42) lists “water conservation measures; improved planning and preparedness for droughts and severe floods; improved water quality protection from cultural industrial and human wastes; enhanced monitoring efforts; and, improved procedures for equitable allocation of water ” as possible adaptation measures. Common in literature pertaining to climate change adaptation is the need for additional data resources to monitor and model for changes in hydrological conditions using precipitation, runoff and evapotranspiration information (Environment Canada 2004).

Capacity and capacity building research in the water sector has garnered considerable attention as a result of the United Nations Development Symposium in 1991, in Delft, the Netherlands. Identified in the Delft Declaration are three basic elements of capacity building (Alaerts *et al*. 1991):

- Creating an enabling environment with appropriate policy and legal frameworks;
- Institutional development, including community participation; and
- Human resources development and strengthening of managerial systems.

Over the past 16 years, research on capacity and capacity building has continued to categorize elements of capacity into major themes. For example, in their work on capacity in the public sector, Grindle and Hilderbrand (1995) identify five dimensions important to capacity building: *the action environment* (economic, political and social context for government action); *the institutional context* (policies, procedures and government responsibilities); *the task network* (the set of organizations or agencies involved in a particular management task); *organizations* (the "building blocks of the task network" where research is undertaken); and, *human resources* (the skills and knowledge of employees). Crisp et *al.*'s (2000) research on health promotion identifies four approaches to capacity building that emphasize the importance of policies and practices; human resource skills and abilities; relationships and partnerships with other organizations; and, community involvement.

Considerable research is dedicated to community, local level, and nonprofit capacity and capacity building. McGuire *et al.* (1994) conceptualize community capacity as a function of citizen participation (e.g., involvement of community members and local political institutions); community structure (e.g., government institutions and vertical and horizontal linkages with communities and other governments); and, development instruments (e.g., the appropriateness and effectiveness of policy tools within the community). In their research on community capacity for adaptation to climate change, Ivey *et al.* (2004) describe capacity as a function of *institutional arrangements* (e.g., local, provincial and federal legislation); *community characteristics* (e.g., public perceptions and public participation in decision-making); and, *community and organizational resources* (e.g., skills of personnel and availability of financial resources). Jones (2003) conceptualizes capacity building in human service organizations as a function of an organization's aspirations (e.g., mission, vision and goals); strategy (e.g.,

set of actions and programs to fulfill goals); skills (e.g., management, relationship building and capabilities); systems and infrastructure (e.g., planning, decision making, physical and technological support); human resources (e.g., staff capabilities, experience and potential); structure (e.g., governance, design and organizational coordination); and, culture (e.g., organizational values and practices).

Ivey's (2000) work on groundwater protection capacity identifies components of capacity as the agency and human resources environment; the community environment; and, the institutional environment. Additional research on local capacity for groundwater protection in Ontario by de Loë *et al*. (2002) conceptualizes capacity as a function of technical capacity (e.g., knowledge and availability of human resources); financial capacity (e.g., quantity and source of financial resources); institutional capacity (e.g., municipal and provincial policies and legislation); political capacity (e.g., leadership and support from local politicians); and, social capacity (e.g., community involvement and education) (de Loë *et al.* 2002).

Several common themes can be drawn from these descriptions of capacity. First, as illustrated in the above examples, the majority of literature emphasizes that multiple, interrelated factors influence capacity (de Loë *et al.* 2002, Ivey *et al*. 2006b; Grindle and Hilderbrand 1995, Ivey *et al.* 2004). de Loë *et al.* (2002) argue that specific elements of capacity will vary in importance depending upon the context in which they are applied. However, other scholars argue that certain elements of capacity are more critical than others.

Biswas (1996, pg. 401), in the context of water management, argues that the most important element of capacity is human resources. He suggests that, even when challenged by weak policies and institutional arrangements, capable managers and employees will successfully carry out organizational tasks:

> Competent, well-trained, and committed individuals can and will always perform their tasks irrespective of policy constraints, absence of appropriate legal frameworks and unresponsive institutional settings. However, even with the best policies, laws and institutions

> and adequate availability of funds, if the right people are not there, progress at best can only be slow and marginal.

Jones (2003) describes a hierarchical approach for capacity assessment. In this pyramid approach to capacity building, aspirations, strategy and organizational skills are considered indispensable components of organizational capacity and are supported by other less critical elements (e.g., systems and infrastructure) at the lower end of the pyramid. However, the majority of capacity and capacity building literature commonly conceptualizes capacity, in some way, as a function of human and financial resources, policy and legislation, political support and leadership, and community support. For the purpose of this review, capacity will be described in terms of the *organizational environment* (i.e., organizational resources and organizational dynamics), the *action environment* (i.e., community and local, provincial and federal support), and the *institutional environment* (i.e., policies, guidelines and legislation).

2.2 Indicators of Capacity

The following discussion identifies indicators of capacity with respect to the major capacity environments identified above. The indicators described in this section will form the basis of the evaluative framework which will be used to assess the capacity for climate change adaptation in Ontario's Conservation Authorities.

2.2.1 Organizational Environment

2.2.1.1 Organizational Resources

Human Resources

The importance of human resources to the capacity of an organization or community is prominent in research on capacity and capacity building across numerous disciplines and in a variety of contexts (Crisp *et al*. 2000; de Loë *et al*. 2002; Franks 1999; Grindle and Hilderbrand 1995; Lemos *et al*. 2007; Tompkins and Adger 2005, Schuh and Leviton 2006; Smit and Wandel 2006). While many scholars (e.g., Crisp et al. 2000; de Loë *et al.* 2002; Grindle and Hilderbrand 1995) view human resources as one of several interrelated

components of capacity and capacity building, others (e.g., Biswas 1996) view human resources as the most critical element to the capacity of an organization or community. As explained by Biswas (1996, pg. 400), "Institutions often become convenient scapegoats for inaction or inappropriate actions, when the real problem is people." Schuh and Leviton (2006, pg. 172) argue that, while considerable emphasis is placed on building the skills and knowledge of staff, greater attention should be given to developing organizational resources and procedures that can enhance staff capabilities:

> When capacity building is the goal of interventions, too often the focus is on individual training, to enhance expertise and make higher order task performance possible. Yet, the organization may not be able to use the increased expertise without some changes in its own processes and resources.

Most broadly, human resources refers to the skills, knowledge, roles, and education of individuals or staff in an organization or community, and their ability and willingness to learn. Franks (1999, pg. 52) uses the term capability to encompass these elements, stating:

> Capability refers to the knowledge, skills and attitudes of the individuals, separately or as a group, and their competence to undertake the responsibilities assigned to them.

Franks (1999, pg. 52) further explains that individuals in an organization can be capable, yet the organization can be lacking in capacity, defined here as "the overall ability of the individual or group to actually perform the responsibilities" as a result of understaffing or weak institutional arrangements.

A significant body of research on capacity emphasizes the importance of skills, abilities and availability of staff to the capacity of an organization. In the context of groundwater protection, de Loë *et al*. (2002) explain that staff with specific knowledge and understanding of related technical activities are vital in order for an organization to undertake its management tasks. Organizations that are lacking in staff with specialized knowledge of particular management responsibilities, or which do not have access to

external specialists, can face significant challenges related to their ability to conduct specific activities, and to interpret and utilize data effectively (de Loë *et al.* 2002).

There are conflicting views in the literature regarding whether a reliance on external specialists reduces capacity. Crisp *et al.* (2000) suggest that by providing training to employees, an organization's reliance on external consultants is reduced which increases its capacity. In contrast, de Loë *et al.* (2002) argue that in certain contexts, using external consultants instead of hiring permanent specialized staff for specific technical activities is more appropriate. A more important consideration when assessing the capacity of an organization is whether existing staff are capable of interpreting and making use of the information provided by external consultants (Ivey *et al.* 2004; de Loë *et al.* 2000).

Appropriate staff size is vital to the capacity of an organization and influences its ability to perform effectively in a number of ways. Staff availability can determine whether employees are able to concentrate fully on their specific responsibilities. In an understaffed organization, employees may often be required to take on numerous responsibilities which can limit the time they have available to dedicate to one set of tasks. Schuh and Leviton (2006) explain that in less well resourced agencies employees may often be required to undertake administrative activities in conjunction with their specified responsibilities within the organization. More developed organizations will have adequate staff available to devote specifically to administrative roles (Schuh and Leviton 2006). For organizations that are currently constrained in terms of staff availability, they may be challenged even more by additional responsibilities and tasks that climate change adaptation may require. Adequate staff availability allows employees within an organization to fully concentrate on specific administrative tasks. When assessing how human resources can affect capacity it is important to consider whether existing staff are being used effectively within an organization. Grindle and Hilderbrand (1995) argue that it is important to examine whether organizations are capitalizing effectively on the specialized skills and knowledge of their employees.

Information Resources

In addition to human resources capability, the capacity of an organization, community or agency can also be affected by the availability of appropriate information and technology. Organizations may have access to employees who are fully capable in terms of their skills and knowledge and have adequate financial resources, but their capacity may be limited if they do not have access to the appropriate information and technology required to effectively undertake specific tasks and responsibilities. For example, climate change and variability can present many challenges with respect to data availability. As Ivey *et al*. (2004, pg.44) explain, capacity will likely be affected by "lack of reliable future climate and hydrologic scenarios", because future projections of climate change are still uncertain. Based on the examples of adaptation options identified in section 2.1, other information needs include access to past and near real-time meteorological data, a water supply database, additional climate station networks and monitoring data, historic and future climate and hydrological data and seasonal hydrological characteristics, flow data collection at additional stream sites (Environment Canada 2004).

Financial Resources

There is considerable agreement in the literature, from local and community capacity to capacity building in developing countries, regarding the significance of financial resources to capacity. Common in this body of research are questions of how availability and access to resources as well as the type of funding source can contribute to or constrain capacity (de Loë *et al*. 2002). Adequate financial resources can contribute to capacity by enabling organizations to secure capable staff, providing greater access to appropriate data as well as providing opportunities for training and education (Ivey *et al*. 2004). Organizations that are limited financially will likely be unsuccessful in implementing projects and undertaking management tasks (Schuh and Leviton 2006).

In their evaluation of local capacity for source water protection, Timmer *et al*. (2007) conceptualized financial capacity in terms of a local government's ability to secure and generate funding. Additional considerations included whether there were sufficient resources available to effectively conduct management tasks, whether the resources were

used and managed effectively and whether there was flexibility with regard to the ability of the local government to adapt to changes. Indicators of financial capacity can refer to the ability of an organization to maintain balanced budgets and to secure external funding, as well as whether financial resources are made available for particular management tasks (Timmer *et al*. 2007). Schuh and Leviton (2006) add that when evaluating financial capacity it is also important to consider whether an organization was required to take financial resources from other programs in order to support its management tasks

Research suggests that a heavy reliance on external funding sources can limit the capacity of an organization. For example, Timmer *et al*. (2007) explain that reliance on external funding sources can limit an organization's ability to conduct ongoing management tasks. de Loë *et al*. (2002) explain that in situations where organizations or communities rely heavily on external sources of funding and then funding is reduced, they may no longer be able to continue conducting their activities. For example, in the Village of Erin, Ontario, because of provincial grant reductions, the community did not have the financial resources available to develop a sewage treatment plant, a development which could have provided benefits to the community with respect to water protection (de Loë *et al*. 2002). Table 1 presents a summary of major elements and indicators of organizational resource capacity for climate change adaptation.

Table 1 – Summary of indicators of organizational resource capacity for climate change adaptation

Element of capacity	Themes
Human resources	
Staff availability and expertise	• Adequate staffing; appropriate skills and knowledge; effective use of skills and knowledge; use of external consultants; ability to interpret and use information provided by consultants
Information resources	
Information availability and access	• Availability of and access to appropriate data and technology
Financial resources	
• Access to and source of re-sources	• Availability of sufficient resources; ability to generate resources; ability to secure external resources; reliance on external funding sources
• Management of resources	• Ability to manage finances and maintain balanced budgets

2.2.1.2 Organizational Dynamics

Organizational dynamics refer to characteristics, features and management approaches of an organization that are identified as contributing to or limiting capacity.

Flexibility

A substantial body of literature focuses extensively on the importance of flexibility to the capacity of an organization. Research emphasizes the importance of flexibility to various elements within an organization that influences its overall capacity. As explained by Grindle and Hilderbrand (1995, pg.444):

> Most organizations that perform well are ones that have cultures stressing flexibility, problem-solving, participation, teamwork, shared professional norms and a strong sense of mission.

Further, flexibility can facilitate innovation and improve management approaches in an organization (Georgsdottir and Getz 2004). Georgsdottir and Getz (2004) define flexibility as "the ability to change" (pg. 166) and identify two types of flexibility: adaptive flexibility and spontaneous flexibility. The authors define adaptive flexibility as "the ability to adopt new strategies to solve a problem when old methods have led to an impasse, or to redefine the problem in order to find an original solution, and spontaneous flexibility as "the ability to find diverse solutions to a problem when there is no external pressure to be flexible" (Georgsdottir and Getz 2004, pg. 167).

The concepts of flexibility and change can for example, pertain to the ability of an organization to modify its management approaches, policies and tasks when new and changing information becomes available (Naess *et al*. 2006). Franks (1999), in the context of capacity building in the water sector, emphasizes this importance, explaining that water managers need to change their current practices to include new understandings of hydrology, water quality and environmental concerns. Research indicates that societies that are viewed as being highly adaptive or as having the capacity to adapt have been able to change quickly in response to new information (Smit and Wandel 2006). Dynamic and flexible organizations have the capacity to respond and adapt to new information (Tompkins and Adger 2005). Of considerable importance is the ability of an organization and its employees to recognize changing conditions and to develop solutions that incorporate these changes (Danter *et al*. 2000). In the context of climate change and variability, existing capacity in an organization or community is a function of its ability to change and adapt as new information regarding climate change science becomes available (Tompkins and Adger 2005). Smit (1997) adds that policymakers need to be aware of new technologies and innovations for climate change as they become available.

Research indicates that, in addition to the overall flexibility of an organization, capacity is also affected by the flexibility of its employees. Employees within an organization who are flexible are able to develop solutions in the face of challenges and constraints. Flexibility encourages individuals to consider different perspectives to existing problems and to develop creative and innovative solutions (Georgsdottir and Getz 2004); these are fundamental components of adaptive capacity (Armitage 2005).

Indicators of flexibility in an organization can involve characteristics of employees as well as management approaches. At the individual level, flexible employees are able to examine and utilize existing knowledge and information from different perspectives to develop innovative ideas and new solutions to problems. From a managerial perspective, flexible organizations encourage their employees to think creatively, to support the development of innovative solutions (Georgsdottir and Getz 2004), and to facilitate environments that encourage problem-solving (Grindle and Hilderbrand 1995). According to (Georgsdottir and Getz 2004, pg. 172), inflexible organizations will "favour conservative decisions, avoid risky behaviours and consequently, stifle the processing of creative ideas", thereby limiting their overall capacity.

Learning and Adaptive Management

Research on capacity and capacity building commonly identifies learning as critical to organizational capacity (Franks 1999; Armitage 2005; Lemos 2007; Folke *et al*. 2005). Learning is also identified as important to individual and organizational flexibility and change (Georgsdottir and Getz 2004). Learning can refer to the willingness and ability of employees to learn from past experiences and mistakes (Armitage 2005; Folke *et al*. 2005; Budreau and McBean 2007) and the willingness and ability of an organization to provide an environment that fosters learning (Franks 1999; Armitage 2005; Lemos 2007; Folke *et al*. 2005).

Organizations learn by developing new understandings and techniques and by obtaining new data and information (Goucher 2007). By evaluating past responses to challenges or changes organizations can determine whether their responses were appropriate and

modify them accordingly or adapt policies when new information becomes available, if necessary (Tompkins and Adger 2005; Smit 1997). In this respect, organizations demonstrate flexibility because they learn from their past responses, change their approaches or adopt new strategies. For example, Naess *et al*. (2005) describe how learning was facilitated at the municipal level as a result of past experiences with flood responses in Norway. As a result of past experiences, changes to policies and regulations at the national level and to the composition of staff at the organizational level were made.

Recent research centered on adaptive capacity across a range of disciplines identifies adaptive management as an important approach to effective management and overall capacity (Tompkins and Adger 2005; Pahl-Wostl 2007). As defined by Bormann *et al*. (1994), "Adaptive management is learning to manage by managing to learn." Pahl-Wostl (2007, pg. 51) adds that adaptive management is "…a systematic process for continually improving management policies and practices by learning from the outcomes of implemented management strategies." Adaptive management is central to adaptive capacity because it emphasizes an adaptive, flexible management approach where a system is able to change and develop different practices as new information becomes available. Adaptive management is particularly important in the face of climate change and variability because it recognizes that there are limits to predictive abilities (Pahl-Wostl 2007). Paul-Wostl (2007) argues that there are two requirements necessary in order for a system to adapt and function in the face of uncertainty, which reflect many of the requirements identified as important to capacity. The key requirements are:

- "new information must be available to the system and the system must be able to process this information" (pg. 53)

- "the system must have the ability to change based on processing new information" (pg.53)

Several avenues for facilitating and encouraging learning in an organization have been identified, many of which are believed to increase organizational flexibility. While a large body of research emphasizes the importance of training and skill development to

capacity, other research emphasizes different approaches to increasing capacity. For example, organizations that are dedicated to constant learning and development, as opposed to relying solely on periodic training exercises through training programs or with the guidance of external consultants, are more effective at building capacity because employees are encouraged to continually improve and think reflectively (Crisp *et al.* 2000). Bodies of research ranging from health promotion capacity and organizational capacity to community capacity identify training and skill development, networks and partnerships, teamwork, and adaptive management as critical to learning, and to overall capacity. In order for an organization and its employees to learn, suitable training and educational opportunities must be made available (Franks 1999). For climate change adaptation, this could include workshops to discuss climate change effects on water resources (Government of Canada 2004) and to understand new data and technology as it becomes available (Pahl-Wostl 2007).

Training and development strongly relate to human resources capacity in an organization because they focus on enhancing human resources capability (e.g., knowledge, skills and attitudes of employees) (Franks 1999; Crisp *et al*. 2000). Continued development and learning are essential as employees are presented with new knowledge, information, tasks and changes that demand new skill sets and perspectives. As Franks (1999, pg. 58) explains:

> Individuals can no longer expect to pass through their working life with only the learning of their initial education to guide them, and most will be expected to undertake some retraining at least once and perhaps a number of times as the nature of their work and their employment changes.

In order to facilitate continued development and learning for employees, organizations must provide opportunities for education and training (Franks 1999). Beyond providing employees with the opportunity to develop their skills and abilities, organizations must develop an environment that allows individuals to effectively make use of their new knowledge and expertise (Crisp *et al*. 2004).

Teamwork, Networks and Partnerships

Networks, partnerships and collaboration are identified as critical to both the capacity of an organization and to the capability of its employees. Developing networks, collaborating and forming linkages with other organizations and groups can have significant positive effects on the capacity of organizations.

At the organizational level, emphasis is placed on the importance of integration among sectors at various levels in government and in organizations. Research suggests that the adoption of new technology and the ability of an organization to change are constrained as a result of separation in management sectors (Tompkins and Adger 2005). Encouraging employees with differing specializations to collaborate provides the opportunity to investigate problems from various perspectives, thereby increasing organizational flexibility (Georgsdottir and Getz 2004). For climate change adaptation, employees could share their knowledge, experience and resources with other departments. Other studies argue for the benefits of vertical and horizontal differentiation of staff within an organization. In their assessment of the development and capacity of non-profit agencies, Schuh and Leviton (2006) suggest that vertical and horizontal differentiation based on an employee's specialization increases the likelihood that a particular program will be implemented because it permits individuals with specific skills to concentrate fully on a particular management task.

Collaboration with external agencies, in addition to teamwork and partnerships within an organization, is of critical importance to capacity. Consistent throughout the literature is an emphasis on the importance of forming partnerships with other organizations at the local level (horizontal linkages) and with senior levels of government (vertical linkages) (de Loë *et al*. 2002). By developing horizontal and vertical linkages with other organizations and groups, an organization can benefit from additional technical and financial resources, data, expertise, experience and managerial abilities (de Loë *et al*. 2002; Smit and Wandel 2006). For climate change adaptation, organizations that may be limited in terms of human, financial and/or information resources, they can draw on the resources and skills of other organizations, through collaboration.

A considerable body of research has focused on evaluating how capacity has been constrained or enhanced by the presence or absence of strong networks and partnerships. For example, in their evaluation of local capacity for groundwater protection in Ontario, de Loë *et al*. (2002) suggest that municipalities lacking in financial and technical resources can enhance their capacity by strengthening vertical and horizontal linkages with other organizations. McGuire *et al*. (1994), in the context of community capacity, add that establishing vertical linkages with senior levels of government is particularly important for local communities because connections between the community and state and federal governments is often lacking. Organizations can enhance their capacity in various ways by developing partnerships and forming networks with other organizations. For example, Smit and Wandel (2006) suggest that greater access to financial resources, as a result of developing partnerships with other organizations, can enable an organization to provide training opportunities and provide greater access to technical resources. Further, partnerships can facilitate the development of unique programs. For example, Crisp *et al*. (2000) explain that the development of a women's health coalition in rural Pennsylvania resulted from resource sharing and partnerships between 56 interested agencies.

In the climate change context, literature suggests that an organization's ability to respond and cope with climate change depends on its previous experiences, arguing that it is improbable for an organization to effectively respond to changes outside its "range of experience" (Tompkins and Adger 2005, pg. 567). This point further emphasizes the importance of collaborating and forming networks. An organization that communicates and forms networks with other groups can benefit from unique insights and approaches to problem solving outside its own range of experience, thereby enhancing its ability to respond and cope with change. Table 2 presents a summary of major themes and capacity indicators related to organizational dynamics capacity for climate change adaptation.

Table 2 – Summary of indicators of organizational dynamics capacity for climate change adaptation

Element of capacity	Themes
• Flexibility	• Ability to modify management approaches; ability to problem solve when constrained by resources; support for creative and innovative thinking; consideration of different perspectives for problem solving
• Learning and adaptive management	• Ability to learn from past experiences; ability to develop new understandings and techniques and acquire new information; assessment of past responses to change; dedication to continuous development and learning; opportunities for training and skill development and opportunities to use newly acquired skills
• Teamwork, networks and partnerships	• Communication and collaboration among employees and departments; collaboration and partnerships with other organizations

2.2.2 Action Environment

Research on capacity and resource management consistently discusses the significance of community and political environments to capacity, capacity building and resource management. As identified in research on capacity evaluation, the action environment refers to nongovernmental organizations, stakeholders, landowners and local residents (Ivey *et al*. 2006a), while the political environment refers to local political leaders (de Loë *et al*. 2002). In this review, the term *action environment* is used to conceptualize the community and political environments within which organizations exist.

Research identifies the role of community as critical to effective resource management and capacity for a number of reasons (Ivey *et al*. 2006a; Ivey *et al*. 2004; de Loë *et al*.

2002; Armitage 2005). First, community members can contribute skills, knowledge and financial resources to an organization, thereby enhancing its overall capacity (de Loë *et al*. 2002). Additionally, support from community members can increase the likelihood that an organization's management tasks will be undertaken successfully (Tompkins and Adger 2005; de Loë *et al*. 2002). If members of the public are able to participate in management decisions and express their concerns and interests, they are more likely to support projects in their community (de Loë *et al*. 2002). Blanco (2006) explains that local communities should be involved in decision-making for climate change adaptation policies and that pertinent information should be made available to the public. Political capacity, on the other hand, can be conceptualized as the level of support and leadership provided by local political leaders (de Loë *et al*. 2002). Leadership from local politicians for management tasks can provide organizations with essential guidance and direction, in addition to facilitating a flexible organizational environment -- a characteristic identified as critical to promoting learning and enhancing adaptive capacity. Further, local politicians can provide support for specific projects and develop institutional arrangements which support these tasks (de Loë *et al*. 2002).

Indicators of capacity in the action environment can include the level of public awareness and support for a particular management tasks and the presence of public education programs, as well as encouragement for public participation and consultation. Indicators of political capacity can include the promotion of specific management tasks through the development of institutional arrangements that effectively guide organizations, financial support or technical support, and the presence of horizontal and vertical linkages with other organizations and community members (Ivey *et al*. 2004; Ivey *et al*. 2002; de Loë *et al*. 2002). Table 3 provides a summary of indicators of capacity for climate change adaptation in the action environment.

Table 3 – Summary of indicators of capacity for climate change adaptation in the action environment

Element of Capacity	Theme
• Community support and involvement	• Opportunities for community members to participate in decision-making; education opportunities for public
• Political support	• Leadership and guidance provided by political leaders; financial and technical support; development of legislation and guidelines; willingness to form partnerships with other organizations and governments

2.2.3 Institutional Environment

Institutional arrangements are defined herein in as "legislation and regulations, policies and guidelines, administrative structures, economic and financial arrangements, and political structures and processes" (Ivey *et al*. 2006b, pg. 196). The significance of the institutional environment is consistently addressed in capacity and capacity building literature. Grindle and Hilderbrand (1995) suggest that, although internal characteristics like organizational dynamics and human resources are indeed important to capacity, one must also consider the broader factors that influence the functions and processes of an organization, government or community. For example, the authors explain that problems with the performance of a country have often been regarded as faults at the organizational or individual level, when in fact they resulted from broader economic, social and political problems. Conversely, Biswas (1996) maintains that capacity is determined primarily by human resources capability, arguing that capable and talented employees can effectively perform, even in the presence of weak institutional arrangements. Regardless, capacity evaluations and capacity building initiatives should consider broader contextual circumstances including institutional arrangements and institutional structures in addition to organizational dynamics and human resources. As Fazey *et al*. (2007) explain, it is the

combined effect of institutional features and organizational resources that influences adaptive capacity.

