

# Credit Valley Conservation

## Technical Report: The Importance of Ecosystem Services to Human Well-Being in the Credit River Watershed



November 2011



Credit Valley Conservation  
Technical Report

**The Importance of Ecosystem Services to Human  
Well-Being in the Credit River Watershed**

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## FORWARD

While also being influenced by a number of outside forces of ‘man’ and nature, the health and well-being of people living in the Credit River Watershed is also inextricably linked to the health of the watershed’s forests, wetlands, streams, soils, plants and animals. However, the exact links between a healthy watershed environment and human well-being are not well understood. Advancing watershed management in a way that appropriately accounts for the interrelationships between the ecological, social, and economic elements of a community is essential to ensuring sustainability. In this regard, understanding the connections between human-well-being and environmental quality is critical.

This report continues to build on Credit Valley Conservation efforts to incorporate these linkages directly into watershed management and decision-making. Related work has been focused on the role and value of ecosystem services provided by the Credit River Watershed. The next step, articulated in this report, asks what environmental attributes watershed managers could focus on to be able to measure and monitor how changes in environmental conditions influence local residents’ well-being. This will help to ensure that management of the watershed is well-informed and optimized to sustain benefits the environment provides in all economic, environmental, and social dimensions of quality of life.

While future works remains, this report takes critical steps towards balancing development with conservation needs and documents our evolving understanding of these new ways of approaching watershed management.

Mike Puddister  
Director, Restoration and Stewardship  
Credit Valley Conservation

“This is a great report that advances the art of well-being analysis beautifully. I found the report particularly relevant to decision makers who have to attempt to balance economic development and conservation efforts.”

Mark Anielski, Anielski Management Inc.

## ABSTRACT

The Credit Valley Conservation Authority (CVCA) commissioned Green Analytics to undertake research that identifies the links between human well-being and environmental quality in the Credit River Watershed. This report summarizes the outcomes of this research.

The role of nature in the provision of well-being has been studied from a number of disciplines generating a wide range of perspectives, conceptual models, and proposed indicators. Each perspective provides valuable insight into the importance of nature for the provision of well-being. This research summarized some of these perspectives and surveyed attitudes, perceptions, importance, and satisfaction that residents in the Credit River Watershed held for environmental attributes linked to well-being. Using information gleaned from the survey, initial steps were also taken to outline a framework for developing indicators of well-being provided by the watershed's natural areas.

For most people, it is extremely important for personal well-being to be near natural areas. Nearly 70% of respondents rated natural areas as an important contributor to their well-being. Generally, the results suggest that having a connection to natural areas inclines an individual to derive benefits from those areas. In other words, once people gain access to natural areas, they derive greater benefits to quality of life, health, and well-being. Furthermore, access is most acutely connected to quality of life when natural areas are within walking distance of one's home.

Approaching the issue of well-being from the perspective of watershed management, with the ultimate objective of integrating suitable measures of well-being into watershed management, two key well-being mechanisms were identified:

1. The role of natural areas in the provision of ecosystem services which maintain or enhance human well-being. Nature in this sense indirectly contributes to the collective well-being of communities and societies; collective in the sense that the benefits of ecosystem services flow to human populations or groups of people rather than to an individual.
2. The role of natural areas in the provision of physical, mental, and social well-being. Here well-being benefits of nature depend on the individuals contact with nature and therefore has a more direct relationship to the individual.

To manage watershed resources for human well-being benefits, attention must be paid to ecological integrity and ecosystem functions, to ensure the flow of ecosystem services, and to managing natural areas to allow various interactions with nature.

## 1.0. INTRODUCTION

The Credit Valley Conservation Authority (CVCA) commissioned Green Metrics Ltd., to undertake research that identifies the links between human well-being and environmental quality in the Credit River Watershed. This report summarizes the outcomes of this research.

The rapid expansion of human activity has transformed the Earth and its ecological landscapes, bringing with it benefits to human well-being (Turner et al. 1990). Since the Industrial Revolution, ongoing capital accumulation, technological change and expansion of institutions focused on human welfare have resulted in a dramatic rise to human well-being (Landes 1999). Human welfare gains in this sense are typically measured by income, wealth, and increases in life expectancy and education. However, global increases to material wealth (i.e. Income or GDP) as a measure of progress and human well-being have largely ignored other driving factors of well-being and quality of life. More recently efforts in the area of environmental management and economics have sought to refocus the role the nature as a contributor to well-being. Most recently this work has focused largely on global scale assessments of linkages between humans and the environment.

This report is focused on reflecting larger global assessments of ecosystem services and human well-being within a local watershed perspective to help highlight relationships between environmental quality and human well-being for the Credit River Watershed. Through a literature review and survey of Credit River Watershed residents, this report summarizes key information for CVCA to consider in its ongoing efforts to improve human well-being through improving environmental quality and track the progress of such improvements over time.

### 1.1. PURPOSE

The purpose of this research is to better understand the linkages between human well-being and environmental quality in the Credit River Watershed. This work will provide information and recommendations to CVCA about how it can enhance its management strategies for conserving and restoring ecological features in the Credit River Watershed while improving the well-being of its residents. Specifically, this research focuses on four key objectives for CVCA:

1. Examine watershed residents' attitudes and perceptions of environmental attributes and services as they relate to their well-being.
2. Capture the current level of satisfaction and perceived importance with various environmental attributes and ecosystem functions.
3. Capture how residents' environmental priorities and level of satisfaction are related to key demographic characteristics.
4. Provide recommendations for choosing a set of indicators and developing a framework that will allow the monitoring of changes in well-being.

## 1.2. REPORT OUTLINE

The following sections of the report support the objectives outlined above:

- Section 2.0: The background discussion on human well-being as it relates to environment through ecosystem services, contact with nature, and values and beliefs.
- Section 3.0: Background information on the Credit River Watershed, including an overview of its geography and a summary of the socio-demographics of its residents.
- Section 4.0: The framework used to guide the survey development and the methods used to develop, implement and analyze the survey data.
- Section 5.0: The results of the survey instrument.
- Section 6.0: Recommendations for future research and monitoring, supported by the findings of this research.

## 2.0. BACKGROUND: WELL-BEING AND ENVIRONMENTAL QUALITY

Well-being is a broad and contested term often used interchangeably with happiness, utility, and quality of life. However, there is growing consensus that there are two fundamental components to well-being: (i) a subjective component; and (ii) an objective component (Sumner 1996; Pacione 2003; McAllister 2005; Newton 2007).

1. *Objective well-being* refers to the material and social attributes believed to foster (or detract from) an individual's or community's sense of wellbeing, such as wealth, education, and health care. These are typically factors deemed important for society, and are easily measured at the population level.
2. *Subjective well-being* refers to an individual's self assessment of their own wellbeing. In this case well-being is not the product of objective attributes of an individual's life, but always depends on the subjective evaluation of objective aspects from the perspective of the individual living the life.

Over the last decade, well-being has become an increasingly important concept for sustainable development policy. There is a growing body of literature exploring the various ways of measuring quality of life and human well-being. Calls for more robust measures of progress, has led to the development of indicator frameworks designed to track well-being or quality of life such as the Genuine Progress Indicator (GPI), Green GDP, Canadian Index of Well-being and the Human Development Index. Furthermore, the French and British governments have been global leaders in the application of well-being to public policy, investing in their own approaches.<sup>1</sup>

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<sup>1</sup> For more information on French efforts see Stiglitz et al. (2009) and for British efforts see Office of National Statistics well-being website: <http://www.ons.gov.uk/well-being>

These indicator approaches are examples of objective measures of well-being. While the natural environment is always considered a component in much of this indicator-based work, the complex relationship between human well-being and ecosystem health tend to be insufficiently acknowledged. Instead the frameworks rely on an implicit and often unacknowledged assumption that a functioning ecosystem is a prerequisite to human well-being. For example, the recently released environment domain report (Morgan 2011) for the Canadian Index of Well-being grouped indicators into 5 areas: air, energy, freshwater, non-renewable resources, and biotic resources. Within these areas the specific indicators (such as ground-level ozone, energy use, and water quality) tend to measure environmental quality itself as opposed to the contribution that environmental quality provides to human well-being.

What is evident from reviewing the literature is that a rapidly growing number of studies are being conducted focusing on the benefits of nature to human well-being. These benefits are typically measured in economic or monetary terms, as highlighted in Section 2.1. However, other measures exist that examine benefits in non-monetary terms, as highlighted in Section 2.2.

## 2.1. ECOSYSTEM SERVICES AND WELL-BEING

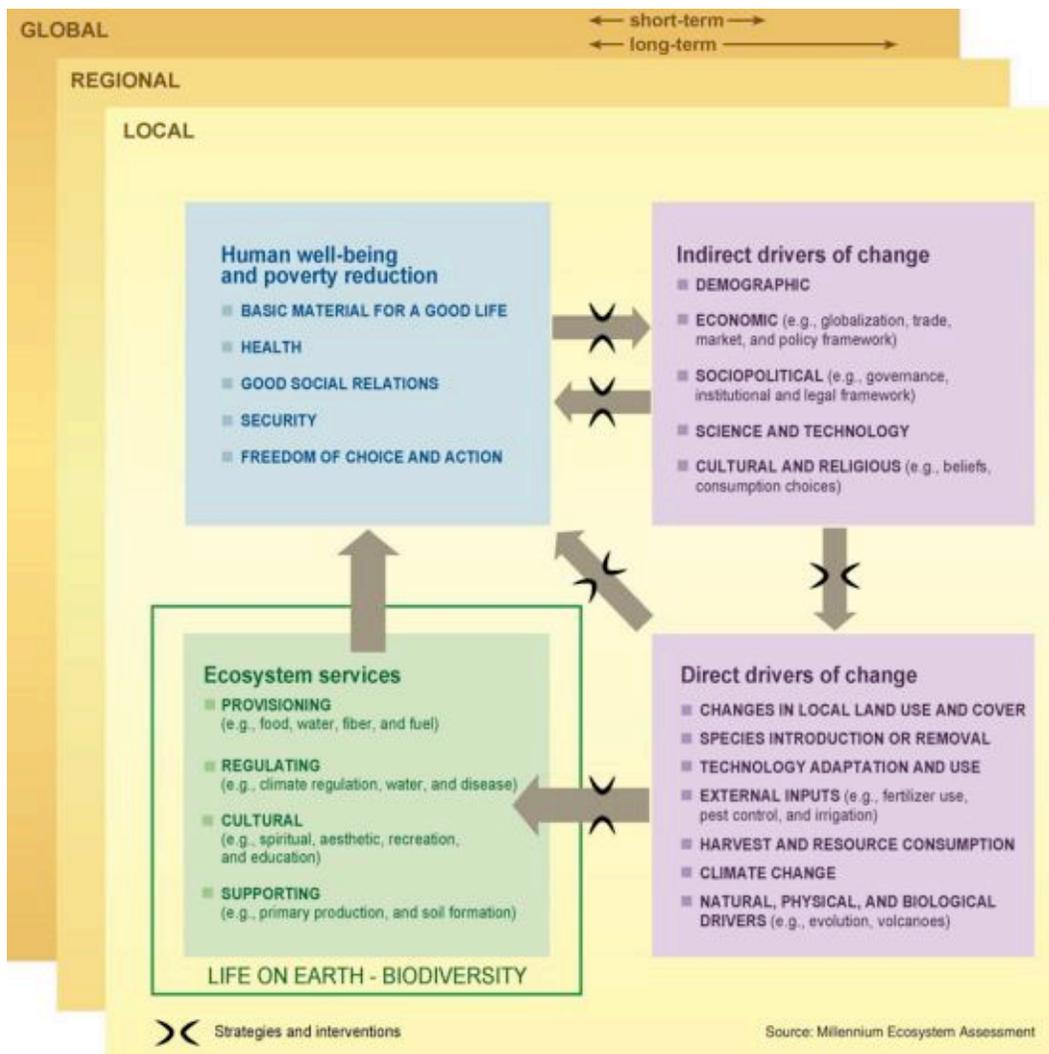
Over the past 10 years a number of key initiatives have been undertaken that bring some clarity to the links between human well-being and environmental quality. Much of this work has focused on the role of ecosystem services. Ecosystem services are often defined simply as the benefits that people obtain from nature (Daily 1997).

