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Measuring Progress on Climate Change Adaptation: Lessons from the Community Well-Being Analogue

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Acronyms

Canadian Index of Wellbeing (CIW)

Climate Change Impacts and Adaptation Division (CCIAD)

Climate Change Adaptation (CCA)

Community Well-Being (CWB)

Gross Domestic Product (GDP)

Genuine Progress Index (GPI)

Natural Resources Canada (NRCan)

Subjective Well-Being (SWB)

Introduction

This paper reports to the Climate Change Impacts and Adaptation Division (CCIAD) at Natural Resources Canada (NRCan), specifically in contribution to the Working Group: Measuring progress on climate change adaptation. The objective of the paper is to evaluate the community well-being (CWB) analogue to provide lessons for the measurement of progress and effective adaptation to climate change. While measuring climate change adaptation activities is in the nascent stage of development, measuring similar activities within the community well-being field is well developed across Canada and internationally through the use of indicators and associated measures. The community well-being analogue can serve as a valuable analogue for the effective and efficient measurement of climate change adaptation.

The paper is structured into five sections. Section one introduces community well-being, providing a brief overview of the roots and indicators of the community well-being concept, and a review and comparison of current measurement approaches within the community well-being field and related adaptation literature. Section two presents a review of the climate change adaptation measurement literature. The methodology is contained in section three, while results from twenty semi-structured interviews conducted with key Canadian and international authorities who are leaders in spearheading community well-being initiatives is in section four. Section five and six assess and discuss the lessons attained from the community well-being analogue that are critical to the development of measurement approaches in the climate change adaptation context and provide some final thoughts.

1.0 Community Well-Being: A Review of the Literature

1.1 Community Well-being Roots

The measurement of community well-being is a well-developed field in Canada (and internationally) that employs a comprehensive set of indicators and associated measures whose roots can be traced back to the social reform period (1830s) in both Europe and the United States (see e.g. BC Healthy Communities, 2013; Institute, 2013; Murphy, 2010; Hak et al., 2007; Ramos and Jones, 2005; Gahin and Paterson, 2001; Christakopoulou et al., 2001; Besleme et al., 1999; Hart, 1999). These early efforts were directed at understanding the way in which overcrowding, contaminated water, and poverty contributed to epidemics and other health problems. Continuing efforts in the area of health, combined with the growing need to manage the economy throughout the 1800s led to the development of other measurement tools including demographic data, crime rates, consumption levels, and unemployment rates (Murphy, 2010; Gahin and Paterson, 2001; Hart, 1999). Despite the early efforts to develop social well-being indicators, the majority of these first measurement tools were primarily economic indicators. Thus, by the 1960s there was a call to develop social indicators; that is a set of measurement tools to study and compare the quality of life (e.g. well-being) in both urban and rural settings. Whilst economic indicators continued to be prevalent measures of well-being [e.g. Gross Domestic Product (GDP)], the use of social indicators waned in the 1970s and 1980s as an important way Canadians understood development and progress (Moro et al., 2008).

The recent revival in research and use of social indicators, along with the emergence of environmental indicators has been spurred by 1) the continuing dissatisfaction with economic indicators, 2) the growing international dialogue about the state of the world's environment (e.g. 1972 Stockholm conference on the environment and the 1992 Rio Summit), and 3) the need to understand the impact of human activities that results from the interaction between the economic, social and environmental dimensions (Agrawala and Fankhauser, 2008; Gahin, et al., 2001).

The idea of measuring community well-being in a more holistic way along three dimensions – social, economic and environmental – was developed subsequent to the Brundtland Commission¹ in the late 1980s and early 1990s, as the idea of sustainable development was popularized. Many of today's CWB processes largely follow the sustainable development model.

1.1.1 Community

Carr (2013) states that communities can include the people living together in a district or neighborhood, and/or groups of people with a shared origin or interests. Each of these twin features has been linked to the concept of “community” which Flint, Luloff and Finley (2008) describe is what people who care about each other and the place they live create as they interact on a daily basis. Communities can be either place-based (e.g. municipality, neighbourhood, particular region), or defined by interests (e.g. sport,

¹ Meakin (1992) outlines the history of environmental initiatives including as Bruntland, Stockholm, Rio. Available online: <http://publications.gc.ca/Collection-R/LoPBdP/BP/bp317-e.htm>

facebook, religion, belief). Virtually all well-being evaluations are focused on place-based communities and understand “place” as the physical setting within which the dimensions of well-being are evident. These include the social (including psychological, cultural, spiritual), economic, and environmental dimensions (Murphy, 2010; Hart, 1999; Gahin and Paterson, 2001).

Yet, it is also understood that all communities are intertwined and do not exist in isolation (Christakopoulou, Dawson and Gari, 2001); they are always linked to other communities (e.g. environmental groups may also be part of a neighbourhood and/or broader umbrella environmental organizations) and to other scales (e.g. a local environmental organization could be part of a national environmental organization and a city exists within a province and within a country). Communities are encouraged by practitioners to think about these various dimensions and connections as they embark on assessing their community well-being.

1.1.2 Well-being

The concept of well-being is often used interchangeably with such concepts as quality of life, and may also be framed in terms such as welfare, health, and sustainability (Murphy, 2010; Hart, 1999). Although achieving agreement on a specific definition is challenging, a widely accepted definition suggests that well-being consists of something beyond the absence of disease. Well-being accounts for elements of life satisfaction that cannot be defined by economic growth alone (Camfield, Crivello and Woodhead, 2009; Paavola and Adger, 2006). Well-being is influenced by both personal perceptions (subjective well-being) and physical circumstances (objective well-being) that can be measured for individuals, communities, countries, etc. The Institute of Wellbeing describes well-being as

“...the presence of the highest possible quality of life in its full breadth of expression focused on but not necessarily exclusive to: good living standards, robust health, a sustainable environment, vital communities, an educated populace, balanced time use, high levels of civic participation, and access to and participation in dynamic arts, culture and recreation” (Institute of Wellbeing, 2013).

In the pursuit of measuring well-being, researchers and practitioners have developed a suite of indicators that can be assessed using a range of well-being data sources. For instance, an indicator of air quality could be the number of smog-free days, particulate levels in the atmosphere or the number of asthma cases reported by hospitals. The information provided by indicators allows decision-makers – individuals, governments, businesses, and so on – to target resources to problem areas and get feedback regarding progress achieved towards well-being (CIW, 2013; Murphy, 2010; Hart, 1999). *Profile* indicators describe the state of well-being, such as education levels, income levels, urban forest cover, to capture a snapshot of well-being, or measure changes in well-being over time. *Process* indicators such as the number/quality of volunteer organizations, feeling of connectedness to the community, examine what community residents *do*, rather than who they *are*, the relationship between groups, people’s perception of well-being and social processes to provide information regarding how the current well-being status could be influenced in the future (Murphy, 2010; Hart, 1999).

1.2 Indicators

Deciding what indicators will be used to measure well-being is a key task for a community as they undertake the assessment exercise. As Roy Romanow states, “The things we count and measure reflect our values as a society and determine what we see on the news, what we hear at the water cooler, and ultimately, what makes it onto the policy of agendas of governments” (CIW, 2013). Others use the analogy of driving with road

signs – having indicators helps decision-makers decide where they want to go and the path to get there (ICSU, 2006).

Indicators are important for a variety of reasons including to: provide the opportunity to encourage democratic participation in visioning a community's goals; measure progress towards achievement of those goals; raise awareness and focus attention on community priorities; provide a feedback and accountability mechanism for decision-makers; and to actively choose future desired outcomes (Gahin and Paterson, 2001). Undertaking activities towards visioning a community's future well-being and choosing indicators that can assess both the current and future states of that well-being are excellent opportunities for a community to articulate its values and goals and foster community involvement. As outlined by Sustainable Seattle (2013), the indicators a community chooses to report about itself reflects its collective values and informs decision-making. The idea of citizens choosing indicators that reflect these values, rather than these indicators being imposed by an outside agency, is an intensely democratic opportunity that values grassroots public participation.

The idea of utilizing indicators to measure community well-being has developed since the 1980s and 1990s to provide information to local decision-making at the grassroots-level. The idea of community indicators of well-being reflects a change in focus from the “top down” imposition of what well-being, sustainability, quality of life, etc. should look like, to a “bottom-up” approach that emphasizes democratic participation and empowerment in the development of locally significant understandings of well-being and its measurement (see e.g. Murphy, 2010; Hart, 1999). Indicators of community well-being, sometimes called “benchmarks” or “vital signs”, are now used extensively by nation-states, regional governments, urban and rural areas, and even neighbourhoods (Hilbrecht et al., 2012;

Ramos, Odette and Jones, 2005). The Community Indicators Consortium lists and provides links to community well-being projects from around the world, including twenty-seven from Canada alone (see CIC, 2013). In the United States there are over two hundred municipalities using some form of community well-being measurement (Harley et al., 2008; Gahin and Paterson, 2001). One of the earliest and longest-running examples of efforts to track well-being is the Jacksonville, Florida *Community Council Quality of Life* indicator program. The council has tracked one hundred indicators of well-being covering nine themes since 1985 (see JCCI, 2013). Other well-known examples include Sustainable Seattle and Sustainable Calgary (Sustainable Seattle, 2013; Sustainable Calgary, 2013). Thus the current state of knowledge about indicators is both in-depth and extensive.