When assessing climate change adaptation, one must consider the role of provincial and federal legislation and their roles in local level management responsibilities. As explained by de Loë *et al*. (2002), even local governments that are committed and supportive can be limited in their capacity if support and enabling legislation from senior governments is lacking. In a similar vein, Mitchell (2005) explains that responsibilities that are spread out over various levels of government both vertically (i.e., from one level of government to another) and horizontally (i.e., between different government departments) can result in unnecessary "investments" with several different organizations making decisions related to one activity. This further emphasizes the importance of vertical and horizontal collaboration to organizational capacity.

Research suggests that institutional arrangements and institutional structures can be both beneficial and problematic to capacity. According to Grindle and Hilderbrand (1995), rules, policies and procedures are necessary to guide an organization in its daily functions and responsibilities. Ivey *et al*. (2004) add that institutional arrangements act to identify the roles and responsibilities of agencies and individuals involved in particular management undertakings. Strong, clear policies, and support for their implementation are necessary in order for an agency or organization to understand its defined responsibilities, and to effectively undertake related tasks (Franks 1999).

In contrast, institutional arrangements and structures can lead to inflexibility, thereby impeding the capacity of an organization, agency or group (Grindle and Hilderbrand 1995). For example, Naess *et al*. (2005, pg. 136) determined that institutional relations and structures delayed learning with respect to municipal flood response in Norway because they acted as "a filter through which new perspectives must pass". Ivey *et al*. (2004) determined that overlapping responsibilities among various actors involved in water management resulting from federal and provincial legislation and guidelines limited the effective management of water shortages in Ontario.

In order for institutional arrangements to enhance capacity rather than limit it, they must be clear and avoid overlap (Ivey *et al*. 2004). Grindle and Hilderbrand (1995, pg. 454) add:

> rules must be straightforward and consistent to ensure transparency and fairness, but they must also provide organizations with clear performance standards, room to manoeuvre in solving problems, and control over decisions that are central to producing the results they are responsible for.

Additional indicators of institutional capacity can include the presence of local, provincial and federal legislation that provides local level guidance for specific management tasks (Timmer *et al*. 2007). Table 4 provides a summary of major themes and indicators of capacity related to the institutional environment.

Table 4 – Summary of indicators of capacity for climate change adaptation in the institutional environment

Element of Capacity	Theme
• Presence and quality of institutional arrangements	• Do appropriate provincial and federal policies exist; are they clear or is there overlap between different arrangements; do they provide appropriate guidance for management activities; are responsibilities undertaken by one agency/department or are they spread out over different agencies;

2.3 Evaluating Capacity

Different methods to conduct capacity evaluations have been identified in the literature. In Gibbon *et al.'s* (2002) research on evaluating community capacity, the authors discuss the use of indicators based on domains or themes identified in the literature as important to the assessment. In this research, the authors describe the use of ranking values assigned to indicator questions as an evaluation method. For example, in the case of the frequency of occurrence of community meetings, a minimum value of one indicated that

regular meetings did not occur and a maximum value of four indicated that meetings with high attendance occurred regularly (Gibbon *et al*. 2002).

Recent studies involving capacity evaluations in the water sector have commonly used frameworks comprised of indicator questions or measures for evaluating capacity (de Loë *et al*. 2002; Ivey *et al*. 2002; Ivey *et al*. 2004; Ivey *et al*. 2006a). For example, Ivey *et al*. (2006a) developed an evaluative framework which used indicator questions to assess four key elements of capacity in the context of source water protection. In this type of framework, conclusions regarding the capacity of a community or agency can be drawn from the type of response to an indicator question. A positive response to a question points to the presence of a particular indicator of capacity, thereby contributing to the capacity of a community or agency (Ivey 2000). Because this framework allows for an evaluation of capacity based upon a key set of capacity indicators, it is argued to provide a complete evaluation of capacity (Ivey 2000). This type of evaluative framework draws on McGuire *et al*.'s (1994) research on building development capacity in nonmetropolitan communities which used indicators and indicator questions to evaluate capacity. Merry *et al*.'s (1995) research on irrigation performance capacity used a similar but more simplistic approach to evaluate capacity, using five basic questions based on five key characteristics of capacity. In a similar vein, Alfonso *et al*. (2008) used indicators and related questions to assess the local capacity for health intervention which allowed for the identification of barriers and facilitators of capacity.

Ivey *et al*. (2004) used indicators and indicator questions to evaluate community capacity for adaptation to climate change based on information from literature pertinent to capacity, adaptation and water resources. The authors note: "Evaluation of exhibited capacity to adapt to existing conditions offers glimpses of the factors that might affect the ability of this community, and perhaps others, to adapt to changes in climatic variability brought on by climate change" (Ivey *et al*. 2004, pg. 39).

The evaluative framework design for this research draws upon the frameworks used in Ivey *et al.'s* (2004) research as well as Ivey's (2000) research on evaluating conservation authorities' capacity to manage groundwater, Ivey *et al*. (2006a) evaluation of the local

capacity for source water protection and McGuire *et al.*'s (1994) work on building development capacity in nonmetropolitan communities. These authors employed the method of developing an evaluative framework with indicators of capacity determined from the literature and indicator questions to correspond with the identified themes. This method of evaluation was selected because it allows for a systematic and broadly-based evaluation using key indicator questions, and because it has been used successfully in comparable studies that evaluated capacity in water resource management. Tables 5, 6, 7 and 8 provide the indicators and indicator questions that will be used to evaluate Conservation Authorities capacity for climate change adaptation in watershed management, based on the themes identified in the literature review. The method of analysis used to assess the responses to the indicator questions will be discussed Chapter Three.

Table 5 – Evaluative framework for organizational resources capacity for climate change adaptation

Theme	Indicator of capacity	Indicator question	Rationale
Human resources	Availability, interest, expertise, and effective use of staff Access to external consultants (if required) and ability to interpret the information they provide	Does the CA have adequate staff available for current and future (i.e., climate change) activities?	If staff availability is a problem affecting current programs within the CA, this could also create challenges for the organization with the addition of climate change activities.
		Does the CA have access to staff or external consultants with appropriate skills and expertise? If the CA uses external consultants, is staff able to interpret the information they provide?	Without access to skilled staff or external consultants, the CA could face challenges in performing specific tasks. If problems do exist, this could have potential implications for climate change integration, depending on the area of expertise that is lacking.
Financial resources	Access to and source of financial resources Management of financial resources	Are sufficient financial resources available to the CA for current and climate change related watershed management activities?	If the CA is struggling financially with existing programs, it may not have the resources to take on additional responsibilities involving climate change.
		Is the CA able to generate financial resources and/or secure external sources of funding?	The majority of funding for CA programs is generated through revenue from core programs and services. The CA's ability to maintain existing programs and/or take on additional tasks involving climate change could be affected if the organization is unable to generate revenue or secure external support.

		Is the CA able to maintain a balanced budget?	Demonstrated management of financial resources is one indicator overall financial capacity
Information resources	Access to and availability of necessary data and information	Are appropriate information and technical resources available to the CA for current activities and climate change related activities?	Existing data gaps and information needs could affect current CA activities, and could have implications for climate change integration. The organization's priority could be to support existing needs before even considering what may be required for climate change.

Table 6 – Evaluative framework for organizational dynamics capacity for climate change adaptation

Theme	**Indicator of capacity**	**Indicator question**	**Rationale**
Flexibility, learning and , adaptive management	Ability to learn from past experiences and use adaptive management approaches Ability to develop new under-standings and techniques and acquire new information; Dedication to continuous development and learning and opportunities for staff training and skill development	Does the CA continuously review or assess its management approaches or adapt them to better achieve desired program outcomes (adaptive management)? Is the CA flexible in its approaches to management and problem solving?	Adaptive management is important for climate change adaptation "because it recognizes that there are limits to predictive abilities" (Pahl-Wostl 2007). Further, it facilitates change to organizational procedures as new information/technology becomes available.
		Is the CA dedicated to continuous learning and development, and does it provide training and skill development opportunities for employees?	Support for continuing development of staff is important for climate change integration, as employees may be presented with new information and procedures.
Networks, partnerships and communication	Communication and collaboration among employees and departments Collaboration and partnerships with other organizations	Do employees within the CA communicate and collaborate with each other and does the CA facilitate collaboration?	Employee collaboration can contribute to the CA's capacity for climate change integration, particularly if certain staff members or departments have more experience and knowledge in this area.
		Does the CA form partnerships with other organizations	Through partnerships with other organizations, resources, expertise and experience can be shared, which is important if the CA is interested in climate change adaptation but is lacking the resources to do so.

Table 7 – Evaluative framework for institutional environment capacity for climate change adaptation

Theme	Indicator of capacity	Indicator Questions	Rationale
Presence and quality of institutional arrangements	Appropriate provincial and federal policies for climate change adaptation and watershed management and clear policies and guidelines	Do appropriate provincial policies exist for watershed management and climate change adaptation?	Appropriate guidelines and legislation are necessary to guide CA's in their regular watershed management activities and for these organizations to understand their responsibilities. Support and clear direction is also important to guide climate change adaptation at the local level.
		Is legislation clear and well defined?	
		Does legislation provide appropriate guidance for management activities?	

Table 8 – Evaluative framework for action environment capacity for climate change adaptation

Theme	Indicator of capacity	Indicator Questions	Rationale
Community support and involvement	Opportunities for community members to participate in decision-making Education opportunities for public Promotion of community awareness and support for CA activities	Are opportunities available for the community to participate in decision-making?	Involvement of the community in decision-making for the CA and through education and other activities that promote awareness of the organization can encourage support by the community for CA activities. The community can also share resources and knowledge with the organization. Educating the community about climate change adaptation could increase the success of efforts by the CA.
		Are education opportunities made available to the public and has the organization developed activities that promote community awareness and support?	
Polit*ical support*	Leadership and guidance provided by political leaders Support by municipal and provincial governments for CA activities through financial and/or technical support	Is adequate support provided by the municipal and provincial governments	Municipal and provincial governments can provide support to the CA through resources which can increase the capacity in areas that may be lacking and increase the likelihood of a successful project.
		Has the Conservation Authority formed linkages/established a good working relationship with the municipality and provincial and federal (if applicable) governments?	

CHAPTER THREE

RESEARCH METHODS

This research uses a case study design to evaluate the capacity for climate change adaptation in watershed management in Ontario Conservation Authorities (CAs). The research methods discussion is organized around the research objectives listed in Chapter One.

3.1 Objective One

Objective 1, development of an evaluative framework for the assessment of Conservation Authority capacity for climate change adaptation, was completed through a review of academic literature related to adaptive capacity including community management capacity, water management capacity and organizational management capacity; climate change adaptation; and, watershed management. The literature is discussed under major capacity themes or environments: the ***institutional environment*** (e.g., political support and guidance), the ***organizational environment*** (e.g., organizational resources and organizational dynamics) and the ***action environment*** (e.g., community awareness and support). These environments are discussed in detail in Chapter Two. The factors identified in the literature as contributing to or limiting CAs' capacity for climate change adaptation were used for the development of an evaluative framework to assess the capacity of CAs to integrate climate change adaptation into watershed management.

Objective 1, development of an evaluative framework for the assessment of the capacity of Ontario CAs to integrate climate change adaptation into watershed management, was achieved through the literature review and is described in detail in Chapter Two. The evaluative framework uses indicators of capacity in the form of indicator questions which are based on elements of capacity identified in the literature. For this evaluation, a positive response to an indicator questions suggested the presence of capacity.

3.3 Objective Two

Objective 2, evaluation of the capacity of Ontario CAs for climate change adaptation was accomplished through a qualitative case study of two CAs. A case study research strategy permitted the collection of data from a range of sources, including reports, meeting minutes and other documentation, and interviews. According to Yin (2003, pg. 15), a case study research strategy is beneficial for evaluation research because it "can *illustrate* certain topics within an evaluation, again in a descriptive mode". The case study approach was appropriate for this research because it facilitated the collection of current (e.g., interviews) and historical (e.g., documents and archival records) information, and an evaluation of CAs' capacity for climate change adaptation

A multiple-case study evaluation of two CAs was undertaken for this research. Yin (2003) argues that multiple-case studies, even using only two cases, are favored over single-case studies because they can broaden the generalizability of the research. The two case studies evaluated in this research, North Bay-Mattawa Conservation Authority (NBMCA) and Credit Valley Conservation (CVC), were selected because they possessed different characteristics when compared (e.g., size of watershed jurisdiction, financial and human resources, location). An evaluation of capacity in CAs with contrasting or differing characteristics was preferred for this research because it allowed for an assessment of capacity and provided insight into the factors affecting CAs of different size and with different resources. Yin (2003) argues that the validity of the findings may be strengthened if the contrasting case studies provide similar conclusions.

3.3.1 Case Study Data Collection

The evaluative framework developed for Objective 2 was used to assess Ontario CAs' capacity for climate change adaptation integration. Information for this multiple-case study evaluation included open-ended, semi-structured key informant interviews with employees in Conservation Authorities and reviews of documents including annual reports, financial statements, press releases, agendas and meeting minutes, and provincial and federal reports and policies. Excluding agendas and meeting minutes, 118 documents, press releases and newsletters were reviewed. Meeting minutes from 2005 to

2008 were reviewed. The information obtained in interviews, documentation analysis, a literature review and direct observation was used to conduct an assessment of capacity, based on the indicator questions in the evaluative framework. The collected information was analyzed to provide responses to indicator questions in the evaluative framework. Multiple sources of data permitted data triangulation whereby the researcher attempted to corroborate information from different sources to develop a conclusion for the capacity evaluation (Yin 2003).

3.3.1.1 Interviews

The interview method was selected for this study to gain the perspectives of key informants in the case study CAs regarding their organizational dynamics and to gather financial, human and technical resources information to corroborate data gained from primary sources (e.g., document analysis, meeting minutes) and secondary sources (e.g., literature review). Prior to conducting key informant interviews, this study received ethics approval from the Office of Research Ethics at the University of Waterloo.

Six semi-structured, open-ended interviews were conducted with key informants in the NBMCA and three were conducted in CVC. Semi-structured, open-ended interviews enabled informants to provide detailed explanations and informed opinions about specific issues raised during the interview process (Yin 2003). Semi-structured, open-ended interviews have been used in previous studies evaluating Conservation Authority capacity (e.g., Ivey *et al*. 2002; Ivey *et al*. 2006). An identical set of questions was used in key informant interviews with each CA. Interview questions were developed based on the indicator questions in the evaluative framework (see Appendix I). Key informants were selected to represent employees in several departments, at comparable levels and with various job responsibilities to understand the perspectives, resources and dynamics in different areas of the organization.

3.3.1.2 Documentation Analysis

Documentation was used to corroborate information from key informant interviews and to provide additional information that was not presented in interviews (Yin 2003). Types

of documentation included agendas and meeting minutes, formal studies including watershed and subwatershed management reports, internal documents, and press releases. Based on the data available from both CAs, meeting minutes from 2005 to 2008 were reviewed to maintain consistency in each case study evaluation. Documents were reviewed to obtain information to answer the indicator questions posed in the evaluative framework. Due to constraints imposed by CVC and unavoidable circumstances, the methodological approach undertaken varied slightly in the two case study CAs. The methodological approach employed in each CA is described below.

Case Study One: North Bay-Mattawa Conservation Authority

Interviews

To secure interviews with key informants at the NBMCA, an information letter was first sent to the General Manager via email. This letter included information about the proposed research, identified potential key informants based on a staff directory available on the organization's website, and inquired about the organization's interest in participating in the study. Six semi-structured, open-ended interviews were conducted with key informants in person over a one-week period in the NBMCA including the GIS Specialist, Communications Specialist, Manager of Development and Planning, Water Resources Specialist, Manager of Source Water Protection and the General Manager. Each interview was audio recorded and notes were taken by the interviewer. Interviews ranged in length from approximately eighteen to fifty-four minutes. The employment period of key informants interviewed at the NBMCA ranged from approximately ten months to seventeen years. Interviews were later transcribed for the purpose of analysis.

Documentation

The following forms of documentation were analyzed for the case study evaluation of the NBMCA:

- Agendas and meeting minutes (January 2005 to February 2008);
- Formal studies including watershed characterizations, subwatershed management plans, groundwater studies, and water management plans; and,

- Administrative documents including organizational progress reports

The NBMCA has a library which includes a variety of documents, reports and resources, as well as an internal online resource database. Documentation reviewed for this research was retrieved from the library and the internal database. The NBMCA supplied the researcher with a computer and an office for the weeklong visit and provided unrestricted access to available documentation. During the visit, the researcher gathered documentation from the resources available in the library and internal database including the most recent watershed characterizations, water management reports and internal documents, current and past agendas and meeting minutes, and past CA reports. Case study notes were taken during a review of documentation for information to corroborate data provided in key informant interviews and to gather any pertinent information that was not provided in interviews. When reviewing the documentation, the researcher looked for information that related to the major themes of the evaluative framework and for information that corroborated that data obtained during interviews. This information was used to provide answers to the indicator questions in the evaluative framework. It should be noted that at the time of this study pertinent reports and meeting minutes for this research were not available for public access on the NBMCA's website.

Direct Observation

The researcher made a weeklong field visit to the NBMCA office in North Bay, Ontario. During this visit, interviews were conducted with key informants and documents were collected to gather information to inform the indicator questions in the evaluative framework. The researcher attended a public open house, held by the NBMCA's drinking water source protection team and its participating consultants, in South River, Ontario. The purpose of the meeting was to allow the NBMCA and consultants to explain existing plans and to gather information and knowledge about potential threats to the municipal drinking water source from the local community. The researcher attended this meeting to observe the NBMCA's public outreach. According to Yin (2003, pg. 93), "Observation evidence is often useful in providing additional information about the topic being studied". To this extent, the researcher was able to observe the organization's

regular day-to-day activities, gather additional information including brochures and pamphlets available for public use and have informal conversations with CA employees.

Case Study Two: Credit Valley Conservation

Interviews

To secure interviews with key informants at CVC, an information letter was sent to the Manager of Corporate Communications, as per the instructions available on the organization's website. The CVC website does not include a staff directory. Therefore, potential key informants were identified from an organizational structure diagram on the website. An effort was made to ensure that consistent position representation was maintained across departments in the organization, to correspond with key informants in the NBMCA. The CVC's senior management team requested the interview questions be submitted for review prior to agreeing to participate in the study. After reviewing the questions, CVC agreed to participate and identified two employees who they felt could best answer the research questions.

Due to unforeseen circumstances, only one of two key informants initially identified by CVC was available to participate at the time the interviews. Two additional key informant interviews were secured, based on recommendations from the first key informant. Three interviews were conducted with key informants in CVC including the Director of Water Resources, the Director of Restoration and Stewardship, and the Director of Lands and Conservation Areas. One interview was conducted in person at CVC's office in Mississauga, Ontario and two were conducted by phone. Each interview was audio recorded and notes were taken by the interviewer during the interview. Interviews ranged from approximately thirty-five minutes to one hour and fourteen minutes. The period of employment of key informants interviewed at CVC ranged from just over one year to approximately twenty-three years. The interviews were then transcribed for the case study evaluation.

Documentation

The following forms of documentation were analyzed for the case study evaluation of CVC:

- CA Board of Director meeting minutes (January 2005 to May 2008);
- Formal studies including watershed characterizations, subwatershed management plans, groundwater studies, and water management plans;
- Administrative documents including organizational progress reports; and,
- Press releases and newsletters.

Documentation reviewed for this research was retrieved from CVC's website. The website provided access to resources and publications including watershed and subwatershed management studies, a watershed report card, water management strategies, monitoring program reports, newsletters, press releases, and Board of Director's meeting minutes. It was the intention of the researcher to review documentation at the CVC office in Mississauga, Ontario. However, CVC employees reported that the documents had been moved to make room for additional workspace and thus were not available during the study period (B01). While recognizing this as a possible study limitation, the researcher feels strongly that the information collected from the CVC website is comparable to that collected from the NBMCA library and internal database, and therefore data collection consistency was maintained between the two case study sites. For example, documentation collected during site visits at the NBMCA including meeting minutes, watershed characterizations, water management reports and organizational documents, were all available through CVC's public website. The documentation was reviewed and case study notes were taken to gather data to corroborate information provided in key informant interviews and to gather any pertinent information not provided in interviews to inform answers to the indicator questions in the evaluative framework.

Direct Observation

One field visit was made to the CVC case study site for the purpose of conducting interviews. Due to challenges encountered by the researcher in gaining access to the CVC library, as well as financial limitations and time constraints, the researcher was unable to conduct a weeklong visit to CVC in a similar manner to that undertaken with the NBMCA. The researcher was able to gather additional information including brochures and pamphlets available for public use during the site visit.

3.3.2 Case Study Evaluation

An evaluation of the current capacity of the two case study Conservation Authorities was conducted through the use of the evaluative framework (Tables 5 to 8) developed in Chapter Three. The evaluative framework was developed from literature review which identified major elements that contribute to the adaptive capacity of an organization. The evaluative framework has three major environments - the *organizational environment*, the *action environment* and the *institutional environment*. The evaluative framework presented in tables 5 to 8 include specific indicators of capacity and corresponding indicator questions based on the elements of capacity identified in the literature.

Transcribed interviews were reviewed to gather data that corresponded to themes of capacity for climate change adaptation identified in the literature; to look for quotations that described elements of capacity in relation to the identified themes; to gather information to corroborate other data sources; and to gather for information that related to the capacity themes that was not available from other sources. A review of documentation was also conducted in the same manner as was the interview analysis, and for the same purpose. For example, when gathering data pertaining to information resources capacity in Credit Valley Conservation's Strategic Plan 2006 (CVC 2007a), discussion of data gaps and needs in this report were recorded, in addition to the gaps and needs identified in interviews with key informants. When gathering information to inform the indicator questions related to the CA's communication with the watershed community, the researcher questioned key informants about their organization's efforts at public education and reviewed documents, press releases and newsletters to look for

evidence and examples of how the authority promoted community involvement, and collected additional information about this theme.

Data were analyzed to provide responses to the indicator questions. A positive response suggested the presence of capacity. For example, using the indicator question: "Are education opportunities available to the public?", if it was determined through an analysis of collected data that education programs and activities are currently available to the community, this would provide a positive response to the indicator question. Therefore, this would suggest the presence of capacity related to the community support and involvement capacity theme. The evaluative framework for this research is structured in such a way that the CA's overall capacity for climate change adaptation is evaluated based on its capacity in three environments – the *organizational environment*, the *action environment* and the *institutional environment*. A summary of the strengths and weaknesses contributing to or limiting capacity for each minor theme in each environment is provided, followed by a summary of the overall capacity strengths and weaknesses for each environment. Finally, overall evaluation descriptions and framework results for the North Bay-Mattawa Conservation Authority and Credit Valley Conservation are provided. Conclusions for the sub-sections of each environment and for the CA's overall capacity are drawn from the strengths and weaknesses determined in each environment, which point to areas where capacity may be limited and/or enhanced. The case study evaluations are described in two chapters, Chapter Five, North Bay-Mattawa Conservation Authority, and Chapter Six, Credit Valley Conservation. Chapter Four describes and evaluates the provincial setting for climate change adaptation integration in CAs.

3.4 Objective Three

Objective 3 was achieved through a comparison of the two case study CAs. A comparison of the case study CAs is provided; the capacity of CA's for climate change adaptation integration is discussed; and, recommendations for capacity-building in Ontario CAs are included.

3.5 Study Limitations

The evaluative framework developed for this research sought to encompass all of the components of capacity within and outside an organization that could affect its capacity for climate change adaptation. While the evaluative framework successfully demonstrated the interconnected nature of elements affecting an organization's capacity, it could have been beneficial to conduct interviews with community members, the provincial government and Conservation Ontario for additional information and insight rather than relying solely on key informant interviews with CA employees and a documentation analysis.

CHAPTER FOUR

WATERSHED MANAGEMENT IN ONTARIO: THE SETTING FOR CLIMATE CHANGE ADAPTATION

The purpose of this chapter is to describe and evaluate the capacity for climate change adaptation in the institutional environment (e.g., policies, legislation, and political support, guidance). An evaluation of institutional environment capacity is appropriate in this chapter because capacity in this environment pertains to both case studies. This chapter first describes the setting for watershed management in Ontario and outlines common barriers and opportunities to the success of this management approach. This is followed by an evaluation of the capacity for climate change adaptation in the institutional environment based on a review of existing institutional arrangements for climate change adaptation in watershed management.

Included in this chapter is a description of the governing agencies involved and the policies and legislation guiding water management; the context for climate change adaptation in Ontario, including examples of initiatives being undertaken by the Federal and Provincial government, Conservation Ontario and Conservation Authorities (CAs); and, an evaluation of the role of the institutional environment in affecting the capacity for climate change adaptation in CAs. This institutional environment is significant to the capacity of an organization because it defines the roles and responsibilities of management organizations, and can indicate commitment and support for specific watershed management goals and objectives. To establish the context for climate change adaptation, the setting for watershed management in Ontario is first discussed.

4.1. Watershed Management in Ontario

This section provides a description and evaluation of watershed management in Ontario, with respect to the agencies that guide and carry out watershed management.