In 2001 the United Nations Environment Programme (UNEP) launched the Millennium Ecosystem Assessment (MEA) to undertake a global assessment of the state of ecosystem services across the Earth's biospheres. The MEA also produced a conceptual framework for understanding and presenting the many inter-linkages between human well-being and ecosystem services. The MEA framework (Figure 1) provides a critical starting point for understanding the basics of human well-being and environmental quality and is useful for identifying and measuring specific components of ecosystems that contribute to objective wellbeing. Within in the MEA framework, ecosystem services are grouped into four broad categories:

1. *provisioning* (e.g., the production of food and water)
2. *regulating* (e.g., the control of climate and disease)
3. *cultural* (e.g., spiritual and recreational benefits)
4. *supporting* (e.g., nutrient cycles and soil formation)

which influence five key aspects of human well-being:

1. basic material for a good life
2. health
3. good social relations
4. security
5. freedom of choice and action



**Figure 1. Millennium Ecosystem Assessment conceptual framework of interactions between ecosystem services, human well-being and indirect and direct drivers of change**

Source: Millennium Ecosystem Assessment 2005

The MEA framework has become a standard for research and policy discussion on ecosystem services.<sup>2</sup> Appendix A provides more detail on the structure and functions of ecosystem services. Table 1 provides an overview of the ecosystem service assessment framework developed by the MEA Working Group.

<sup>2</sup> While the MEA has become the standard classification for policy discussions, there is still some debate over the most appropriate way to categorize and organize ecosystem services. For more information on that debate see de Groot et al. (2002), Boyd and Banzhaf (2006), Wallace (2007), Fisher et al. (2009), and Haines-Young and Potschin (2010).

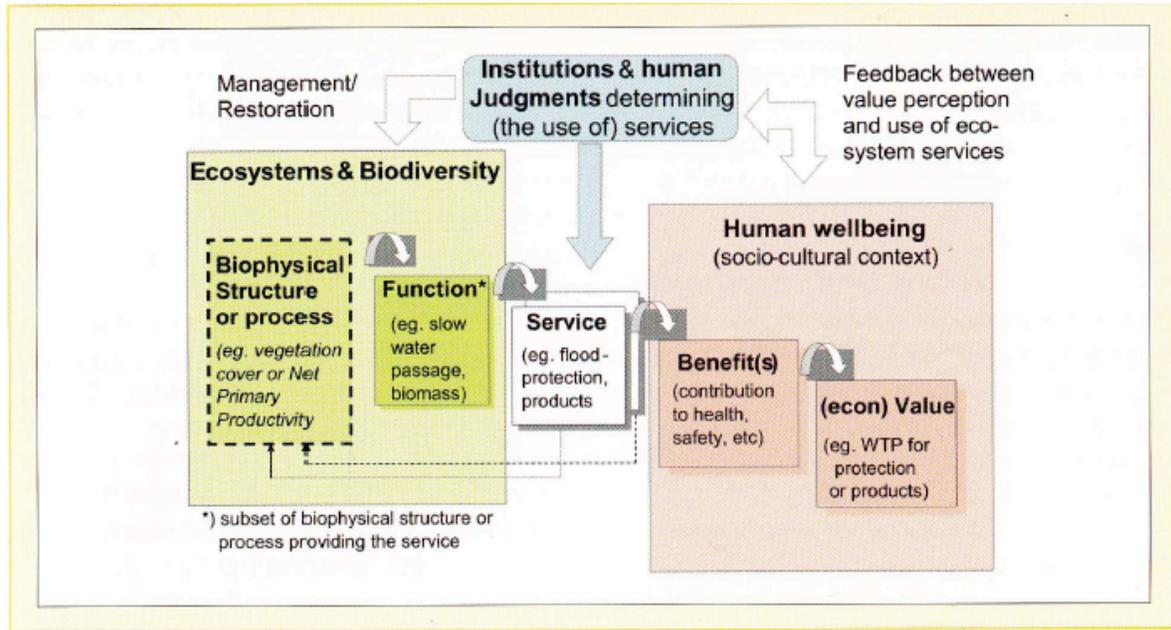
**Table 1. Framework for understanding ecosystem services**

<b>Provisioning</b>	<b>Regulating</b>	<b>Cultural</b>	<b>Supporting</b>
Food	Air quality regulation	Cultural diversity	Soil formation
Fibre	Climate regulation	Spiritual & religious values	Photosynthesis
Fuel	Water regulation	Knowledge systems (traditional & formal)	Primary production
Genetic resources	Erosion regulation	Educational values	Nutrient cycling
Biochemicals, natural medicines and pharmaceuticals	Water purification, waste treatment	Inspiration	Water cycling
Ornamental resources	Disease regulation	Aesthetic values	
Fresh water	Pest regulation	Social relations	
	Pollination	Sense of place	
	Natural hazard regulation	Cultural heritage values	
		Recreation, ecotourism	

Source: Millennium Ecosystem Assessment 2005

Expanding on the work of the MEA, The Economics of Ecosystems and Biodiversity (TEEB) published a report in 2010 that builds an economic case for the conservation of ecosystem services (TEEB 2010). This report yields an even more practical approach to understanding the linkages between human well-being and ecosystem services. Figure 2 provides the schematics developed by TEEB, and further reflects the links between the benefits of ecosystem services, their economic value and the role of institutions and human judgments in determining how ecosystem services are used. In this case, measures of human well-being are defined by the benefits and subsequent value that people place on services provided by ecosystems and biodiversity.

What is particularly valuable about the conceptual diagram in Figure 2 for the purposes of this research is that measuring well-being could focus on either benefits or the value provided by nature. The distinction is subtle but important. Benefits are the actual gains in well-being resulting from the direct and indirect contribution of services (Haines-Young and Potschin 2010). In contrast, economic value is the measurement of that gain in well-being in monetary terms. For example, the flood protection services result in reduced flood risks that improve well-being (benefit), which could be valued based on avoided flood damages. Therefore, one could focus on measuring benefits (e.g. changes in flood risk) or measuring value (e.g. avoided damage costs). In either case the focus is on objective measures of well-being.



Source: TEEB Foundations 2010, Chapter 1

**Figure 2. The Economics of Ecosystems and Biodiversity pathway from ecosystems to human well-being**

Source: The Economics of Ecosystems and Biodiversity 2010

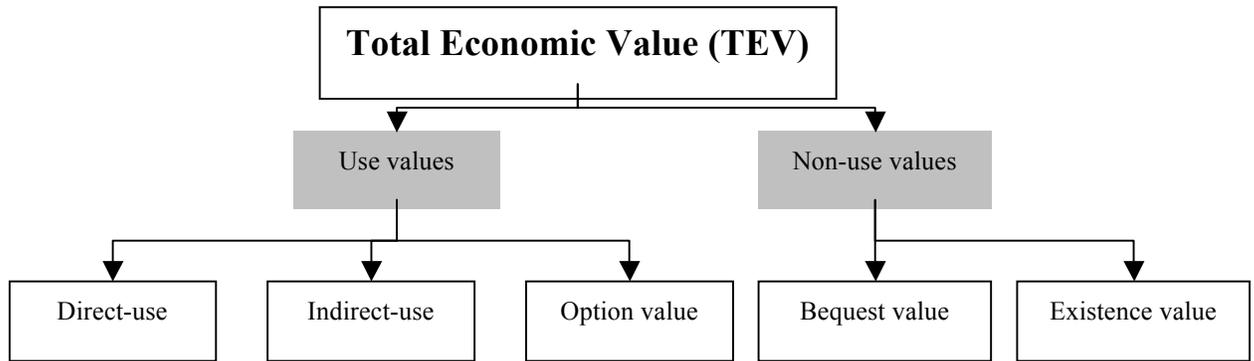
Depending on the objectives of a monitoring program, it may not be necessary to move to valuation. On the other hand, if valuation is the preferred metric the Total Economic Value (TEV) framework provides a way to do so. The concept of TEV, typically employed in environmental valuation, suggests that economic value is the sum of nature’s use values and non-use values.<sup>3</sup>

Total Economic Value framework has been developed to assist in understanding the range of values that people hold for ecosystem services. The concept of TEV, typically employed in environmental valuation, suggests that economic value is the sum of use values and non-use values of nature, which are further subdivided into a suite of current and future values, as outlined in Figure 3.

Ecosystem valuation seeks to capture the use and non-use values associated with the non-market aspects of ecosystem services. This framework has been discussed in the literature in extensive detail.<sup>4</sup> While the TEV framework is accepted in the literature, calculating estimates of benefits for each of the categories listed is not always possible. It is important to note that this framework reflects the types of values that society generally places on the environment, therefore reflecting socio-economic benefits of establishing, maintaining or enhancing the functioning of ecosystems.

<sup>3</sup> For more information on the TEV approach see Plottu and Plottu (2007).

<sup>4</sup> Eric Plottu and Beatrice Plottu, “The concept of Total Economic Value of environment: A reconsideration within a hierarchical rationality,” *Ecological Economics* 61 (2007): 52–61.



**Figure 3. Total economic value framework for environmental valuation**

Source: National Research Council of the National Academies, 2003

As Figure 3 depicts, the services afforded to society by ecosystems can be categorized into two main values: use and non-use values. Use values reflect the value derived by humans from consumption (directly or indirectly) of the services, or from having the option of consuming them at some point in the future. Use values are of three types:

1. **Direct-use value:** derived from the direct use of the ecosystem or resource, such as the value timber, aggregates or agriculture productivity.
2. **Indirect-use value:** derived from the indirect use of the ecosystem or resource, such as the value of a wetland for flood control.
3. **Option value:** derived from preserving a use value of water today for the option of using it in the future, or preserving forest biodiversity today so that it may be available in the future.

Non-use values, in contrast, are derived without consumption taking place. Non-use values (also referred to as the inherent values) are of two types:<sup>5</sup>

1. **Bequest value:** the satisfaction that individuals derive from the knowledge that existing natural areas will be protected for future generations.
2. **Existence value:** the satisfaction of knowing natural areas or endangered species exist.

In terms of capturing the economic value of ecosystem service, the TEV assists analysts in soliciting a broad array of values for nature from survey or study participants. In this regard, the TEV framework was used in this study to attribute the importance and use of ecosystem services.

<sup>5</sup> The TEV framework recognized by Australia's National Oceans Office includes two additional non-use values: quasi-option values and vicarious-use values.

## 2.2. WELL-BEING FROM CONTACT WITH NATURE

While the ecosystem service approach as outlined by the MEA and TEEB provides a strong foundation linking environmental quality to human well-being, it fails to capture all dimensions of well-being advocated by well-being literature (Newton 2007). For example, the way physical, mental, and social well-being is supported by the natural environment is not clearly articulated in the ecosystem services framework. Newton (2007) argues that the well-being literature can supplement that dealing with ecosystem services. In fact, research suggests that humans function best physically, emotionally, socially, and spiritually when engaged with nature (Kaplan and Kaplan, 1996; Burns, 2005).