Given the plethora of approaches to studying well-being, communities can tailor their approach to well-being according to their own needs. Communities may choose to undertake a quick or in-depth analysis of one or more dimensions, a broader analysis across several dimensions, or any other combination that reflects that community's values and needs. Communities may also decide to choose amongst the various types of indicators and measurement tools available. Indicator presentation styles vary from a "report card" design which provides grades information (i.e. A, B, C, etc.) or stoplight (red-yellow-green) (JCCI, 2013; Population Connection, 2002). Other approaches use positive and negative symbols to indicate changes (Tasmania Together Progress Board, 2002). The International Institute for Sustainable Development (IISD, 2002) Dashboard

of Sustainability² illustrates results along a colored dashboard similar to a car dashboard's gauges.

1.2.2 Dimensions of Well-being

The *social* dimension assesses the community's viability and its capability to solve problems. The social dimension is sometimes subdivided into categories such as social capital and human capital. It may also include a process category associated with understanding how and why current well-being levels have developed, community capacity to influence well-being and what can be done to change well-being in the desired direction. The social dimension can be measured by assessing information such as education levels, strength of social networks, population change and leadership. The *economic* dimension acknowledges the important link between the economic strength of communities and their well-being. For instance, unemployment and poverty (typical economic measurements) are often associated with poor health and neighbourhood pessimism. The economic dimension may use basic indicators, such as GDP that focus on market activities, composite indicators that move beyond market activities (e.g. the Genuine Progress Indicator³), or attempts to assess the economic dimension relative to a

² The Dashboard of Sustainability is available online: <http://www.iisd.org/cgsdi/dashboard.asp>

³ GPI is a metric that attempts to measure whether the environmental impact of the products produced and consumed in a country is a negative or positive factor in economic health, and also account for the amount of people currently dependent on the government for support (Lawn, 2003).

broader well-being/sustainable development framework (e.g. triple bottom line audits⁴).

The *environmental* dimension acknowledges the importance of the natural world to human well-being. The natural environment provides a plethora of ecosystem services such as flood water management, and is considered to contribute to economic, social and psychological/spiritual well-being (e.g. tourism, city green spaces, natural vistas – a lake at sunrise). Examples of measurements for the environmental dimension include number of days/year with air quality above an acceptable level, people's perception of the level of satisfaction with the natural environment, and number of households who participate in recycling.

Well-being studies might also explore the relationship between the environmental, economic and social dimensions, for example, the impact of industrial pollution on human and ecosystem health. Or, these studies might seek to understand how community-level dimensions of well-being exist within a broader matrix of relationships and resources that can either enable or hinder efforts to enhance well-being. For instance, local infrastructure is linked to regional and national systems, local environments are part of larger scale ecosystems and people have social linkages beyond their local community. Thus, in addition to assessing the three dimensions of well-being at the local level, a community may want to think about the opportunities that could be available by leveraging resources and relationships outside their jurisdictions as well as the resource

⁴ The triple bottom line audit approach is a process for evaluating community performance, focusing on the integration of social well-being, environmental protection and economic viability goals. It arose as a concept of corporate accountability, which goes beyond the traditional economic and financial aspects of a business entity (Rogers and Ryan, 2001).

and relationship challenges they might need to overcome to attain their well-being objectives. An indicator such as “Broader Linkages” for instance, could be measured by assessing 1) the percentage of available national project funding a local community is able to access, 2) the quality of local infrastructure as compared to other communities; or 3) by evaluating local views of the community’s connections with the rest of the region or country (Auld and MacIver, 2005).

1.2.3 Well-Being Data

Well-being can be understood to consist of objective circumstances (e.g. pollution levels) and/or subjective perceptions of these conditions (e.g. views of that pollution). Well-being is also frequently thought of in terms of process (e.g. how/why well-being came to be the way it now is – focus on actions and engagement) and profile (outcomes: what well-being looks like – focus on snap-shot). Well-being can be measured using either qualitative (e.g. interviews) or quantitative (e.g. statistics) data sources. Well-being arises from a combination of what a community has, what they can do with what they have, their goals and aspirations, and how they think about what they have and can do. Information collected by the community specifically for the purposes of measuring CWB is referred to as primary data. Primary data collection can include surveys, questionnaires, and local agency reports. Secondary data refers to measurement information collected by agencies and researchers for other purposes, but that can be used to measure CWB. Statistics Canada census information is an example of secondary measurement data many communities may use to inform their CWB measurement process.

Subjective well-being (SWB) is an individual’s perception of their quality of life. SWB is often characterized as having two components – happiness/satisfaction and self-

realization/flourishing (see e.g. Oswald and Wu, 2010; Camfield and Skevington, 2008; Cummins, 2000; Davidson and Cotter, 1991). The former aspect of SWB, called hedonic valuation, suggests that factors such as money, genetics and identity influence happiness (e.g. social cohesion). In contrast, the latter aspect of SWB, called eudemonic valuation, focuses on assessing the way in which quality of life is affected by people's capacity to self-determine and realize their own goals, for instance, social empowerment. Economists use subjective well-being scores from survey data about happiness and life satisfaction as a proxy for quality of life. Researchers have studied the impact of income, unemployment, and other socio-economic factors on SWB. More recently they have started to assess the trade-offs between perceptions of well-being and such environmental attributes as air pollution, climate, commuting time, local amenities and environmental attitudes.

Objective well-being is defined as the valuation of well-being using an external valuation technique (e.g. census data), rather than people's perceptions. It is defined as the requirement that people's basic needs are met (e.g. social-economic security) and that they have the necessary resources to meet the social requirements for citizenship (e.g. democratic participation) (Camfield and Skevington, 2008; Phillips, 2006).

A qualitative approach is defined as measuring characteristics or attributes of a thing, rather than simply counting it (McGregor, 2007). For instance, perhaps census data suggests that homeless levels are high in a particular area. Follow-up interviews may then explore who is part of the homeless population, how they became homeless, perceptions of homelessness or of the resources available to help homeless people, and so on. A qualitative approach is important because it can: measure areas of people's lives that are influential and important to well-being but are seldom measured such as sense of place;

encourage participatory approaches; improve the accuracy of measurement; make indicators more understandable and relevant; and focus attention on measuring what matters, rather than what is easily measurable (Marshall and Rossman, 2010). Qualitative methods include interviews, story-telling, life histories, participant observation, community mapping exercises, etc. A quantitative approach, such as statistical analysis, is defined as measurement based on a number including real estate values, population, and percent satisfaction with the environment. A quantitative approach is important because quantities can often be compared through time or across communities and quantitative data is often more readily available. Further, data that is measured in the same number system (e.g. money) can be added, subtracted, etc. and so can be reported using a single number. This is often attractive to decision-makers – the best example is GDP (Marshall and Rossman, 2010).

1.3 Review and Comparison of Measurement Approaches within the Community Well-Being Field

The selection of a community well-being approach is guided by factors such as data type, measurement process, indicators included, measurement intervals, costs, actors involved, and the level of community engagement. These factors influence what CWB approach a community may choose to adopt, as each approach requires different investments and will produce different results for the community. Table 1 provides an overview of several community well-being measurement approaches being utilized in Canada and abroad.

In general, Canadian CWB initiatives are based on, or are derived from these various frameworks. In most cases, these frameworks are adapted to meet the specific needs and desires of the community. Several communities in Canada are utilizing approaches based

on the Canadian Index of Wellbeing (CIW). The CIW is a composite index comprised of 64 indicators organized under 8 headline indicators. This robust approach captures a breadth of information about the community, but requires a high-level of community engagement to drive the process. Communities lacking the capacity to support this approach, such as smaller municipalities with a shortage of community organizations or utility corporations, may choose an approach, such as The Indices of Well-Being, which uses census data, thus requiring little direct community engagement. Census-based approaches are lower cost and generally easier to conduct, but lack the benefits of community engagement and public participation including a more informed, educated and engaged populace; and collaboration between various actors and organizations.

It is important that communities are aware of the potential advantages and draw-backs when choosing their preferred approach. Communities must also be cognizant of what the indicators actually measure. Murphy (2010) outlines a suite of best practices when choosing to measure community well-being, including: obtaining agreement on what to measure; possessing the ability to disaggregate the data; measuring what is important to measure, not just what is easily measured; clear thinking on what an indicator actually measures; a realistic evaluation of what can be measured; honest reporting of results; utilizing indicators as part of the “big picture”; continually reviewing the relevance of indicators; and focusing on participation and process.