Watershed management in Ontario falls mainly under the guidance of the provincial government (Brandes *et al*.2005; CO 2001). Watershed management partners in Ontario

include the public, private water users, First Nations and other aboriginal groups, Conservation Authorities, and municipalities (CO 2001). Watershed management requires a combined "bottom up" approach (i.e., local level decision-making) and "top down" approach (i.e., provincial and federal agencies) with support and involvement from all levels of government and the community (CO 2001). Environmental regulations are enforced by the provincial government; water supply, wastewater, storm water and rural municipal drains are controlled by municipalities, subject to provincial regulation and oversight; and, watershed management activities including monitoring, stewardship and environmental advisory services are undertaken by Conservation Authorities (CO 2001). Numerous provincial ministries and agencies are involved in watershed management; however, water quality and quantity issues are mainly guided by the Ministry of the Environment and the Ministry of Natural Resources (CO 2001; Brandes *et al*.2005). Some federal support and guidance for activities related to watershed management in Ontario is provided through the Federal Fisheries Act and funding support for Areas of Concern in the Great Lakes-St. Lawrence Basin, as well as for individual watershed projects (CO 2001).

The federal government's role in water management has been heavily criticized by non-governmental organizations, with many pointing to the need for a federally-guided water strategy in Canada. Historically, considerable discussion has centered on the fragmented nature of water management in Ontario and limited enforcement or utilization of existing policies (i.e., the *Federal Water Policy*) (Brandes *et al*. 2005). Examples of these criticisms are provided below:

> The lack of a comprehensive water policy and the fragmentation of water responsibilities has sometimes led to uncertainty about specific water management roles and responsibilities and resulted in inconsistent links between planning and implementation (CO 2001, pg. 38).
>
> The fragmentation of water management responsibilities in Ontario currently presents a challenge to watershed managers. It has led to inefficiencies and duplication of effort, lack of monitoring, and information gaps. Notable gaps are found in the area of groundwater management. Yet, where support from government

> agencies and water users has occurred, co-ordination has been possible leading to actions that have effectively addressed pressing water issues (CO 2001, pg. 42).
>
> With a multitude of agencies and departments sharing authority, water management in Canada has been described as "a bewilderingly complex administrative galaxy" (Brandes *et al*. 2005, pg. 29).

Despite these constraints and weaknesses, watershed management plays a vital role in protecting natural resources (Ontario 1997).

4.1.1 Conservation Authorities

Conservation Ontario (CO) is the umbrella organization representing Ontario's thirty-six Conservation Authorities (CO 2005). The vision of Conservation Ontario is: "watersheds where human needs are met in balance with the needs of the natural environment" and its mission is: "to provide leadership through coordination of watershed planning, implementation of resource management programs and promotion of conservation awareness, in cooperation with others" (CO 2005). Conservation Ontario works with the local and political community to communicate, establish relationships and assist with decision making in Conservation Authorities (CO 2005).

The *Conservation Authorities Act*, passed in 1946, regulates Ontario Conservation Authorities (CAs) and provides them with the authority to control actions related to water quality (e.g., dam operations, water quality surveys, input into planning decisions); water quantity (through flood and erosion control, and fill, construction, and watercourse alteration regulations); and land use (through floodplain management, shorelines and conservation lands) (Ontario 2003; Ontario 2006a).

Ontario Conservation Authorities (CAs) were established in 1946 with the passing of the Conservation Authorities Act of the Province of Ontario (CO 2005; Mitchell and Shrubsole 1992). Interest in locally based conservation evolved in the 1920s and 1930s over concerns about drought, deforestation, soil loss and flooding in Ontario, and due to recognition that a different scale for resource management along watershed boundaries was necessary (CO 2005). The purpose of CAs is to assist in provincial and municipal

coordination of resource management and to encourage and support resource management initiatives with the specific mandate "to further the conservation, restoration, development and management of natural resources other than gas, oil, coal and minerals" (Mitchell and Shrubsole 1992, pg. 1). Today CAs are involved in a range of activities and programs including community relations, water quality monitoring, outdoor recreation, and fish and wildlife management (CO 2005).

Shrubsole and Mitchell (1992, pg. 65) provide a summary of the range of powers of CAs under *the Conservation Authorities Act* of 1946:

- "study and investigate the watershed and to determine a program whereby the natural resources might be conserved, restored, developed, and managed;"
- "acquire by purchase, lease or otherwise and to expropriate any land that it might require;"
- "determine the proportion of the total benefit afforded to all municipalities received by each of the;"
- "erect works and structures and create reservoirs by the construction of dams and other works;"
- "control the flow of surface waters in order to prevent floods or pollution or to reduce the adverse effects from them;"
- "alter the course of any river, canal, brook, stream or watercourse, divert or alter, temporarily or permanently, the course or any river, stream, road, street, or way;"
- "use lands owned or controlled by the authority for such purposes considered proper and not inconsistent with its objectives;"
- "plant and produce trees on Crown lands with the consent of the Minister, and on other lands with the consent of the owner;"
- "collaborate with departments and agencies of government, municipal councils and local boards and other organizations;" and
- "cause research to be done."

Ontario Conservation Authorities are highly regarded at a global level: "From a global perspective, Ontario's Conservation Authorities are seen as being successful working models for effective watershed management" (CO 2001, pg. 34). Today there are thirty-six Conservation Authorities in Ontario, five in northern Ontario and thirty-one in southern Ontario (CO 2005). As of 2004, CA jurisdiction covered approximately 90% of the population in Ontario, including over two hundred and fifty municipalities (CO 2004a).

Staff resources, watershed populations and areas of jurisdiction range greatly in CAs. In 1999, the number of full time permanent and contract staff in CAs ranged from a maximum of 392 to a minimum of 4 (Ivey 2000). Watershed management activities undertaken by Conservation Authorities vary greatly. This is the result of variations in resource management issues in different watershed, differing financial and technical situations in CAs, and environmental characteristics (e.g., climate and geology), and population (CO 2001). On average, the collective annual spending in CAs is approximately $160 million dollars (CO 2005). Revenue sources for CAs come from provincial transfer payments and special projects, federal government support, municipal levies, municipal special projects, and self generated funding (CO 2004b). The breakdown of 2002 Conservation Authority Sources of Revenue is as follows (CO 2004b):

- 47% - Self Generated
- 32% - Municipal Levy
- 8% - Municipal Special Project
- 6% - Provincial Special Project
- 5% - Provincial Transfer Payment
- 2% - Federal Government

Over the past decade, Conservation Authorities have faced major provincial funding cutbacks, resulting from changes in government during the "Common Sense Revolution" in 1995 (Michaels *et al*. 2006). In 2004, CAs received $7.6 million compared to $58.9 million received in 1992, an 87% reduction (CO 2004b). In 2002, the shortfall of provincial funding to CAs was $9.1 million, which was projected to increase to $13.8 million in 2005 (CO 2004b). Conservation Ontario (2004b) reports that, because of these funding cutbacks and as a result of the additional responsibilities given to municipalities due to funding reductions, CAs are facing significant challenges in fulfilling their obligations. CAs have responded to these financial constraints by taking actions including selling land and decreasing staff resources (Michaels *et al*. 2006), as well as sharing resources by developing and strengthening partnerships with other organizations (CO 2004b). As of 2000, staff resources in CAs were reduced by 50% to 75% compared to 1995 (Michaels *et al*. 2006). Michaels *et al*. (2006) explain that, prior to this, CAs had

typically not been presented with rapid reductions in provincial funding and the quick organizational changes these reductions required:

> The fallout from the election of the Conservatives to the Ontario provincial government in 1995 came suddenly to the extent that some conservation authorities were caught off guard by the depth and rapidity of the loss of provincial funding. The budget cuts forced conservation authorities to manoeuvre at a faster rate than they would have chosen to do so (Michaels *et al*. 2006, pg. 988).

Conservation Authorities adapted to these cutbacks in a number of ways, including reducing their broad involvement in watershed management activities to focus solely on water management; by proactively seeking external sources of funding, developing and strengthening relationships with other organizations; and, raising user fees (Michaels *et al*. 2006). Conservation Authorities demonstrated flexibility and adaptive capacity through their responses to these cutbacks.

Attention to drinking water protection and watershed management in Ontario has grown significantly as a result of the incidence of death and illness in Walkerton, Ontario in 2000 caused by the consumption of contaminated drinking water. Stemming from this crisis, watershed management was affected when new legislation was developed by the provincial government for the protection of drinking water sources. Specifically, the *Clean Water Act* was enacted in 2007 by the Government of Ontario, with the objective to "protect municipal drinking water through a collaborative and locally driven multi-stakeholder process" (Ontario 2008a). Conservation Authorities are now involved in the coordination of source protection planning; they work with community members, municipalities and other organizations. CAs take on the role of Source Protection Authority and coordinate and provide technical assistance to the Source Protection Committee, in the preparation of terms of reference, assessment reports and source protection plans. These responsibilities include the identification of threats to drinking water sources in defined source protection areas, in conjunction with municipalities, community groups and other stakeholders (Ontario 2008a). Funding for source water protection planning comes from the Ministry of the Environment and the Ministry of Natural Resources, and Conservation Ontario works with CAs to provide guidance and

support for the planning process (Ontario 2008a). From 2004 to 2008, $120 million was committed by the Province for source protection planning. At the time of this evaluation, climate change adaptation was not in the mandate for source water protection planning.

4.1.2 Evaluations of Watershed Management

Globally, Ontario Conservation Authorities are highly regarded for their approaches to watershed management (CO 2001). Identified benefits to watershed management include the following:

1. "partnership formation among agencies";
2. "role and responsibility clarification";
3. "information sharing";
4. "greater stakeholder involvement"; and,
5. "consensus building" (Ontario 1997, pg. 8-9).

Nevertheless, evaluations of watershed management emphasize that improvements are needed and highlight factors affecting the overall ability of organizations involved in the process (Ontario1997; CO 2001).

In 1997, the Watershed Planning Implementation Project Management Committee (PMC) consisting of the Ontario Ministries of Environment and Energy, Natural Resources, Municipal Affairs and Housing and Agriculture, Food and Rural Affairs, the Association of Municipalities of Ontario, and the Association of Conservation Authorities of Ontario released a report that evaluated watershed management in Ontario (Ontario 1997). The report concluded that watershed management is imperative for the protection of the natural environment. Additionally, it directed attention to various barriers to this approach (Ontario 1997). In 2001, Conservation Ontario released a report titled "The Importance of Watershed Management in Protecting Ontario's Drinking Water Supplies". The importance of watershed management was further emphasized in Justice O'Connor's Report of the Walkerton Inquiry, which states:

> The Watershed is the most meaningful unit for drinking water source protection planning. Impacts on water resources are integrated within watersheds, not municipalities. Residents of a

> watershed have a common interest in water quality, regardless of political boundaries (O'Connor 2002, pg. 90)

CO's 2001 report identified elements important for, and the common barriers to, successful watershed management based on a review of international watershed management. Key components for successful watershed management include (CO 2001, pg. 33):

- Political endorsement
- Enabling legislation
- Co-ordination and a co-ordinating body at the watershed/subwatershed level
- Sustainable funding
- A multidisciplinary, integrated approach
- Clear goals and objectives
- Good data, appropriate technical and analytical skills, and useful decision-support tools
- Public involvement and partner collaboration
- Shared action plans and a range of incentives to undertake action
- A continuum of proactive planning, monitoring, and updating
- Dynamic leadership

An additional requirement for the successful execution of watershed management studies is a project leader who provides adequate leadership by supporting consensus building, guiding stakeholder participation and addressing stakeholder concerns (Ontario 1997).Common barriers for watershed management include (CO 2001, pg. 33):

- Lack of sustainable funding
- Excessive bureaucracy and politics
- Weak environmental legislation
- Lack of up-to-date watershed data and useful decision-support tools
- Lack of technical expertise and/or technical assistance
- Fragmentation of responsibilities among agencies
- Resistance to change
- Lack of monitoring and evaluation procedures
- Unrealistic expectations

Past evaluations of watershed management in Ontario have highlighted factors that are contributing to or limiting the success of this management approach (e.g., CO 2001 and Ontario 1997). Factors identified as contributing to the success of watershed management in Ontario include enabling legislation through the *Conservation Authorities Act*, the *Ontario Water Resources Act* and the *Federal Fisheries Act*; a coordinating body at the watershed scale (i.e., Conservation Authorities) with clear goals and objectives; and the involvement of provincial and federal governments, municipalities and stakeholders with emphasis on public involvement (CO 2001; Ontario 1997). Factors identified as limiting the success of watershed management include a lack of political support particularly with respect to stable, long-term funding in addition to funding cutbacks that have affected watershed programs; varying resource availability across watershed agencies with a tendency for greater access to resources in larger CAs and municipalities; inadequate resource and data availability; inconsistent efforts to collaborate with partners, and a lack of effort to communicate and educate the public about the purpose of watershed management; and, the absence of a proactive and adaptive approach to planning and monitoring. This discussion highlighted common strengths and weaknesses identified as affecting the success of watershed management and provided the setting for watershed management in Ontario. The factors described above correspond to the elements identified in Chapter Two as important to an organization's capacity for climate change adaptation. The following discussion outlines and evaluates the institutional environment capacity as it relates to climate change adaptation. It is appropriate to evaluate the institutional environment capacity in this Chapter because this environment pertains to both case study evaluations. Chapters Five and Six provide evaluations of the organizational and action environments in the NBMCA and CVC respectively.

4.2 Climate Change: The Provincial Setting

In Ontario, the projected effects of climate change include more frequent and extreme rainfall events, more droughts, decreased water levels from water sources including lakes,

rivers, streams and groundwater, and decreased water quality (CO 2008). Selected potential adaptation options include measures for water conservation, enhanced planning for drought and flood events, and increased monitoring (Government of Canada 2004). Climate change effects, mitigation and adaptation have been discussed in a number of provincial reports over the last six years. In the Part Two Report of the Walkerton Commission of Inquiry (O'Connor 2002, pg. 84) the Honourable Dennis O'Connor states: "There is no question that when it comes to water resources, sustainability must be a cornerstone of public health." O'Connor adds that although long-term conservation and ecological management recommendations are not the focus of his safe drinking water mandate, there are some opportunities for adaptive management and climate change adaptation considerations (O'Connor 2002). Noted opportunities were identified in water budgets, "contingency plans for extreme events", best management practices, and "community-based environmental stewardship" (O'Connor 2002, pg. 88).

In 2007, the provincial government released "Go Green: Ontario's Action Plan on Climate Change" which outlines the government's commitments and goals to reduce the Province's greenhouse gas emissions (Ontario 2007). While the majority of the plan focuses on transportation and energy, "Go Green" briefly discusses adapting to climate change. This includes the establishment of an Expert Panel on Adaptation and the appointment of two professors of science to "assess the vulnerability of Ontario to the effects of climate change and to make recommendations to address these threats" (Ontario 2007, pg. 34).

Other more recent government reports provide additional discussion on climate change. For example, in the Ontario Minister of the Environment's 2007 Annual Report on Drinking Water, a section describing emerging environmental issues includes mention of climate change and drinking water. According to this report: "A top priority for our government is to understand the impact of climate change on water quality and quantity, so that we can develop strategies to deal with this critical issue" (MOE 2007, pg. 31). There is no explanation as to how the government plans to do so; however, the report does note that the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosys-

tem has been renewed in cooperation with the federal government, (COA) (MOE 2007). The COA contains goals and commitments from the provincial and federal governments regarding climate change, including support for the development of "evidence, indicators, and model projections of climate and ecosystem change in the Great Lakes Basin" (pg. 39); managing climate change impacts by collaborating with other organizations and the Great Lakes' community; and providing decision makers and others with necessary information on atmospheric hazards. In the Ontario Ministry of Natural Resources' (MNR) 2007-2008 Published Results-based Plan, the MNR indicates that it will support and collaborate with the Ministry of the Environment to create a strategy that provides actions to mitigate the effects of and adapt to climate change in fish and wildlife management (MNR 2007).

Currently, there is no federal strategy for climate change adaptation in watershed management. However, Environment Canada offers several avenues for freshwater resource research related to climate change. At the Federal level, a number of reports have been released pertaining to climate change. For example, the Canadian Climate Impacts and Adaptation Research Network (C-CIARNa) of Natural Resources Canada developed a document titled "Adapting to Climate Change-An Introduction for Canadian Municipalities" (C-CIARN 2006a). This report emphasizes the importance of considering climate change to municipal decision-makers and provides information and examples of how municipalities across Canada have adapted to and can continue to adapt to this change (C-CIARN 2006a). Highlighted in this report are examples of how communities of different sizes and levels of capacity (from the Greater Vancouver Regional District to the small coastal community of Annapolis Royal) have proactively approached climate change adaptation (C-CIARN 2006a).

Environment Canada's 2004 report titled "Threats to Water Availability in Canada" describes the impacts of climate vulnerability and change on water resources including groundwater, river and streams, lakes and reservoirs, and wetlands. Emphasized in the report is the need for more leadership, support and capacity building surrounding threats to water availability, including climate vulnerability and change (Environment Canada

2004). C-CIARN-Ontario's 2006-2007 State-of-Play report titled "The Status of Climate Change Impacts and Adaptation" provides the context for climate change effects in Ontario, and emphasizes the need for understanding of these effects among stakeholders including planners, mayors and councillors, in order to proactively adapt to these changes (C-CIARN 2006b): "The largest impediment to mainstreaming climate change into policy is the realization and acceptance that the issue is one of grave importance and will impact the lives of every human planet (C-CIARN 2006b, pg. 14)." Highlighted in this document is the need for greater research support from the federal government.

In 1998, the Climate Change Action Fund was initiated by the federal government to support research aimed at understanding climate change, impacts and adaptation with $15 million in support over a three year period (Government of Canada 2003). More recent support for climate change has come from the Government of Canada's Climate Change Impacts and Adaptation program which provides funding for research aimed at increasing the understanding of the threats to vulnerability resulting from climate change, and research into adaptation measures (NRC 2008).

Critical reports about Canada's water resources have emphasized the need for greater governmental leadership at all levels on a variety of issues including climate change, while other reports identify positive aspects related to governmental action surrounding water resources. For example, Sierra Legal Defence Fund's Drinking Water Report Card for Canada notes: "Canada's National Water Policy Institute has warned of the threat from climate change to Canada's water supply, which the current federal government is studiously ignoring" (Christensen 2006, pg. 333). The Gordon Water Group's Blue Print for Federal Action on Fresh Water (2007) reports positively on actions being taken to protect water resources, particularly in Ontario, through the *Clean Water Act* and source water protection. However, this report still emphasizes that there is great need for support at the Federal level. Further highlighted in this report is recognition of the efforts and achievements of locally based organizations:

> Local organizations are showing leadership on the ground. Local governments and citizens' groups-municipalities, irrigation districts, watershed-based agencies such as Ontario's Conservation Authorities, and environmental groups-are assuming greater responsibility for watershed management. With a special understanding of their watershed and activities occurring within them, these organizations are often best able to develop locally-tailored, practical solutions and to make the difficult decisions required to ensure economic growth does not compromise ecosystem health. However, a lack of support from senior governments can make it very hard for these organizations to succeed and concerns have been raised that governments in Canada "tend to lead with responsibility and lag with resources (GWG 2007, pg. 17).

In 2007, Conservation Ontario (CO) conducted a research project to gather opinions from the public about source water protection and the water quality in Ontario; to determine the level of public awareness about these issues; and, to determine how to best develop stewardship programs tailored to different stakeholder groups. The survey results highlighted the public's awareness of CAs and CO, noting that seven out of ten individuals have heard of their CA and three in five have heard of CO. However, most residents were unaware of the role CAs play in protecting water resources (Decima Research 2007a). Respondents in northern and rural communities reported a greater awareness of what a watershed is compared to those in southwestern, central and eastern Ontario (Decima Research 2007a). Major concerns for water quality identified by the public were industrial pollution, pesticide use and garbage dumps and landfills (Decima Research 2007a). According to another 2007 study, conducted by Conservation Ontario and the Ministry of the Environment, of the public's awareness of the Clean Water Act and source water protection, using rural and urban residents in Ottawa and London, Ontario, there are differing views about CAs and CO among residents. Some Ottawa residents responded positively about their local CA's role in raising awareness of water quality, while London residents had more negative attitudes. According to this study, London residents reported that "there are gross inefficiencies in the system" (Decima Research 2007b, pg. 12). Further, "The CA is perceived to have enough human and financial resources, but these are not used to their full potential" (Decima 2007b, pg. 12). Forty-three percent of respondents in the first study perceived climate change as a major concern affecting water resources (Decima Research 2007a). The study involving Ottawa

and London, Ontario residents reported that there are lower levels of concern about climate change effects, which are a reflection of the confusion and lack of awareness among participants about how climate change affects water supplies (Decima Research 2007b).

In interviews with the NBMCA, employees noted that they were unsure of Conservation Ontario's role in climate change. One employee reported that they thought Conservation Ontario was starting to consider climate change (A02) and another indicated that he was aware that climate change initiatives are being undertaken in other CAs (A04). While Conservation Ontario currently does not have a mission statement or strategy related to climate change, its March 2008 e-newsletter featured a section on climate change adaptation titled "Conservation Authorities Help Communities to Adapt to Climate Change". Included in this article is a brief description of how climate change may affect watersheds and Conservation Authorities through:

- More drought conditions,
- Frequent severe weather,
- Extreme rainfall,
- Lower levels in rivers, lakes, streams and groundwater sources,
- Reduced coldwater fisheries,
- Reduced wetland and marsh habitats,
- Poorer water quality, and
- Greater competition for water supplies, creating more frequent water restrictions (CO 2008).

The article continues on to describe the role of CAs in assisting municipalities to adapt to climate change through activities including watershed monitoring; mapping of water and other resources to track quantity, uses and watershed health; protecting water resources through watershed stewardship programs; updating flood and erosion plans; monitoring low water levels and promoting conservation; and, developing integrated watershed management plans (CO 2008). Also included in this article are links to three Conservation Authorities that feature discussions, actions and resources towards climate change adaptation (Asuable Bayfield CA, Toronto and Region Conservation, and Credit Valley Conservation).

Climate change has been a topic of discussion and interest in watershed management in some CAs for several years. CAs that have been identified as having proactively considered climate change adaptation considerations include Ausable Bayfield Conservation Authority (ABCA) and Credit Valley Conservation (CVC) (CO 2008). In 1999, a symposium was held on the topic of Climate Change and Watershed Management with representatives from the Federal, Provincial and Municipal government, and the Toronto and Region Conservation Authority (TRCA 1999). This symposium emphasized the need for watershed management that considers climate change impacts and adaptation (Bruce 1999) and the need for policies and support at all levels of government to assist with adaptive management to climate change impacts at the local level (TRCA 1999). Another workshop in 2005 held by the TRCA and the Ontario Canadian Climate Impacts and Adaptation Research Network emphasized the fact that four storms since Hurricane Hazel have exceeded the rainfall amounts experienced in that storm event, pointing to the need for careful use of this storm event as a standard, and recognition that climate change adaptation will require community partnerships (MacIver 2006); the importance of the use of adaptive management approaches in municipalities (D'Andrea 2006); the opportunity for climate change integration in Drinking Water Source Protection (de Loë 2006); and the potential opportunity for watershed planning to integrate climate change adaptation and mitigation into water management (Haley 2006). In 2006, Pollution Probe released a report titled "Mainstreaming Climate Change in Drinking Water Source Protection Planning in Ontario" (de Loë and Berg 2006). This report further emphasized the importance of integrating climate change considerations into water management in Ontario and highlighted examples of how local water management agencies, such as Conservation Authorities, can do so in their current source water protection related activities (de Loë and Berg 2006).

4.3 Summary

Although climate change is identified as an issue of importance and concern among agencies and Ontario communities, existing efforts by the federal and provincial

governments to address this issue are weak and, for the most part, nonexistent. While climate change is addressed in some provincial documents, guidance for climate change adaptation at the watershed level is lacking. Some Conservation Authorities have begun to consider climate change and although there is currently no guidance by Conservation Ontario, the organization is beginning to communicate the actions of these CAs to the community. In addition, there still remains instability in provincial and federal support for current watershed management approaches in CAs and a lack of understanding about the role of these organizations in the community. Table 9 provides the evaluation for institutional environment capacity for climate change adaptation.

Table 9 – Evaluation of climate change adaptation capacity in the institutional environment

Theme	**Indicator questions**	**Evaluation**
Presence and quality of institutional arrangements	• Do appropriate provincial policies exist? • Is legislation clear and well defined? • Does legislation provide appropriate guidance for management activities?	No; policies for climate change adaptation in watershed management do not exist. No; there are existing challenges stemming from current legislation for watershed management. No; currently guidance for climate change adaptation in watershed management is minimal.

CHAPTER FIVE

NORTH BAY-MATTAWA CONSERVATION AUTHORITY

The purpose of this chapter is to evaluate the capacity of the North Bay-Mattawa Conservation Authority (NBMCA) to adapt to climate change in its watershed management activities. A description of the NBMCA watershed and a history of the organization is first provided, followed by a capacity evaluation from an analysis of documents and key informant interviews.