**Table 2. Summary of key relationship between nature and physical, mental and social well-being.**

Type of Well-being	Relationship to the Natural Environment	Source
Physical	Natural environment plays a supporting role in promoting physical activity	Sallis et al. 1998
	Exposure to natural improves heart rate, blood pressure, and muscle tension	Ulrich et al. 1991
	Contact with nature speeds recovery in hospital patients	Ulrich 1984
	Elderly people recover more quickly from directed attention fatigue after resting in a garden	Ottosson 2007
	Exercising in a natural environment improves physical well-being more so than exercising in non-natural environments	Pretty et al. 2005
Mental	Contact with nature influences the rehabilitation potential of people affected by crisis	Ottosson 2007
	Green outdoor settings reduce ADHD symptoms in children	Taylor et al. 2001 Kuo and Taylor 2004 Ottosson 2007
	Contact with nature improves cognitive performance and productivity	Taylor et al. 2001
	Contact with nature alleviates stress and anxiety	Park et al. 2010 Maas et al. 2009b
Social	Natural settings increase community bonds and social integration	Coley et al. 1997 Taylor et al. 1998 Maas et al. 2009a
	Presence of trees and grass increases sense of safety	Kuo et al. 1998
	Natural areas are strongly correlated with more creative play in children	Taylor et al. 1998
	Greener homes, greener buildings, and greener neighborhoods produce healthier social behavior and less social dysfunction	Weinstein et al. 2009 Kuo 2010

The bulk of research focused on the influence of natural areas on physical, mental, and social well-being has been in relation to green spaces or urban natural environments. The main theme within this literature is human contact with nature, which drives the benefits to human well-being regardless of whether it is directly with natural areas or indirectly through views of nature (Newton 2007, Kuo 2010). Table 2 summarizes a selection of the key relationships between well-being and contact with nature found in the literature.

What these studies demonstrate is that access to and contact with nature influences psychological, as well as social functioning. As stated by Kuo (2010), “greater access to green views and green environments yields better cognitive functioning; more proactive, more effective patterns of life functioning; more self-discipline and more impulse control; greater mental health overall; and greater resilience in response to stressful life events.” For a more detailed discussion of various studies that explore the influence that contact with nature has on physical, mental, and social well-being see Kuo (2010).

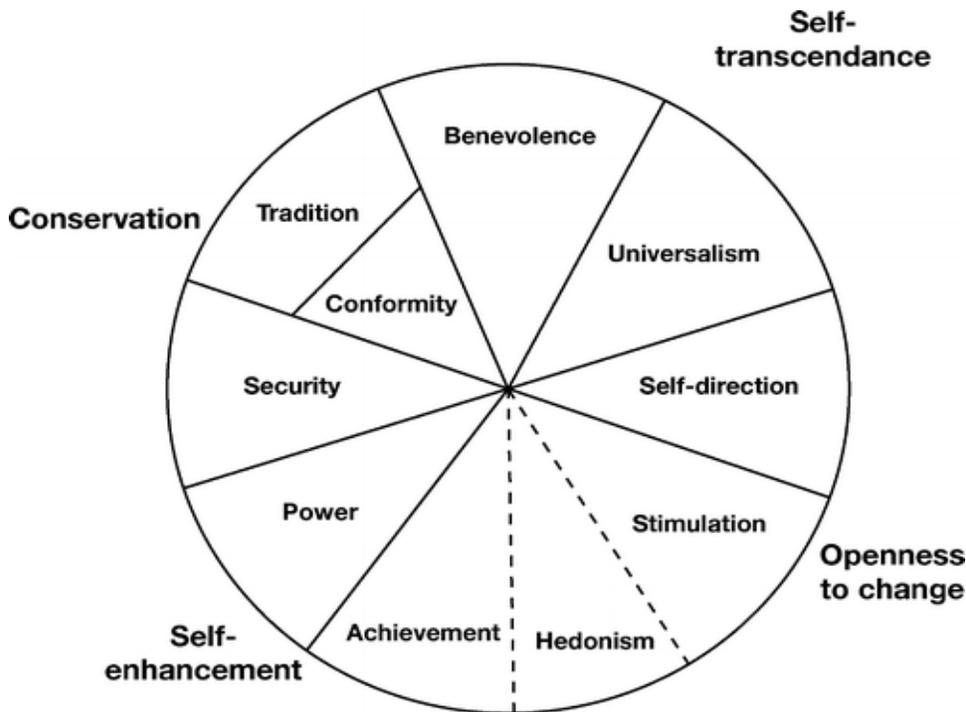
### **2.3. ROLE OF VALUES, ATTITUDES, AND BEHAVIOUR IN WELL-BEING**

To understand perceptions of environmental attributes and services as they relate to well-being (objective 1), as well as their satisfaction with these attributes and services (objective 2), it is important to account for values, attitudes, and behaviour.

In addition to the work of economists, both social psychologists and sociologists have developed models that characterize human/nature relationships. In contrast to economic definitions of value, which stress benefit to an individual or group, sociological and social psychological values refer to broad principles that provide an orientation to individuals and societies.

Figure 4 demonstrates the widely-used Schwartz values scale (Schwartz 1994) that includes self-transcendence (related to an interest in others, which may include the environment) versus self-enhancement (related to concern with self), and openness to change versus conservatism. Understanding how well-being is provided by nature can benefit from a consideration of the value configurations of those who live in the area of interest. For example, for people holding self-interested values (such as having money and material possessions), versus people holding other-interested values (such as protecting natural areas from human disturbance), there may be unique ways to encourage greater participation in natural areas conservation. To someone with self-oriented values, it would be important to demonstrate the benefit to the individual, such a better health or lower stress; to a person holding other-oriented values, argumentation that explicates how protecting natural areas is beneficial to future generations and other species would be more effective for encouraging acceptance and appreciation of protected areas. Figure 4 illustrates these value clusters in slightly more detail, showing how the four axes produce many sub-types of value clusters. In this study, we use different labels than those included

within Figure 4. Section 5.5 describes the three value clusters (living large, counterculture, and virtuous citizens) that emerged from our analysis.



**Figure 4. Schwartz values scale**

Source: Dietz, Fitzgerald and Shwom 2005

Self-enhancement values concern power, wealth and personal achievement. At the other end of that axis, self-transcendence captures concerns for the environment and care for others. Conservation values engage security and tradition, while openness to change stresses new experiences and independence (Schwartz 1994). Typically, all of these values are present in every individual or society, but some may feature more prominently than others. With respect to the environment, the dominance of a certain values sphere will greatly shape societal relationships with nature, and therefore could influence both objective and subjective components of well-being derived from nature.

Values are widely considered to be antecedent (and more stable) than structures like beliefs and attitudes, yet also contribute to the formation of beliefs in individuals, groups, and society at large. In general, beliefs and attitudes are influenced by context (Schwartz 1994). For example, how cities are designed, whether a society has high levels of trust among neighbours, and the proximity of wild areas to city and town centers are all variables that can influence the general levels of environmental concern in a region. With respect to well-being, the overall environmental orientation of a region (pro-growth or pro-conservation) will influence support for and use of natural areas which in turn influences both actual and perceived well-being benefits derived from these areas.

Beliefs are the judgments and mental acceptance of the validity of a situation, statement or object. In regards to the environment, the most widely used measure of general environmental concern is the New Ecological Paradigm (NEP), which was developed by Riley Dunlap and Kent Van Liere in the 1970s and 1980s (Dunlap et al. 1994). The NEP reflects a dichotomous classification in a 15-item scale: on one hand, it measures adherence to the belief that humans are equal to and part of the rest of nature (indicating strong environmental beliefs/concern) or the belief that humans are superior to nature (indicating weak environmental beliefs/concern). In numerous studies, strong environmental concern has been positively linked (often the strongest explanatory variable) to support for and use of protected areas (Bonnes et al. 2011; Corraliza et al. 2002; Carrus et al. 2005). It follows then, that how an individual self-assesses or perceives nature contributing to their well-being may be influenced by their beliefs about the environment.

Understanding attitudes and actions are a focal point for social scientists. Economists most often try to demonstrate that rational actors are forever seeking to improve their own welfare, or well-being, while sociologists take a more critical stance on this approach, arguing that the public is far less autonomous than we might assume. In fact, sociologists have long argued that most activity is largely dependent on social context, rather than rationality. For example, Kennedy et al. (2011) demonstrate that the neighbourhood of residence strongly influences the behaviours that households adopt (controlling on attitudes and socio-demographic variables), attributing this contrast to differences in urban design and neighbourhood culture, a topic explored in more depth by Florida (2009). Carres et al. (2005) used environmental concern in a region to predict support for natural areas, finding that in regions with strong environmental concern, protected areas were more widely used and appreciated than in regions with low environmental concern. An awareness of social context makes more understandable the frequently observed gap between what people say they *want* to do and what people really do. With respect to how a region's people connect well-being to natural areas, their proximity to natural areas, familiarity with others who use natural areas, and the general value orientation of a society (e.g., motivated by material wealth (or materialism) or by helping others) will likely affect the extent to which natural areas are supported, used, and the degree to which these areas benefit the well-being of both individuals and communities within a region.

## 2.4. SUMMARIZING THE LINKAGES

Understanding the linkages between environmental quality and human well-being requires a model of human ecology where anthropological, biological, epidemiological, psychological and sociological perspectives can be combined (van Kamp 2003). Admittedly, trying to capture all of these perspectives is a complex undertaking fraught with data gaps. Furthermore, individuals and societies vary in their dependence on nature. How well-being is expressed or experienced is often context- and situation-dependent, and it reflects local social and personal factors,

such as geography, ecology, age, gender and culture (Prescott-Allen 2001).

Given the complexity of measuring well-being in all its dimensions we measured something slightly different through this research. We asked survey respondents to rate the importance of natural areas to their well-being. Thus, the dependent variable throughout this report is the extent to which natural areas aid well-being. Connecting the previous points (in Section 2.3) to the central research objective, if it is difficult for a person to use natural areas, it is less likely that person will attribute natural areas to be of great importance to their well-being. In a social context where most people visit a park once per year, it is unlikely that natural areas will benefit their quality of life substantially. Quality of life tends to be linked with habits and routines: the people who use parks on a weekly basis are much more likely to see a benefit from this exposure to their quality of life. Those who have parks within walking distance of their home are even more likely than others to use parks frequently. To summarize, a sociological stance on environmental values, beliefs and behaviour improves our understanding of why people use or do not use natural areas. This information combined with the research linking physical, mental, and social well-being to contact with nature (Section 2.2) and ecosystem services (Section 2.1) provides a first step toward understanding the role of nature and natural areas in providing well-being to watershed residents.

### **3.0. PROFILE OF THE CREDIT RIVER WATERSHED**

#### **3.1. GEOGRAPHY**

The Credit River, located in one of the more densely populated regions of Canada (the Greater Toronto Area), has roughly 1,500 km of tributaries that drain nearly 1,000 km<sup>2</sup> of land. The watershed has three relatively distinct physical regions, which are referred to as the upper, middle and lower watershed, and is characterized by the spatial distribution of land features (Figure 5).

The *upper watershed*, which lies above the Niagara escarpment, is characterized by till plains, hummocky moraines and glacial spillways. The highly permeable soils and hilly topography of this region lead to significant rates of groundwater recharge, supplying water to the regional groundwater aquifers, which is the source of domestic water consumption for most of the residents in this rural portion of the watershed. The flow of the river and its tributaries is largely maintained by groundwater discharge. Dominant vegetation cover includes sugar maple forests and white cedar swamps. Traditionally, agriculture has been the main land use in the area, however in recent years the land use has been shifting to rural estate development.