Table 1 - Comparison of Community Well-Being Approaches

Community Well-being Index (O'Sullivan, 2011)	
Data Type and Level	Quantitative, secondary
Measurement Process	CWB Index scores are derived from Canada's Censuses of Population, which are conducted every five years. Scores have been calculated for 1981, 1991, 1996, 2001 and 2006
Well-being Indicators Included	Income (based on income per capita), Education (based on high school and university completion rates), Housing (based on housing quantity and quality) and Labour force activity (based on employment and labour force participation rates)
Measurement Intervals	Every 5 years
Costs	Low
Actors Involved	Researchers and expert practitioners
Level of Community Engagement	No community engagement
Canadian Index of Wellbeing (CIW, 2011; 2013)	
Data Type and Level	Quantitative, primary and secondary
Measurement Process	Mixed methods (subjective survey, census data)
Well-being Indicators Included	Composite index of 64 indicators, organized into 8 headline indicators, subdivided into 8 indicators in each headline. Headline indicators: Community vitality, democratic engagement, education, environment, healthy populations, leisure and culture, living standards, time use
Measurement Intervals	Conducted every 5 years
Costs	High
Actors Involved	National leaders and organizations, community groups, research experts, indicator users and the Canadian public
Level of Community Engagement	Very high. Framework and indicators are developed through multiple rounds of consultations. Community organizations and public are integral part of the process

Indices of Community Well-being (Calgary) (Cook and Linde, 2011)

Data Type and Level	Quantitative, secondary
Measurement Process	Calgary communities are evaluated based on both incidence and prevalence of the various indicators. Both incidence and prevalence are expressed as index values
Well-being Indicators Included	Economic (Poverty, Employment, Housing), Persons in low-income households, Children receiving social assistance, Seniors receiving social assistance, Unemployed adults, Unemployed youth; Social (Family Stability, Social inclusion, Education), Lone parent families, Recent movers, Recent Immigrants, Knowledge of official languages (English or French), Unattached individuals, Seniors living alone, Persons not completing high school, Renters Spending >30% of Income on Shelter Costs, Families Below Housing Affordability Threshold, Dwellings requiring major repair; Physical (Personal Health, Personal Safety) , Hospital in-patients, Emergency room visits, Person and property crimes
Measurement Intervals	Annually with each census since 1986
Costs	Low
Actors Involved	Municipal users, practitioners and researchers
Level of Community Engagement	No community engagement

Community Sustainability Questionnaire (Australia) (Globalism Institute, 2013)

Data Type and Level	Qualitative, primary
Measurement Process	Conduct qualitative surveys with residents to measure community perceptions of well-being (subjective/objective; profile/process)
Well-being Indicators Included	Place to live (satisfaction with local conditions); Social community (community networks and involvement); Economic community (income, employment, investment and spending patterns); Political community (levels of participation); Personal space (feelings about, and meanings of their locality); Part of the city (transport links, mobility)
Measurement Intervals	Conducted once as a snapshot
Costs	Low

Actors Involved	Researchers, practitioners, community partners
Level of Community Engagement	High community engagement

Forest Management Policy and Community Well-being in the Pacific Northwest (Charnley, Donoghue, and Moseley, 2008)

Data Type and Level	Quantitative and qualitative
Measurement Process	Analyze quantitative data about the indicators; compare with US census data for socioeconomic changes, followed by in-person interviews
Well-being Indicators Included	Employment diversity, percent employment, percent of people living below the poverty level, household income inequality, percent of population 25 years and older with a university education, and average travel time to work
Measurement Intervals	One time study of management plan
Costs	High
Actors Involved	Community members and experts
Level of Community Engagement	High. 311 community members and 96 agency employees were interviewed in 17 randomly chosen forest communities

The Genuine Progress Index (GPI) (Alberta) (Wilson & Tydmers, 2013)

Data Type and Level	Quantitative, secondary
Measurement Process	Statistics Canada census data measured between 1961 to 1999
Well-being Indicators Included	51 indicators around 5 themes: Time-use accounts, Social capital accounts, Human health and wellness accounts, Natural resource and environment accounts, Economic accounts
Measurement Intervals	Benchmark exercise
Costs	High
Actors Involved	Researchers, practitioners

Level of Community Engagement	No community engagement
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Index of Economic Well Being (Osberg and Sharpe, 2011)

Data Type and Level	Quantitative, secondary
Measurement Process	Snapshot using census data
Well-being Indicators Included	Consumption flows, stocks of wealth, economic equality and economic security
Measurement Intervals	Measured 1981-2010
Costs	Low
Actors Involved	Researchers
Level of Community Engagement	No community engagement

The Human Development Index (UNDP, 2013)

Data Type and Level	Quantitative, secondary
Measurement Process	Aggregate measure of well-being based on education and health status, as well as income and inequality using census data in various countries.
Well-being Indicators Included	HDI is a composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), being educated (measured by adult literacy and enrolment at the primary, secondary and tertiary level) and having a decent standard of living
Measurement Intervals	Annual
Costs	High
Actors Involved	Researchers and practitioners
Level of Community Engagement	No community engagement

Happy Planet Index (Abdallah et al.,2012)

Data Type and Level	Mixed methods, secondary and primary
Measurement Process	Each of the three component measures – life expectancy, well-being and ecological footprint – is given a traffic-light score based on thresholds for good (green), intermediate (amber) and poor (red) performance. These scores are combined to an expanded six-colour traffic light for the overall HPI score, where, to achieve bright green – the best of the six colours, a country would have to perform well on all three individual components
Well-being Indicators Included	Three component indicators (life expectancy, well-being, and ecological footprint). The index is weighted to give progressively higher scores to nations with lower ecological footprints
Measurement Intervals	Every 3 years
Costs	High
Actors Involved	Researchers, experts, citizens
Level of Community Engagement	No community engagement

Ecological Footprint Calculation (<http://www.footprintnetwork.org/en/index.php/GFN/>)

Data Type and Level	Quantitative, secondary
Measurement Process	Calculated using 6,000 data points per country per year
Well-being Indicators Included	Cropland for the provision of plant-based food and fiber products; grazing land and cropland for animal products; fishing grounds (marine and inland) for fish products; forests for timber and other forest products; uptake land to neutralize waste emissions (currently only the areas for absorbing anthropogenic carbon dioxide emissions are considered); and built-up areas for shelter and other infrastructure
Measurement Intervals	Annual
Costs	High
Actors Involved	Researchers and experts

Level of Community Engagement No community engagement

2.0 Climate Change Adaptation

In the climate change field, adaptation refers to adjustments in human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2013; Preston et al. 2011; Smit et al. 2000). The term adaptation, as currently used in the climate change adaptation field, has its origins in the natural sciences (evolutionary biology) where it broadly refers to the development of behavioural or genetic characteristics that enable organisms or systems to cope with environmental changes in order to survive and reproduce (Smit and Wandel, 2006; Kitano, 2002; Winterhalder, 1980; Futuyama, 1979). Dobzhansky et al. (1977) and O’Brian and Holland (1992) highlight that organisms have developed individual adaptive features or individual adaptations to ensure survival across multiple scales including from an individual in a population to an entire ecosystem.

According to Butzer (1989) the application of adaptation in terms of human systems stems from seminal work conducted by anthropologist and cultural ecologist Julian Steward who used cultural adaptation to describe the adjustment of culture cores (regional societies) to the natural environment through subsistence activities (Smit and Wandel, 2006; Butzer, 1989). Anthropologists and archeologists suggest that adaptation is a consequence of selection acting on variation through cultural practices (adaptations) which have historically allowed a culture to survive (O’Brien and Holland, 1992; Butzer,

1989). Social science research conducted by Denevan (1983) for example, found that cultural practices that allow societies to flourish are considered adaptations, which can be distinguished based on behaviour and technological innovations in response to a range of stimuli, including environmental stress.

As demonstrated in the social science scholarship, Denevan (1983) and Holling (1986) recognize that societies that are able to respond to, or cope with, change quickly and easily are considered to have high adaptability or capacity to adapt. Some scholars of adaptation, notably Odum (1970) and Holling (1986), have employed the concepts and terminology of biophysical ecological change with a focus on flows of matter, energy and information, and related concepts of resilience, equilibrium and adaptive management. Others, including Burton et al. (1978) have focused on perception, adjustment and management of environmental hazards, otherwise known as the natural hazard perspective. Similarly, research on global environmental risk and the social amplification of risk places adjustments and adaptations in the context of human driving forces, biophysical constraints and the social, economic and political attenuation of risks (Smit and Wandel, 2006; Kasperson and Kasperson, 2001, 2005; Pidgeon et al., 2003; Turner et al., 2003; Blaikie et al., 1994; Downing, 1991).

Climate change adaptation encompasses adjustments in practices, processes or structures in response to projected or actual climate and extreme weather events. This approach is different than mitigation, which focuses on activities that reduce or eliminate the release of greenhouse gases that contribute to climate change. Federal, provincial and territorial governments in Canada have acknowledged the importance of adaptation and are beginning to provide financial resources to facilitate adaptation planning for cities and municipalities (NRTEE, 2012; City of Toronto, 2012; Ontario Government, 2011; FCM,

2012 & 2009; ICLEI, 2008; Infrastructure Canada, 2006; City of Homer, AK, 2007; City of Keene, NH, 2009)

There is an increasing recognition of the potential impacts of climate change in cities. Around half of the world's population currently live in cities and the proportion is set to rise further in future years (Ford and Smit, 2004; Brooks, 2003; Kates, 2000). Cities are also the centre of economic and political activity, and there is a growing resonance in considering city-level issues as a means to advance climate policy discussions (Hallegate 2007; Parry et al. 2007). Canada is vulnerable to a range of impacts associated with climate change, including rising temperatures, more frequent, intense storms and rising sea levels (Pearce et al. 2012; Prowse et al. 2009). These changes are already being felt in towns and cities across the country (FCM, 2012; Bruce, 2011; Infrastructure Canada, 2006; Bruce and Nobel, 2006; Ford and Smit, 2004). Some of the effects are already being experienced, including thawing permafrost in the North, increased numbers of insect pests and expanding range of disease vectors as winters warm (Grothmann and Patt, 2011; Smit, 2001). There is also an increase in urban flooding, which according to the Insurance Bureau of Canada now eclipses fire as the top insurance claim (IBC, 2013). Both the cities of Toronto and Calgary experienced flooding in 2013 resulting from powerful thunderstorms, causing major losses (Feltmate and Thistlethwaite, 2013).