5.1 NBMCA Watershed

The NBMCA's jurisdiction covers approximately 2,800 square kilometres in the watersheds of Lake Nipissing and the Ottawa River Basin. The watershed area includes Lake Nipissing, Trout Lake, Wasi Lake, the Mattawa River, the North Bay Escarpment and parts of Algonquin Park (NBMCA 2008a; Figure 5.1). The climate of North Bay is characteristic of the climate of northeastern Ontario. Summer months are generally warm and wet, with the wettest months in August and September. Winters are cold and dry, with the driest months in February and March (NBMCA 2007a; WHI 2006). The mean annual precipitation is 1, 008 mm and is highest from June to October (NBMCA 2007a). The City of North Bay has a population of 53, 966 and is the largest urban area in the NBMCA watershed (Statistics Canada 2006; WHI 2006). Rural lands are used for wood product production, farming, and recreation, with some cash crop potato farming (WHI 2006).

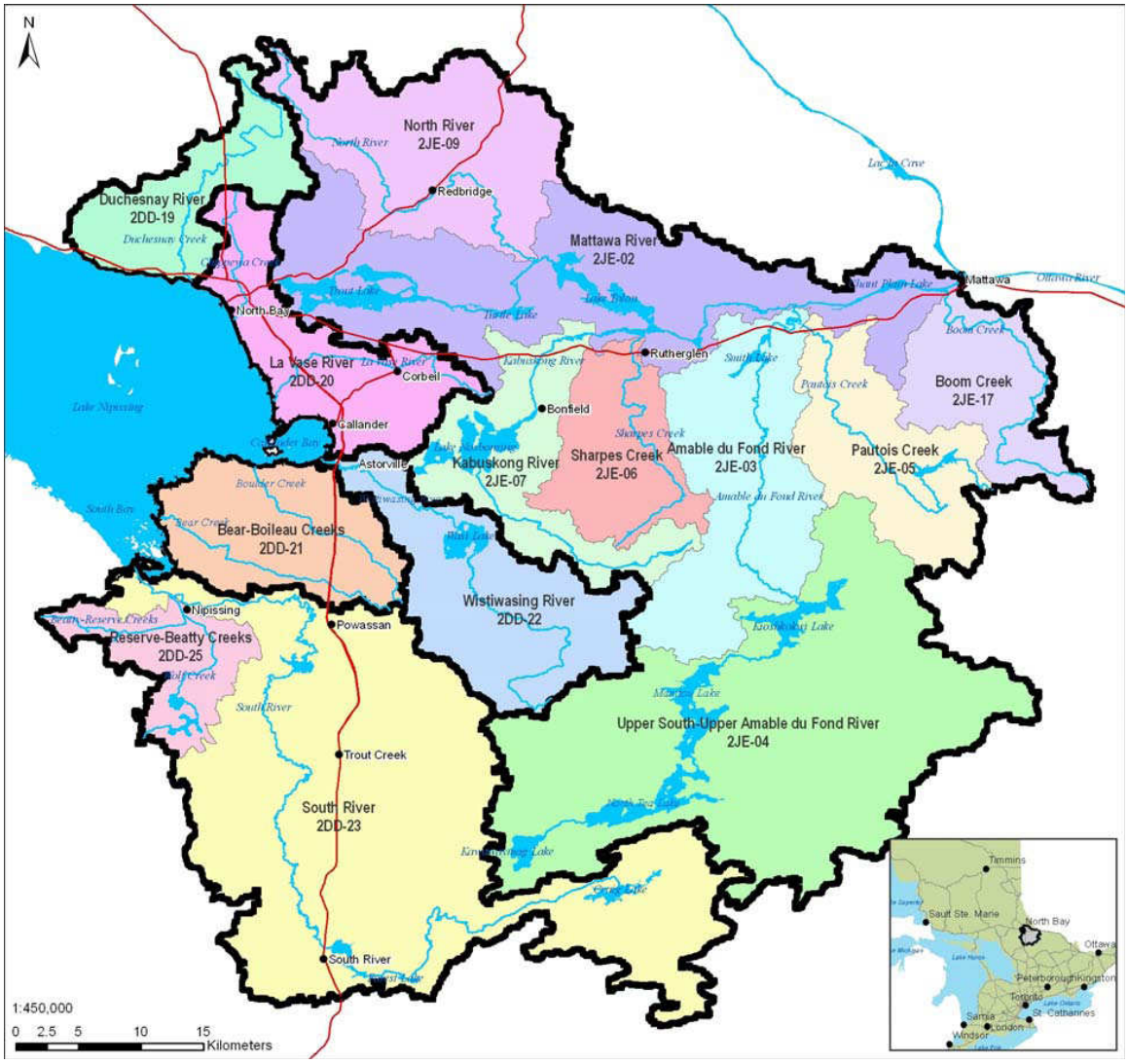

Figure 1 – NBMCA watershed jurisdiction (SWPP 2007).

5.2 North Bay-Mattawa Conservation Authority

The North Bay-Mattawa Conservation Authority, located in North Bay, Ontario, was established on June 16th, 1972 under section 8 of the *Conservation Authorities Act* of Ontario (OMNR 1972). Participating municipalities include Bonfield Township, the Municipality of Callander, Calvin Township, Chisolm Township, East Ferris Township, the Town of Mattawa, Mattawan Township, the City of North Bay, Papineau-Cameron Township, and the Municipality of Powassan (NBMCA 2008b). Specific activities

undertaken by the CA include flood prevention through the administration of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses regulations; flood protection through the operation of a backflood control structure, channel maintenance and channel dredging; and, flood warning through the flood forecasting and warning program (NBMCA 2008c; NBMCA 2008d).

At the time of this evaluation, the CA had 19 employees, 6 of whom formed the Drinking Water Source Protection Team. There is also a Sewage Area Manager and Sewage System Inspector in Parry Sound. The composition of the authority is as follows:

- Secretary-Manager;
- **Administration:** Financial Officer, Assistant Bookkeeper, Administrative Assistant;
- **Drinking Water Source Protection:** Project Manager, Water Resources Specialist, Communications Specialist, Community Relations Coordinator, GIS Specialist, Technical Assistant;
- **Environmental Planning:** Director of Planning and Development, Regulations Officer, Regulations Technician, Database Management Technician; Sewage Systems Inspector (2); and,
- **Field Operations and Maintenance:** Field Operations Supervisor, Naturalist (Environmental Educator) (NBMCA 2008e).

5.3 Capacity Evaluation

Objective 3, the evaluation of the capacity of the North Bay-Mattawa Conservation Authority to adapt to climate change, is addressed here using the evaluative framework developed in Chapters Two and Three. Chapter Four provided a description and evaluation of the provincial setting for watershed management and climate change adaptation in Ontario Conservation Authorities (CAs) and outlined examples of climate change adaptation initiatives currently in progress in CAs and municipalities in Ontario.

5.3.1 Climate Change and the NBMCA

Interviews with conservation authority employees and a document analysis reveal that the NBMCA has not yet considered climate change adaptation in any of its watershed management programs. Key informant interviews also indicate that employees have

varying opinions and views regarding the organization's interest in and capacity for climate change adaptation. Conservation authority employees report that there has been limited discussion about climate change locally. Employees were also unsure of Conservation Ontario's plans for and standpoint on climate change adaptation in CAs (A06; A01; A02). Most key informants expressed interest in climate change as an important consideration for conservation authorities and as a personal concern (A01; A02; A04; A05; A06). Employees acknowledged the importance of climate change, particularly for flood warning, storm water management and infrastructure (A03). One employee explained that climate change adaptation planning is also beneficial because it can contribute to collaborative efforts and communication among different organizations and levels of governments including Conservation Authorities, Conservation Ontario, the provincial government, municipalities and community groups: "it is a good example of bringing partnerships together to look at these problems".

At the time of this evaluation, climate change integration was not in the mandate for source water protection planning and the NBMCA's drinking water source protection planning team was not undertaking activities directed toward climate change adaptation (A01; A05; A06). However, some key informants felt that Conservation Authorities are an ideal organization for considering climate change adaptation particularly with respect to their role in drinking water source protection planning and the increased staff numbers that this program contributed (A06; A05). One key informant noted that climate change integration into drinking water source protection planning would be cost effective and provide important information for government planning. As this key informant explained:

> In the same sense that Justice O'Connor identified conservation authorities as the logical entities to deal with source water protection because of their organization on a watershed basis, the same thing feeds into climate change (A06).
>
> I think Conservation Authorities are well positioned to take that task on and certainly with the increase in staffing due to the drinking water source protection program, we've got the capacity - the core capacity to work into that and it would be probably the most efficient way to proceed (A06).

Employees emphasized the importance of monitoring for climate change effects (A06, A03) and noted that more monitoring stations within the watershed are necessary to notice the effects in localized areas (A06). One employee felt that the authority could start to monitor for climate change effects using minimal staff resources by setting up weather stations fitted with telemetry (A06). Another employee emphasized the importance of considering adaptation options as resources managers and as people in the community, explaining that the effects of climate change should be considered for the environment and the built landscape. This key information also expressed concerns about the reliability of data currently being used for floodplain standards:

> Most of our standards in the province of Ontario, including our own floodplain standards that we use to guide development and protect life, limb and property from flooding hazards are based on historical assumptions about rainfall and its frequency and intensity, and some of those things are being challenged right now (A04).

In contrast, some key informants reported that they do not believe that the NBMCA has the resources or overall capacity to consider climate change adaptation for reasons including resource availability and climate change uncertainty. Employees reported that the CA is lacking capacity in areas including staff availability and with respect to specialists including hydrologists and engineers, which could be important for assisting the organization with climate change adaptation (A03). Other noted areas of concern include existing challenges time constraints among CA staff and the possible need to hire additional employees for climate change adaptation, continued uncertainty surrounding climate change and data needs (A03). Some employees felt that climate change adaptation is a provincial initiative (A03, A04), noting that they will wait to hear from the province about new initiatives and programs that may involve the Conservation Authority (A03). Informal discussions with CA employees reveal that staff members are not considering climate change in flood forecasting, but are interested in beginning to consider it. Another employee noted that the data being used for the Regulatory Flood (e.g., the hundred year flood, Timmins flood, Hurricane Hazel), “is almost out the window” (A03). However, staff members note that historical flood information is

currently used for flood forecasting, and the Conservation Authority is in need of equipment updates and an information database, before it can even start to consider climate change. One key informant also noted that it would be counterproductive to begin to tackle climate change issues that are being considered elsewhere (A03). One employee stated:

> It is certainly not something as an authority that we have the luxury to sit down and look at and think about. We just have to go with what is happening today. We can plan a little bit in the future and we have an idea of things that are coming up that we have to prepare for, and until that gets a little bit more in the forefront and we have a little bit of direction, we probably won't think about it too much (A03).

Key informant interviews suggest that the local community has raised some concerns about climate change, particularly with respect to drinking water source water protection planning. One employee noted that they believe the community is looking for practical ways to help with climate change adaptation and is looking for "a voice that has that authority", to provide them with guidance (A02). However some employees noted that, in general, they feel the public does not see the Conservation Authority as tackling "big picture" issues because of its organization on a watershed basis (A02). One employee felt that it would be very beneficial to work with the public to change their attitudes and behaviors, but did not think the organization was prepared to take on that task (A02):

> There is that famous quote - you love what you understand, you understand what you are taught. We need to get to that level and understanding, and maybe part of that may mean including more tangible messaging, or tying it into messaging that people have heard and are aware of rather than trying to start from scratch with things where they have to learn a whole new language to understand (A02).

Issues surrounding the identity and the purpose of the conservation authority were also raised in interviews with employees, regarding the organization's role in climate change adaptation and other broad environmental issues. One employee felt that there is confusion and differing opinions both internally and within the public, regarding the conservation authority's role in environment and conservation:

> Maybe part of it is there is still contradictory science out there, but even internally I don't think it's been tackled-the idea of are we to be an environmental organization for the community-doing things like energy conservation...water festivals (A02).

To date, the CA has not included climate change information in any of its public awareness or education programs (NBMCA 2008f; NBMCA 2008g).

Key informant interviews and a document analysis indicate that the NBMCA has not yet officially discussed or incorporated climate change adaptation into its watershed management activities. The analysis also indicates that the opinions of employees within the CA vary with respect to the organization's capacity for climate change adaptation. Some employees believed that climate change adaptation is an important consideration for the CA and felt that there are opportunities for the organization to begin to do so. In contrast, other employees believed that the CA is experiencing challenges that are affecting its current capacity and felt that these existing challenges would limit the organization's capacity for climate change adaptation. The following discussion provides an evaluation of the NBMCA's capacity for climate change adaptation in the organizational environment and the action environment. Although the NBMCA has not yet considered climate change in its watershed management programs, insight into the capacity strengths and limitations in the organization can suggest what capacity the CA may have to adapt to climate change (Ivey *et al*. 2004).

5.3.2 Organizational Environment

5.3.2.1 Organizational Resources

For this research, the organizational resources environment refers to human, financial and information resources. Availability and access to human, financial, and information resources, and appropriate staff interest and expertise are major factors that can affect the overall capacity of the NBMCA and its capacity to adapt to climate change. If the CA is challenged by limited staff availability and financial and information resources in existing watershed management activities, its capacity to undertake additional activities related to climate change adaptation may be limited.

Human Resources

The number of employees in CAs ranges greatly. In 1999, the number of permanent and/or contract fulltime employees in CAs across Ontario varied from 244 to 4 (Ivey 2000). In March 2008, the NBMCA employeed19 fulltime permanent and/or contract employees, six of whom form the Drinking Water Source Protection (DWSP) team (NBMCA 2008e). While the main responsibility of employees involved in DWSP is to "coordinate the development of a Source Protection Plan" (NBMCA 2008h), staff members hired for DWSP planning offer their support and services to other programs within the authority. One NBMCA employee reported that, although he was initially hired to fulfill a requirement for DWSP, he is now officially involved in many projects in other areas of the organization outside of source water protection (A02). Unofficially, this employee has played a major role in various conservation authority activities since being hired (A02). Another employee involved in drinking water source protection explained that 10% of the assigned responsibilities are dedicated to activities outside of source water protection (A01).

Key informant interviews suggest that limited staff is a concern among NBMCA employees. Some employees reported that time constraints were an issue and explained that they barely have enough time to complete their core activities, which limits their ability to take on new initiatives within the organization (A02; A03). One employee explained that staff members only have time to complete the jobs they are assigned. This employee felt that the conservation authority could benefit from an additional employee, particularly to assist with an upcoming program (A03). Another staff member stated that she is stretched to her limits in terms of time availability and, as a result, is physically unable to undertake additional projects that she feels would greatly benefit the organization (A02). Employees also expressed concerns about their ability to meet the demands of the septic reinspection program (A03; A04).

The NBMCA reported that it has had challenges trying to secure specific qualified staff members in the past, and consequently changed the position requirements. For example, because the authority was unable to secure an employee with a background in water

resources engineering, the engineering requirement was removed and the authority successfully recruited a water resources specialist (A06). This employee noted that, although the addition of the position of water resources specialist has greatly benefited the organization, it would be beneficial in some situations to have someone on staff that is a qualified water resources engineer, particularly when dealing with developers (A06). Employees indicate that the conservation authority does consult with the City of North Bay for engineering expertise when required (A01). Concerns were also raised regarding the skills and general knowledge of staff members. One employee noted that some staff members require basic computer skills training, noting that "Keeping up with that business aspect of it sometimes falls to the wayside in terms of making sure that everyone is there. We still need to function as a business in some regards and to keep up with those skills, to be relevant" (A02).

Staff members report that the City of North Bay has been excellent in providing information, support and expertise (A01; A06). The DWSP team frequently works with consultants on technical studies for source water protection and is very pleased with the working relationship (A06). The team has not had any difficulties securing consultants for DWSP projects (A06). Consultants have been used by the DWSP team for projects including technical studies, the North Bay-Mattawa Source Protection Region's conceptual water budget (SWPP 2007), to assist in public open houses (NBMCA 2008b), and for core CA program studies including flood damage reduction and watershed management studies (MPL 1981; TSH 1997). Employees reported that they did not have any problems working with the consultants, nor are there any problems interpreting the information provided by them, noting that they work together every step of the way and it is easy to communicate if questions or problems arise (A01; A06).

Existing challenges involving staff resources and the time constraints experienced by current employees suggest that the NBMCA's capacity for climate change integration could be limited. If staff is already stretched to its limits with existing responsibilities, they will not have the time to take on the additional activities that climate change adaptation may demand. Although the CA has had problems securing specialists,

employees have demonstrated a self-directed approach to expand their skill sets, and the organization has been able to seek assistance and expertise from the City. This established working relationship and resource sharing could be beneficial for the CA's capacity for climate change adaptation if the organization is lacking in specific expertise that the City may have.

Financial Resources

The NBMCA is financially supported through sources including provincial funding, revenue from land sales and municipal levies. DWSP is fully funded by the provincial government (NBMCA 2008h). In 2007 the NBMCA had a budget of 2.68 million dollars and reported its fourth balanced budget in a row (NBMCA 2007b). The 2008 approved budget is broken down as follows:

- Ministry of Natural Resources transfer payments (10%)
- Member municipalities (17%)
- Other program grants (21%)
- Carry over from 2007 (14%)
- Land sales (4%)
- Revenue generated through core programs and services (34%) (NBMCA 2008i)

The Conservation Authority has faced many challenges in the past stemming from years of financial difficulties. Key informant interviews with conservation authority employees revealed that staff members believed that many challenges within the organization, such as staff time constraints and data needs have resulted from the NBMCA's financial situation (A02; A03). Over the past five years, the NBMCA has faced significant financial challenges as a result of debt incurred from the construction of a new Conservation Authority building, Interpretive Center and Lookout Tower, and problems associated with the CA's involvement with the local skill hill (NBMCA 2007b). In 2003, the authority had a debt of 5.4 million dollars and actions have been taken to manage and reduce this debt through loan forgiveness, a long term mortgage and municipal contributions (NBMCA 2007b).

Key informant interviews suggest that the NBMCA's financial challenges have affected many activities within the organization. One employee explained that efforts to reduce costs within the organization have increased the time and effort required to complete specific tasks: "we're doing everything on a shoestring budget and it takes more time". For example, instead of placing ads for conservation authority events in the local paper, the authority posts them for free at grocery stores and libraries; an effort which can be cost effective but timely" (A02). Another employee reported that water quality sampling was not completed in some previous years as a result of funding cutbacks (A05). Trout Lake spring phosphorus data records from 1975 to 2006 indicate that data are unavailable for 10 of 31 years (TLAC 2007). Data are now being collected because of financial support provided through DWSP (A05; A06).

According to another employee, financial limitations have restricted the organization's ability to conduct new watershed studies: "When you talk about capacity, it's all about money and people-having the people to do the job. You have to have the money for that or it's not feasible and you can't do it" (A03). This employee explained that although staff members have expressed interest in conducting new watershed studies to acquire updated data and identified this as a critical issue to the authority's senior management team, time and financial constraints have limited the NBMCA ability to do so (A03). In the past, the authority was actively involved in watershed studies with employees and summer students; however, time and funding issues have limited this involvement (A03). Recently, the authority has had greater involvement in watershed studies through its participation in DWSP. Watershed characterizations were completed for the Village of South River, the Town of Mattawa, the Municipality of Powassan, the Municipality of Callander, and the City of North Bay (NBMCA 2007b). In 2006, the NBMCA, the City of North Bay, the Municipality of Powassan and the Town of Mattawa, initiated a groundwater study funded by these organizations and the Ministry of the Environment (WHI 2006).

The Conservation Authority is eligible for funding from a range of provincial ministries including the Ontario Ministry of Natural Resources, the Ontario Ministry of the

Environment, the Ontario Ministry of Northern Development and Mines, and the Ontario Ministry of Health (A04). One employee explained that often, provincial funding assists the authority in securing additional support from the municipality and the community (A04). Key informant interviews reveal that employees have differing opinions regarding their satisfaction with the level of financial support provided by the provincial government. Employees involved in DWSP indicated that they are satisfied with the funding provided by the provincial government (A05; A06); however, staff involved in other core programs within the authority raised concerns about the level of financial support. One employee noted that, although the authority can be very successful in securing funding from provincial sources when "their interests are served" (A04), the CA struggles and has expressed frustrations with gaining additional support for core activities including Development, Interference, and Alterations, Forecasting, Erosion Control, and Infrastructure.

Employees within the authority reported that they do seek external sources of funding for various projects, although there is no one assigned specifically to this task (A02; A04). One employee explained that because of the size of the authority, staff members work collectively on funding proposals depending on the expertise required (A04). However, another employee felt that it would be beneficial to have someone specifically in charge of coordinating and proactively seeking funding (A02). Currently, a senior management team in the authority discusses potential projects that employees have expressed interest in undertaking (A04). The team collectively decides whether to carry forward with the funding proposal and determines which staff members would best contribute to the development of the funding proposal (A04). Although employees indicated they were confident in their ability to secure external funding, they explained that even if funding was secured for potential initiatives within the organization, the authority would not have the human resources available to carry out the activities (A02): "Sometimes it's not even an issue of money - it's more an issue of staffing and time available" (A02).

Despite some evidence of the NBMCA's ability to maintain a balanced budget, the financial constraints currently experienced in existing programs, in addition to limited

efforts to secure external sources of funding as a result of time and staff limitations, suggests that the organization's capacity for climate change adaptation could be limited. If the CA is experiencing financial constraints in existing programs, its capacity to take on additional expenses that climate change adaptation may require could be limited. If the CA is not seeking many opportunities to secure external funding due to time constraints, this suggests that they may not have the time or staff resources to seek additional funding to support potential climate change adaptation initiatives. Further, the fact that the CA is currently unable to complete activities of critical importance with existing staff members suggests that it would be unlikely that the organization would begin to take on additional projects when there are still needs for regular activities within the organization.

Information Resources

Data and information resources required for core programs and drinking water source protection activities conducted by the Conservation Authority are gathered from a variety of sources, including Land Information Ontario, the City of North Bay, the Ontario Ministry of the Environment, and the Ontario Ministry of Natural Resources (A01; A02; A03; A06). Although climate change adaptation has not yet been considered in the NBMCA, it is important to evaluate their current information resources capacity. This will determine if there are existing challenges in obtaining data and provide indications as to how this could affect the NBMCA's capacity for climate change adaptation. If the CA is challenged in securing information resources for existing programs, the causes of these challenges could also affect the organization's ability to secure data important for climate change.

Key informant interviews suggest that data availability is an issue affecting core programs and services and DWSP activities in the NBMCA. Some CA employees reported data issues related to GIS and mapping information, noting that a lot of information available to them is at a regional scale and not locally based (A01; A06). Another employee explained that the NBMCA does not have access to orthoimagery and aerial photography (A06). This employee explained that aerial photography or

orthorectified aerial photography would provide the team with detailed information on vegetation and topography (A06). Conservation Ontario indicated that this data would be made available; however, an employee noted that the release of this data continues to be delayed (A01). According to one employee, a group had formed in southwestern Ontario and placed a bid to get satellite imagery work done. The NBMCA was interested in participating in this but was unable to "pull it together" (A06).

One employee indicated that, because core Conservation Authority programs and services rely on data from watershed studies, it would be beneficial to undertake new studies in order to update the information used to make planning decisions (A03). This data need has been identified as a critical issue to the organization's senior management team (A03). Another employee noted that, as a result of funding cutbacks, there were some years where water quality sampling was not undertaken. These data gaps have been identified as part of DWSP planning (A05). Other data gaps identified in the NBMCA's conceptual water budget include no pan evaporation measurements, sparse availability of climate data, and the absence of a stream flow gauge at the Turtle Dam on Turtle Lake, which has limited the ability to complete a suitable water balance for the lake (SWPP 2007). One employee also reported that there are no flow data available for the entire Wasi watershed, which has limited the team's ability to understand the hydrology of the system (A06). Currently, the drinking water source protection team utilizes municipal technical studies to develop watershed characterizations for each of the municipalities in the source protection region (A06). Through the NBMCA's involvement in DWSP, watershed reports and studies including watershed characterizations and water budgets were undertaken for watersheds in the NBMCA's source water protection region. As of 2007, draft watershed characterizations had been developed for the City of North Bay, the Municipalities of Callendar and Powassan, the Town of Mattawa, and the Village of South River (NBMCA 2007b).

The NBMCA is currently experiencing challenges with respect to data availability in certain areas. Most of these challenges are the result of barriers at the provincial level and due to the CA's past financial problems. Although these data and information needs

are affecting current watershed management programs, conclusions can be drawn about the CA's capacity for climate change adaptation from the results of this evaluation. Recognizing that there are a vast number of data and technological needs with respect to climate change at the global, national, provincial and local scale, certain data needs in the NBMCA could affect their capacity for climate change adaptation. The CA is currently challenged with respect to climate data, an absence of stream flow gauge stations and limited water quality monitoring data, and these data needs are consistent with certain information resources identified as important for climate change adaptation (Government of Canada 2004).

Summary of the NBMCA's organizational resources capacity for climate change adaptation

Staff and information availability and financial constraints are limitations to the NBMCA's capacity to adapt to climate change. Staff availability and financial constraints are limiting the NBMCA's capacity to take on new initiatives and programs within the organization and limited data availability has affected the CA's ability to complete specific projects. These existing challenges suggest that the NBMCA's capacity for climate change adaptation could be limited. With these existing challenges, it is unlikely that the CA would have the capacity to take on additional tasks and financial expenses that climate change adaptation could demand. However, the self-initiated learning undertaken by existing staff suggests that the CA's employees have the interest and ability to develop their skills which could be directed toward training for climate change adaptation. Table 10 provides the evaluation of the NBMCA's organizational resources capacity for climate change adaptation.