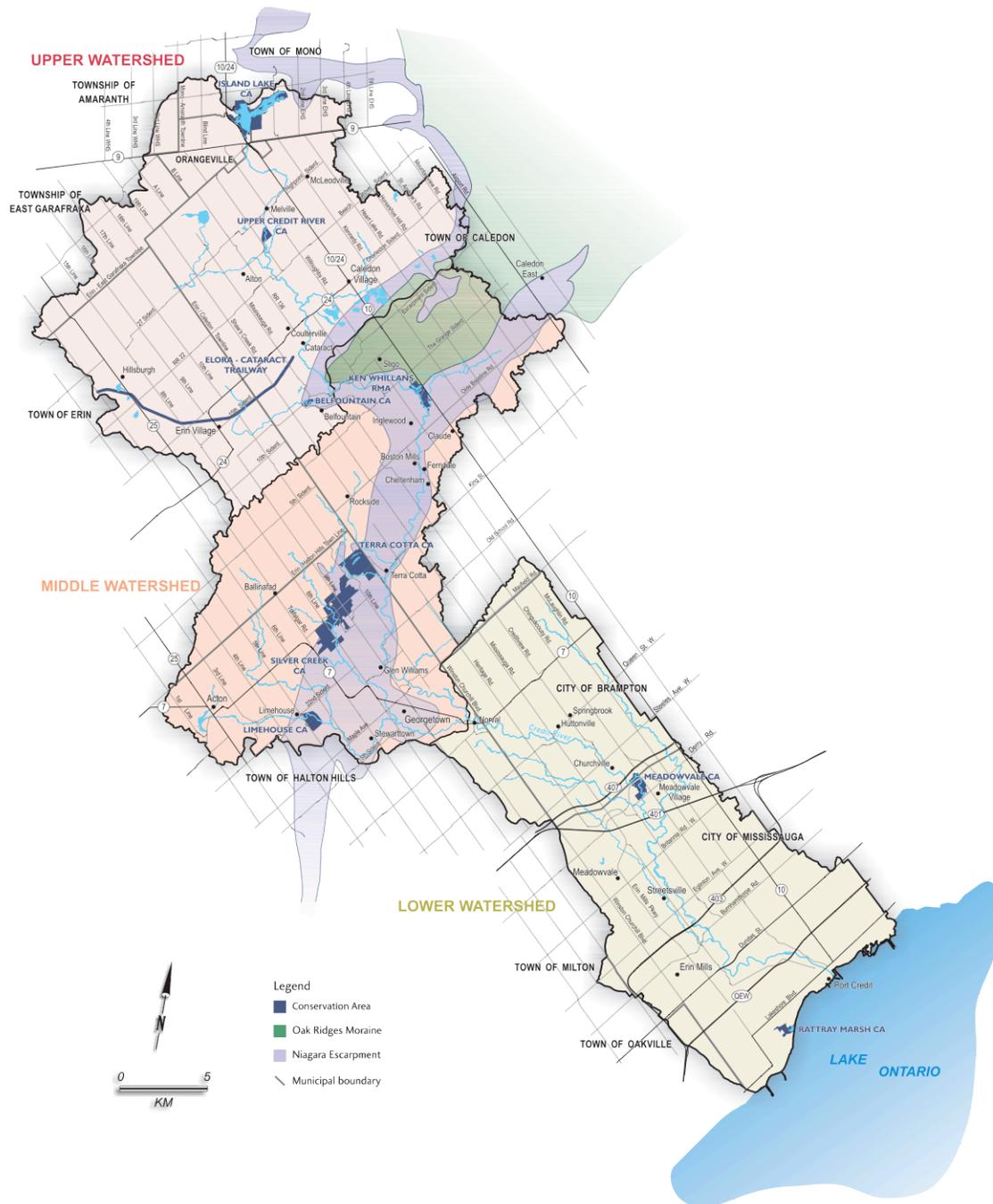


Figure 5. Map of the Credit River Watershed

The *middle watershed* includes the Niagara Escarpment and is dominated by steep slopes, significant rock outcrops and thin soil conditions. In some areas sharp cliff faces dominate the landscape. Such topography leads to high volumes and velocities of runoff, with the Credit River flowing through a steep-walled, narrow valley. The Oak Ridges Moraine is a central feature of the eastern portion of this

region. The Escarpment plateau is heavily forested with a mixture of deciduous stands in upland areas and coniferous swamps in lowland areas. Land use is strictly regulated along the Escarpment and the Moraine. There are numerous recreational areas and trails in this part of the watershed.

The *lower watershed* is characterized by a relatively flat surface topography with a gentle southward slope towards Lake Ontario. The soils typically have low rates of infiltration compared to the other regions, leading to higher rates of runoff. As a result of urban development in this portion of the watershed, many of the tributaries have been channelized or enclosed. The lower watershed is highly urbanized, with population densities ranging from 500 to more than 1,000 people per square kilometre (Credit Valley Conservation 2007). This region encompasses most of Mississauga and the western edge of Brampton. The large majority of residents in this portion of the watershed obtain their drinking water from Lake Ontario.

### **3.2. SOCIO-DEMOGRAPHIC PROFILE**

In 2009, Credit Valley Conservation (CVC) acquired from Statistics Canada a complete set of census data tailored specifically to CVC's administrative boundaries using data collected in 1996, 2001 and 2006 census years.

The socio-demographic trends in the Credit River Watershed are typical of rapidly urbanizing areas. Population has increased by 32% between 1996 and 2006, with over 750,000 people now calling the Credit River Watershed home. Similarly, the number of private dwellings grew by 32% from 1996 to 2006, to over 240,000 dwellings, compared to only 16% across Ontario over that same time period.

The lower watershed accounts for 88% of the watershed's total population. With population centralized in the lower portion of the watershed and with continued development and population-growth pressures, large portions of the watershed's population could potentially have limited access to natural features.

Watershed residents appear to be younger and wealthier on average than the rest of Ontario, with nearly 50% of the population aged 34 and younger (compared to 45% for Ontario) and a median household income of just over \$90,000 (compared to \$60,455 for Ontario).

Another noteworthy demographic trend is the significant multicultural population. In 2006, 56% of residents reported English as their dominant mother tongue, compared to 75% across the province, and the number of immigrants accounts for 46% of watershed population.

## **4.0. METHODS: ASSESSING LINKS BETWEEN ENVIRONMENTAL QUALITY AND HUMAN WELL-BEING**

### **4.1. SURVEY SAMPLING AND IMPLEMENTATION**

Ipsos Reid, a survey-based marketing research firm, was contracted to conduct the survey through an internet panel.<sup>6</sup> Internet panels are now a preferred mode of administration and offer a number of advantages over mail, telephone and other methods (Dillman 1999). While this survey approach does limit the participation of households without access to Internet, statistics show that a high percentage of southern Ontario households have access to Internet either at home or at work (Statistics Canada 2007).

An initial draft of the questionnaire was examined in detail through the use of a focus group conducted at the University of Alberta in late February 2011. The focus group consisted of 10 individuals, and had the objective of assessing clarity and flow of the questionnaire in general, as well as an understanding of how individuals interpreted the questions. The survey was then revised based on the feedback from that process, which was tested with a second focus group of eight individuals in early March 2011. With feedback from the second focus group included, the questionnaire was then sent to CVC to be reviewed by local watershed experts to ensure the questionnaire properly addressed the local environmental and socio-economic context.

Prior to launching the full survey, a final pre-test was conducted in mid-April 2011. The main purpose was a final check to ensure the questionnaire was properly understood and to flag any issues that might have been overlooked in previous testing. A total of 95 individuals completed the questionnaire. The data were collected and examined. No significant issues were identified.

The final survey was administered between April 15 and April 26, 2011 to the Internet panel—a representative sample of adults aged 18 or older who reside in Credit River Watershed municipalities:

- Region of Halton (Town of Oakville, Town of Halton Hills, Town of Milton)
- Region of Peel (City of Brampton, City of Mississauga, Town of Caledon)
- Town of Erin
- Town of Mono
- Town of Orangeville
- Township of Amaranth
- Township of East Garafraxa

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<sup>6</sup> Ipsos Reid maintains a panel of approximately 7,600 residents within the Municipalities of the Credit River watershed region for survey purposes. Ipsos Reid staff actively manage their panel members in order to maintain representation of key demographic characteristics (e.g. city/town of residence, gender, age, income, children in household, household size, education, etc.).

A total of 1,003 respondents completed the survey. A copy of the full survey is provided in Appendix B.

## 4.2. STATISTICAL ANALYSIS

A statistical analysis was conducted to understand the frequency distributions of the survey responses and to build a regression model that provides a model structure, incorporating several independent variables in order to measure the relative importance placed on ecosystem services and other variables related to well-being.

We began our analysis by checking the frequency distributions for every closed-ended question on the survey. This information allows us to make statements such as, “52% of respondents are female.”

Next, we conducted factor analyses on two of the questions with multiple items (Q10 and Q11).<sup>7</sup> The factor analysis on the value items (Q10) explains 48% of the variance. The items were loaded onto three factors, which we call “living large,” “virtuous citizens” and “countercultures.”<sup>8</sup> To assess the internal reliability of these resultant scales we used Cronbach’s alpha.<sup>9</sup> The general rule-of-thumb is to accept as a scale any items with an alpha score over 0.500 (Cronbach 1951). The living large group has an alpha of 0.695, virtuous citizens’ alpha is 0.878, and countercultures’ alpha is 0.712. The belief items (Q11) loaded onto two factors: Polyannas and Cassandras. These two factors account for 40% of the variance in Q11 items. The alpha score for Polyannas is 0.744; the score for Cassandras is 0.731. As highlighted in Section 2.3, respondents’ values and beliefs are expected to influence (i) one’s perception of the role natural areas have in contributing to their well-being, and (ii) their behavior in terms of actually engaging in nature-based activities, which ultimately influences the amount of well-being they can derive from natural areas.

The next stage of the analysis was to build the regression model. To do so, we first ran a correlation analysis comparing Q1 to all other variables in the dataset. Scanning the results, we selected those variables that were correlated by at least 0.400 ( $p = 0.050$ ). These variables were then recoded in an appropriate form for multiple linear regressions. We created dummy variables from the yes/no response sets; formed scales with questions that had multiple items correlated with Q1 (e.g., Q2 and Q3), and recoded ordinal variables to an interval form, using midpoints to create an interval variable. The scale variables that we formed include importance of services and use of services.

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<sup>7</sup> Factor analysis is a statistical method used to describe variability among measured variables in terms of a potentially lower number of variables, or clusters.

<sup>8</sup> Since the clustering of these variables is roughly unique across studies, we created names for the values and beliefs scores. These names do not reflect any specific precedent in the literature. For a more detailed description see section 5.5 of the report.

<sup>9</sup> Cronbach’s alpha is a commonly used measure of how well a set of variables measures the concept they are intended to measure.

## 5.0. RESULTS

This section of the report presents the results of the survey responses, the statistical analysis and a summary of the open-ended questions from the survey instrument. As mentioned previously, the survey instrument is presented in Appendix B.

In interpreting the results of the survey instrument, we were most concerned with identifying those survey responses where there was a clear indication of preference (i.e., where respondents indicated a 4 or 5, at the upper end of the 1 to 5 scale of importance).