While the drivers for adaptation in Canada may be outside the local context, adaptation and its measurement typically take place within the municipal and household levels (Bulkeley, 2013; Nilsson, Swartling and Eckerberg 2012; Aall, Carlsson-Kanyama and Hovelsrud, 2012; Measham et al. 2011; Wheeler, 2008). Because climate change impacts are local and context specific, the role of local governments is seen as key to the success of adaptation efforts (see e.g. Adger et al., 2009; Adger, Arnell and Tompkins, 2005;

Tompkins, 2004; Adger, 2001). Local-scale actors will ultimately have responsibility for implementing adaptation; to be successful municipalities will need to collaborate with civil society, the private sector and higher levels of government. There is, therefore, a pressing need to build institutional capacity at different levels, in particular with regards to: sharing scientific knowledge and incorporating marginalized voices; identifying local needs; ensuring both horizontal and vertical accountability; efficiently transferring resources; coordinating policy across sectors; and cooperating across national boundaries (Pielke et al., 2007; Tompkins, 2004). In addition, formal and informal institutions influence adaptation by structuring the way climate impacts are experienced, connecting individual and collective responses to these impacts and channeling external resources for adaptation. As such, it is widely recognized that adaptation needs to be based on an understanding of local contexts and in particular the pressures, obstacles and incentives confronted by local actors (ICLR, 2010; Adger et al. 2009). This highlights the need to develop effective strategies to measure local-level adaptation and track its progress (Wheaton and McIver, 1999).

In terms of planning for adaptation and measuring its effectiveness, Smit et al. (2006) note that productive adaptation initiatives are often incremental, modifying existing management strategies or plans. This is commonly known as *mainstreaming* (Huq and Reid, 2004). Adaptation to climate change is likely to be but one of a range of competing social, environmental and economic priorities facing local communities (e.g. access to markets, food security). They note that successful climate change adaptation and vulnerability reduction is rarely undertaken with respect to climate change alone, and vulnerability reduction appears to be most effective if undertaken in combination with other strategies and plans at various levels and when it becomes an embedded part of

policy decisions and measurement processes. Since mandated adaptation processes do not always anticipate the capacity constraints of local jurisdictions to take on new priorities, there is a strong case for greater mainstreaming of adaptation and measurement efforts with existing initiatives of local actors to deal with the threats and opportunities that they already face. The role of local government, and in particular, the need to strengthen the capacity of local actors to prioritize and implement adaptation responses and measurement, is thus receiving increasing attention.

3.0 Research Design and Methodology

The secondary data outlined above was supplemented through twenty interviews. Data was collected with key Canadian authorities as well as supporting international informants who are leaders in spearheading community well-being initiatives. The goal of the interviews was to refine understanding of community well-being measurement tools and approaches, and to further develop understanding of actor involvement and their role in measurement. Complete analysis details, along with the use of QSR NVIVO 10 qualitative data analysis program will be described. The complete analysis of all interview data will follow in the subsequent section.

3.1 Data Collection

To meet the objectives for this study, semi-structured interviews were conducted with twenty key informants who are both experienced with, and currently engaged in leading community well-being initiatives. The questions were shaped and formulated from the literature review to address the specific objectives of the study, and are consistent with

accepted research methods in this field (Lincoln et al., 2011; Braun and Clarke, 2006; Kitchin and Tate, 2000). The goal of the interviews was to collect rich and detailed information, allowing respondents to construct their own accounts and experiences with the issue while contextualizing the barriers, opportunities and experiences with the CWB process (Kitchin and Tate, 2000). Interviews are commonly used as a qualitative method to provide an account of the respondent's experiences and gather knowledge to inform the projects' objectives (Wiles et al. 2005).

Based on information and findings from the literature review, a questionnaire consisting of eleven semi-structured questions was constructed (Appendix 1). Questions were developed specifically for either CWB experts or municipal officials to better tease-out the most relevant information from the participant.

Key informants from rural, small town and large municipalities and experts from across Canada helped the research team obtain a cross-section of Canadian perspectives. Supporting interviews with international experts from the United States of America and Australia provided an international perspective and lessons for this report. Municipal government representatives (n=11) were contacted in communities engaged in developing and/or delivering CWB initiatives, while academic experts (n=6) were contacted at their host institutions. As part of the academic group, interviews with climate change adaptation specialists (n=3) contributed additional insight to help develop realistic and tangible lessons for the measurement of progress and effective adaptation to climate change. The research followed all ethical protocols prescribed by Wilfrid Laurier University.

Respondents interviews were voice recorded. The interview data was transcribed using a word processor. Interview transcripts were twelve to twenty-six pages in length. Interview data was analysed using QSR NVIVO 10 software which is the tenth-generation of NUD*IST (Non-Numerical, Unstructured Data Indexing, Searching and Theorising) data analysis software. Transcripts were loaded into the program and organized into three parent nodes (Table 2). The “Actors involved in CWB” parent node presents findings on who is involved in CWB processes, at what level they are involved, and provides insight on how various actors and stakeholders are managed. As the data was processed, sub-nodes were used to capture and organize this data, organized by the type of key actors within particular CWB processes. The second and third parent nodes, “Strengths of municipal-level CWB process” and “Challenges of municipal-level CWB process” emerged as the most suitable way to organize and analyze the data to provide lessons for the measurement on climate change adaptation. Sub-nodes for these parent nodes are outlined in Table 2. Results from the analysis are presented in Section 4, below.

Table 2 - Interview Analysis Themes

<i>Parent Node</i>	<i>Sub-Node(s)</i>
Actors Involved in CWB Strengths of Municipal-level CWB Measurement	Business; Government; NGO; Citizens; Universities Locally focused measurement; Community involvement; Sharing of information; ID priority research areas and visioning; Indicator data
Challenges of Municipal-level CWB Measurement	Financial/resource constraints; Data collection; Buy-in and support for community well-being measurement; Siloing of municipal departments; Municipal election cycles

4.0 Results

4.1 Actors Involved in Community Well-Being

To help ensure measurement occurs in an effective, efficient manner with buy-in and support from the community, respondents indicated that a key strength of the CWB approach is the inclusion and collaboration between a broad group of actors including NGO, local government, private sector businesses, citizens, universities and research institutions. Several respondents stated that the CWB process in their community was specifically focused on fostering collaboration between these actors and stakeholders through various methods, including hosting meetings out in the community (as opposed to city hall), encouraging dialogue and input from interested stakeholders, and providing mechanisms to include information from all interested stakeholders such as community surveys and outreach to community groups. Several respondents note that their CWB process also helped to “de-silo”⁵ municipal departments, crediting this to the collective focus on improving the well-being of the community.

In terms of managing actors and stakeholders for effective measurement, one municipal government official compared their work on the CWB process to “a dating service” that works to connect people and organizations who want to work together. The respondent

⁵Siloing refers to the problem of departments that work in isolation and do not share information with others in the same organization. De-siloing requires reciprocal sharing of information and collaboration between departments to work towards a more integrated approach where information and resources are shared across departments (see Boxelaar, Paine, and Beilin, 2006).

explained that the city arranged for groups and organizations in the community to sit-down and conduct a mapping exercise, to understand who is doing what, identify gaps and develop common goals. This approach fosters collaboration between previously disconnected community groups, and has resulted in a more robust, informed and equitable CWB measurement process in the community.

Since indicators reflect the community's values, respondents from this study emphasized the importance of obtaining a high level of community engagement between the various actors and stakeholders to obtain agreement on what is important to measure. By necessity, not all community well-being values can be included or represented by an indicator, so respondents noted that it is important to include the diversity of views expressed within the community when deciding on indicators.

Managing participants in a measurement process was noted by one respondent as being “the biggest advantage and the biggest challenge of the organization”. Because their CWB process is citizen-driven, it is often difficult to organize meetings, manage participation and keep the process organized. The respondent emphasized the need for a clear agenda, along with support from the local government to help make the process more efficient and effective.

Several respondents emphasized the importance of presenting and interpreting measurement data in a way that is accurate and everyone understands. For example, child abuse numbers in one respondent's community radically changed over a short time frame, with many fearing that child abuse was dramatically increasing. Analysis by CWB leaders revealed that the data changed due to a new police policy that aggregated all mild/moderate abuse cases into the child abuse category, which inflated the number. The

respondent noted that it is important that all stakeholders understand why the numbers change and what policy changes can serve to disguise data when undertaking a CWB measurement process.

Many respondents noted the important role universities play in supporting the measurement of CWB. One respondent emphasized the role of the university in driving the CWB measurement process in their community by providing resources and students to work on various projects to collect data from residents. Funding at the university-level to support data collection, however, is sometimes problematic, with one respondent indicating that funding may be available for a student to study a specific community, but there isn't always funding for a faculty member to direct the study.

4.1.1 Insights from Actors Involved in Climate Change Adaptation Measurement

When asked to provide insight on managing and including actors and stakeholders in the climate change adaptation (CCA) context, several respondents noted that measuring progress on climate change adaptation is challenging since it has less of a cohesive focus than CWB initiatives. The challenge of defining a long-term vision for the outcome of adaptation, along with the substantially-longer timelines associated with making adjustments to infrastructure, institutions, and so on was thought to result in a much different decision-making environment. The absence of agreed definitions of acceptable performance in adaptation, or even agreement over what constitutes success, coupled with the wide range of potential adaptation activities and a need for multi-stakeholder agreement on levels of acceptable risk, were cited by CWB respondents as barriers facing the measurement of climate change adaptation.

By extension, the multi-sectoral nature of adaptation and the involvement of a large number of responsible organizations and partners at different scales could be a much

different group of stakeholders to manage. For instance, each may have different requirements for indicators and their own appropriate monitoring and evaluation systems and information networks. Respondents from this study believed this could be a difficult challenge to overcome in the development of measurement approaches for CCA.

Despite these challenges, respondents agreed that the CWB analogue offered multiple lessons since adaptation is often seen to require local scale engagement and targeted action. Respondents generally indicated that aspects of CWB models developed for use at the municipal scale could be adapted to measure progressive and effective climate change adaptation. Respondents noted that mainstreaming, the involvement of local leadership, and tapping into local knowledge were important points of departure for CCA measurement processes.