Table 10 – Evaluation of the NBMCA's organizational resources capacity for climate change adaptation

Theme	Indicator question	Evaluation
Human resources	Does the CA have adequate staff available for current and future (i.e., climate change) activities?	No; staff resources are a limitation and affect the ability of the organization to undertake additional projects.
	Does the CA have access to staff or external consultants with appropriate skills and expertise? If the CA uses external consultants, is staff able to interpret the information they provide?	Yes; current staff have appropriate skills and proactively seek training or outside expertise if required. Yes; the NBMCA has access to external specialists through the City of North Bay and is able to interpret the information provided.
	Are CA employees interested in climate change integration?	Limited; employee interest in climate change adaptation in the CA varies. While all employees noted the importance of the issue, some felt that the organization did not have the time or resources to take on any new initiatives.
Financial resources	Are sufficient financial resources available to the CA for current and climate change related watershed management activities?	No; financial limitations are affecting the NBMCA's ability to complete current and climate change related activities.
	Is the CA able to generate financial resources and/or secure external sources of funding?	Limited; funding can be secured through external sources but staff availability is limiting the NBMCA's ability to proactively seek it.
	Is the CA able to maintain a balanced budget?	Yes; the NBMCA has maintained a balanced budget for the last four years.
Information resources	Are appropriate information and technical resources available to the CA for current activities and climate change related activities?	Limited; data needs have been identified, but challenges in securing resources have been encountered due to time and financial availability, and factors outside the CA's control (e.g., holdups at the provincial level).

5.3.2.2 Organizational Dynamics

For this research, organizational dynamics refer to the characteristics, features and management approaches of an organization that are identified in the literature as contributing to or limiting capacity. Major elements that can contribute to the NBMCA's capacity to adapt to climate change include whether the organization is flexible, promotes an environment of learning and adaptive management, forms partnerships and collaborates with other organizations. Although the NBMCA has not yet begun to consider climate change adaptation in its watershed management programs, evidence of

organizational dynamics capacity suggests that the CA could have the capacity to adapt to climate change. For example, organizations that demonstrate flexibility and use adaptive management approaches in existing programs will have the capacity to problem solve and adapt their policies and activities to the changes that climate change integration may require.

Flexibility, Adaptive Management and Learning

Key informant interviews suggest that NBMCA employees are flexible with respect to self-directed learning and training for specific job responsibilities. Staff members often reported that their jobs required "a learn as you go" approach. One employee explained: "a lot of stuff is learned on the job, learn on the go. If you have the technical background it is easy to pickup and learn" (A03). Other employees reported that they have been training themselves in specific areas where formal training is not available (A01). The self-initiated learning undertaken by CA employees when training opportunities are unavailable demonstrates that NBMCA staff are flexible in situations where resources are not available. As one employee explained in reference to the type of training available to employees:

> Usually you are in specialized programs or initiatives where you have to build skill sets internally, specialized activities, and we do that quite a bit, and I think most CAs invest quite a bit in their staff in terms of providing new skills sets for them so they can do new things (A04).

Key informant interviews suggest that NBMCA employees are, for the most part, satisfied with the education and training opportunities available to them (A01; A03). Most employees reported that the NBMCA encourages and supports staff participation in training activities, and noted that opportunities are available to upgrade their skills. One employee stated "They've been really good about encouraging training" (A01), while other employees explained that opportunities are always available to take part in training and workshops through Municipal Affairs and Housing and Conservation Ontario (A03). For DWSP, it was reported that employees can dedicate one day a month to training, and can identify and request specific training activities (A05). Another employee described

the NBMCA and Conservation Authorities in general as "proactive" with respect to training and educational opportunities (A04). However, one employee did indicate that she felt the education and training opportunities available for this position were limited compared to opportunities available for other positions within the authority (A02). He felt that this was most likely due to the authority's financial limitations, and because the authority does not fully recognize the value of this particular position (A02). With respect to Drinking Water Source Protection, one employee reported that if a training need is identified, all project managers will discuss it and determine if it is necessary and worth pursuing:

> It's hard to get some of those skills through on one day training sessions and it ends up being expensive too, when staff has to travel. You don't get a lot out of a day. It's not like a University course where it is much more effective when you are working at something for several weeks. It's just the way people learn" (A06).

Other issues identified by NBMCA employees include concerns that the CA does not evaluate annual events they organize to determine how they can be improved, and that the organization does not consider the business purpose of conducting certain events (A02). The results of the evaluation also suggest that the NBMCA does not employ an adaptive management approach in its watershed management programs. In fact, one employee spoke to the fact that many of the CA's annual public events are held yearly without discussion or consideration of possible ways to improve the success of these activities (A02).

A review of NBMCA meeting minutes from 2005 to 2008 reveals that two CA employees and the Chair of the NBMCA attended the A.D. Latornell Conservation Symposium in 2006 and recommended that the authority continue to attend this conference in the future (NBMCA 2006a). In an informal conversation with one NBMCA employee she noted that the CA did not participate in the symposium held the following year. There was no evidence found through key informant interviews and a documentation analysis suggesting that the organization and/or any of its employees have participated in training related to climate change adaptation. The A. D. Latornell

Conservation Symposium is an annual event with participants and attendees from Ontario Conservation Authorities, Governments and in the private sector. The 2007 symposium offered presentations from other CAs and organizations on the topics related to watershed approaches to climate change (Latornell 2008). By attending this event, the NBMCA could have had the opportunity to observe and communicate with other organizations about how they are adapting to climate change in their organizations.

Key informant interviews and a documentation analysis indicate that flexibility and adaptive management within the NBMCA are lacking. Employees within the organization demonstrated flexibility in their initiatives to learn and develop their skills, and the CA supports learning through training and education. However, the CA should support opportunities for employees to participate in and observe other CA's actions toward climate change adaptation and other proactive initiatives at conferences such as the A.D Latornell Conservation Symposium. An absence of an adaptive management approach in the organization could also affect the CA's capacity for climate change adaptation. Adaptive management would contribute to the CA's capacity because it would enable the organization to continuously review and assess its programs and policies and adapt them to new and changing needs, and information and technology.

Communication and Collaboration

Key informant interviews suggest that interdepartmental communication in the NBMCA is strong among members of the drinking water source protection team, but weak in other areas. As described in section 5.3.1, members of the DWSP team contribute to other activities within the NBMCA (A01; A02; A05). One employee explained that 10% of her duties are related to activities in the authority outside of source water protection. Other examples of interdepartmental relationships within DWSP team and the authority include providing setback, regulations, and canoe race maps (A01), and developing information brochures and other forms of marketing for various departmental programs. One employee has also begun training in water resources engineering in order to provide additional support to regular programs within the authority (A05).

Employees reported that there are some challenges within the organization that they believe are affecting the overall efficiency of the organization. One employee explained that the level of awareness and knowledge of staff members concerning general Conservation Authority information is lacking. As this staff member explained in reference to the conservation authority's funding sources, "People had no idea even internally that the municipal levy only counts for 17% of our revenue. People in the community thought it was near 100% and people in the office thought it was about 60%" (A02). The CA held an internal brainstorming session in 2006 which identified strengths and weaknesses in the organization, and some concerns such as the need for website improvements have since been addressed (NBMCA 2007b; NBMCA 2006b; A02; NBMCA 2008i). Interviews and a documentation analysis suggest that, outside of DWSP, efforts and opportunities for CA employees to communicate and collaborate with one another are limited.

The DWSP team has a regional working group that includes four other northern Ontario Conservation Authorities that hold regular meetings and conference calls (A06; Unknown 2006) also source meeting minutes as evidence. Interviews with Conservation Authority employees indicate that the organization collaborates with other CAs, particularly for DWSP in northern Ontario. According to one employee, the 19 project managers for drinking water source protection planning share information and resources which assists greatly with the progress of the program (A06). Information and resource sharing comes in different forms, ranging from proposal request development to program evaluation. For example, project managers share templates for proposal requests and work together to provide feedback to the government on the source water protection program (A06). One employee noted that this feedback is important because concerns and potential problems that may arise locally for a program that is being developed provincially can be addressed (A06).

Key informant interviews and a documentation analysis suggest that the NBMCA communicates and collaborates with outside organizations for core Conservation Authority programs and drinking water source protection related activities (A01; A03;

NBMCA 2008h). The NBMCA has developed partnerships with a number of community groups, including The Friends of Laurier Woods, the Sturgeon-Nipissing-French-Wanapitei Water Management Group, the City of North Nay Emergency Preparedness Team, and the Greater Nipissing Stewardship Council (NBMCA 2008l; Warrick 2004). One employee reported that the CA is actively attempting to establish a partnership with Nipissing University, noting that the CA was able to secure a Professor to participate on the water development and water budget peer review committee (A06). This Professor also provided the NBMCA with advice and support for cost effective ways to collect data (A06). As a result of this partnership, a student recommended by the University was hired by the conservation authority as a summer student in 2007. The student was able to conduct research for his thesis work by collecting data for the conservation authority, a benefit to the student and the CA: "we didn't have any problem with allocating them with resources to assist them in doing their research knowing that we would get some information back from it" (A06).

Key informant interviews and a documentation analysis suggest that internal communication is limiting the NBMCA's capacity for climate change adaptation, while its communication and collaborative efforts with outside organizations and the community are beneficial to the organization's capacity. Through communication and collaborative efforts between employees and departments within the CA, information, expertise and ideas about climate change adaptation can be shared. However, the NBMCA's partnership with the local University is a positive step toward resource sharing in the community.

Summary of the NBMCA's organizational dynamics capacity for climate change adaptation

The evaluation of the CA's organizational dynamics environment suggests that the organization's capacity for climate change adaptation could be limited by a lack of interdepartmental communication and collaboration, as well an absence of adaptive management. Collaboration and adaptive management are important to the CA's capacity for climate change adaptation, because they allow for resource sharing and collaborative problem solving. For the NBMCA, this is of particular importance because

resource sharing could provide the organization with additional resources and support in areas where these resources are currently limited. An adaptive management approach is important to the organization's capacity because it encourages the organization to continuously review existing management approaches. Further, through adaptive management, an organization is able to adapt its approaches to new and changing information and policies. The organization's relationship with the local university is a beneficial contributor to the CA's capacity, as it facilitates resource sharing and collaboration. Table 11 provides an evaluation of the NBMCA's organizational dynamic capacity for climate change adaptation.

Table 11 – Evaluation of the NBMCA's organizational dynamics capacity for climate change adaptation

Theme	Indicator question	Evaluation
Flexibility, learning, adaptive management	Does the CA continuously review or assess its management approaches or adapt them to better achieve desired program outcomes (adaptive management)? Is the CA flexible in its approaches to management and problem solving?	Limited; minimal evidence of assessment through internal brainstorming sessions. Employees have demonstrated some flexibility through self-directed learning.
	Is the CA dedicated to continuous learning and development, and does it provide training and skill development opportunities for employees?	Yes; the NBMCA encourages employees to participate in training opportunities. Employees are also dedicated to self-directed learning. However, the CA has missed past opportunities to participate in networking opportunities that could provide the organization with information about how other CAs are adapting to climate change.
Networks, partnerships and communication	Do employees within the CA communicate and collaborate with each other and does the CA facilitate collaboration?	Limited; resource sharing with other departments is limited mainly to DWSP.
	Does the CA form partnerships with other organizations	Yes; collaborative partnerships exist with local organizations, the City of North Bay and Nipissing University. Some efforts at communication exist with other northern Ontario CAs.

5.3.4 The Action Environment

The action environment refers to the level of community support and involvement in the NBMCA's watershed management activities, the efforts of the conservation authority to

promote public awareness and involvement in watershed management, and the support and leadership provided at the political level.

Community Support and Involvement

The North Bay-Mattawa Conservation Authority has a Conservation-in-Action program -- a volunteer program aimed at increasing public awareness about watershed management activities and the protection of natural resources (NBMCA 2008j; A02). The community can become involved by participating in volunteer programs including water quality testing, rainfall monitoring and clean-up projects (NBMCA 2008j). According to the NBMCA (2008j), the goals of the program are to:

- "Expand the NBMCA's opportunity to manage local watershed resources."
- "Increase the level of community involvement in local environmental resource management."
- "Strengthen community relationships with the public, private and educational sectors."
- "Promote an atmosphere in which volunteers learn about local resource management."
- "Raise the level of "public awareness" on local environmental issues by encouraging volunteers, through active participation, to be "ambassadors" of the environment."

The Conservation Authority also offers public education sessions through its "Natural Classroom". This program "is designed to promote environmental awareness among children and adults through a variety of science-based programs which incorporate interaction with the environment and hands on learning activities" (NBMCA 2008f). Activities include interpretive walks and environmental education activities (NBMCA 2008f). One employee explained that roughly 80% of the program endeavor is aimed at curriculum based programs and approximately 20% is geared toward the general public (A04). According to this employee, the relationship with the school board "works well", because the school board has a desire to provide environmental education to its students, and the authority has the desire to "get a message out, particularly to the young community, about how things work in the environment and what watersheds are, how they function, and how our human imprint on the landscape can affect these things"

(A04). For the general public, the NBMCA has developed information brochures that describe DWSP activities (NBMCA 2007d), conservation programs (NBMCA N.D), and provides information resources about wellhead protection areas and private wells from Conservation Ontario (CO 2007a; CO 2007b). The Drinking Water Source Protection team also releases a quarterly newsletter to the public that describes activities and processes at the local level (NBMCA 2006c; NBMCA 2007c).

The NBMCA holds a variety of community events throughout the year including the Mattawa River Canoe Race and awards events that recognize the environmental contributions of students and groups in the community (i.e., Ken Adams Memorial Award, Dorothy Walford Memorial Award, Ward Smith Environmental Youth Award). The NBMCA also holds volunteer events to raise money for the Foster Wild Environmental Fund which raises money for the Conservation Authority's programs and services (NBMCA 2007b; NBMCA 2008k). Documentation analysis revealed that climate change effects and adaptation are not included in any of the CA's existing public education programs (NBMCA 2008k).

Communication with the public has increased over the last few years. In 2007, the number of media releases issued increased 30% from 2006 (NBMCA 2007b). The conservation authority communicated its financial challenges and long term debt elimination plans to the public through media releases in the local newspaper and through electronic media (NBMCA 2007b; Adams 2007a). In 2007, the conservation authority re-launched its website with a new design that includes a news and events section and forms and resources available for the public to download (NBMCA 2007a; Adams 2007b). Site tracking statistics indicate that the number of site visits has increased "exponentially" compared to the previous site (NBMCA 2007b).

The opinions of CA employees varied, when asked about the level of public awareness of, and interest in watershed management. Some key informants believed that the public was very interested in environmental issues in the watershed, noting that members of the community had raised concerns about septic systems and the effect of additional

development on the water quality of the lake (A06). One employee believed that the events in Walkerton, Ontario played a role in raising the level of environmental concern among community members about water quality (A06). Other employees expressed concerns about the public awareness programs available for watershed management. One employee felt that the conservation authority was not doing enough to educate people about water quality issues due to the organization's limited budget (A02).

Key informant interviews suggest that NBMCA employees feel that the public does not understand the role of the CA. One employee explained that there still remains uncertainty among the community about how the conservation authority is funded (A02). This year, the authority provided a breakdown of funding sources to the community through the NBMCA website and local newspapers (NBMCA 2008i; Adams 2008). Employees noted that it is just as important a responsibility for the authority to explain its role and duties to the local community, as it is to undertake watershed management programs (A02). Interviews indicate that certain employees felt that the authority should place greater emphasis on communicating its roles and responsibilities to the community (A02). One employee explained that, in the past when the authority had to dredge a local creek they provided an information letter to the public in the affected area indicating where and when the activity would take place, and this letter resulted in many objections by the community. Last year, when the authority was required to undertake an activity within the community, the NBMCA explained the reasons for the activity and the public responded positively (A02).

Although the CA has not yet communicated with the public about climate change in public meetings or through education programs, conclusions can be drawn about the organization's capacity for climate change adaptation based on its existing relationship with the community. This is because support from the community and opportunities for the public to participate in CA decision-making can increase the success of activities being undertaken by the organization. The fact that the CA is concerned with the community's understanding of the purpose of the organization could be problematic for gaining support for climate change adaptation initiatives. If the community is already

uncertain about the role of the CA, then the public may not be receptive to the organization tackling broader environmental issues like climate change (A02). However, increased efforts by the CA to promote public awareness about the purpose of the NBMCA are a positive step toward gaining support from the community and increasing capacity in the action environment.

Municipal and Provincial Support

The NBMCA communicates with the local municipal government for resources and support for core programs and services and drinking water source protection planning. The drinking water source protection team has a data sharing agreement with the City of North Bay (the City) where GIS data is obtained through the City's mytown GIS system (A01). The NBMCA works closely with a number of departments at the City including building, planning, and lands and trails (A03). The CA seeks support, expertise and advice for strategies from city engineers and consults with the CNB and the NBMCA's nine other member municipalities for the Municipal Plan Review. They also collaborate and share resources for lands and trials activities (A01; A06; A03). Interviews with conservation authority employees indicate that they are very pleased with the relationship, contact and support with the local government for core programs and services and for drinking water source protection planning. Employees noted that they believe the City is very helpful in providing support and that a good relationship has been established (A01; A06; A03). One employee noted that the City of North Bay recognized very early, the value of North Bay's drinking water source and, up until the changes to the *Clean Water Act* were made, was able to maintain excellent water quality with minimal water filtration (A06). A documentation analysis indicates that the NBMCA and its partner municipalities collaborate on and share watershed studies and other pertinent documents such as watershed characterizations and surface water vulnerability studies.

The NBMCA's relationship with the provincial government primarily involves drinking water source protection planning (NBMCA 2008h). Because the DWSP team relies on support and guidance from the provincial government, its responsibilities and tasks can be delayed if the required information from senior levels of government is not provided

quickly (A01; A06). One employee reported that the provincial government can be slow in providing guidance and regulatory information, which he noted was not entirely the government's fault as it is a part of the regulatory process (A06). The staff member explained that the progress of the drinking water source protection team has been somewhat delayed as a result of delays at the provincial level. One major challenge involving DWSP risk assessment is a lack of guidance for assigning vulnerability scoring to specific pollutant threats to source waters (A06). The province is currently working on providing numerical values for these pollutants (A06). In the meantime, consultants have been told to use their best knowledge to assign a numerical value for the preliminary report thus allowing them to complete the contract and permit the drinking water source protection team to move forward with its activities (A06; A01). The government has acknowledged that it may be necessary to hire consultants to modify the numerical values at a later date (A06). Employees involved in drinking water source protection noted that they have been required to carry forward with technical studies without access to this information (A01).

The drinking water source protection team also identified challenges related to cooperation and support from different branches of the local Ontario Ministry of the Environment (A06). According to one employee, drinking water source protection falls under two branches of the local Ministry of the Environment, one which is fully allocated in terms of staff, explaining: "the departments are not being funded to take on additional work generated by the demands of source water protection" (A06). As a result, the Ministry has been reluctant to provide assistance or direction to the conservation authority, which could be of great benefit, because the local Ministry has experience in monitoring activities within the watershed (A06):

> If you've got somebody who's been working at the Ministry of the Environment for 15 or 20 years, there is a lot of corporate knowledge and historical knowledge about what was done, where the issues are [in the watershed]. That really helps us focus on where the areas of concern are, which is far more efficient and in better interest for the people of Ontario as far as effective management of resources, if you've got people in the government office who already have all of these reports and are

> knowledgeable, then if they could feed that information to us, it would be very helpful (A06).

Employees indicate that the conservation authority has recently received more support from the local ministry (A06).

Employees have mixed reviews about the support provided by Conservation Ontario and the provincial government. Staff members noted that Conservation Ontario pooled together ESRI licenses which reduced the financial cost to the conservation authority (A01). Staff members involved in DWSP felt that the nature of the program, which some employees felt operated on a trial and error basis, slowed the speed of the program process (A01). Another employee expressed frustration at not being formally notified of changes that had been made to the program when the changes directly affected his/her responsibilities (A01).

Summary of the NBMCA's capacity for climate change adaptation in the action environment

The NBMCA's action environment capacity for climate change adaptation is strengthened its working relationship with the City of North Bay and through its efforts to communicate and collaborate with other organizations. The established support and resource sharing could positively contribute to future activities such as climate change adaptation undertaken by the NBMCA. However, the CA continues to face challenge with respect to the community's understanding of the purpose of watershed management and the role of the organization, and this could affect its ability to gain public support for climate change adaptation efforts in the future. To date, there has not been any guidance and support for climate change adaptation from the provincial government and the NBMCA is experiencing challenges with communication and support from the Ministry of Environment in existing programs. Table 12 provides the evaluation of the NBMCA's capacity for climate change adaptation in the action environment.

Table 12 – Evaluation of the NBMCA's capacity for climate change adaptation in the action environment

Theme	Indicator Questions	Evaluation
Community support and involvement	Are opportunities available for the community to participate in decision-making?	Yes; through public open houses and community events.
	Are education opportunities made available to the public and has the organization developed activities that promote community awareness and support?	Yes; through pamphlets, information sessions, the NBMCA website, and community and annual awards events. However, the CA has not yet communicated with the public about climate change adaptation and problems exist with the community's understanding of the role and purpose of the NBMCA.
Political support	Is adequate support provided by the municipal and provincial governments	Yes; an excellent relationship exists with the municipality. However, challenges exist with the provincial government, in terms of a lack of guidance and long-term support.

5.4 Summary

The North Bay – Mattawa Conservation Authority has a modest level of capacity for climate change adaptation. Strengths contributing to the CA's capacity include the organization's efforts to educate, and communicate and collaborate with the local community, its strong relationship with the City of North Bay which facilitates resource sharing and support for CA activities, its partnership with the local university, and the willingness and ability of employees to learn and develop new skill sets. Weaknesses limiting the CA's capacity include varied interest in climate change adaptation among employees, insufficient human and financial resources, a lack of guidance and long-term, stable funding at the provincial level, the absence of an adaptive management approach, and existing problems in communicating the role of the CA to the local community.

CHAPTER SIX

CREDIT VALLEY CONSERVATION

The purpose of this chapter is to evaluate the capacity of Credit Valley Conservation to adapt to climate change in its watershed management activities. A description of the CVC watershed and a history of the organization is first provided, followed by a capacity evaluation from an analysis of documents and key informant interviews.

6.1 CVC Watershed

The CVC watershed jurisdiction covers an area of approximately 1,000 square kilometers (CVC 2007a; Figure 6.1). The Credit River is close to 90 km in length and includes three subwatersheds (CVC 2007a). This area is surrounded by Lake Ontario, the Humber River and Etobicoke Creek, the Nottawasaga River and the Grand River, and Sixteen Mile Creek (CVC 2006a). The watershed has several natural features including the Oak Ridges Moraine and the Niagara Escarpment (CVC 2007a). As of 2001, the watershed area had an estimated population of 758,000 (CVC 2007a). Land uses in the watershed have the following proportional areas (CVC 2007b):

- Urban (23%)
- Active and inactive agriculture (38.7%)
- Forest (17.4%)
- Pasture lands and old fields (15.32%)
- Wetlands (6.15%)
- Water bodies (1.23%)

The climate of the watershed is typical of Southern Ontario with warm summers and mild winters, which can vary depending on the location and the mean annual precipitation in the watershed is 850 mm (CVC 2007b).

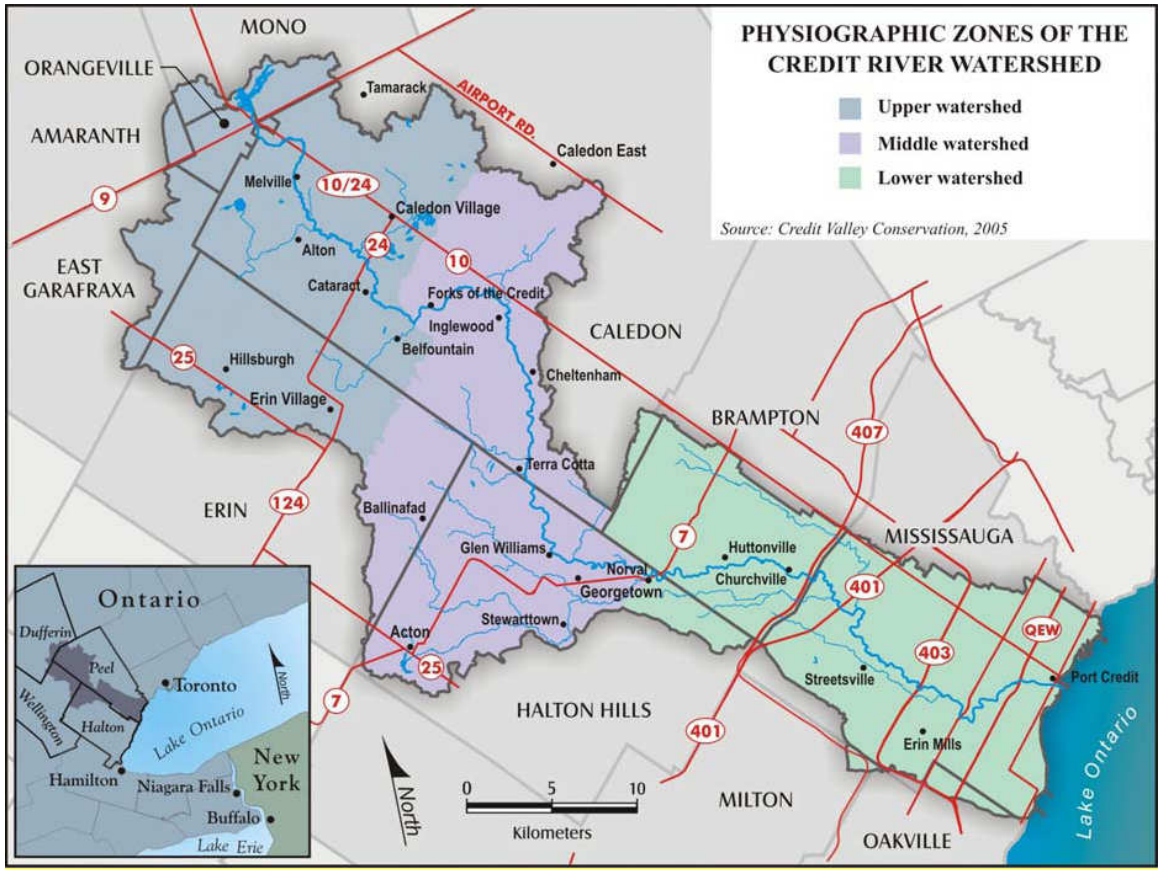

Figure 2 – CVC watershed jurisdiction (CVC 2007a).