### 5.1. IMPORTANCE OF ECOSYSTEM SERVICES AND CONTACT WITH NATURE

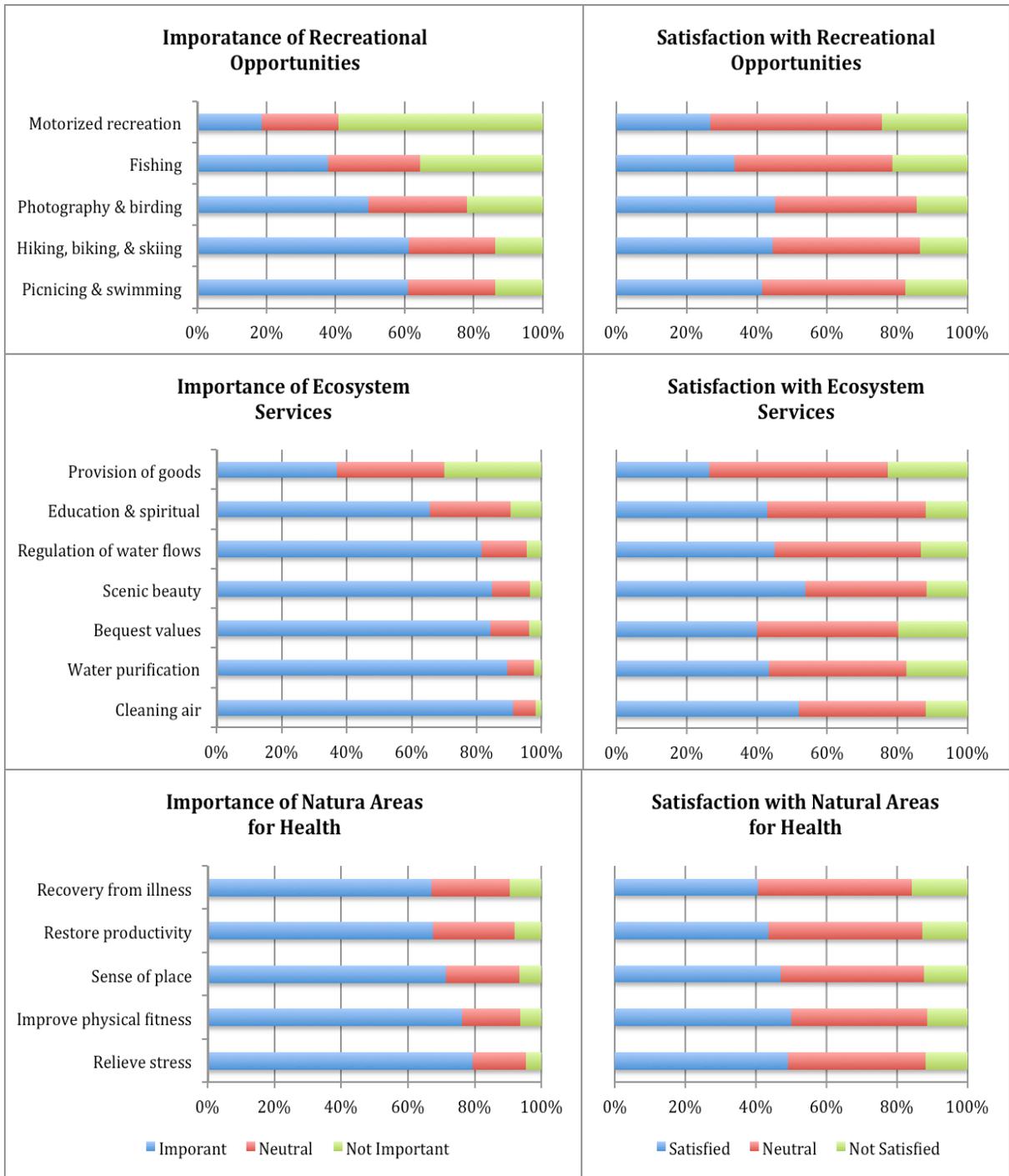
In the first survey question, survey respondents were asked to indicate the importance of nature to their overall well-being. For most people, it is extremely important for personal well-being to be near natural areas: **67.9% of respondents rated natural areas as an important contributor to their well-being.**

The ecosystem services that were most strongly linked to well-being from natural areas include trees for cleaning the air (91.2% of respondents) provision of clean water (89.4%), scenic beauty (84.7%), wetlands and treed areas for regulating water flow (81.5%), protecting the environment for future generations (84.2%) and community belonging or a sense of place (71.5%).

One area of particular interest in the results is the contributions of nature to various aspects of health. Respondents indicated that contact with natural areas are important for relieving stress (79.4% of respondents), aiding physical fitness (76.2%), restoring productivity and concentration (67.4%) and recovering from illness (67.0%).

### 5.2. PERCEIVED QUALITY OF ECOSYSTEM ATTRIBUTES

While watershed residents recognize a clear link between ecosystem services and their well-being, they have several areas of concern with regard to the perceived quality of and satisfaction with ecosystem services in the Credit River watershed. For example, 16.4% report “the highest satisfaction” with trees for cleaning the air, 14.2% with provision of clean water, and 13.3% with wetlands and treed areas for regulating water flow. Figure 6 compares the importance of and satisfaction with ecosystem services provided by natural areas in the Credit River Watershed.



**Figure 6. Comparing importance of and satisfaction with environmental attributes for their contribution to well-being.**

When asked what they see as the most obvious threats to the quality of natural areas, participants selected urban development (82.8%) and pollution and waste from industrial or commercial activities (68.4%) as the most severe. Considerably less of the respondents were concerned with spread of invasive species (34.5%),

over use of areas for recreation (24.9%), climate change (25.2%), agricultural practices (12.6%), forest practices (11.4%), and fishing practices (6.5%).

### **5.3. WILLINGNESS TO CONTRIBUTE TO BETTERING THE WATERSHED**

As well as soliciting respondents' satisfaction with existing conditions in the watershed, the survey instrument also sought to identify the degree to which respondents were willing to contribute to the betterment of the watershed.

To remedy the disturbances to natural areas, 36.6% said they would volunteer time to help with community restoration projects, 34.0% of participants said they would be willing to restore natural area on their property, and 23.7% said they would donate money to conservation organizations. Another 6.1% responded "other" to this question with responses including the following:

- Pay taxes
- Pick up litter, keep the park clean when visiting
- Vote for politicians who value protecting the watershed
- Use natural consumer products, recycle and reuse
- Use the natural features of the watershed to demonstrate my value for them
- Educate other people
- Lobby government agencies, write letters to politicians

This is an interesting result as it highlights the role the environment can play in contributing to social cohesion.

### **5.4. USE OF ECOSYSTEM SERVICES**

The most commonly used natural areas (used at least once per week) are parks/trails within walking distance of the home (33.3%) The next most frequent are parks and trails within driving distance (11.0%). The frequency of visits to the remaining types of natural areas is negligible.

The most common recreational reasons people visit natural areas (at least once per week) are enjoying scenic beauty (20.3%), hiking (13.3%) and photography or birdwatching (7.6%). More common are the health-related reasons to visit natural areas. For example, 21.2% visit natural areas at least once per week to improve physical fitness, 19.1% visit to relieve stress and 11.3% visit to restore concentration and productivity.

### **5.5. VALUES AND BELIEFS OF SURVEY RESPONDENTS**

From the value statements, three respondent typologies were created and named based on the distribution of responses to the value items from the survey. The typologies include those who are "Living large," the "Virtuous citizens" and the "Countercultures." Table 3 shows the results of the factor analysis, which we used to

reduce the number of items into distinct dimensions, based on responses from survey participants. The numbers in the table indicate the strength of correlation between an item and the sub-scale in which it fits. Typically, a value above 0.400 is considered an acceptable level of correlation. To create the scales, we summed all items that were found to measure a similar concept (e.g., living large, or being motivated by material values). All items are measured on a five-point scale (0 to 4) representing the measures ‘strongly agree’, ‘agree’, ‘neutral’, ‘disagree’, and ‘strongly disagree’, respectively. Thus, summing the five items that represent living large results in a scale ranging from 0 (weak) to 20 (strong).

**Table 3. Results of the factor analysis**

	<b>Living large</b>	<b>Virtuous citizens</b>	<b>Countercultures</b>
Leading an exciting life filled with stimulating experiences	.734		
Having an impact on people and events	.650		
Leading a varied life filled with challenges, novelty, and change	.632		
Having the right to lead or command	.762		
Having material possessions and money	.599		
A world free of war and conflict		.754	
Safety for my loved ones		.712	
Showing self-discipline and restraint		.503	
Protecting the environment and preserving nature		.569	
Equal opportunity for all human beings		.669	
Social justice and caring for the weak		.689	
Honouring parents and elders		.708	
Being interested in everything and exploring new things			.549
Unity with nature, fitting in with nature			.683
Existing in harmony with other species			.652

The majority of respondents are roughly in the middle of the living large scale, suggesting that the sample is moderately motivated by materialistic goals. Fewer than 10% are in the upper end of the scale. For the scale measuring virtuous citizens, ranging from 0 to 28, most respondents score at the upper end of the scale, which shows that the sample is strongly motivated by other-oriented values. Finally, respondents score more highly on the counterculture cluster than the living large cluster, but not as strongly as the virtuous citizen cluster. That is, the sample is best

described as largely other-oriented, with an interest in new experiences, and moderate materialist values. Within the sample, there are those who are more strongly motivated by self- versus other-oriented values, and we will see in the regression analysis that this has some bearing on support for natural areas.

The belief statements, drawn from the popular and widely used NEP scale (Dunlap 1994), created two subgroups of the sample, which we label Cassandras (or pessimists) and Polyannas (or optimists). Briefly, Cassandras believe in strict limits to Earth's carrying capacity and believe human action should reflect the tenuous balance between healthy and unhealthy ecosystems. In contrast, Polyannas believe in the power of human ingenuity to solve environmental problems and feel that humans have every right to consume resources as they see fit. The scale for Cassandra beliefs ranges from 0 to 24 and is quite strongly represented in this sample. Over half of respondents scored in the upper end of the scale (between 18 and 24). Polyanna beliefs are less common: over half of the sample scored on the lower end of the scale (on a scale of 0 to 28).

## 5.6. REGRESSION ANALYSIS: WELL-BEING AND NATURAL AREAS

The regression model is built upon the question, "Considering all the factors that contribute to your well-being, how important is it for your well-being to be near natural areas?"

The multiple linear regression model was used to help determine which of the demographic, beliefs, values and ecosystem service-related variables could be used to predict the degree to which being near natural areas contributes to an individual's sense of well-being. Of the 15 variables entered, 8 yielded significant relationships, producing an adjusted  $R^2$  of 0.42 ( $F(1,002) = 43.92, p = 0.001$ ) for the prediction of well-being.<sup>10</sup> This means that the model explains 42% of the variation in the extent to which respondents feel that being near natural areas can contribute to their well-being. Table 4 presents the results of the regression analysis.

Interpreting these findings shows, that for each one-point increase on the income scale (equaling \$5,000), the importance that a participant assigns to natural areas for personal well-being increases minutely on the importance scale (1 to 5). Those who live with a spouse are less likely to perceive a relationship between ecosystem services and well-being. People who live within walking distance of a natural area are more likely to feel that natural areas matter for their quality of life. Of the values clusters, those who seek money and power are less likely to perceive well-being benefits from natural areas. This finding is in line with recent work from the World Wildlife Fund (Common Cause 2010), which argues that while we all have a complex constellation of values, each of us is motivated primarily by either intrinsic (e.g., collectivist) or extrinsic (e.g., individualist) values. Here, those living large are

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<sup>10</sup> Variables not found to be significant in the regression model include: age, gender, education, employment, having a view of natural areas, and the two beliefs categories: Polyannas and Cassandras.

similar to extrinsic values and the virtuous citizens and countercultures are in line with intrinsic values.

**Table 4. Regression analysis results**

Variable	Coefficient	t-score	p-value
Household income	0.053	1.970	0.049
Respondent lives with spouse/partner	-0.054	-2.080	0.038
Live within walking distance of a natural area	0.080	3.108	0.002
Extent of “living large”	-0.111	3.543	0.000
Extent of “virtuous citizen”	-0.072	-2.108	0.035
Extent of “counterculture”	0.246	6.244	0.000
Extent to which respondent feels ecosystem services are important	0.480	14.645	0.000
Frequency a respondent uses natural areas	0.092	3.487	0.001

Interestingly, the virtuous citizen values cluster is negatively related to our variable of interest. This may be because a central feature of the virtuous citizen is social justice. Recently, several critics have noted the weak (or even non-existent) relationship between environmental goals and social justice concerns (Agyeman et al. 2009).

The strongest relationship among the values clusters lies in the counterculture crowd: with a one-point increase on the 0 to 12 scale, there is a quarter-point increase in importance ascribed to the natural area/well-being relationship.

Interestingly, it does not appear to matter what people believe about the human/nature relations (as measured by Cassandras vs. Polyannas): what people do matters more than what they say they believe. Those who score higher on the scale of services they feel are relevant to overall well-being, score one half-point higher on the natural area/well-being variable for each one-point increase. Finally, those who use natural areas are more likely to see a benefit to their well-being from such use.