First, mainstreaming was suggested as a way to leverage current CWB measurement approaches with the need to measure progress on CCA. Since many CWB processes are already underway and communities are becoming familiar with these measurement initiatives, respondents suggested that CCA could be integrated into existing CWB frameworks. In addition, they pointed out that focusing on measuring progress towards dealing with problems currently facing communities, such as increasingly intense storms and heat waves, allows communities to integrate CCA measurement into a range of municipal activities including infrastructure development and long-range planning. It was also suggested that the CWB analogue offers useful insights on how CCA measurement could be integrated into policy decisions and could bridge the gap between the public and private sectors. One respondent noted that some businesses in their community, specifically the local hydro and natural gas utilities, are beginning to integrate climate change as a risk consideration in annual business plans. The respondent stated that the

local utility corporations were taking the lead on mainstreaming climate change risks management into their business cycles and hoped that other businesses would follow their lead. The respondent believed that municipalities should be able to utilize this data to help develop and measure CCA and noted the work done by the Halifax regional municipality⁶ on developing ways to integrate climate change and CCA into decision making with business and industry.

Second, several respondents suggested that engaging existing local leadership could be an important mechanism to help overcome CCA measurement challenges and foster a collective focus. In CWB initiatives, engaging leadership brings community partners and interested stakeholders together to work collaboratively. As stated by one respondent, strong leadership drives successful CWB initiatives and is important for managing and engaging diverse stakeholders. Another respondent noted success in utilizing a leadership group comprised of municipal CWB experts, business leaders, NGOs, local utility representatives, and local health and education representatives to work together to determine what kinds of data are missing and how to collect additional data.

Third, CWB experts explained that there exists a wealth of local knowledge about community well-being tools that could be leveraged for insights into measuring local-scale CCA. The experience of undertaking CWB processes provides a good background

⁶ The Halifax regional municipality *Climate SMART (Sustainable Mitigation and Risk Tool Kit) risk management approach to incorporating climate change into decision making test-case project* has developed a risk management tool that municipalities can use to more fully incorporate climate change in the decision making process as part of business unit planning activities. The results of the seven-step interactive session can be found on pg. 167 of the *Climate SMART climate change risk management strategy* (2007) available at <http://www.halifax.ca/climate/>

for understanding how CCA measurement could be undertaken in particular communities. It was suggested that local expertise regarding community values and available data could be utilized during a CCA measurement exercise. Moreover, local knowledge can be used to supplement existing data sources. One respondent suggested that when other data is unavailable, undertaking in-depth interviews with a range of local residents is one way to fill the gaps and develop some baseline understandings across a broad geographical area.

4.2 Strengths of Municipal-Level Community Well-being Approaches

4.2.1 Locally-Focused Measurement

Study respondents indicate that a key strength of the community well-being measurement approach is a focus on the local scale. Respondents maintained that ultimate goal of any CWB measurement process is to ensure everyone has access to the services and supports they need to lead healthy, active lives. Municipal respondents from Canada are using a wide range of community engagement tools and strategies to measure residents' perspectives on both their personal and community's well-being. According to several respondents, determining what is important to measure at the local scale can be achieved by surveying a representative sample of residents, hosting town-hall meetings, collecting input online via a website, and active community outreach (e.g. handing out postcards asking what they love/hate about their city). Respondents emphasized that the results from local engagement helps to inform and improve services, policies, advocacy, and community-wide action focused on increasing the well-being of residents. Effective, efficient measurement requires focusing on local-relevant issues.

Several respondents suggested that setting clear geographical borders (e.g. municipal boundaries, census tracts) is an important component of scoping CWB measurement initiatives. This is especially important in very large communities to keep the focus local, and ensure that CWB findings can be influenced by local policy changes⁷.

When deciding on indicators, respondents also addressed the issues associated with local-broader scale connections. It was suggested that it is important to measure actionable indicators, and avoid indicators outside of the community's purview. One respondent gave the example of a community wishing to monitor a federally-controlled waterway. The respondent noted that it was important that the local community be aware of this and that those leading the CWB process relay this information to community members. In addition, several respondents noted that measurement at the local scale can contribute to broader scale assessments. One respondent indicated that in their province, local scale measurements across more than 400 small communities are following a standard methodology, allowing for comparisons and inferences to be drawn for the whole region.

4.2.2 Community Involvement in the Measurement Process

In general, respondents from this study indicate that a high-level of community engagement is a central tenant of CWB measurement processes. Dialogue about well-being is a key part of the process of community building and commitment to democratic participation. The focus on these processes, rather than just on end-points or outcomes,

⁷ The City of Calgary *Indices of Community Well-Being for Calgary Community Districts* uses 196 neighborhoods (called 'communities') as boundaries for their local-scale CWB process. This approach uses 19 economic, social and physical indicators to provide information for community leaders and service providers. Available online

http://www.calgary.ca/CSPS/CNS/Documents/indices_of_well_being.pdf

was a reoccurring theme expressed by study respondents. Municipal authorities and CWB experts stressed that the process of undertaking a dialogue about community well-being has the potential, in and of itself, to contribute to improved quality of life. The ability for CWB processes to bring together traditionally siloed groups, organizations, and citizens to focus on achieving common goals is an often overlooked aspect of the process that was considered important by several respondents. One international respondent from Australia noted that in their case (a large city), they have been regularly engaging the community for eighteen months just to develop a measurement framework that includes a “wish list” of indicators the community has deemed important and locally relevant to measure. The respondent noted the importance of taking time to develop an approach that is viewed to be legitimate and representative of the needs of the community.

4.2.3 Sharing of Information

In general, respondents stated that information shared while undertaking a community well-being measurement process in their community has been a key strength of the process. Discussions can lead to the identification of measurements or baseline data that already exist. In one example, a municipal official explained that during CWB meetings, it was discovered that obesity data had been collected by the local school board. This was then used for a health-related benchmarking process in the community. In another example, a municipal respondent described that their city was looking to establish cooling centres to serve older residents. A CWB measurement meeting revealed that one local organization had data, which they shared, to help locate the cooling centres close to high concentrations of senior residents.

Discussions can lead to better informed decisions between organizations. A respondent representing a municipal utility emphasized the importance of meetings with local

municipal planners to discuss CCA-informed infrastructure decisions. CWB discussions fostered dialogue and collaboration between these organizations resulting in the installation of larger municipal culverts on several projects.

4.2.4 Identification of Priority Research Areas and Visioning

Respondents from this study indicated that an important strength of the community well-being process is to identify priority research areas and to develop a vision to guide the future direction of their community. The results of a visioning exercise serve as a basis to select, adapt or create indicators that are meaningful to the community's understandings of their well-being. To develop their well-being measurement approaches, several municipal respondents described their community's work to envision their community 10-15 years into the future and to establish long-term goals and guiding principles. A municipal respondent from the United States of America described their visioning process as being aimed at "resetting" their community well-being measurement approach. The city gathered input via a qualitative survey, focus groups, community meetings, and online participation from over 50,000 residents over two years to develop the vision, determine the indicators, and decide how to proceed with the process. The process produced two hundred indicators across ten dimensions or themes such as economy and education that focused on measuring aspects of the external environment that affect personal well-being, and have purposefully avoided measuring personal happiness and satisfaction metrics that cannot be altered by public policy decisions. The respondent indicated that all indicators (quantitative/qualitative, subjective/objective) were considered in the process, regardless of whether information was available or not. For this project, the CWB practitioners then sought to find information on each indicator, and if the information does not exist, have worked to develop ways of measuring the

indicator. The respondent stated that by utilizing this approach, the process has produced more legitimate and actionable CWB measurements and strong support from the community. According to this respondent, the feedback received from the community in the development of their long-term vision suggests that the CWB measurement initiative is a useful tool that can be used to enact changes in public policy and affect personal behaviours. The respondent believes that extensive public outreach and participation is a key component of any successful CWB measurement approach.

Another municipal respondent explained that CWB meetings improved the municipal government's understanding of the community's values, needs, and desires for the future, and the development of more effective measurement tools. A key output has been the development of a novel project aimed at improving local air quality that involves a multitude of stakeholders and actors, including the municipal government, environmental and other NGO groups, local utilities, businesses and industries. The project is unique in that the focus is on "getting the right people to the table, to get the right measurements, and to challenge groups to put their territorial issues aside". The respondent emphasized the innovation of the project using the example of the local hydro company sitting at the table and committing resources to conduct free energy audits of people's homes. The respondent noted that although each group and business participating in the project has their own stake, that the overall goal of improving CWB has broken down some of the barriers and allowed for open discussions.

4.2.5 Indicator Data

Respondents, in general, maintained that the presence or absence of key sources of data influenced decisions on what the community chose to measure. Respondents noted that census data was often used as a key source of data. However, when data was unavailable

to measure a particular indicator, communities often developed surveys to fill in the gaps. These surveys generally focused on collecting profile data (snapshot) and contributed to the initial base of information by providing current data that is tailored to the needs of the community. This survey data is most often based on scaled (likert)⁸ responses to produce quantitative data⁹. Respondents indicated that surveys were the easiest method of collecting snapshot information from the community. One respondent indicated that a low return rate (3%) on their first CWB survey prompted them to start an awareness campaign using social media, outreach at community events, media advertising and a revamped website. One year later, a similar survey was distributed to city residents, resulting in a 14% return rate. The respondent emphasized the importance of creating awareness about the initiative, which for their community has resulted in increased buy-in and support.