6.2 Credit Valley Conservation

Credit Valley Conservation was established on May 13, 1954 under the Conservation Authorities Act of Ontario (CVC N.D). Regions and counties located within the watershed area include the Regional Municipality of Peel (Town of Caledon, City of Brampton, City of Mississauga), the Regional Municipality of Halton (Town of Halton Hills), Wellington County (Town of Erin), and Dufferin County (Town of Orangeville, Town of Mono, Township of East Garafraxa, Township of Amaranth) (CVC 2004a). The watershed is divided into three regions: the upper watershed, the Niagara Escarpment (middle) and the lower watershed (CVC 2007b). In 2007, the CA had 82 permanent, fulltime staff and in 2008 this number increased to 128 (personal communication, July 25, 2008).

6.3 Capacity Evaluation

Objective 3, the evaluation of the capacity of Credit Valley Conservation to adapt to climate change, is addressed in the following discussion using the evaluative framework developed in Chapters Two and Three. Chapter four provided a description and evaluation of the provincial setting for watershed management and climate change adaptation in Ontario Conservation Authorities and outlined examples of climate change adaptation initiatives underway in Conservation Authorities and municipalities in Ontario.

6.3.1 Climate Change and Credit Valley Conservation

Key informant interviews and a document analysis suggest that climate change effects, adaptation and mitigation are issues of priority for CVC. As one key informant stated: "it's front and center in all of our work" (B03). This key informant further noted: "We say around here, if we can't do it now, if we can't effect change now, we'll never be able to. So we think the time is exactly right" (B03). In a presentation on global warming given jointly by CVC and TRCA to the Region of Peel Council, the CAs reported that global warming effects would further intensify the land use impacts experienced in Peel watersheds (CVC 2007c). This includes potential effects for flooding and erosion, water quality and quantity, and ecosystems (CVC 2007c). Potential impacts of global warming for Peel watersheds identified in this presentation include, but are not limited to, the following (CVC 2007c):

- "More frequent severe storms/flooding" (pg. 27);
- Impacts to water quality and quantity from wetter and drier climate change scenarios;
- Reduced water levels in Lake Ontario; and,
- Increased numbers of exotic and invasive species.

In this presentation, CVC and TRCA identified 21 different roles for Conservation Authorities in adapting to climate change in water management, ecosystem management and environmental education, which are as follows (CVC 2007c, pg. 31-33):

1. “Enhance flood warning and prevention programs”
2. “Ensure flow regime maintained”
3. “Environmental education, awareness, outreach”
4. “Protect hazardous areas/green space”
5. “Promote/conduct retrofit of urban lands”
6. “Promote low impact development”
7. “Programs/projects to reduce impervious cover”
8. “Promote adaptation re sewage treatment”
9. “Implement spills response”
10. “Coping strategy for climate extremes”
11. “Expand current monitoring program”
12. “Assess potential to impact new policies”
13. “Increase field presence”
14. “Implement subwatershed studies”
15. “Forest/wetland habitat creation/restoration”
16. “Terrestrial corridor establishment”
17. “Aquatic corridor resolution”
18. “Increase trees planted!”
19. “Work with landowners re environment”
20. “Habitat protection”
21. “Protect representative ecosystems/conservation areas”

In 2007 and again in 2008, CVC requested and received $2.5 million from the Region of Peel to support efforts to mitigate and adapt to the effects of global warming (CVC 2007d; CVC 2007e; CVC 2008a; B01; B03). The Region of Peel also provided $2.5 million to TRCA in support of climate change efforts (CVC 2007e). The funding was provided for flooding and erosion, water quality and quantity, and ecosystems, because these were identified as areas that will be “directly impacted by global warming” (CVC 2007c). According to a 2007 CVC press release (CVC 2007c), the funding will be spent on activities and resources including the installation of real-time cameras to monitor a creek in a flood prone area; climate monitoring stations; the purchase of 10,000 large stock trees to be planted in an effort to reduce carbon emissions; retrofitting impervious surfaces in urban areas to encourage water to run into the ground rather than storm sewers; inventory of dams to support the migration of coldwater fish; planting along streambeds; and, expanding CA conservation areas to facilitate the migration of plants and animals. One key informant explained that one purpose of the tree planting program is to address climate change mitigation and adaptation efforts (B02). This employee noted that planting wind rows of trees can assist in reducing the impacts of extreme

weather on croplands and assist with stabilizing streambanks from major rainfall events in the rural landscape (B02). According to this employee, CVC is "now moving more aggressively into the urban landscape at a much more limited scale" (B02). These efforts include encouraging the planting of shade trees, the use of xeriscaping and water conservation efforts by landowners (B02).

One key informant explained that the Region of Peel was the only municipality in the watershed that was asked to contribute funding for climate change (B01). When asked why this was, the key informant explained the CA did not think it would receive any additional funding from smaller municipalities because of their limited budgets (B01). The employee further explained that the Region of Peel is particularly interested in efforts to protect the watershed because of its location at the lower end of the watershed: "they realize that anything that is done upstream to protect water quality that is coming down from the upper watershed would benefit Peel" (B01).

CVC considers climate change impacts and adaptation in a variety of ways. In a 2007 CVC press release on global warming, the CAO of CVC is directly quoted as stating "CVC has not been idle for the last 10 years in the area of global warming" (CVC 2007f). The press release continues on to describe ways in which CVC has addressed climate change including the use of computer models for groundwater and surface water quality; the mapping of natural environments; the development of implementation plans to protect subwatersheds and plans to implement them in the near future; the creation of strategies for all aspects of the watershed (e.g., water management, stewardship); a framework for water allocation; and, a green lands securement plan (CVC 2007f). While recognizing their efforts to mitigate and adapt to global warming, the CA acknowledges that additional work is needed (CVC 2007f). As stated by the CAO: "CVC has more to do to refine some of these studies to direct our responses to global warming" (CVC 2007f). According to CVC meeting minutes from February 2007:

> Conservation authorities have a mandate and capacity, in partnership with Peel Region, the Province, the Government of Canada and other environmental partners, to deliver projects and programs designed to adapt to and mitigate global climate change and improve the environment (CVC 2007f, pg. 4).

Interviews with key informants suggest that CVC is focusing its climate change efforts on a number of programs within the organization. One key informant explained that, as a result of the additional funding received from the Region of Peel, CVC has incorporated climate change adaptation and mitigation projects in all departments (B01). Key informants explained that an updated Strategic Plan from the 2006 version will be released in the next few months and will identify climate change as the number one issue for CVC (B03). The current 2006 Strategic Plan refers to climate change as a priority 3 concern. This priority ranking refers to the effects of climate change on the watershed with respect to its place in the CVC mandate, the organizational expertise to focus on the issue and how it relates to the mandates of other organizations. Examples of priority 1 concerns include drought and flooding, water supply and neighborhood and development pressure (CVC 2007a). According to interviews with key informants, climate change threats are heightening existing concerns in the watershed:

> Well…climate change isn't emerging anymore. Certainly, as you know, it's here and has been for a while. That one, it's not anything new. I think it's just the cumulative effect of issues. I mean for us, land use change has always been the biggest challenge and it's the development in the watershed and its growth, and how do you manage growth in such a way that you still have sustainable healthy ecosystems. So that land use change is an ongoing challenge and what we're just seeing now is a layering now of climate change and more information about climate change on top, so it's just exacerbating the already existing issue that we have. So I don't see anything new on the horizon, I just see one on top of the other and its getting tough to really try to hold the line (B03).

As another key informant explained:

> As a general comment I'd have to say that we've talked about climate change response for the last few years now, and the more we've thought about it and looked at our programs, a lot of what we always did can be connected back to climate change response. Anything that is good for watershed ecology, generally speaking, is going to be good for responding to weather extremes. So habitat restoration for

> instance, something we've been promoting for a long time is good for wildlife species…helping facilitate migration which is going to be absolutely essential for species continuation is being able to move from a stressed environment. So reconnecting habitat patches is something we've always done…we've always done it because we're dealing with a fragmented landscape, but now, as a result of climate change, those corridors become that much more important. Water conservation is something, it's a big part of our business, so it just becomes enhanced at that much more critical when we convey those messages, that we work with the community to start to make change…help them be a bit more proactive in responding to the issue and becoming more prepared…to deal with those stresses that are likely to come their way (B02).

Additional areas of emerging interest or concern for the CA were raised in interviews with key informants. Organizationally, key informants revealed that CVC will be constructing a new building to house additional staff, noting that the CA is out of space and 25% of the existing staff are currently working at locations outside the main office (B01). Key informants explained that although CVC is limited in its ability to mitigate climate change effects, the organization is attempting to reduce its ecological footprint and, as such, will be constructing the new building to LEED specifications, in addition to driving energy efficient vehicles and facilitating tree planting efforts (B01). In terms of adaptation, one key informant explained that CVC is considering ways to promote the "protection and enhancement" of the natural environment through various possible means, including planning policies, land acquisition and public outreach (B01).

CVC employees reported that the organization is concerned with the climate change predictions of extreme wet events of increased frequency and intensity, and the effects they could have in the watershed (B01). One employee explained that CVC is trying to encourage municipalities to consider these predictions when developing or permitting development on land and in their storm water controls in order to prevent extreme runoff, flooding and erosion (B01). One example of this concern is the effect of increased runoff in areas of urban intensification, like Mississauga, that are listed in the Places to Grow Act (B01).

CVC employees also reported that the organization is concerned about the effects of climate change on water availability in the region, explaining that municipalities such as

Orangeville and Halton Hills have already reached threshold levels in terms of their use of groundwater resources (B01). Climate change, coupled with predicted population growth have been a cause for concern for the CA because of how this could affect the ability of current groundwater resources to meet the needs of a growing population and due to the possible detrimental effects climate change predictions may have for wetlands and coldwater fish populations (B01). Concerns regarding the potential effects of climate change on water quality were also identified during public and technical workshops in the Credit River Water Management Strategy Update (CVC 2007b).

Climate change adaptation efforts by CVC include incorporating climate change data in terrestrial models and securing additional data for scenarios in the watershed; considering different climate change scenarios (e.g., wet and warm and dry and warm) in water management strategies and watershed report cards; studying the potential effects of climate change on various species in Natural Areas Inventory Studies (B03; B01; CVC 2007f; CVC 2007e); and expanding the tree planting program (B02). In CVC's Credit River Water Management Strategy Update, climate scenarios are used in order to consider the combined effects of urbanization on water quality and hydrology (CVC 2007b). The report indicates that the organization intends to continue to monitor and adapt to climate change (CVC 2007b). In CVC's 2001 Integrated Watershed Monitoring Program Summary Report, the organization explains that terrestrial monitoring program data collected through EMAN monitoring protocols will provide baseline data and long-term information that could be "related to climate change, land use changes and other impacts and management activities" (CVC 2002, pg. 21).

CVC is also collaborating with the Toronto and Region Conservation Authority and the Region of Peel on an urban forest canopy study to document the status and functions of the canopy. One key informant explained that this study will demonstrate the importance of the canopy in mitigating the impacts of the urban environment including providing shade, reducing energy and treating the polluted air; which in part, will address climate change issues (B02). Other identified efforts include a future workshop for the agricultural sector to discuss adaptation strategies:

> We hope to bring together some leading research around that, just to bring a pool of expertise together for our farming stakeholders to learn about some of the management strategies they can consider, and being more responsive to weather extremes that we anticipate in the future (B02).

In addition to their involvement with the tree planting program, by participating in the Conservation Youth Corps, the CA educates youth about climate change and suggests actions they can take at home to reduce their impacts on the environment. Information kits containing products including low flow shower heads are distributed to participants (B02; CVC 2008b; CVC 2007h; CVC 2007i).

Key informant interviews suggest that CVC has not received any direct funding for climate change efforts from the provincial government (B01). In 2007, CVC received two property transfers from the provincial government for protected green spaces, which benefit the organization's climate change efforts (CVC 2007j). According to one key informant, CVC recently received $300,000 from the province through the source water protection program for a climate change project that involves downscaling climate change models to the watershed level (B01). The key informant further explained that, besides the research conducted by Environment Canada and Natural Resources Canada on the downscaling of climate change models to the Great Lakes Basin Level, downscaling to the watershed level is a new endeavor in Canada (B01). In reference to CVC's ability to downscale climate change models to the watershed scale, one key informant stated: "But even with 300,000 there is a limit to what we think we can accomplish this year" (B01). When asked whether CVC had the staff expertise to complete this project, the key informant reported that the CA does have the expertise with respect to surface and groundwater but is lacking with respect to monitoring related to climate and meteorology. The employee noted that CVC is teaming up with the Adaptation and Impacts Research Division of Environment Canada at the University of Waterloo, which has the resources and expertise related to climate change and modeling (B01).

When asked whether CVC had the capacity to integrate climate change adaptation into watershed management, the opinions of key informants varied. Key informants noted that the additional financial contributions from the Region of Peel have been extremely beneficial to the organization (B01; B02). One employee explained that CVC has studied, researched and planned for climate change is now able to move forward "into an implementation action mode" as a result of the additional financial support, (B03). The financial support has enabled the CA to move forward in hiring employees with technical expertise to proceed with various climate change projects (B03):

> I think we are very well equipped organizationally, financially, technically now, to tackle the big challenges of climate change and land use change and really move into an action implementation mode. So that's new for us. That's new for this CA, and that's because we got a significant increase in resource capability last year.

In terms of funding, employees reported that additional financial support is required from the provincial government, particularly for education programs, flooding and erosion, and climate change (B02; B03). Another employee stated that the provincial government is "well engaged at the water availability level", however; additional resources for and attention to flooding and erosion and terrestrial modeling are needed (B01). In the context of provincial support for climate change, one employee stated:

> They have a significant role to play. I think the municipalities are really leading the charge more so than the Province is. They need to get more involved. There is no question. I don't think they need to be duplicating things, but they could be providing more support (B02).

Another key informant explained that CVC recently examined whether, as an organization, they are structured in a way that facilitates managing the "changing environment" (B03). According to this employee, CVC's executive team concluded that the CA is well structured to do so, and noted that the organization is satisfied with the functionally based structure of departments (B03). This employee explained that integration teams across different departments will "ensure that we will have the right people at the table for the various programs that we are working on" (B03). Another key informant explained that although climate change is "obviously a lot bigger than our

mandate", the CA has "a role to play" in terms of educating the community about the mitigation and adaptation actions that can be taken to protect the watershed (B02).

One key informant believed that CVC's capacity for climate change adaptation in watershed management programs will be limited by the science available to them (B01). For example, in terms of downscaling climate change models to the watershed scale, efforts are still being made to validate downscaling from the global to great lakes basin scale, and so to downscale to the watershed scale with result in large margins of error: "If we get another ten people at it, I don't think that's the answer" (B01). When asked about the resources required for the CVC to integrate climate change adaptation into watershed management, one key informant explained that it is too early for the organization to determine the additional resources that climate change capacity may require. He noted that this will require an advanced understanding of climate change from the organization over the next few years and explained that CVC's main priority will be the downscaling of climate change models to the watershed scale (B01).

Key informants noted that there is "increasing awareness" from the community regarding environmental issues. This is because the early presence of smog days this year and changes in summer and winter weather were likely to capture the attention of the public and remind them of environmental changes that are occurring (B02). Key informants referenced public surveys across Canada which indicated that the environment is the "number one priority" for Canadians (B02; B03). One key informant explained that climate change would be likely to receive more attention if it is communicated as it relates to water availability because the community is more likely to relate to issues of water scarcity in the watershed (B01). CVC's efforts to inform and engage the community about climate change include a Special Edition release of a Currents newsletter, discussing climate change in the watershed and a public survey about climate change impacts, along with additional Current newsletters discussing climate change information (CVC 2007h; CVC 2007k). According to one key informant: "The challenge is to try and make the issue and the response to that issue real. To make it something that people understand" (B02). This key informant noted that it is important to explain to the

community how efforts like installing low flow toilets and CFC light bulbs, are small actions that can be taken which can have positive effects, "rather than continuing to focus on the negative" (B02):

> What are some of the good things that can come from changing our lifestyle? And, if people can see that there is going to be a benefit to them and a benefit to the world around them, I think they're more inclined to take action (B02).

While acknowledging the importance of CAs' priority for water, flooding and erosion planning, one key informant noted there has been a change in the CA's role over the past 50 years toward the integration of land management, terrestrial and aquatic ecosystem monitoring and natural heritage systems development (B03). He explained that CAs are now in a position to "move things on the action side". According to one key informant, defining and mapping natural heritage systems, providing science information to municipalities for planning purposes, and monitoring and collecting, analyzing and modeling data are the "key to protection" (B03). As this key informant explained: "it's always the cart before the horse…it's too bad that we didn't have this a long time ago because we could have protected so much more" (B03). More specifically, this includes making efforts to encourage the adoption of the "natural heritage systems approach" in planning. As this employee stated:

> I see that as a really vitally important part right now for CAs, to really push the agenda right now with its science in many areas, in water management, in natural heritage management and getting it into policies. That's a really important role for use and I think that's one that we need ongoing support from government to play that role and get those policies developed so that we can protect what we have today (B03).

Other issues identified by key informants include a lack of effective communication with watershed residents which, according to one employee, is an issue that has not yet been fully addressed by the CA (B02). This employee further explained that the CA has jurisdiction over a watershed which is very culturally diverse, and the organization needs to find effective ways to communicate with this public:

> We have a considerable number of new Canadians who bring with them, not only different cultural backgrounds and different ways of relating to the natural environment…as well as a different language. So we have a lot to do yet around finding ways of better connecting with that component of our watershed community. That to me is a major concern because that population is continuing to grow and become a more and more significant proportion of the watershed.

Employees also reported continued concerns with development pressure:

> So while we do what we can do to restore habitats, there are other habitats that are getting destroyed by urban development primarily and that continues to be a problem. That just further aggravates the problems that we see in the horizon from climate change, so we've got to continue to focus on that as well (B02).

Key informant interviews and a documentation analysis indicate that climate change adaptation is a priority for Credit Valley Conservation. The CA has secured external funding specifically for climate change adaptation related activities in the organization and has taken actions to consider adaptation options in its watershed management activities. Further, employees within the organization demonstrate interest in and recognize the importance of climate change adaptation and support adaptation initiatives in this CA. Although CVC already demonstrates capacity with respect to climate change adaptation, an evaluation of its current capacity can provide insight into the organizations strengths and weaknesses and how they may enhance or limit further climate change adaptation efforts.

6.3.2 Organizational Environment

6.3.2.1 Organizational Resources

Organizational resources encompass the human, financial and information resources available to an organization. Availability and access to human, financial and information resources and appropriate staff expertise are major factors that can affect the overall capacity of CVC and its capacity to adapt to climate change.

Human Resources

CVC, like all Conservation Authorities, is governed by a Board of Directors. There are five major departments in the organization: Corporate Services, Restoration and Stewardship, Lands and Conservation Areas, Water Resources, and Environmental Advisory Services (Planning). These departments are managed by five Directors and the Chief Administrative Officer (CVC 2008c). CVC is involved in Drinking Water Source Protection as part of the CTC Source Protection Region, which includes the Credit Valley, Toronto and Region, and Central Lake Ontario Source Protection Authorities (CTC 2008). As of 2008 there were 128 fulltime staff and 50 casual employees from or contract fulltime staff members employed at CVC. In 2007 there were 82 fulltime staff and 25 casual staff (Personal communication, July 25 2008). The majority of key informants did not express any concerns regarding the availability of human resources in this organization and noted that the CA has been able to expand its resources in this area over the past few years as a result of additional funding, which has enabled the CA to concentrate further on climate change adaptation efforts. One key informant reported that CVC is experiencing some challenges in finding skilled individuals to fill positions within the CA, including difficulty in hiring planners for the planning department (B03). According to key informants, the CA was able to expand its staff resources in recent years as a result of additional funding from the Region of Peel (B01; B02; B03).

Interviews with key informants suggest that CVC uses external consultants for a variety of projects, although the extent of reliance on consultants varies with each department. Employees reported that the CA uses external consultants for different purposes including hydrogeologists for groundwater modeling; to increase the organization's understanding of terrestrial resources; for assistance with conservation area renovations; and for watershed and subwatershed planning (B01; B02; B03). In reference to the use of external consultants for groundwater modeling, one key informant explained:

> The kind of groundwater modeling work that has been required as part of the Clean Water Act has just outstretched our ability to do that kind of thing in-house. We have three professional hydrogeologists, but that wouldn't come close to touching the

> amount of knowledge that we have had to acquire. We have had a half a dozen contracts out to external consultants for hydrogeology work (B01).

Another key informant noted that, compared to the Water Resources Department, the Restoration and Stewardship department only uses external consultants periodically, as most of the required work is done using in-house staff (B02). CVC employees reported that the CA plans to use coastal engineers for a shoreline management strategy, and consultants with training in economics for the development of a business plan for a potential wetland nursery (B02).

Key informants noted that the CA has been challenged in securing external consultants for specific activities. However, these challenges do not stem from insufficient financial resources or disapproval from the CVC Board of Directors (B01; B03). For example, one employee explained that the demand for groundwater specialists by CAs in Ontario is extremely high as a result of the additional groundwater related activities being undertaken:

> Because every Conservation Authority in the province is pursuing a groundwater specialist, there isn't sufficient capacity on the outside, in the external consultants, to meet the demand. We will compete with our neighboring Conservation Authorities for the time of an individual consultant, and as a result there has been a delay in meeting timelines because consultants are spread too thin (B01).

Key informants did not report any difficulties in interpreting the information provided by external consultants, noting:

> We take great pains in producing our requests for proposals, so it is quite clear. We try to be as clear as we can as to what we are looking for, what the deliverables are. We work very closely through the whole project, through regular reports (B01).

The evaluation of CVC's human resources suggests that there are no major issues with respect to staff resources, time availability and skills of existing staff, particularly with the additional financial support for climate change research. The problems encountered in trying to secure consultants are a common occurrence across CAs due to issues beyond

the control of the organization, and not because of a lack of financial resources. Funding from the Region of Peel has enabled the organization to expand its human resources to focus more on climate change adaptation. Existing staff availability and expertise, and the already existing focus on climate change issues suggest that CVC has the human resources capacity for climate change adaptation

Financial Resources

CVC is funded by its member municipalities, the province and through its own programs and services (CVC 2008d). According to board meeting minutes from January 2008, the CVC has a budget of $24,033,907 (CVC 2008e). A review of financial statements from 2003 to 2006 indicates that the organization has maintained a balanced budget in these years (CVC 2004b; CVC 2005; CVC 2006b; CVC 2007l). CVC's 2006 funding sources are broken down as follows (CVC 2008d):

- Member Municipalities (76%)
- CVC Generated (17%)
- Province (7%)

The 2006 expenses are broken down as follows (CVC 2008d):

- Watershed Management (32%)
- Community Education and Programming (14%)
- Conservation Land Management (25%)
- Watershed Stewardship (10%)
- Environmental Advisory Services (14%)
- Corporate Services (5%)

According to key informants, CVC does not generate a lot of revenue through its conservation areas (B01). Financial support for CVC programs and services varies depending on the department. Drinking Water Source Protection Planning (DWSP) is fully funded by the provincial government, whereas financial support for CVC stewardship and outreach programs is more indirect (B02). For example, financial support for the outreach and stewardship program for the Oak Ridges Moraine is provided by the Oak Ridges Moraine Foundation which is funded by the provincial government (B02).

According to CA employees, the majority of municipal funding comes from the Region of Peel (ROP). Although ROP only represents approximately one-third of the watershed area, it makes up a considerable percentage of the population and is therefore a major financial contributor to CVC (B01; B03). In 2007, ROP contributed an additional $2.5 million to CVC and the Toronto and Region Conservation Authority (TRCA) to fund efforts focused on global climate change mitigation and adaptation (CVC 2007c). An additional $2.5 million was provided by ROP to CVC to further support climate change activities in the watershed (B01; B03; CVC 2008a). Key informants reported that ROP is especially supportive of activities in the watershed because they are located in the lower end of the watershed area and are interested in the effects of activities downstream (B01).