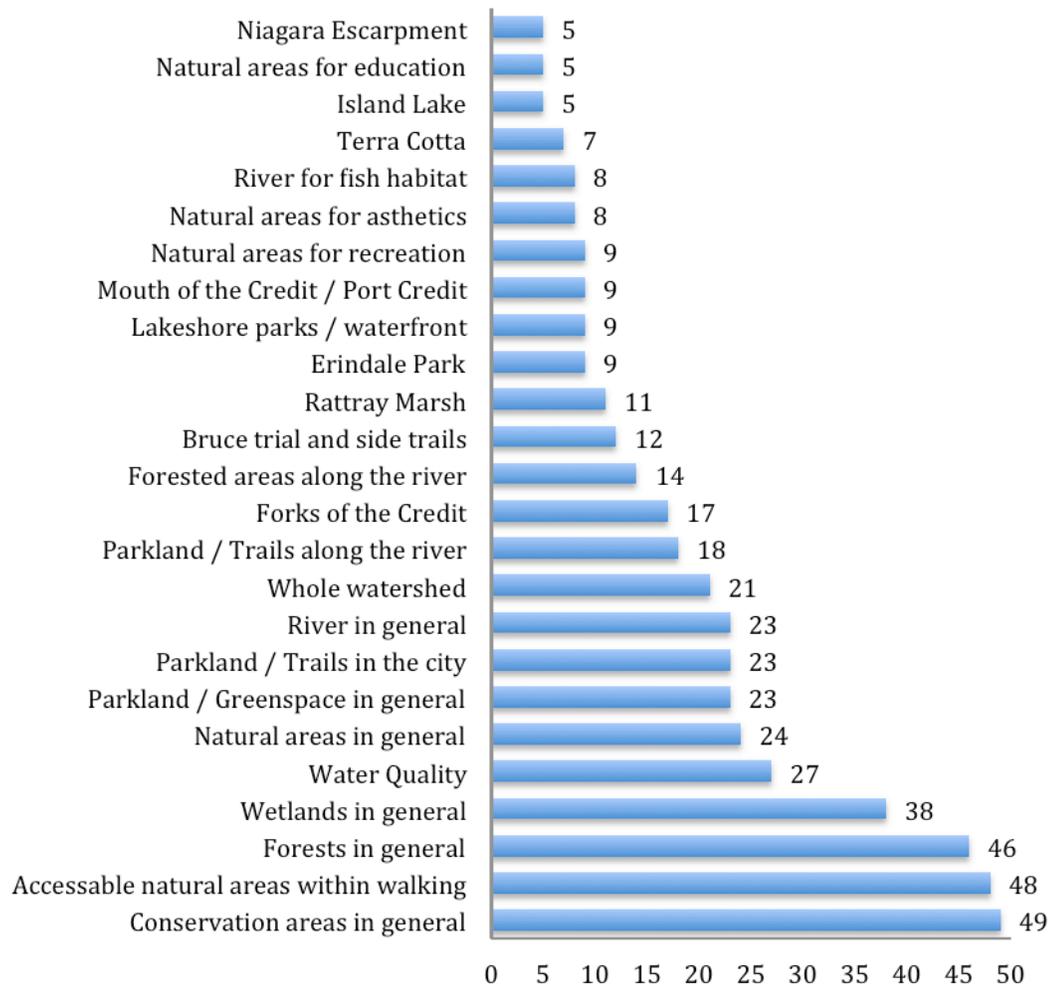
## 5.7. SUMMARY OF OPEN ENDED REPONSES

Two written-response questions were included in the survey: one to gauge respondents’ subjective values, and another to allow them a place to provide comments. General themes expressed in these open-ended responses are summarized in Table 5.

**Table 5. Summary of the open-ended responses to survey questions**

Survey Question	Themes and Sentiments Expressed
<p>What do you think is the most valuable natural area or feature associated with the Credit River Watershed (natural areas or features can include conservation areas, your local park, a forest woodlot or a wetland)?</p>	<ul style="list-style-type: none"> <li>• The forests, treed areas, plants and animals, natural habitat, marshes, wetlands</li> <li>• Greenery and green spaces</li> <li>• The beauty, existence, wonderment and peacefulness of the natural areas and nature</li> <li>• Public parks</li> <li>• Picnic areas, fishing, canoeing, birdwatching, bike and walking/hiking trail systems, and other recreation</li> <li>• Clean natural areas, clean water</li> <li>• Educational programs for youth</li> <li>• Various lakes, lakeshore areas and conservation areas</li> <li>• Escape from urban areas</li> <li>• A place that reduces stress</li> <li>• Spiritual well-being</li> <li>• Fresh, clean, unpolluted air</li> <li>• Scenery, scenic beauty</li> <li>• Ability of treed areas to keep the air clean</li> </ul>
<p>Do you have any further comments about natural areas in the Credit River watershed?</p>	<ul style="list-style-type: none"> <li>• Areas require more protection from urban development</li> <li>• Tighter regulations on development in the area</li> <li>• Concerned over urban development encroaching on natural areas</li> <li>• Anger over the extent of residential, commercial, and industrial development that has taken place in natural areas</li> <li>• Concerned over pollution damaging the areas</li> <li>• Area must be preserved and maintained</li> <li>• Preserve and protect the area for future generations</li> <li>• Some form of program for picking up litter is required</li> <li>• Concerned about the level of garbage in the watershed areas</li> <li>• More access to park education and information would be valuable</li> <li>• Establish an awareness program for youth</li> <li>• Motorized recreation vehicles should not be permitted in the watershed</li> <li>• Concern over quarrying activities in or near the watershed</li> </ul>

While Table 5 highlights a number of the general themes or sentiments expressed, more specific responses were also provided with respect to most valuable natural areas or features (Q5), the top 25 of which are depicted in Figure 7. Many of the more popular responses had respondents simply stating forest or conservation areas as the most valuable. Others were much more specific, such as Forks of the Credit or the woodlot that my house backs onto. What was particularly interesting was the number of people that indicated accessible natural areas that are within walking distance or within their neighbourhood.

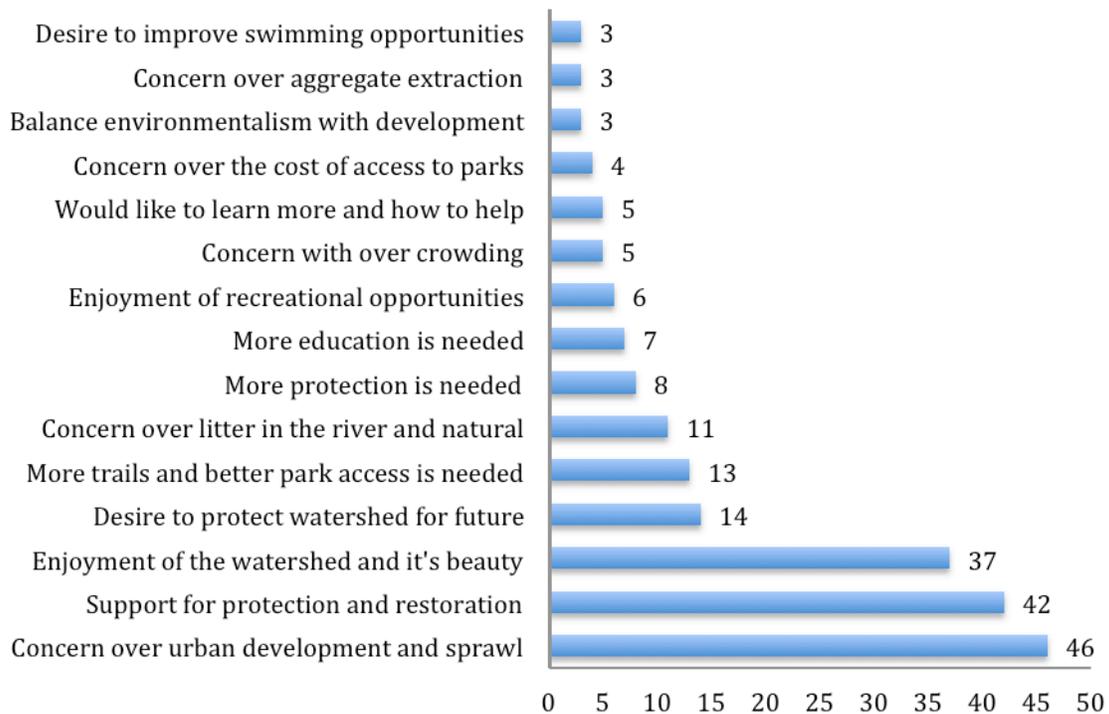


**Figure 7. Top 25 comments on the most valuable natural feature associated with the Credit River Watershed (based on number of responses per category).**

A total of 435 respondents (or 43% of the sample) commented on Q5. Below is a selection of responses to provide an example of comments elicited:

- “The Credit River in Mississauga provides a really great natural area for the growing city, but it would be worthless if the river upstream wasn't protected.”
- “Behind our house is a stream/woodlot and wetland. It cannot be built on because it is labeled flood plain. It is very valuable to me personally.”
- “I enjoy the forests and treed areas along the river and elsewhere in the watershed. My own neighbourhood is heavily treed primarily with old oaks, the shade providing welcome cooling in summer.”
- “You can't boil the Credit River Watershed down to one area. It is the combined package that gives the Credit its value.”
- “There is a small picnic area in Terra Cotta that is right on the banks of the Credit River and it is absolutely gorgeous. It is so nice to sit and have a picnic lunch by the water.”

The second open-ended question (Q9) provided an opportunity for respondents to express any other thoughts or concerns. Table 5 highlights the general themes and sentiments. The results were also examined in more detail and Figure 8 depicts the top 15 general responses. There were a total of 194 unique responses (or 19% of the sample) to this open-ended question. The top concern expressed was development and urban sprawl. Beyond the concern over urban development the comments largely reflected general support for protection and restoration of natural areas and states related to appreciation of the watersheds aesthetic beauty.



**Figure 8. Top 15 comments about natural areas in the Credit River Watershed (based on number of responses per category)**

### 5.8. DEMOGRAPHIC PROFILE OF SURVEY RESPONDENTS

As much as possible, the survey sample was gathered to represent a statistically significant representation of the population in the Credit River Watershed. Below is a summary of the demographic profile of the survey respondents.

- Over three-quarters (77.4%) of respondents live within walking distance of a natural area.
- Only 32.9% of participants can see a natural area from windows in their home.
- Women comprise 48% of the sample.

- The majority of respondents live in Mississauga (43.1%), with large proportions of the sample also residing in Brampton (27.9%), and Oakville (12.5%).
- The majority of respondents (71.8%) were born and raised in Canada. Less than 2% of the sample has lived in Canada less than 2 years.
- Most respondents (68.1%) live with a partner.
- Roughly half (46.1%) of participants are employed full-time (over 35 hours/week). Retirees make up 18.4% of the sample

One area where the sample appeared to be largely different from the population was with respect to households with versus without children. Nearly three-quarters of the sample (73.1%) do not have any children living in the household. Whereas, according to 2006 census data less than 30% of watershed households do not have children living at home. This may introduce bias in the results if there is a systematic difference in the responses of those with children versus those without. However, conducting an ANOVA test to compare the mean responses of the two sub-groups revealed no statistically significant difference in their response to the importance of natural areas to well-being.

Table 6 provides a comparison of demographic variables between the survey sample and the population of the watershed. While there appears to be a somewhat dissimilar distribution of educational attainment between the sample and population, the categories used for education in the survey didn't exactly match those in the census, resulting in the need to aggregate some categories for comparison. Overall, the proportion of individuals with high school diplomas and lower education seems representative of the population. As well, if the higher levels of education are grouped together the sample appears more representative of population.