The same CWB respondent noted that it is important to assess survey data against census information to ensure the survey is geographically representative of the municipality and that the gender distribution matches the census profile. They also emphasized the importance of having highly-qualified researchers, rather than volunteers, analyze the survey data to ensure validity.

⁸ Likert-scale responses are a method of ascribing quantitative value (numbers) to qualitative data (e.g. agree, neutral, disagree) to make it amenable to statistical analysis (Marshall & Rossman, 2010).

⁹ Example likert-scaled surveys are available from the Jacksonville Community Council quality of life indicators project. www.jcci.org

Other key sources of data used to inform Canadian CWB initiatives are quantitative data from Statistics Canada, including: health profiles (e.g. Canadian community health survey), crime data (e.g. Statistics Canada crime and justice research paper series; Statistics Canada police-reported crime statistics), and commuting time (e.g. Statistics Canada report on commute to work). Other agencies also provided a range of information, including Human Resources and Skills Development Canada (employment information), local health units, municipal government election results, local library data, and food banks. Municipal utility corporations often contribute data on energy and emissions monitoring. Conservation authorities contribute information on water conservation, as well as data on the quality and general health of the local environment. Research institutes that contribute or develop various CWB indexes are an important source of information, providing reports that describe how to measure indicators, what the indicators mean, and so on (e.g. leisure and culture; health populations; time use). Community foundation reports (e.g. vital signs reports¹⁰) also provide useful indicator information.

Respondents cautioned that sensitive or polarizing topics should be clearly defined and that any potential impacts needed to be carefully explained. A respondent used an example of presenting data on high school graduation rates from their city in a CWB meeting. They described that participants' perspectives could change depending on the context provided for comparing the information. For instance, a high school graduation

¹⁰ Annual Vital Signs reports by Community Foundations of Canada provide a comprehensive look at how 26 communities are faring in key quality-of-life areas. Available from <http://www.vitalsignscanada.ca/en/home>

rate of 85% is neither good nor bad unless it is put into context. Initially, it may seem low because it is preferable that all youth graduate. However, they noted that if other comparable cities have lower graduation rates, the target seems to be doing well. If however, the rate declined over the past three years from a high of 94%, this again changes the view of how well the community is doing on this indicator. Finally, if there were a nationally accepted goal to which all schools aspired, this would provide another perspective of the score. The respondent noted that putting the information in perspective is especially important when both gathering and communicating information on sensitive topics such as mental health, addictions and marginalized populations.

Several respondents indicated that they are beginning to work with corporations and private industry to share proprietary data that could be used in CWB measurement (e.g. tonnage handled by shipping port as a local economic-vitality indicator; third-party flood hazard maps, and other consultant reports). Several CWB practitioners noted success in obtaining data from utility corporations, but that private-sector data remained hard to obtain due to privacy and ownership concerns. Respondents did note some recent success in getting data such as corporate air emissions that has proved useful to the community in their development of a clean air initiative associated with their CWB process.

Many respondents indicated that the way indicator data were presented is one of the more important communication decisions in the CWB process. If the report is not immediately comprehensible and user-friendly, it may not be helpful to the policymakers, funders and citizens for whom it was designed. Several respondents noted success in communicating indicator information using colours (e.g. green, yellow, red) and graphs to clearly illustrate indicator data.

4.3 Challenges of Municipal-Level Community Well-being Approaches

4.3.1 Financial/Resource Constraints

In general, respondents in this study indicated a key challenge of conducting community well-being assessments at the municipal scale is a lack of funding and lack of resources to complete the work. One respondent from a small northern Canadian community explained that work on community well-being is done “off the side of desks” because the day-to-day activities focus on addressing immediate problems in the community. The respondent explained that CWB research by a doctoral student has helped their community identify some issues that are important within the community, but unfortunately the community does not have the resources to address these issues. The respondent acknowledged that funding is available for short-term studies, but they lack support and funding from upper-level government to continue this work.

Human resource constraints were noted as a problem by municipal officials from a small community in Eastern Canada. They noted that in their community, they received seed-funding for a short-term CWB assessment project, but they lacked the resources to address the issues. In addition, several respondents felt that municipal officials may be too busy meeting the short-term needs of the community (garbage collection, road maintenance) and lacked the resources necessary to conduct CWB measurement exercises.

One respondent expressed concern over the lack of a long-term vision in their municipality. The respondent believed that despite initial survey work conducted by a

provincial university to identify needs within the community, the administration chose not to act on the recommendations because of cutbacks to personnel.

4.3.2 Data Collection

Regardless of data type (qualitative/quantitative; primary/secondary data sources), many respondents from this study indicated a general shortage of data, missing datasets, data aggregation problems (e.g. assembling inconsistent data from various studies), shortages of highly-qualified personnel to analyze data, and difficulties articulating data into meaningful indicators.

In general, respondents indicated it was easier to measure profile indicators¹¹ because much of the data for comparison could be found in the census. Secondary quantitative census data was the most common input for CWB studies because, in general, it has been collected at regular intervals for a long period of time. When attempting to measure process indicators, several respondents noted it is difficult to agree on metrics such as how to qualitatively measure the strength of volunteer community organizations. Several respondents conceded that their CWB process has not yet progressed to this level of measurement, instead focusing on quantitative measurement such as the number of community volunteer organizations. As indicated in Table 1 most CWB initiatives in Canada follow this trend, utilizing quantitative census data with a strong focus on profile measurement.

¹¹ Profile indicators describe the state of well-being, and are often measured by such data as education levels, income levels, total forested area, and so on. Profile indicators illustrate the way things are now, and can demonstrate how things have changed over time (Murphy, 2010).

Despite this challenge, communities in Canada undertaking CWB measurement processes are beginning to establish trends that can measure change over time as information is collected over the long-term. One respondent from a large community felt that within several years, some of the early adopters of the CWB process including their large city, could expect to have collected enough data to begin to measure change over time that will affect policy decisions on important issues such as police funding, health care policies, and infrastructure decisions. The respondent noted the success of long-running CWB initiatives in the United States to affect public policy decisions, some of which have been on-going for several decades.¹²

Many respondents stated that much desired data simply does not exist, is fragmented, or is not available for long enough time periods to draw inferences. When data were not available for the preferred indicator, then other, perhaps less appropriate indicators were sometimes substituted. For example, a CWB respondent noted that median income for seniors was not available, so senior poverty and retirement income statistics were used instead. Another respondent stated that when searching for indicators to develop a disabilities subcategory, only very limited data were available and all information was from the census. Thus, this subcategory included only the number of residents with disabilities, the number and rate of individuals in poverty, and their employment status compared to non-disabled persons. It did not include other indicators such the health and emotional well-being of people with disabilities.

¹² Examples of exemplary U.S. community indicator projects, such as Sustainable Pittsburgh, community indicators initiative of Spokane, the City of Santa Monica, and Boston Indicators can be found on pg. 360 in *Handbook of adult resilience* (Reich et al. 2010).

The translation of data into indicators was a common concern raised by many in this study, with several respondents noting that the census was never designed to capture the kinds of data needed for a CWB process. Several respondents indicated that census data was useful to establish baseline community information and identify trends which could then be further examined through a CWB measurement process, but cautioned that census data can be easily misconstrued and should be supplemented with primary data such as a community survey to allow for comparison and verification.

Collecting and analyzing information in a consistent, acceptable format is a data collection challenge raised by several respondents. A CWB researcher from Australia noted that it is important to tailor data collection techniques to the community. In a community that has access to university researchers, for example, municipal officials could work directly with researchers to deploy students on projects to collect data from the community. Researchers can also work with local municipal practitioners to develop research instruments such as surveys and websites tailored to the needs of specific communities. This approach allows for consistent data collection across multiple communities and utilizes university resources in an innovative way to provide projects for students to complete as part of their studies.

4.3.3 Buy In and Support for Community Well-Being Measurement

Respondents generally indicated that their community has supported and bought into the community well-being measurement process. However, they noted that it is necessary to invest resources and be transparent about the costs to taxpayers. Respondents from municipalities actively conducting community well-being exercises explained that it is important to keep residents updated on the measurement process. This was done in a variety of ways, including town hall-style meetings; meetings in the community with

participating groups and citizens; dissemination of research through mail and social media; and general communication of the project provided at local events. One respondent indicated that outreach was needed to “justify the benefits and costs” to the community, while another respondent described their community as having “a strong passion” for the project and a constant appetite for the results. They credited this to the city’s robust communication plan. One municipal representative noted that in order to maintain buy-in and support, the CWB measurement process only focused on measuring things that can be changed with policy, and not things like the number of sunny days to avoid being viewed simply as a “taxpayer-funded academic exercise”.

Maintaining buy-in and support from the community to effectively measure CWB was described by one respondent as being “simultaneously our biggest advantage, and most difficult challenge” due to the many relationships that must be maintained between various actors and stakeholders. A different municipal respondent stated that managing the involvement of all participants in their community-driven CWB measurement process is a “difficult balancing act” but is required to maintain community buy-in and legitimacy. To overcome this challenge, respondents indicated that it is important to keep the public informed of the process through multiple sources and find ways of including stakeholders at times when most can attend meetings. One respondent noted the success of having CWB stakeholders organize meetings that fit participants’ schedules, using the example of scheduling meetings to avoid conflict with the grant application due-dates for many NGO groups.