Interviews with CVC employees suggest that the organization is actively involved in seeking funding from external sources (B01; B02; B03), and is encouraged to do so by its participating municipalities, particularly in response to provincial funding cutbacks (B01). One means that CVC seeks external funding is through the Credit Valley Conservation Foundation (CVCF) (CVC 2008f; B01; B02; B03). CVCF was established in 1964 by Credit Valley Conservation and works to secure and provide funding support to the CA for its environmental initiatives (CVC 2008f). The Foundation raises money for CVC projects by hosting community events including Canoe the Credit and an annual Conservation Gala (CVC 2008f; B01; B03). Additionally, CVC and its member municipalities worked together to secure funding from the Ontario Heritage Trust and the Nature Conservancy of Canada for the Greenland Securement Strategy (CVC 2007j).

Key informants reported that funding applications were put forward this past spring to secure support for CVC's Conservation Youth Corps, a youth program for high school students that provides them with experience in natural resources management (B02; B03; CVC 2008g). CVC employees explained that although the organization encourages departments to apply for funding opportunities from external sources, they do not pursue all available opportunities due to time constraints (B02). CVC does not have anyone on staff specifically dedicated to seeking external funding (B02).

The effects of provincial funding cutbacks on programs and projects have been discussed by the CA (CVC 2007a), and were raised in interviews with the key informants (B01; B02; B03). Employees explained that certain CVC programs, including monitoring and education, were terminated in the past as a result of funding cutbacks to Conservation Authorities in the 1990s. According to key informants, recent funding from the province has benefited the organization. One employee explained that the "restored support" from the province for drinking water source protection planning facilitated capacity building for monitoring programs within CVC (B01). Further, employees reported that the CA's ability to conduct research related to groundwater resources has improved (B01). As one key informant explained: "we're probably at the leading edge among Conservation Authorities in our understanding of groundwater and what things need to be done to protect groundwater resources" (B01). Another key informant explained that increased financial support over the last few years has facilitated stronger involvement in new initiatives such as climate change adaptation and mitigation by CVC (B02). Additional financial support also enabled CVC to provide financial incentives to landowners to encourage them to participate in restoration projects (B02). For example, CVC is responsible for a private landowner tree planting service, which offers inexpensive plant materials and free site visits and technical support to help restore privately owned land (CVC 2008h). One employee acknowledged that the additional financial support requires that CVC be more responsible for its programs and services: "As our budget has grown, we have got to be able to account for program effectiveness around watershed restoration" (B02).

CVC has demonstrated considerable success in securing funding for programs and activities with the assistance of the Credit Valley Conservation Foundation. The funding received for climate change adaptation efforts from the Region of Peel with the Toronto and Region Conservation Authority has facilitated adaptation efforts within the organization. This also indicates that the CA is committed to receiving and making use of financial support provided for climate change initiatives in the organization and suggests that CVC has the financial resources capacity for climate change adaptation. However, the CA has been affected in the past by funding cutbacks and could be affected

in the future because of its heavy reliance on external support for climate change adaptation.

Information Resources

Over the past decade CVC has initiated or become involved in several studies aimed at protecting the health of the watershed. In 1999, the Integrated Watershed Monitoring Program (IWMP) was implemented by CVC with the overall objectives "To protect and improve water quality and quantity in" and "To protect and improve biological diversity and productivity of" the Credit Valley watershed (CVC 2004, pg. 4). The purpose of the IWMP is to "detect environmental changes (both spatially and temporally) within the watershed over time" across disciplines including meteorology, hydrogeology, hydrology, terrestrial, fluvial geomorphology, water quality, and biology (CVC 2004, pg. 4). CVC collaborates with the provincial government on a number of monitoring initiatives which contribute to the IWMP including the Provincial Water Quality Monitoring Network (PWQMN), the Provincial Groundwater Monitoring Network (PGMN), and the Ontario Benthos Biomonitoring Network (OBBN) (CVC 2004a). Participation in these programs has enabled CVC to collaborate and share resources with the provincial government. For example, for the PWQMN, CVC provides monthly water quality data to the Ontario Ministry of the Environment obtained from specified monitoring locations among the over 150 in the watershed. These data contribute to a provincial database and can also be used by CVC (CVC 2004a; CVC 2002). The IWMP has generated significant amounts of data that are incorporated into a database developed by CVC and intended for use by CA employees and other groups (CVC 2004a).

Interviews with key informants suggest that the availability of and access to information and data resources is adequate in some areas and insufficient in others, and that data and information resource gaps range depending on the department. CVC's Integrated Watershed Monitoring Program Report (CVC 2002) reported on the organization's adoption of Ecological Monitoring and Assessment Network (EMAN) protocols for forest community biodiversity monitoring, and acknowledged existing data gaps in the Credit River watershed. The report indicates that the CA established three new water

chemistry stations to fill water chemistry data gaps and gain additional information which was lacking for some areas of the watershed (CVC 2002). Other identified data gaps include hydrogeological information and real-time streamflow data for the Shaws Creek subwatershed area (CVC 2006a). The subwatershed report also indicates that rainfall data are lacking or unreliable, as a result of closures of meteorological stations and poor calibration of rain gauges in the area (CVC 2006a). This report emphasized the need to collect additional climate information in the subwatershed (CVC 2006a).

One key informant added that in general, among all CAs, terrestrial resources have "tended to take a backseat to more issues that are directly related to water" (B01). In contrast, key informants noted that CVC has "made quantum leaps" with respect to the organization's knowledge of groundwater resources as a result of provincial funding through Drinking Water Source Protection Planning and the Clean Water Act: "we are probably at the leading edge among CAs in our understanding of groundwater and what things need to be done to protect groundwater resources" (B01). According to CVC's Credit River Water Management Strategy Update (CVC 2007b), groundwater quality data in the southern area of the watershed was lacking because monitoring in the area was not occurring, since groundwater was not used as a drinking water source in the area. The report notes that groundwater wells have now been installed in the area for the purpose of long-term monitoring (CVC 2007b).

According to key informants, although CVC "could be considered by most Conservation Authorities as having a pretty robust monitoring program", the availability of monitoring data and the number of monitoring locations could be improved, particularly in the face of land use changes and urbanization (B01; B03). As one key informant stated "We recognize that it is something that you are always playing catch-up with" (B01). Key informants also noted that the CA is having difficulty in obtaining the volume of monitoring data necessary to develop long-term data series for natural heritage modeling (B03). Another key informant explained that monitoring programs are usually the first programs to be affected by funding cutbacks because of the large quantity of data required through monitoring in order to prove trends (B01). According to this key

informant, monitoring programs were reduced due to provincial funding cutbacks in the 1990s. The organization is now rebuilding its monitoring programs with additional provincial funding support through the Clean Water Act and Drinking Water Source Protection (B01). CVC employees acknowledged that compared to other CAs where resources and funding are lacking, the organization is fortunate in that they are able to carry out monitoring programs (B03).

Although the data requirements for climate change adaptation may vary depending on the specific activity, most broadly, data identified as important for adaptation include past and near real-time meteorological data, a water supply database, climate stations, monitoring data, historic and future climate and hydrological data, flow data, and seasonal hydrological characteristics (Environment Canada 2004; de Loë and Berg 2006). CVC's Integrated Watershed Monitoring Program provides an excellent source of data, facilitates resource sharing and is a means to identify data needs for the organization. In addition, provincial support for drinking water source protection planning has enabled the organization to secure additional water resources data. Further, the CA has begun to expand its information resource base related to climate change adaptation with the funding provided from the Region of Peel and through collaboration with Environment Canada and the Toronto and Region Conservation Authority. The existing data and information resources available to CVC, in addition to efforts to secure additional data related to monitoring, hydrogeological information, real-time streamflow data, rainfall data, climate information and additional meteorological stations provide the organization with a base of data resources necessary for climate change adaptation. The additional funding earmarked for climate change adaptation will also contribute to the CA's efforts to secure additional information and data.

Summary of CVC's organizational resources capacity for climate change adaptation

CVC's organizational resources capacity for climate change adaptation is strengthened by its existing human resources and its financial stability, and its ability to secure external funding from different sources to support current programs and climate change adaptation related activities. As a result of its financial and human resource capacity, the

CA has been able to identify and take measures to fill existing data gaps, and to expand its knowledge of climate change by identifying and making efforts to secure necessary data. The Integrated Watershed Monitoring Program is an excellent avenue for CVC employees to access and share information resources. Table 13 provides an evaluation of CVC's organization resources capacity for climate change adaptation.

Table 13 – Evaluation of CVC's organizational resources capacity for climate change adaptation

Theme	Indicator question	Evaluation
Human resources	Does the CA have adequate staff available for current and future (i.e., climate change) activities?	Yes; CVC is well staffed and additional financial resources have enabled employees to focus on climate change adaptation issues. The CA has been challenged somewhat in securing skilled staff and/or external consultants in some areas. However, existing staff have appropriate skills and expertise and the CAs partnership with Environment Canada provides an additional resource base for climate change activities.
	Does the CA have access to staff or external consultants with appropriate skills and expertise? If the CA uses external consultants, is staff able to interpret the information they provide?	Yes; CVC uses external consultants and is able to interpret the information provided. Some challenges exist with respect to securing external consultants.
	Is the CA and its employees interested in climate change integration?	Yes; the organization has conducted research, secured funding and formed partnerships all related to climate change adaptation, with the intent to make it the number one priority in the organization.
Financial resources	Are sufficient financial resources available to the CA for current and climate change related watershed management activities?	Yes; CVC has received an additional influx of financial resources for climate change research.
	Is the CA able to generate financial resources and/or secure external sources of funding?	Yes; through the CVC foundation, municipalities and other sources. One employee reported time constraints to the organization's ability to pursue all possible funding.
	Is the CA able to maintain a balanced budget?	Yes.
Information resources	Are appropriate information and technical resources available to the CA for current activities and climate change related activities?	Limited; availability is limited in some areas and excellent in others. Attempts have been made by the organization to address these gaps and additional funding for climate change adaptation has facilitated this.

6.3.2.2 Organizational Dynamics

Organizational dynamics refer to the characteristics, features and management approaches of an organization that are identified as contributing to or limiting capacity. Major elements that contribute to capacity include the organization's flexibility, and whether it promotes an environment of learning and adaptive management and forms partnerships and collaborates with other organizations.

Flexibility, Adaptive Management and Learning

Interviews and a documentation analysis suggest that CVC demonstrates flexibility, and promotes and utilizes adaptive management approaches in CA initiatives and programs. In January 2007, CVC released its Strategic Plan 2006 that describes the current state of water management, natural heritage, fisheries, stewardship, land management and conservation areas in the watershed. This plan enables the CA to proactively consider current and future issues in the watershed (CVC 2007a). In 2007, CVC released a Credit River Water Management Strategy Update to the previous strategies completed in the 1980s and 1990s (CVC 2007b). The update, which began in 2003, was driven by the organization's desire to integrate new watershed information obtained since the previous report (CVC 2007b). This included incorporating the latest scientific and technical knowledge and information on development pressures, and legislative and policy changes affecting water management (CVC 2007b). According to CVC (2007b), updates to the existing water management strategy further contribute to the organization's goal to be proactive because they incorporate information related to current and future changes in the watershed. The Water Management Strategy Update describes initiatives and projects that were undertaken based on recommendations in previous strategies (CVC 2007b). For example, as a result of recommendations from the Water Management Strategy produced in the 1990s, 16 of 20 subwatershed studies have been undertaken (CVC 2007b).

CVC also evaluates the effectiveness of watershed strategies through an Integrated Watershed Monitoring Program to determine whether policies and practices require updating(CVC 2004a). For example, the Shaws Creek Subwatershed Study Background

Report was undertaken in 2006 to analyze existing data to ensure that duplicate efforts are not put forward and resources are not spent on work that has already been completed(CVC 2006a). In these reports, CVC emphasizes the importance of a proactive and Adaptive Environmental Approach to watershed management, whereby current and future concerns for the watershed are identified and potential responses to these concerns are developed (CVC 2007a; CVC 2007b).

Interviews and an analysis of meeting minutes suggest that employee training and education is a priority for CVC. Employees indicated that, for the most part, they are very satisfied with the training and education opportunities available to CVC staff (B01, B02). As one employee explained:

> The Directors, our COA in CVC and our Board understand the value of training. There isn't a staff member that isn't off to a workshop, a conference, a seminar-and probably more than one in any year. We encourage it, we facilitate it, we look for leading edge training opportunities (B01).

Another employee noted: "We realized that having well trained staff is essential to us carrying out our job properly" (B02). CVC promotes employee education through individual staff training plans, where potential training requirements and opportunities are identified (B01; B03). In CVC meeting minutes, the organization promoted employee attendance at the A.D. Latornell Conservation symposium, Ontario's most attended annual conservation conference (CVC 2007l; Latornell 2008). One employee explained that CVC gives preference for attendance to employees who have never attended the event (B01). Conversely, another key informant explained that although CVC greatly values the importance of education and training, they would always like to see more resources dedicated to employee development (B02). In 2007, CVC staff identified the need for better opportunities for management training CVC staff (CVC 2007m). In response, CVC allotted an additional $50,000 to support additional staff training (CVC 2007m).

CVC supports and facilitates employee development and utilizes an adaptive management approach by continuously reviewing and adapting policies and programs to

new information and changes, if necessary. The CA's flexible and adaptive approach and support for employee development contribute to the organization's capacity for climate change adaptation, because they enable CVC to adapt its management approaches when new information and technology related to climate change become available.

Communication and Collaboration

According to key informants, communication and collaboration are of great importance to CVC. When asked about departmental communication and collaboration, key informants all reported that CVC recognizes that internal communication is an issue that could be improved and noted that they are currently in the process of assessing how to do this (B01; B02; B03). However, key informants report that communication between departments has improved (B02; B03). One key informant noted that other CAs like CVC who have expanded as a result of additional funding and staff resources, are presented with challenges involving communication (B03). This employee explained that it is important for organizations to reflect on these changes and determine how to better improve integration between departments (B03).

Departments within CVC collaborate in a number of ways. For example, a lands monitoring program undertaken by CVC has expanded from property management related activities to include activities associated with the natural heritage department including invasive species data collection (B03). In addition, CVC is currently in the process of developing a watershed restoration strategy that requires participation from each of the CA's environmental departments (B02). One employee noted that the best example of departmental collaboration within CVC is the organization's work on subwatershed studies (B01). Because subwatershed plans are comprehensive and encompass various environmental resources in a watershed including aquatic and terrestrial systems, wildlife, soil and climate, ground and surface water, and planning policy, departmental collaboration is critical for preparing these reports (B01; B02; CVC 1998).

Interviews with key informants suggest that CVC is actively involved in collaborative initiatives with other CAs. This ranges from resource sharing between CAs to the coordination of activities and studies in the watershed (B01; B02; B03). For example, CVC is part of the Greater Golden Horseshoe which consists of nine CAs who attempt to coordinate and "harmonize" CA policies (B01). Drinking Water Source Protection Planning has also facilitated additional collaboration between CAs (B02). Key informants explained that although the CVC watershed jurisdiction is surrounded on all sides by different CAs (i.e., Conservation Halton, Grand River CA, Toronto and Region CA), the majority of collaboration is with Toronto and Region Conservation Authority (TRCA). This is because CVC and TRCA have jurisdiction over the same watersheds in the Region of Peel (B01; B02; B03). Key informants explained that collaboration and communication between CVC and TRCA are essential when developing programs and policies because the watershed falls in both of the organization's jurisdictions (B01).

According to key informants, communication and collaboration between CVC and TRCA ensures that there is consistency in the activities and policies being developed for municipalities in the watershed, and eliminates duplication of programs developed by each CA (B02; B03). Further, in cases where similar activities are being conducted by each CA, collaboration allows the organizations to present a "united voice" to partner municipalities (B03). For example, one key informant explained that CVC and TRCA are currently collaborating on terrestrial ecosystem enhancement modeling to ensure that the models developed for the Credit River watershed in the Region of Peel are consistent (B03). Additionally, CVC is partnering with TRCA to provide education programs in the watershed (B03). Key informants reported that the collaborative efforts between CVC and TRCA require the CAs to think outside the boundaries of the watershed in delivering similar programs, while recognizing the uniqueness of each watershed (B02). CVC`s Flow Management Study (PEL 2007), acknowledges that future collaboration with adjacent CAs will be required for the implementation of future recommendations.

TRCA also received funding for climate change adaptation efforts in the watershed from the Region of Peel. According to one key informant, this additional financial support has required greater collaborative and integrative efforts between TRCA and CVC:

> Over the last couple of years as a result driven largely by funding, the need for seamless program delivery has become paramount. We have a lot of new funding coming from the Region of Peel over the last few years and it has really forced us to think more integratively and to think about that sort of seamless program delivery (B03).

When financial support was reduced in the 1990s, TRCA was able to maintain its education program while CVC`s program was affected by the cutbacks (B03). As a result, CVC is currently working to develop its education program and is relying on TRCA for support. For example, TRCA provides more youth education programs, and instead of duplicating these programs CVC asked TRCA to deliver them in the shared watershed jurisdiction with support from CVC (B03). One key informant emphasized that although CAs are very interested in collaboration, major factors affecting their ability to do so are financial support and staff resources: "there is a real desire to do that. It's having the resource ability to do it and as long as those resources are available, the staff and funding, then definitely that is a focus of CAs" (B03). Efforts to collaborate have been affected by funding cutbacks in the past; however, CVC was able to hold a lands workshop forum for the first time in twelve years last year, which facilitated collaboration and resource sharing (B03).

CVC has made many efforts to facilitate communication and collaboration within departments in the CA and with external organizations. In particular, the organization's partnership with the Toronto and Region Conservation Authority provides an excellent avenue for resource sharing between CAs. These organizations have collaborated in the past on a variety of projects including jointly seeking funding for climate change adaptation from the Region of Peel. These strong partnerships and the recognition and effort toward improving internal communication contribute to the CA's capacity for climate change adaptation because employees and different organizations can share

expertise, experiences and resources related to climate change that may not be available to the organization.

Summary of CVC's organizational dynamics capacity for climate change adaptation

CVC's organizational dynamics capacity for climate change adaptation is strengthened by its proactive and adaptive approach to watershed management and its collaboration and communication with TRCA. The CAs proactive and adaptive approach to watershed management indicates that the organization has the capacity to adapt to new information and technology that climate change adaptation may require. Collaborative efforts between CVC and TRCA aimed at climate change adaptation initiatives resulted in additional financial support for the CA from a member municipality, specifically for climate change, and could further encourage resource sharing and additional joint efforts for climate change initiatives. However, some limitations to capacity are identified with respect to communication and collaboration within the organization; they are being addressed, and programs such as the IWMP further encourage collaboration. Table 14 provides the evaluation of CVC's organizational dynamics capacity for climate change adaptation.

Table 14 – Evaluation of CVC's organizational dynamics capacity for climate change adaptation

Theme	Indicator question	Evaluation
Flexibility, learning, and adaptive management	Does the CA continuously review or assess its management approaches or adapt them to better achieve desired program outcomes (adaptive management)? Is the CA flexible in its approaches to management and problem solving?	Yes; watershed management and subwatershed management strategies are continuously evaluated as well as organizational approaches. CVC encourages and Adaptive Environmental Approach within the organization.
	Is the CA dedicated to continuous learning and development, and does it provide training and skill development opportunities for employees?	Yes; CVC facilitates and encourages staff training and development wherever possible, through employee training plans.
Networks, partnerships and communication	Do employees within the CA communicate and collaborate with each other and does the CA facilitate collaboration?	Yes; through IWMP and other projects. CVC is also in the process of improving integration and collaboration among departments.
	Does the CA form partnerships with other organizations	Yes; partnerships and collaboration exists with other CAs and organizations.

6.3.3 The Action Environment

The action environment refers to the level of community support and involvement CVC's watershed management activities, the efforts of the conservation authority to promote public awareness and involvement in watershed management and the support and leadership provided at the political level.

Community Support and Involvement

Key informant interviews and a documentation analysis suggest that CVC communicates and collaborates with the watershed community in a variety of ways. According to CVC (2008n), the organization "believes in conservation through cooperation". The CVC identifies approximately forty different community partners on its website, ranging from educational resource organizations to citizens groups (CVC 2008i). The CA collaborates with landowners, community groups and other organizations through its Restoration and Stewardship Program and encourages participation through stewardship and

electrofishing opportunities (CVC 2008j; B02). CVC has over 2400 ha of conservation areas available to the public for recreational use including fishing and canoeing (CVC 2008k). The CA collaborates with the municipalities to provide outreach and education through events including lawn garden workshops (B02), and has established a partnership with the local school board who runs its education training program in CVC's conservation areas (B03). In addition, CVC established a youth program called the Conservation Youth Corps that provides students with hands-on experience in natural resources management (CVC 2008g; B03).

Key informant interviews suggest that CVC is focused on community outreach and education and is in the process of revitalizing its education programs (B03). According to one key informant, the organization's education programs were affected by funding cutbacks in the 1990s (B03). With the addition of a new educational coordinator, CVC is currently in the process of rebuilding these programs (B03). According to meeting minutes from June 2007, any new CVC recreation programs are to be education focused (CVC 2007m). The CA concentrates on providing education at various levels to a variety of individuals with different backgrounds in the community, including students and adults, and professional consultants who work in the watershed, such as engineers, hydrogeologists and hydrologists (B03). According to one key informant, CVC is focused more on providing education to adults and professionals than on youth education (B03). Community participation is encouraged for the development of watershed reports and studies. For example, community members and other stakeholders were encouraged to participate in focus groups to provide input into a subwatershed study that included a guided bus tour of the subwatershed area (CVC 2006a).

One informant explained that the CA relies on staff with a range of educational backgrounds to ensure that the organization's approaches to watershed management meet ecological needs while building support within the local community (B02). This employee added that it is important for the CA to communicate the benefits of participation in CVC programs to the local community and to build trust with the organization's stakeholder groups (B02). This employee reported that the CA is

currently undertaking research on ecological goods and services in an attempt to convey to the community the value of the watershed to gain better support for watershed stewardship and sustainability efforts (B02). Key informants reported that although they feel there is community support of watershed management and a general understanding of the importance of the water, the majority of the public does not understand the meaning of watershed management (B02). Lack of environmental awareness in the community was cited as a Priority 1 threat to the watershed in CVC's Strategic Plan 2006 (CVC 2007a, pg 59):

> There needs to be a greater role played in fostering awareness of general environmental, natural and earth science themes such as, but not limited to, habitats, species, landscapes, functions, influences and ecosystem services.

Further, a lack of understanding regarding the role of the organization by the community and other stakeholders was identified as a weakness in the CA (CVC 2007a).

CVC worked with the Municipal Presidents of the Ayuquila Watershed in Mexico to assist them in their watershed management efforts. The initial intent was to provide Mexico with information about watershed management in collaboration with CVC and the University of Guelph, and to use CVC and Conservation Authorities as models for watershed management (CVC 2007n). As a result of this collaboration, Mexico created the first watershed management agency in the country on February 4th, 2008 (CVC 2008m).

CVC facilitates communication with and participation by the watershed community in a variety of ways, including workshops, stewardship opportunities, youth programs and newsletters, indicating that the CA has strong capacity in this area. However, issues with the public's understanding of watershed management, and the diversity of backgrounds in the community could affect the CA's capacity for climate change adaptation. If the community does not fully understand the purpose of watershed management and the role of CVC, the organization may also face challenges in undertaking and promoting activities important for climate change adaptation.

Municipal and Provincial Support

At the local level, collaboration and communication with CVC and its partnering municipalities occurs in a number of different ways. As one key informant reported, the CA is "encouraged to maintain a working relationship with all of our watershed municipalities" (B01). This employee further explained that CVC's relationship with partnering municipalities varies depending on "the size and the sophistication of the municipality", and noted "our relationship with the City of Mississauga would be quite different than our relationship with the town of Erin" (B01). The key informant explained that the CA works with the larger municipalities on activities like storm water management and with the parks and recreation department on tree planting initiatives; and, with the planning departments on planning applications (B01). Other examples of collaboration identified by key informants include education and outreach through lawn garden workshops for urban areas, source water protection outreach programs, urban restoration, and community planning events (B02). CVC also communicates to municipalities in the watershed through the distribution of the newsletters *Currents* and *Cascades* (B03; CVC 2008n).

Key informants reported that, in general, they are satisfied with the level of support provided by CVC's partner municipalities; however, they noted that there is always room for improvement (B02; B03). One key informant stated that he felt that the municipalities, particularly the larger ones, are aware of and support CVC initiatives, but noted that communication could be improved (B03). Another key informant explained that because the Region of Peel is located at the lower end of the watershed, it is more likely to support initiatives undertaken upstream that could affect water quality downstream (B01). When asked if he felt that there was adequate support from participating municipalities, one key informant explained that municipalities can be "insular" with respect to looking to CVC as a prospective partner for certain initiatives (B02). This key informant noted that there have been some instances where CVC has been notified of municipal projects after completion that would have been of interest to the CA (B02).

Key informant interviews suggest that CVC employees feel that provincial support and guidance are insufficient in various CA programs. One key informant reported that CVC collaborates with the local district office of the Ministry of Natural Resources on a number of projects (B03). This includes a current effort by the CA to reopen and revitalize a Conservation Area that was closed as a result of provincial funding cutbacks (B03). This project involves direct collaboration with the MNR district office biologist (B03). One CVC employee noted that this MNR biologist is actively involved in watershed issues and provides guidance for fisheries rehabilitation initiatives and acts as Chair of the implementation committee for the Credit River fisheries management plan (B02).