Finally, ethnic origin of the sample looks representative of the population for the most part, with the exception that South Asians and East and Southeast Asians appear to be slightly under represented in the sample.

**Table 6. Comparison of demographic variables from survey sample to watershed population**

<b>Demographic Variable</b>	<b>Survey Sample</b>	<b>Watershed Population*</b>
<b>Gender</b>		
Male	48.0%	49.1%
Female	52.0%	50.9%
<b>Education</b>		
Grade school or some high school	7.1%	18.9%
High school diploma or certificate	39.2%	26.6%
Apprenticeship, trades or technical diploma or certificate	5.7%	6.6%
Non-university diploma (e.g. college, CEGEP)	10.5%	17.5%
University undergraduate degree (Bachelor's)	16.7%	24.4%
Graduate university degree	6.9%	5.9%
Other	14.1%	
<b>Ethnic Origin</b>		
South Asian	5.3%	14.9%
East & Southeast Asian	4.8%	10.2%
West Asian or Middle Eastern	0.7%	3.2%
European	54.6%	51.2%
African	1.0%	2.0%
Central or South American	1.8%	1.5%
Caribbean	3.2%	4.9%
Canadian	23.7%	10.3%
Aboriginal/First Nations/Metis	1.0%	0.8%
Other	2.5%	1.0%
Prefer not to answer	1.4%	
<b>Income</b>		
Less than \$40,000	14.4%	17.4%
\$40,000 to \$79,999	29.7%	31.7%
\$80,000 and Over	35.9%	51.0%
Prefer not to answer	20.0%	

\* Watershed population numbers are based on the 2006 census estimates for the Credit River Watershed.

## 6.0. DISCUSSION OF SURVEY FINDINGS

The following discussion section is organized around the first three central research objectives. The fourth objective is addressed in detail in Section 7.0.

1. *Examine watershed residents' attitudes and perceptions of environmental attributes and services as they relate to their well-being.*

Generally, what this model tells us is that having a connection to natural areas inclines an individual to derive benefits from those areas. However, participants need not identify as pro-environmental in order to seek benefits to quality of life from engaging in natural areas. For instance, measures of environmental belief were found to be statistically insignificant.

As stated earlier, behaviours matter much more strongly than beliefs. That said certain value-cluster types are more likely to seek quality-of-life benefits from natural areas—namely, the countercultures. On the other hand, for those who are living large, money and power are more likely to be perceived as a well-being generator than spending time in nature. For virtuous citizens, a more important requirement for quality of life might be spending time with family or helping others. However, in terms of making a case for parks, the results suggest that once people gain access to natural areas, they derive great benefits to their quality of life, health, and well-being. Furthermore, access is most acutely connected to quality of life when natural areas are within walking distance of one's home. That the countercultures are the only value cluster to be positively associated with seeking quality-of-life benefits from natural areas fits with existing values research – as they are less associated with conservative values than are the virtuous citizens, and more associated with other-oriented values than those who are living large, they are the most likely to seek benefits to their quality of life in a way that may differ from the mainstream and is connected to their concern for others and other species.

2. *Capture the current level of satisfaction and perceived importance of various environmental attributes and ecosystem functions.*

It is clear that watershed residents place primary importance on ecosystem services as a contributor to their well-being. The most common ecosystem services and attributes that contribute to the well-being of watershed residents include trees for cleaning the air, clean water, scenic beauty, wetlands and trees for regulating water flow from flooding and erosion, protecting the environment for future generations and providing residents with a sense of place.

One of the interesting findings suggests that while residents generally associate high levels of importance with ecosystem services and contact with nature, their use of the natural areas in the watershed is quite low (about 11%) with the exception of those who live within walking distance of natural areas. This has interesting implications from the perspective of the two key primary roles of nature in the

provision of well-being. First, people perceive ecosystem services and having contact with nature as important for their well-being regardless of whether or not they actually use natural areas. While the results show that those who actually use natural areas are more likely to see benefits, those who don't use natural areas still perceived their importance. Second, their behaviour in terms of using natural areas and therefore the amount of contact they have with nature is low, which limits the physical, mental, and social well-being benefits they can derive. However, this did not hold for those that live within walking distance of a natural area, since they did indicate they derive well-being benefits. Therefore, access plays a key role influencing behaviour towards increased contact with nature.

Theoretically, the benefits individuals derive from contact with nature should exist regardless of whether or not residents perceive well-being benefits. The policy implication here is that improving access to natural areas influences the behaviour of watershed residents, resulting in more contact with nature. This then should improve residents well-being in the various ways articulated in Section 2.2.

In terms of ecosystem services, the general level of support (as indicated by the importance placed on these variables) is strong. This suggests that policy actions taken by Credit Valley Conservation that improve ecosystem functions and therefore ecosystem services are likely to be perceived as improving the watershed well-being.

Despite the level of importance placed on the environmental attributes of well-being, satisfaction with the quality and quantity of attributes was low, with most attributes being rated as satisfactory by less than half of the sample. This suggests that residents in the watershed have some concerns over the current state of environmental attributes in the Credit River Watershed for the purpose of their well-being. The perceived threats to ecosystem services in the watershed were dominantly urban development and industrial pollution. Further research might seek to explore this in more depth. For example, what could be done that might improve watershed residents' perception or levels of satisfaction with the environmental attributes of the watershed.

### *3. Capture how residents' environmental priorities and level of satisfaction are related to key demographic characteristics.*

Most demographic variables were found to be statistically insignificant descriptors of respondents' perceived importance of and satisfaction with natural areas as a source of well-being. Specifically age, gender, education, employment status, and length of time living in Canada were all found to be statistically insignificant variables. The only demographic variables significantly related to respondents' sense of well-being derived from natural areas was household income and relationship status.

#### *4. Other noteworthy findings*

The results also indicated that up to one third of the watershed residents are ready to take action to improve the environmental conditions of the watershed. The main actions that residents are willing to undertake include donating time and money to conservation activities.

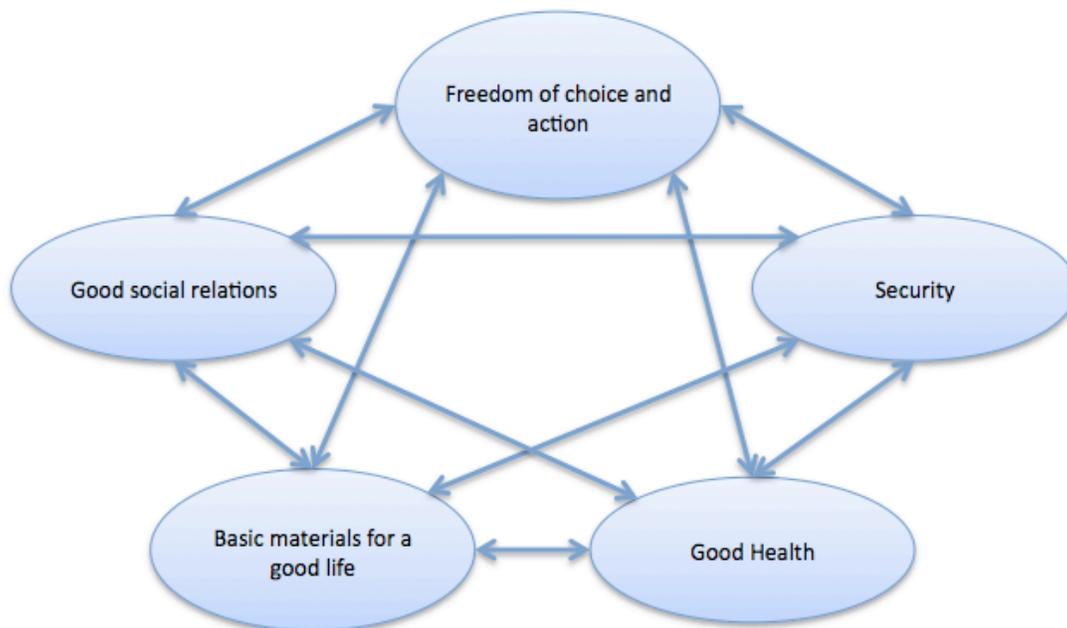
### **7.0. TOWARD WELL-BEING INDICATORS**

To address the fourth objective of this project, to provide recommendations related to a well-being indicator framework, this section of the report aims to outline the key components of an indicator framework, a process for defining a framework, and to provide recommendations for indicators that CVC might want to consider in developing a socio-economic indicator monitoring system. It should be noted that the recommendations of indicators for CVC are confined to the socio-ecological relationships explored in the survey research contained within this report. Further, research and stakeholder engagement is needed to refine an operational indicator framework to support a socio-economic monitoring system.

#### **7.1. A CONCEPTUAL FRAMEWORK**

The MEA framework developed in 2003 captures the main dimensions of human well-being, which was adopted for the purposes of moving toward a set of indicators. The framework, presented in Figure 9, provides a schematic to capture the five key dimensions of human well-being and their interrelationships.

The elements of life that contribute to each dimension of well-being are substantial. Understanding how environmental quality (e.g., quantity and quality of ecosystem services) contributes to the various dimensions of well-being is key to developing a set of indicators. Ultimately, the natural environment is the foundation upon which each of the five dimensions relies on. Table 7 provides an overview of how various elements of the natural environment contribute to well-being.



**Figure 9. Dimensions of human well-being**

Source: Millennium Ecosystem Assessment 2005

**Table 7. Contributions of ecosystem services to human well-being**

Dimension of Human well-being	Ecosystem service sub-elements
Good social relations	<ul style="list-style-type: none"> <li>• Realization of aesthetic and recreational values</li> <li>• Ability to express cultural and spiritual values</li> <li>• Opportunity to observe and learn from nature</li> <li>• Development of social capital</li> <li>• Avoidance of tension and conflict over declining resource base</li> </ul>
Freedom of choice and action	<ul style="list-style-type: none"> <li>• The ability to influence decisions regarding ecosystem services and human well-being</li> </ul>
Security	<ul style="list-style-type: none"> <li>• Safe environment</li> <li>• Resilience to ecological shocks</li> <li>• Secure rights and access to ecosystem services</li> </ul>
Good health	<ul style="list-style-type: none"> <li>• Adequate food and nutrition</li> <li>• Avoidance of disease</li> <li>• Clean and safe drinking water</li> <li>• Clean air</li> <li>• Energy for temperature control</li> </ul>
Basic material for a good life	<ul style="list-style-type: none"> <li>• Access to resources for viable livelihood</li> </ul>

Source: Millennium Ecosystem Assessment 2005

## 7.2. FOUNDATIONS OF A WELL-BEING INDICATOR FRAMEWORK

There is a rich body of literature on both the process and components of an indicator framework. This section is not meant to capture the full extent of the body of literature but to highlight key themes that are emerging. Further research is needed to fully capture the ideas and issues that are emerging in the literature related to developing indicator frameworks of well-being.

Indeed, developing an indicator framework to support the monitoring or comparison of well-being across jurisdictions is a multi-faceted process that requires adaptive management to continuously improve the indicator framework to meet the changing demands faced by environmental managers and policy-makers at multiple scales (Gustavson et al 1999).

Designing a well-being indicator framework can take many different forms. In a review of the literature on the design of indicator frameworks a trend emerges in the components that are consistently used to inform the framework (Reed et al 2006). Figure 10 below outlines the process and components associated with an indicator framework. The components of the indicator framework development process are described in more detail below. It should be noted that many of the stages of the indicator framework development process could be done in parallel.