4.3.4 Siloing of Municipal Departments

The siloed or disconnected nature of various municipal departments was identified as a problem facing community well-being exercises by several respondents. Two

respondents from communities conducting a CWB measurement process indicated that the CWB process has helped “de-silo” municipal departments, fostering new relationships and better matching the needs of residents to city resources. Despite these successes, other respondents acknowledged that siloed municipal departments continue to be a problem facing CWB measurement processes. One respondent emphasized that their planning department was completely disconnected from the utility department, which they felt was very problematic given that planning and design decisions were being made without the input of those tasked with building and maintaining various infrastructure.

4.3.5 Municipal Election Cycles

Several respondents in this study noted that the short-term nature of municipal election cycles has created a challenging atmosphere for CWB initiatives. Officials are pressured to keep taxes low, which can make it difficult to direct resources towards longer-term studies such as CWB assessments. One municipal representative explained that it is important to be transparent with the taxpayers about the costs. They noted most expenses arise from third-party consultants, as the meetings are held in the community at a very low cost. The same respondent noted that in their community, council views the CWB process as an investment in the community’s future that will pay dividends later. Other respondents raised concerns over maintaining funding for the measurement projects, noting the recovery effort from the 2008 recession.



5.0 Insights from the Community Well-Being Measurement Process

This section integrates the background research provided in Sections 1 and 2 with the interview data results to discuss insights from the community well-being measurement

process applicable to the development of climate change adaptation measurement approaches. The lessons distilled from this discussion are presented at the end this section.

5.1 Measuring Well-being

As indicated in Table 1 there are various methods and frameworks available to measure CWB, all of which have different data requirements and produce different results.

Respondents noted that communities typically choose to use a measurement tool that is already available (e.g. Sustainable Livelihoods, BC Healthy Communities, Community Well-being Index). It is also common that the measurement tool will be synthesized or adapted to meet the needs of the community. In particular, the tools will be adapted based on the types of indicators considered important to the local community and the availability of data. Several overall best practices were suggested by CWB experts.

Respondents stated that sensitive or polarizing topics should be clearly defined and that any potential impacts needed to be carefully explained. Many respondents suggested that setting clear geographical borders, such as using municipal boundaries or census tracts, is an important component of scoping CWB measurements. When deciding on indicators, respondents cautioned that scale issues require consideration. These include choosing indicators that are actionable at the local level, while avoiding indicators outside of the community's purview (e.g. federally-controlled water resources). It is also important to focus on measuring indicators that are in the public realm and can be altered by public policy decisions. In addition, respondents cautioned that qualified personnel should be used to analyze the data and translate it into useable indicators.

As also noted in the literature review (Michalos et al., 2011; Land et al., 2011; Fayers and Hand, 2002; Booyesen, 2002; Diener, 1994; Bollen, 1984) respondents from this study

suggested that it was much easier to collect data on profile rather than process indicators because there is often existing quantitative census data that can be used. They maintained that it can take several years of data collection before the assessment of long-term trends is possible. Many communities found it useful to begin their assessment of CWB by developing a snapshot using easily available data and indicators.

As the pattern in Table 1 reflects, respondents suggested that, despite some drawbacks, census information was useful to profile the community, establish some baselines and trends and served as a starting point to begin the CWB process. This approach allows communities to avoid starting from scratch and build a process of gathering information specifically tailored to the needs of the community. One respondent also noted the benefit of beginning with census data when establishing a CWB initiative, because it provides quick results for municipal councils and ratepayers who may be skeptical of the process or concerned about associated costs. Further, given municipal election cycles, some respondents felt it was important to expedite at least some initial results.

Beyond census data, other quantitative data was also commonly used. CWB experts suggested that particular sectors and disciplines may have existing data or standards which could be accessed during the design of an evaluation to avoid “re-inventing the wheel”. This included a range of Statistics Canada data, information from Human Resources and Skills Development, as well as data from local health units, election results, libraries, food banks, local utilities, conservation authorities, research institutes and community foundation reports. In some cases, it was only through the information sharing that is a hallmark of the CWB process that needed data was revealed to be available. This included data held by private corporations, local utilities, school boards, health care networks, and community organizations such as the Red Cross, Salvation

Army, etc. When using another organization's data, several measurement caveats were outlined by respondents. First, it is important to know if the methods or criteria for collecting those data change over time to allow for the accurate assessment of the associated indicator. Second, in some cases available data can be fragmented or not available over long enough time periods to show any valid trends or establish accurate baselines. Third, across all data types, many respondents indicated that needed data were often missing or could not be aggregated across data sets due to differences in data collection methods.

Two hurdles that need to be overcome to obtain needed data are the siloing of departments, agencies and organizations and the need to deal with privacy and proprietary data concerns. Respondents noted that CWB activities were particularly effective at overcoming the problem of siloing, with one respondent referring to the process as a "dating service" that connected people and organizations who wanted to work together. The CWB process helps break down barriers and provides a forum for more open discussions, allowing participants to understand how they can benefit while also contributing towards collective goals. Several respondents did mention some recent success in obtaining needed proprietary information through the CWB process. It is also important to note, however, that despite participative CWB processes, siloing remains an ongoing challenge. As one respondent outlined, in their municipality the planning department is completely disconnected from the utility department.

According to respondents, a common method for gathering new or missing information was through community surveys. Surveys can be used to assess either objective data about CWB or perceptions associated with CWB (subjective data). Surveys designs most often used Likert-scaled questions. It was remarked that to ensure validity, surveys

should be reviewed for geographical representation within the municipality and gender distribution. One problem noted with surveys was associated with low return rates. This can be addressed by creating awareness of the initiative prior to distributing the survey.

Another good source of local data was interviews with life-long residents; this qualitative approach can be aggregated to provide a broader perspective and can be used to fill-in where quantitative data is lacking. Other ways mentioned to collect local data included hosting town-hall meetings, collecting input online via social media and websites and soliciting feedback using postcards.

Respondents asserted that universities can play an important role in providing both resources and students to help with the CWB measurement process. Researchers can help develop survey instruments and provide expertise in analyzing information. The key problem with this approach as well as other short-term grants was that there may not be any funding available to follow through from any suggested recommendations.

5.2 CWB Participation and Buy-in

Undertaking activities towards visioning a community's future well-being and choosing indicators that can assess both the current and future states of that well-being are excellent opportunities for a community to articulate its values and goals as well as foster community involvement and local democratic processes (Oswald and Wu, 2010; Camfield and Skevington, 2008; Hart, 1999). As outlined by the respondents and Sustainable Seattle (2013), the indicators that communities choose to report about itself reflect their collective values and inform decision-making. Without agreement on indicators, any associated measurement processes might not be seen as legitimate.

Lessons obtained from CWB measurement processes indicate that initiatives with the strongest community buy-in are locally-developed, locally-focused, community-driven,

include a diverse number of actors and stakeholders, and operate in a way that fosters collaboration and work towards a common goal (Hak et al., 2007; Ramos and Jones, 2005; Gahin and Paterson, 2001; Christakopoulou et al., 2001; Hart, 1999). Communities communicate research findings and general information a variety of ways, including town hall-style meetings; meetings in the community with participating groups and citizens; dissemination of research through mail and social media; and general communication of the project provided at local events. In one instance where the CWB process is being facilitated by city staff, but driven by community members, extensive buy-in has resulted in participating organizations offering their own space to hold meetings.

In addition, a common tenant of successful and long-running CWB measurement initiatives is early, meaningful, and regular opportunities for people to participate in the process (Beckley et al., 2008; McGregor, 2007; Rogers and Ryan, 2001). One municipal representative outlined that the community had spent two years gathering input to develop their vision and determine the process and indicators. In Australia, to assure buy-in and representativeness, an eighteen month period was devoted to developing a locally-relevant indicator framework. Thus, in contrast to the comments made about expediting early results to justify the project to rate payers and politicians, others suggested that moving slowly to get the right indicators in place was needed to ensure buy-in.

Beyond this tension, sustaining community-buy-in was also described by respondents as being difficult and time consuming. Relationships between various stakeholders must be developed and maintained, organizing meetings and keeping the measurement process moving can present challenges, and the public requires constant updates. Processes with a heavy emphasis on citizen engagement might not be appropriate for communities with time or other resource constraints. Particularly in smaller communities, there is often a

lack of funding and human resources to complete the work and CWB initiatives might be undertaken in addition to regular day-to-day activities.

While it may seem cosmetic, the presentation format is one of the more important decisions to be made in the CWB process. If the report is not immediately comprehensible and user-friendly, it may not be helpful to the citizens, policymakers and funders for whom it was designed. To ensure usability, several presentation styles were examined in the literature review. The Dashboard of Sustainability (IISD, 2002) illustrated results along a colored dashboard similar to a car dashboard's gauges. The "report card" style provided grade information (A, B, C, D, F.) (Population Connection, 2001). Other indicators use positive and negative symbols to indicate change (Tasmania Together Progress Board, 2002).

In contrast with CWB processes, respondents suggested that defining a vision and action plan for CCA measurement might prove more challenging. They maintained that there is limited agreement about what successful adaptation should look like. These experts suggested that CCA requires longer timeline planning, multi-stakeholder and multi-scalar involvement. That said, they also noted that lessons from CWB processes and best practices could be quite useful for bringing disparate stakeholders to the table and overcoming barriers. In particular, they noted that mainstreaming CCA measurement into other ongoing measurement processes, involving local leadership and existing CWB expertise and utilizing local knowledge provide particularly valuable opportunities to leverage the CWB analogue.