CVC and the MNR also collaborated on the development of an environmental assessment for a restoration project on the Rattray Marsh (B01; CVC2007e) - a shoreline marsh in one of the CA's conservation areas (B02). Key informants were unsure of whether the MNR would be of assistance during the implementation of this project (B02). One employee indicated that additional support surrounding fisheries science is required (B02). This employee noted that, although fisheries management is mandated by the MNR, the ministry does not "have much presence in our watershed" with the exception of the local MNR biologist (B02). This employee continued on to explain that the biologist is currently "worked to the max", and additional staff resources for aquatic science would be beneficial (B02). Other key informants felt that the CA's relationship with the MNR is satisfactory. One employee stated: "We definitely have a good working relationship with the MNR" (B03).

According to CA employees, CVC's relationship with the Ontario Ministry of the Environment (MOE) is centered on water resources policies and programs including Permits to Take Water and the *Water Resources Act* (B03). The provincial government fully funds CVC's Drinking Water Source Protection planning. CVC employees reported that this provincial support has enabled the CA to advance its understanding of groundwater resources and this has greatly benefited the partner municipalities (B01). One employee noted that the MOE has provided additional financial incentives for

stewardship projects involving source water protection that required a closer working relationship between the Ministry and CVC (B02). According to one employee, CVC has been "quite successful on the provincial level", in terms of securing funding (B01). Another employee stated that additional support is required for "broader based initiatives", including additional materials for education and outreach initiatives (B02). With respect to education and outreach, this employee explained that the MOE is "still learning as they go" (B02). This employee acknowledged that the MOE is progressing in this area but felt that the ministry should be spending more time with and seeking advice from CAs because they have more experience with education and outreach.

Employees acknowledged that CVC has a good working relationship with the provincial government; however, issues related to financial support were identified (B01; B03). Issues and concerns regarding provincial support were raised by key informants in a number of responses to interview questions, and employees often referred to the provincial funding cutbacks that occurred in the 1990s, when discussing resource issues in CVC (B01; B03). Key informants reported that programs including monitoring and education were negatively affected as a result of provincial funding cutbacks and CVC is now working to rebuild these programs with the support of addition municipal funding from the Region of Peel (B03). Key informants reported that the major issue for CAs is obtaining long-term, secure, stable funding (B03). One employee noted that local politicians have encouraged the CA to communicate with the provincial and federal governments to gain support in providing stable and long-term funding (B03). Key informants reported they were not aware of any organized action currently taking place to secure stable funding from these governments, but noted that Conservation Ontario (CO) is "really starting to try and put plans together to work more closely with the Province and with the federal government to secure funding for CA work" (B03). One employee explained that Conservation Ontario assists CAs in terms of establishing "common positions in responding to provincial and federal initiatives" (B02). The CA has not yet received support financially or in the form of legislative guidance for climate change adaptation from the provincial or federal government.

CVC's action environment capacity for climate change adaptation is strengthened in particular by the organization's strong working relationship with the Region of Peel that has provided the CA with financial support for watershed management activities, and recently for climate change adaptation initiatives. This strong relationship and the Region's existing interest in and support for climate change initiatives within CVC indicate that the organization may continue to gain support from the region for additional climate change related activities in the future. Although the CA has a working relationship at the local level with the Ministry of Natural Resources and with the Ministry of the Environment for drinking water source protection, additional financial support and guidance from the provincial government were identified as needs for CVC.

Summary of CVC's capacity for climate change adaptation in the action environment

CVC's capacity for climate change adaptation in the action environment is strengthened by its relationship with partner municipalities and particularly the Region of Peel. These relationships, the CA has gained additional expertise and resources, and support for climate change adaptation. Weaknesses in capacity exist in terms of the watershed community's understanding of the CA. Long-term, stable funding support at the provincial level was identified as a resource need. However, the CA was able to secure funding for climate change adaptation from other sources. Table 15 provides the evaluation of CVC's capacity for climate change adaptation in the action environment.

Table 15 – Evaluation of CVC's capacity for climate change adaptation in the action environment

Theme	Indicator Questions	Evaluation
Community support and involvement	Are opportunities available for the community to participate in decision-making?	Yes; through focus groups in subwatershed studies and public surveys.
	Are education opportunities made available to the public and has the organization developed activities that promote community awareness and support?	Yes; through volunteer programs, pamphlets and CVC's website, community awards and events, and newsletters. Some problems with the watershed community's understanding of the role of the CA and the purpose of watershed management were identified.
Political support	Is adequate support provided by the municipal and provincial governments	Limited provincial support and strong municipal support; provincial support is provided at the local level through a relationship with the local OMNR. However, a lack of guidance and support for climate change adaptation has been identified. CVC collaborates with the watershed municipalities on various projects in a number of departments and provides a newsletter and has established a strong relationship with the TRCA, which facilitates resource sharing.

6.4 Summary

Credit Valley Conservation's capacity for climate change adaptation is well-developed. Strengths contributing to the CA's capacity include recognition of climate change adaptation as a priority within the organization and strong interest in and support for climate change related activities by employees, the skills and availability of human resources as well as the availability of financial resources for climate change, a proactive and adaptive approach to watershed management, and a strong relationship with the Region of Peel and Toronto and Region Conservation Authority. Weaknesses limiting the CA's capacity include existing challenges in communicating the purpose of the CA to the local watershed community, and a lack of guidance and long-term, stable funding at the provincial level for climate change adaptation.

CHAPTER SEVEN

DISCUSSION AND CONCLUSIONS

This research sought to answer the question: "What capacity do Ontario Conservation Authorities currently have to adapt to climate change in their watershed management activities?" Objectives one and two were achieved through the development of an evaluative framework that was used to assess the capacity for climate change adaptation in two case study Conservation Authorities, the North Bay – Mattawa Conservation Authority and Credit Valley Conservation. The completion of objective three – to propose recommendations for improving the capacity for climate change adaptation in Ontario Conservation authorities, is accomplished in the discussion that follows.

This chapter provides a comparison and discussion of the capacity for climate change adaptation in the North Bay – Mattawa Conservation Authority (NBMCA) and Credit Valley Conservation (CVC) based on the results of the evaluations of the institutional environment, organizational environment and action environment in Chapters Four, Five and Six. Finally, recommendations toward capacity-building for climate change adaptation in Ontario Conservation Authorities are presented.

7.1 Case study comparison

A capacity evaluation of two case study CAs was undertaken in Chapters Five and Six using an evaluative framework developed in Chapters Two and Three. The framework was developed through a review of capacity and capacity-building, climate change adaptation and water management literature. The evaluation was informed by data acquired through key informant interviews, documentation and direct observation. The case study evaluation was conducted to assess the CAs' capacity for climate change adaptation in watershed management. Insight into an organization's capacity to adapt to future changes in climate can be drawn from its current capacity to adapt to present circumstances (Ivey *et al*. 2004). Therefore, for this research conclusions about the capacity for climate change adaptation in Conservation Authorities were drawn from an

evaluation of their existing capacity in the institutional, organizational and action environments.

Overall, the capacity for climate change adaptation varies considerably between the NBMCA and CVC. The case study evaluation indicates that the NBMCA and CVC are at very different stages with respect to their current climate change adaptation efforts. CVC has already begun to adapt to climate change and has made significant efforts to support adaptation initiatives by developing partnerships with TRCA and securing financial resources specifically for activities related to climate change. In contrast, climate change adaptation is currently not being considered in the NBMCA. Despite this difference, the results of the evaluation point to the opinions and attitudes of the organizations and their employees as playing a significant role in the CAs' capacity for climate change adaptation. In CVC, climate change adaptation has been identified as a main priority by the organization and efforts have been made to integrate climate change considerations into its watershed management programs and activities. Employees within this CA expressed considerable interest in and enthusiasm for CVC's involvement in climate change adaptation. In comparison, the opinions and attitudes of employees in the NBMCA varied with respect to the importance of considering climate change adaptation within the organization, and in terms of the CA's capacity to adapt to climate change. All employees acknowledged the importance of climate change adaptation in general, but some employees believed that it is an issue that should be handled at the provincial level, and questioned whether the NBMCA had the capacity to consider climate change adaptation.

In the institutional environment, inadequate support and guidance for climate change adaptation is affecting the capacity of the NBMCA in particular. Existing policies, support and guidance for climate change adaptation at the watershed level are nonexistent, and the need for guidance and long-term, stable financial support were identified by both CAs. However, in the absence of provincial funding, CVC has demonstrated better capacity in its ability to dedicate time and resources to secure external funding at the municipal level for climate change adaptation. In the NBMCA,

existing time constraints and limited staff and financial resources availability are affecting the organization's ability to make efforts to secure external resources for climate change adaptation activities. Some employees reported that climate change adaptation is more of a provincial initiative and believed that the CA should wait for provincial support and guidance.

In the organizational environment, the capacity in each CA varies considerably. The NBMCA is challenged by limited human and financial resources availability and this is affecting the organization's ability to conduct existing activities, as well as its capacity to take on additional activities such as climate change adaptation. CVC does not demonstrate any financial limitations and was able to secure additional funding from the Region of Peel for climate change adaptation. This has enabled the organization to hire additional employees and expand its research to further consider climate change adaptation. The abilities of existing staff in each CA are appropriate and NBMCA employees have demonstrated a willingness and ability to develop their skills when required. For both CAs, emphasis and support are placed on the importance of education, training and development. However, the NBMCA missed an opportunity to participate in and observe efforts aimed at climate change adaptation being undertaken in other CAs by not participating in the most recent A.D Latornell Conservation Symposium. In CVC, attendance at this conference is a priority, and employees within the CA actually presented research at the 2007 conference.

For CVC, adaptive management approaches in this organization are explicit. This CA encourages and utilizes adaptive management in watershed programs and subwatershed reports; emphasizes the importance of evaluating and adapting existing programs and strategies; and, puts this approach into action by updating existing reports to incorporate new and pertinent information. This CA demonstrates a proactive approach to management by considering current and future threats and changes to the watershed and identifies them to the municipality and community through reports and presentations. In contrast, the NBMCA is not using an adaptive management approach in its programs. Employees within the organization demonstrated flexibility and a proactive approach

with respect to self-initiated learning and development. However, evidence of adaptive management approaches is restricted to one internal brainstorming session aimed at improving internal and external organizational communication.

Efforts aimed at organizational communication and collaboration differ significantly in each CA. For the NBMCA, weak organizational communication and collaboration are limiting the capacity of the organization. For CVC, the importance of departmental communication and collaboration is more strongly emphasized by the organization. The CA recognizes this importance and has started to consider approaches to improve departmental integration, particularly because it has expanded its staff and financial resources. Evidence of existing communication and collaboration is demonstrated through cross departmental efforts in subwatershed studies and through the Integrated Watershed Monitoring Program.

Both CAs demonstrate capacity in their efforts at communication and collaboration with external organizations. The NBMCA communicates with four northern Ontario CAs as part of a regional working group for drinking water source protection. External communication involving drinking water source protection also occurs through resource sharing between project managers in different CAs. The CA established partnerships with a number of community groups and with the local university which facilitates resource sharing. For CVC, a strong relationship involving communication and collaboration exists with the Toronto and Region Conservation Authority. The CAs share resources, work jointly to ensure consistency in policies and activities in the watershed, and successfully secured additional financial support from the Region of Peel specifically for climate change adaptation.

Both CAs demonstrate comparable capacity in the action environment, with similar strengths and weaknesses. For the most part, the NBMCA and CVC's relationship with the provincial government is comparable. The CAs both indicated that additional support from the province is necessary, including long-term, stable funding and guidance. Although the type of support differs for each CA, the capacity in these organizations is

strengthened by the support provided at the municipal level. For the NBMCA, the organization's involvement in drinking water source protection has resulted in additional communication and resource sharing with participating municipalities in the watershed which has positively affected the CA's capacity. In particular, the CA seeks support from the City of North Bay for engineering advice and uses the City's Geographical Information Systems database. For CVC, in addition to collaborative efforts with participating municipalities on activities in the watershed, the CA received additional support from the Region of Peel for climate change efforts in the watershed in 2007 and 2008. In both CAs, there is recognition of the importance of communicating the role of the organization to the public and the NBMCA and CVC make efforts to educate and involve the public in watershed activities. Both CAs identified concerns and challenges with the public's understanding of Conservation Authorities and the value that the community places on watershed management.

7.2 Reflections on climate change adaptation capacity in Conservation Authorities

For all Conservation Authorities, a lack of support and guidance at the provincial level could affect their capacity for climate change adaptation over the long term. Currently, policies or legislation guiding climate change adaptation in watershed management do not exist. Further, the existing state of institutional arrangements guiding water management has been heavily criticized as being too fragmented (Brandes 2005; Christensen 2006). Although certain CAs, such as Credit Valley Conservation, may have the existing capacity to begin to adapt to climate change in the absence of this guidance and support, other CAs may not have the capacity to do so without this support. Regardless of the ranging capacity in CAs, additional support would be beneficial in assisting these organizations in initiating and/or maintaining climate change adaptation initiatives over the long-term.

Support at the municipal level, particularly in terms of funding, has facilitated CVC's climate change adaptation efforts. Although both organizations identified a need for long-term, stable funding and support at the provincial level, this research highlights the

important role that municipal governments can play in the capacity of CAs. In both CAs, municipal support in the form of resource sharing, expertise and collaboration plays a significant role in these organizations. For the NBMCA, the City of North Bay provides expertise, advice and information resources, and for CVC, financial resources from the Region of Peel have supported the CA's climate change adaptation efforts. However, similar to the past negative effects of funding cutbacks on CVC's programs and activities, a heavy reliance on external funding could affect the organization's ability to maintain programs involving climate change adaptation if this support is reduced (Michaels *et al*. 2006; de Loë *et al*. 2002).

As is demonstrated through this evaluation, the organizational environment capacity in Conservation Authorities varies significantly, particularly with respect to organizational resources. For the NBMCA, financial and human resources in particular are lacking and this is affecting the organization's capacity in other areas, despite the demonstrated capability of employees within the organization, and this is also affecting the CA's information resources capacity. This supports Franks (1999) argument that, even with capable employees, an organization's ability to perform is affected by the availability of resources. For example, because of insufficient human and financial resources, employees are stretched to their limits in terms of completing existing tasks and the organization has not been able to undertake necessary watershed studies. Further, the CA is constrained in its ability to participate in, or initiate new programs which supports the argument of Schuh and Leviton (2006) that financial constraints can affect the ability of an organization to complete management tasks. Financial limitations can further add to the time constraints experienced by employees because efforts to reduce organizational costs can increase the time spent on activities. In contrast, CVC demonstrates strong capacity with respect to financial and human resources which has enabled the organization to further expand its resources and participate in and initiate additional programs. CVC demonstrates capacity in securing external sources of funding to support its existing and developing programs, as is seen in the additional funding secured for climate change projects from the Region of Peel.

A notable difference between the NBMCA and CVC is the varying opinions and levels of interest in climate change adaptation among employees. In CVC, key informants strongly support climate change adaptation in the organization, whereas in the NBMCA the opinions of employees varied regarding whether climate change adaptation is an important consideration for CAs and whether the CA had the capacity to adapt. This finding supports Biswas' (1996) argument that it is the employees that play a critical role in an organization's capacity more than the presence and quality of institutional arrangements, as is demonstrated in CVC. Drawing on this, is support for the argument that capacity is also affected by the flexibility of an organization and its employees (Georgsdottir and Getz 2004). Flexible organizations support creativity and innovative thinking among employees, and enable employees to recognize, respond and adapt to new information and technology (Danter *et al*. 2000; Georgsdottir and Getz 2004; Smit and Wandel 2006; Tompkins and Adger 2005). CVC demonstrates flexibility, encourages creative thinking among employees and supports their participation in conferences, such as the A.D. Latornell Conservation Symposium – an excellent avenue for other organizations to network and display creative and new approaches to watershed management. Participation in this type of event could bring new ideas to an organization like the NBMCA, and encourage employees to think creatively about how they can begin to integrate climate change adaptation into their watershed management activities.

The results of the evaluation also support the argument for the importance of networks and partnerships to an organization's capacity for climate change adaptation, as presented by Smit and Wandel (2006), de Loë et *al*. (2002) and Tompkins and Adger (2005). For CVC, a strong relationship involving communication and collaboration exists with the Toronto and Region Conservation Authority which has contributed to the CA's capacity for climate change adaptation. The CAs share resources, work jointly to ensure consistency in policies and activities in the watershed, and collaborate on various projects including terrestrial ecosystems enhancement modeling and education programs. This partnership is beneficial for the organization because it facilitates resource sharing and a team effort for both CAs for activities aimed at improving the health of the watershed. A

particularly significant benefit for CVC's capacity for climate change adaptation was the joint effort to secure funding specifically for climate change from the Region of Peel.

For the NBMCA, the organization demonstrates efforts aimed at establishing partnerships with external organizations. The CA's relationships with Nipissing University and the City of North Bay are beneficial to the organization in that they facilitate resource and knowledge sharing. Although the NBMCA has not yet begun to consider climate change adaptation, well-established relationships with these organizations could provide the organization with resources and expertise that the organization may not otherwise have for climate change initiatives in the future. In CAs such as the NBMCA, which are experiencing financial and human resources constraints, collaborative efforts and partnerships with other organizations can contribute to their capacity for climate change adaptation. As is demonstrated in CVC, organizations can share resources and work jointly to approach climate change adaptation without it being necessary to secure additional human resources specifically for this purpose. In addition, the CAs can work jointly to secure external funding for specific activities aimed at climate change adaptation.

Consistent with past experiences identified in the literature, CAs continue to face challenges in communicating the purpose of watershed management and explaining the role of their organizations to the local community (Decima Research 2007a). A lack of understanding about CAs and the purpose of watershed management could present challenges for the NBMCA and CVC if or as they engage in activities related to climate change adaptation in their watersheds. As explained by Tompkins and Adger (2005) and de Loë *et al*. (2002), support from the community can contribute to the successful completion of an organization's activities and tasks if the public understands the purpose of the project being undertaken. These authors further explain that support from the community can enhance the capacity of an organization, because community members can contribute their skills, knowledge and resources. Better communicating the role of the organization and the purpose of watershed management to the local community should remain a priority for Conservation Authorities. With respect to climate change

adaptation, CAs should work toward developing and communicating mission statements and goals regarding climate change adaptation, and actions they plan to take to achieve these goals to the local community. CAs should also communicate the effects of climate change at the watershed scale to the local community. In addition, these organizations should begin to integrate climate change considerations into existing educational programs for the watershed community. Educating the public about the importance of climate change adaptation in watershed management and how community members can contribute to adaptation efforts is an important step toward gaining community support (Strong 2000). Public information campaigns that describe the issues surrounding climate change, possible solutions, and how community members can change their behaviors to benefit adaptation efforts are argued to be effective communication tools (Strong 2000). CAs should consider these as a possible avenue to communicate with the public about climate change adaptation.

The research question for this thesis was: "What capacity do Ontario Conservation Authorities currently have to adapt to climate change in their watershed management activities?" As is evident from the evaluation results described above, the capacity for climate change adaptation varies considerably between the two CAs used in this study. Each CA demonstrates different strengths and weaknesses that contribute to or limit the capacity in these organizations. Recognizing the organizational differences between the NBMCA and CVC (e.g., staff size and financial resources) that are contributing to or limiting their capacity for climate change adaptation, it is important to discuss how external factors or characteristics of different watershed jurisdictions may affect the adaptive capacity of these CAs.

For the NBMCA, key informant interviews and a documentation analysis suggest that the majority of past and current challenges encountered by the CA relate to financial and human resources. The watershed jurisdiction of this CA is not facing population growth pressure to the extent that southern Ontario jurisdictions are. In fact, from 1996 to 2001 the population in northern Ontario declined by 4.5% and was stable from 2001 to 2006. Projections for 2031 suggest that the population will decline an additional 4.5% (Ontario

2008b). Further, no major concerns related to water quality and quantity were identified by key informants in the NBMCA. For CVC, key informant interviews and a documentation analysis suggest that this CA has dealt with, and continues to face, challenges related to population growth and development, water quality and water quantity (CVC 2007a; CVC N.D). The Greater Golden Horseshoe, of which the Credit Valley Watershed is a part of, has been identified as "one of the fastest growing populations in North America" (pg. 12), with a projected population growth of an additional 3.1 million by 2031 (Ontario 2006b). From 1991 to 2001, the Credit Valley watershed experienced a population growth of 16% and continues to receive 21,000 new immigrants each year (CVC 2007a).

The contrasting levels of adaptive capacity between the NBMCA and CVC may indeed be affected by past challenges experienced in each CA. As discussed by authors including Armitage (2005), Folke *et al*. (2005), Franks (1999), Lemos (2007), and Pahl-Wostl (2007), the ability of an organization to learn from past experiences and challenges, to evaluate past responses and adapt them if necessary, and to use adaptive management, are important to the capacity of an organization. Due to the nature of the setting of CVC and the watershed characteristics in its jurisdiction, this CA has already been called upon to consider and cope with issues that have affected and continue to affect the watershed including population growth, land use change, and water quality and quantity issues. As a result, CVC has already gained experience in adapting to change, and has had the opportunity to learn from past experiences and challenges. This CA has built up its adaptive capacity to cope with these changes and this is evident through the adaptive management and proactive approach used in the organization that facilitates learning, and adjustment to change when required. In contrast, the NBMCA has not experienced the challenges and threats that CVC has encountered in its watershed and has not yet been called upon to or challenged to develop its adaptive capacity to the same extent as CVC.

Efforts should be made between all CAs to better communicate their successes and challenges with each other and to share the knowledge and lessons learned from their past

experiences in watershed management. In this way, CAs that may be facing similar challenges affecting their climate change adaptation capacity and that may not have been challenged to build adaptive capacity based on past experiences can learn from the challenges and successes of other CAs. To date, Conservation Ontario has made some attempts to highlight the efforts made by CAs to adapt to climate change in watershed management in a newsletter. In addition, the A.D Latornell Conservation Symposium provides an avenue for CAs to highlight their experiences and research approaches. However, a stronger effort should be made to encourage and facilitate greater networking among CAs, so that these organizations can look for and learn from leaders who have successfully begun to adapt to climate change.

7.3 Future research

This research sought to determine what capacity CAs currently have to adapt to climate change in watershed management, in its broadest form with the assumption that climate change effects will be felt at the watershed scale. Future research could focus more specifically on assessing the vulnerability to climate change in individual watersheds and with individual Conservation Authorities. Further, it could focus on determining the ideal adaptation options for these organizations based on their individual capacities and watershed characteristics. Additional research could also be conducted to develop more specific recommendations for capacity building in the institutional, organizational and action environments.

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APPENDIX

Appendix I Interview Question Guide

Describe your roles and responsibilities within the conservation authority.

a. How long have you been with this conservation authority?
b. What kinds of skills, knowledge and expertise are required for your position?

B. Describe the technical data and/or information resources required for your job.
   a. How and where do you access this information?
   b. Are data/information resources readily available and accessible, or have you encountered any challenges in obtaining this data? Explain.
   c. Is the quality of data/information resources adequate, or are there any areas where they are lacking? Explain.
   d. Does an example of a particularly challenging situation related to technical resources (or staff, financial, skills) that affected your ability to undertake a particular task come to mind? Explain.
   e. Explain how you/your organization overcame this challenge.

C. What opportunities are available to staff to upgrade their education and training?
   a. How are you encouraged to take on new roles, initiatives and studies within the conservation authority?

D. How do you collaborate with other employees and other departments in your conservation authority?
   a. Can you identify the departments and provide some examples of projects you have collaborated on.
   b. If no, can you explain why?

E. Do you consult with experts from other organizations/levels or external consultants for expertise if staff is unable to undertake a specific task? Explain.
   a. Have you encountered any challenges in securing external consultants or in interpreting the information they provide? Explain.

F. How does the conservation authority seek external sources of funding?
   a. Explain this process.
   b. How does the conservation authority work together with other organizations to secure new funds for watershed management activities?
   c. Can you provide examples of recent applications for funding for current and/or future projects?
   d. How do you collaborate with the local government(s) in the watershed?
   e. Can you describe some of these collaborative efforts?

f. Do you feel that adequate guidance and support is provided to the CA from the local government? Explain.

G. Can you describe your relationship with the provincial government?
    a. What kinds of support does the provincial government provide (financial, information, technical) for your specific position?
    b. Do you feel that the provincial government provides the CA with adequate guidance and support for watershed management? Explain.

H. Can you provide examples of partnerships between the CA and other organizations?
    a. How do these partnerships benefit the conservation authority's watershed management activities?
    b. Outline the education programs available for the community, to increase their awareness about water quality and water quantity issues in the watershed.
    c. Outline the programs available to encourage community/public participation in watershed protection.
    d. How does the public communicate and raise issues and concerns with the conservation authority?
    e. What kinds of issues have been raised by the local community since you have been with the conservation authority?

I. Can you identify any emerging or future challenges or issues that the conservation authority views as important to watershed management?
    a. Can you explain why these are important?
    b. How is the CA currently considering/incorporating/taking action to address these challenges in your management plans?
    c. Has the conservation authority discussed how to approach these challenges in the future? Explain.
    d. What kinds of resources do you believe the CA will require to cope with these challenges, and can you explain whether you believe the CA currently has the capacity to manage these challenges?

J. Explain how future land use change, population change and/or climate change impacts are being considered in your current watershed management practices?
    a. Have plans been developed to incorporate climate change into current watershed management activities?
    b. Has the local/provincial government addressed the importance of considering climate change?
    c. Is this something you/your organization would be interested in undertaking?
    d. What kinds of resources/skills do you think this would require?

e. Do you think the CA has the capacity (skills, data, financial) resources to adapt to climate change? Can you identify some challenges the CA may face?