The final key lesson from many projects is that undertaking the CWB measurement process, in and of itself, contributed to the development of quality of life (JCCI, 2013;

Sustainable Seattle, 2013; Sustainable Calgary, 2013; Camfield and Skevington, 2008; Cummins, 2000). Respondents maintained that dialogue about well-being develops awareness, encourages community building and contributes to democratic participation. Successful community indicator projects aim to create lasting changes in values and capacities, both in the community and in government agencies. They suggested that CWB measurement processes can contribute to the de-siloing of municipal departments; the development of relationships between the public, private and NGO sectors; inspire community members to actively contribute to their collective quality of life; and ensure, inform and improve local services.

5.3 Lessons from the CWB Analogue

The following draws together insights from this study of the CWB analogue to provide specific lessons that would be applicable to the measurement of climate change adaptation.

Focus on participation and process – Dialogue on the development of CWB approaches and potential indicators is a key part of the process for measuring well-being. For CCA, focusing on these processes as well as the final outcomes has the potential to contribute to increasing the capacity to undertake CCA activities, deepen awareness and education about climate change adaptation, and encourage citizen participation in measurement initiatives.

Develop flexible, adaptable measurement instruments – There are a range of CWB measurement processes that are typically adapted to suit the needs of the local community. Developed CCA measurement processes will also need to be flexible and include a range of indicators and measurement approaches.

Define the scope of the project – Broader and longer-term CCA projects will require larger and on-going commitments of resources including money, time and personnel. Communities should clearly assess and define the temporal and geographic scope of their measurement processes as well as the sectors and dimensions that will be included.

Aim for wide agreement on chosen indicators – Prior to starting any CCA measurement processes, an assessment of which indicators are most important to the community should be undertaken. These indicators are often chosen as part of a visioning process and should reflect the range of perspectives about the community's values and aspirations. This can help ensure community buy-in for the CCA measurement initiative.

Choose actionable indicators that can inform decision-making – Choose indicators that can support and inform the development of new policies, programs or activities at the local scale. Indicators that only provide information, but no clear understanding of how to operationalize them, are not useful in moving towards CCA.

Decide on the data types – There are several choices to be made about the data that will be used to measure particular CCA indicators. This includes decisions about objective/subjective, profile/process and secondary/primary data. Objective, profile and secondary data are often more readily available, however, this information might not be appropriate for the measurement of some desired indicators.

Find the right data – It is important to know how well the data fits the desired CCA indicator. When the available data is poor, fragmented or compromised in any way, analysts should be cautious and transparent in how the results are evaluated.

Access data from a wide range of sources – Useful data for measuring CCA could be available from federal and provincial sources as well as from a plethora of local, public and private organizations. While privacy and proprietary issues might limit access to these data, this can sometimes be overcome through measurement processes that develop relationships amongst stakeholders and a focus on common goals.

Ensure data accuracy and validity – Particularly when secondary data is used to measure CCA, researchers need to understand how the information was collected and if that has changed over time. Caution also needs to be exercised when aggregating data from a variety of sources and time periods. Otherwise, the reported results for the associated indicators might be inaccurate.

Develop buy-in and support for measurement initiatives – Successful CWB measurement initiatives are those that are locally developed, community driven, include a wide range of stakeholders and work to foster collaboration. Achieving buy-in generally involves extensive public outreach, both for data gathering and raising awareness about the program, before undertaking CCA data collection. Both traditional methods and social media can be important tools to connect with the community's target audiences and raise awareness about the measurement project.

Work towards de-siloing to access needed data – With its focus on process, participation and inclusivity, CWB measurement processes are often able to bring together traditionally siloed municipal departments, organizations, and citizens to focus on achieving common goals. Siloing is a measurement issue that restricts collaboration and data sharing. As such, the CWB measurement analogue provides insight on how to foster de-siloing, notable through processes that strive to include a multitude of

stakeholders in an efficient and effective manner. CCA measurement should strive to involve multiple stakeholders across various scales. Measurement exercises should facilitate the development of a shared vision, where everyone understands how they benefit from being involved.

Be prepared for potential friction on sensitive topics – In any measurement process, some topics can be polarizing or highly sensitive. These can often be addressed by developing collaborative processes, using neutral terminology and focusing on the assessment of the tactical issues most people would like to see resolved (e.g. poverty or flooding).

Recognize conflicting priorities – Community members might hold conflicting goals such as the concurrent desires for extensive collaboration, lower taxes, and immediate results. To reduce the probability that such tensions will derail the CCA measurement process, the community should actively discuss and resolve any noted conflicts.

Utilize university-based researchers – Many successful CWB initiatives result from strong partnerships with university researchers. Fostering these relationships within a CCA measurement process can bring expertise, resources and funding for the project which may not otherwise be available.

Assess opportunities for mainstreaming – Mainstreaming is the practice of embedding additional processes such as CCA measurement, into activities already being undertaken by the community. Mainstreaming reduces the burden and maximizes the efficiencies of measurement exercises especially on small communities. Of note, some available CWB initiatives currently include the measurement of CCA, while other CWB approaches could easily be modified to include its measurement.

Develop clear and understandable results – It is important to present results and reports in a way that is accessible, easy to understand, and makes sense to the reader. Formats that use metaphors to present results, including dashboards and report cards, have been found to be very effective for the discussion and wide dissemination of measurement outcomes.

6.0 Final Thoughts

This report has outlined the community well-being measurement literature and reported on the results from the primary data collection with twenty CWB experts. Lessons learned were then outlined for the development of measurement approaches associated with climate change adaptation. It is clear that successful measurement approaches provide communities with the opportunity to develop processes that are locally-relevant and foster relationships between myriad, often disconnected actors, stakeholders and municipal departments. As CCA measurement approaches are developed, early successes will likely be more easily achieved using easily accessible quantitative data and profile indicators. Since CWB measurement processes are well established and CWB will be profoundly affected by the impacts of climate change, a fruitful approach might also be to embed CCA measurement within existing CWB frameworks. This is already occurring in some jurisdictions. Progress on measuring CCA is very much in the nascent stages of development, and as such, the CWB analogue is a valuable tool to inform and support effective and efficient measurement of climate change adaptation at the municipal scale.

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8.0 Appendix 1 – Interview Questions

Please note: Where indicated, questions are aimed specifically at either CWB experts (E) or municipality participants (M).

- 1) Could you please tell me a little about yourself, your municipality (or agency), and your involvement with community wellbeing (CWB) initiatives?
 - Why did you/your community get involved with measuring CWB?
 - What is gained by undertaking such a process?
 - How long have you been involved?
 - M- What stage are you at in your measurement process? (initiation-implementation)

- 2) Please describe the community wellbeing initiatives you are involved with/have an interest in:
 - Which CWB model(s) are you using and why?
 - Which dimensions are covered by your preferred model (social, economic, environmental)?
 - Can you describe the key indicators and information used in your CWB model?
 - M- Which departments/agencies are involved in the CWB initiative and why?
 - Who else is involved? (NGOs, business, public....)

- 3) A) M - In undertaking your initiative, how is CWB being measured in your municipality?
 - What types of indicators are you using and why?
 - Are they *process indicators* (what people can do) such as rates/opportunities for public participation and/or *profile indicators* (what exists) such as economic vitality
 - Are they objective (facts) or subjective indicators (people's opinions)?
 - What kinds of data/information are you using and why?
 - Qualitative or quantitative?
 - Existing information or new data?
 - Over what time period? (e.g. Snapshot vs. LT monitoring)
 - Other important factors to consider when thinking about measurement?

B) E- When thinking about CWB measurement, what is your opinion about the following factors when choosing a particular approach?

- Indicator type: Process/profile, subjective/objective,
- Data type: Qualitative/quantitative, existing/new, temporal period
- Other?

4) Several factors can determine the choice of, and preference for, particular CWB models.

E- How do the following factors influence the selection of the CWB approach and successful implementation?

M- Did any of the following factors influence which CWB model your community chose to use or how you were able to undertake the measurement process?

- Can you comment specifically on the:
 - Complexity/breadth of measurement (e.g. # of indicators or sectors involved, level of data required, length of time period, geographic scale)
 - Information/data issues: Collection constraints, quality, ownership, availability
 - Project timeline constraints
 - Resource requirements and financial costs
 - Type of people/groups involved
 - Level of community engagement required
 - Any other challenges or opportunities
- 5) Does your CWB approach incorporate the measurement of climate change adaptation? If so, please describe.
- If not, please elaborate.
- 6) Considering the multitude of CWB approaches and indicators, do you feel any of these could be modified to measure progress on climate change adaptation? If yes, which ones and how?
- Could you comment on specific indicators you feel can be developed to provide information about climate change adaptation.
- 7) Do you feel there is/would be sufficient buy-in and support from the public to use municipal resources to undertake climate change adaptation and measurement?
- What methods and tools are being used/could be used to inform the public?
 - If already existing, how well have these approaches been received by the public?

- 8) In your opinion, what are the primary challenges for municipalities to measuring progress on climate change adaptation?
- Probe on specific concerns: Uncertainty over future climate; long timescales; choice of indicators, data collection [methodologies, management (e.g. data aggregation, collecting data in a consistent format), and cost]; political will, upper-level government support (provincial & federal); translation of ‘high-level’ indicators into locally relevant indicators.
- 9) Measuring progress on climate change adaptation requires strong coordination across sectors, policies, strategies and plans. Please elaborate on the challenges and opportunities of managing various actors, and their role in measurement at the municipal scale.
- Are there any specific actors in your municipality (e.g. private business, NGO, government agency) that are vanguards on climate change adaptation?
 - If yes, please describe their role
- 10) What role, and to what extent, do you feel that municipal-scale climate change adaptation activities and programs are able to inform/influence the development of national programs across Canada?
- E.g. transferrable indicators, data sets, units of measurement, etc.
- 11) Can you think of anything else that you believe would be important for us to know?