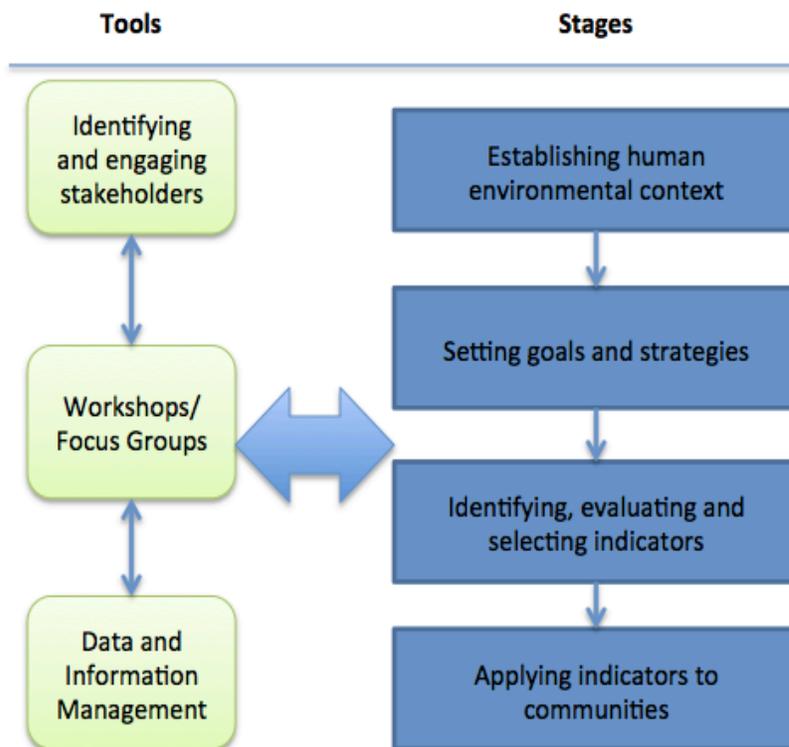


Figure 10. Tools and stages of an indicator framework development process

Determining how much time and resources to commit to each component of the process is a subjective decision that needs to be made by proponents of the process informed by input from key stakeholders. Further, the degree to which stakeholders feed into the process or drive the process will need to be determined from the outset. Reed et al. (2006) classifies the process of consulting stakeholders as a top-down approach, whereas a process driven by stakeholders is referred to as a bottom-up approach.

### **Establishing Human-Environment Context**

Establishing the human-environmental context in a watershed relies on two key sources of information: (1) existing information and data on the watershed; and (2) input from stakeholders in the watershed, including expert opinion from ecologists and others who can assess the ability of the environment to provide well-being conditions. At this stage of the indicator framework development process the goal is to develop an understanding of the watershed's human-environment system. Some key first steps have been taken toward this end with the survey administered as part of this research and summarized in the previous sections.

Determining the appropriate tool to gathering contextual information on the watershed can be driven by three key factors:

- The willingness of the proponent to invest in a participatory process involving stakeholders
- The local or global nature of the problems or challenges the watershed is facing
- Existing processes undertaken by the project proponent to gather information on the human-environment system in the watershed.

### **Setting Goals and Strategies**

In this stage of the indicator development process the objective is to work with stakeholders to develop broader watershed scale goals and strategies to work towards over time. As such, who is involved and the time frame of the goals are critical to establish early on in the process.

Approaches to setting goals and strategies in a stakeholder-based process are numerous and are accompanied by a rich body of literature. The on-the-ground application of these approaches varies. The more widely researched processes used to assist in setting goals and strategies are outlined in Table 8 below.

Determining which approach is most applicable to a watershed has not been identified. Therefore, researchers or policy-makers will need to research the approach that is most appealing to them and to apply the approach that is most suited to the resources available to the indicator framework development proponent.

**Table 8. Examples of approaches to setting goals and strategies**

Approach	Top-Down/Bottom-up	Description
Firm-level strategic planning	Top-down	Traditional process used by firms to determine their own goals and the strengths, weakness, opportunities, and threats that may deter the achievement of these goals.
Sustainable Livelihoods Analysis	Bottom-up	Tool that focuses on defining watershed based forms of capital and to discuss how these forms of capital can and have been leveraged to overcome key challenges.
Soft Systems Analysis	Bottom-up	Involves the use of problem situations to work with stakeholders to desirable and feasible goals and strategies.
Multi-criteria decision analysis	Bottom-up	This process involves the use of empirical data and empirical preference ranking to example the range of goals and strategies and to rank these through mathematical programming and stakeholder engagement.

### Identifying, Evaluating, and Selecting Indicators

The identification, evaluation and selection of indicators requires that specific goals have been identified for the watershed. Indicators, to be effective need to meet two criteria. First, the indicator must objectively measure progress towards one of the goals identified in the *Setting Goals and Strategies* stage of the process. Secondly, it must be possible for local users to apply the indicator (e.g. the Chesapeake Bay sneaker index measures the depth of water a white sneaker can be seen as a measure of water quality). Reed et al (2006) articulate a suite of evaluation criteria that should be considered to assess the ability of an indicator to meet the two key criteria of measurability and ease of use.

It should be noted that the process for identifying indicators is not standardized. There are a number of quantitative and qualitative approaches to determining appropriate indicators. The quantitative approaches are similar in scope to the research conducted for this report, whereby statistical analysis and context experts are used to identify indicators. The qualitative approaches, however, rely primarily on expert knowledge and peer-reviewed articles (Beckley et al 2002). Similar to all other stages of the indicator framework development process, the indicator identification process can be a bottom-up or top-down approach. Both of the approaches have their relative strengths and weaknesses and should be considered carefully for their suitability to the indicator framework proponent.

Characteristics of an indicator will vary based on the goal, desired outcomes, or strategy the indicator seeks to address. However, there are key elements that indicators should encapsulate. These elements include:

- The scale of the goal or strategy being addressed;
- A unique extent of a geographical location being addressed (if applicable);
- The trajectory of the quantity of a social, economic and/or environmental attribute, and;
- The trajectory of quality of the social, economic and/or environmental attribute.

The following section of this report begins to outline a proposed indicator framework for CVC given the research conducted to date.

### **Applying Indicators to Communities**

Reed et al (2006) indicate the final step of an indicator framework is to collect the necessary data to populate it so that local communities to monitor changes in social, economic or environmental attributes can use it.

Applying an indicator framework to local communities to support decision-making requires that indicators be monitored for changes that might require management actions to be undertaken. In this regard, there are two widely used approaches to applying indicators in a local region. The first approach is to use thresholds (e.g. phosphorous loading limits) as a means to identify triggers for actions to be taken. An example of this approach is Alberta's Cumulative Effects Management System (Alberta Environment 2011).

A second approach to applying indicators to guide decision-making is to use targets or baselines as a means to determine if management actions are required. In this regard marginal changes in indicators (over time or space) are monitored. Pre-determined changes in an indicator are used as goal posts to guide what and when management actions may be required to mitigate threats to the condition of a particular indicator.

Communicating indicators can be done in a number of ways. The Alberta GPI approach, for example, uses a wheel or flower diagram to communicate the changes in a suite of indicators against a 0 to 100 scale (Anielski et al. 2001). Using a common scale then enables indicators to be aggregated into an index (like the gross domestic product) to enable local communities to communicate overall well-being for a region. Reed et al (2006) outline some key considerations for why an aggregate index may not be desirable as a means to communicate aggregate level sustainability.

### **7.3. PROPOSED INDICATOR FRAMEWORK FOR THE CREDIT RIVER WATERSHED**

The survey research conducted for this project was not intended to estimate specific well-being indicators. However, this research provides guidance and foundational information on the human-environment interaction, which can be used to begin forming goals, objectives, and indicators that are relevant to the Credit River

Watershed.

To move toward an indicator framework for CVC, this research draws on the MEA well-being framework highlighted in Section 7.1 and on ideas expressed by Newton (2007), which highlights the role that contact with nature plays with all five domains of well-being not explicitly captured by ecosystem services. Table 9 outlines a proposed framework for CVC to consider, which has been designed to capture the two key mechanisms through which nature provides well-being, specifically within the context of the Credit River Watershed. These two key mechanisms can be described as follows:

1. Indirectly through the provision of ecosystem services (as described in Section 2.1)
2. Direct interaction with nature that serves to improve well-being (as described in Section 2.2)

**Table 9. Proposed human well-being and environmental quality indicator framework**

<b>Well-being Mechanism</b>	<b>Scale Considerations</b>	<b>Domains</b>	<b>Example Indicators</b>
Ecosystem services	<ul style="list-style-type: none"> <li>• Provincial</li> <li>• Watershed</li> <li>• Local community</li> </ul>	Good social relations	<ul style="list-style-type: none"> <li>• Recreational index of natural areas</li> <li>• Aesthetic index by subwatershed</li> <li>• Use of natural areas for cultural and spiritual activities</li> </ul>
		Freedom of choice and action	
		Security	<ul style="list-style-type: none"> <li>• Natural areas adjacency index</li> </ul>
		Good health	<ul style="list-style-type: none"> <li>• Water quality index</li> <li>• Flood risk index</li> </ul>
		Basic material for a good life	
Contact with nature	<ul style="list-style-type: none"> <li>• Watershed</li> <li>• Local community</li> </ul>	Good social relations	<ul style="list-style-type: none"> <li>• Use of green space for social functions</li> </ul>
		Freedom of choice and action	
		Security	<ul style="list-style-type: none"> <li>• Index relating green space to measures of safety</li> <li>• Perceptions of safety</li> </ul>
		Good health	<ul style="list-style-type: none"> <li>• Availability of natural areas</li> <li>• Use of natural areas for relieving stress</li> <li>• Use of natural areas for improving physical fitness</li> <li>• Use of natural areas for restoring productivity</li> <li>• Urban canopy cover</li> </ul>
		Basic material for a good life	

This distinction becomes more relevant when viewed from a watershed perspective. For example, natural areas or features that are in close proximity to watershed residents are more likely to be used by residents<sup>11</sup> and therefore more likely to provide well-being benefits to those residents. This suggests that for densely-populated areas of the watershed, the policy (or monitoring program) focus should be on ensuring that as many people as possible have accessible natural features in close proximity. However, ecological integrity of the whole watershed system is essential for the provision of ecosystem services to watershed residents. Therefore, maintaining a network of natural heritage with varying degrees of accessibility is necessary to maintain well-being benefits from ecosystem services.

It should be noted that the two key mechanisms described above are not completely distinct. There does exist some overlap between the two. For example, use of natural areas for improve physical fitness could overlap with recreational activities.

The Credit River Watershed's unique geospatial distribution of land use allows Credit Valley Conservation to maximize the well-being benefits the watershed can provide. This can be achieved by exploring indicators and policy that seek to maintain and improve natural heritage in the upper more rural portion of the watershed, ensuring downstream ecosystem services are provided to the large population of watershed residents concentrated in Brampton and Mississauga. Within the urban areas in the lower reaches of the watershed, focus should be placed on maintaining and improve access to green space and natural areas to facilitate the physical, mental, and social well-being benefits provided by contact with nature.

Given CVC's mandate and the highly developed nature of the watershed, not all of the domains in Table 9 are directly relevant. For example, the environment plays a key role in the providing basic materials for a good life. While it cannot be stated conclusively at this time, considering the socio-economic context and highly urbanized state of the watershed, access to resources and materials is not likely large concern for the watershed population and is outside CVC's mandate. Similarly, freedom of choice and action is also outside the scope of CVC's mandate. Those domains were left in the table as they are a key part of the well-being framework and may be more relevant in other jurisdictions.

The example indicators shown in Table 9 represent some of the linkages between environmental quality and human well-being explored in the literature and through the survey instrument developed for this study. Below is a brief description of a few example indicators:

- *Availability of natural areas*: the ability of all residents to enjoy natural areas is critical to promoting social relations, as natural areas become an environment for people to learn more about nature and about each other.

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<sup>11</sup> This is supported by the results of the survey presented in Section 5 and summarized in Section 6.

- *Natural areas adjacency index*: survey results indicate that the adjacency of natural areas to residential communities is critical to access and therefore increase use of natural areas.
- *Recreational index of natural areas*: through a quantitative estimate of area, coupled with a qualitative characterization of recreation areas by different forms of recreation provides the ability to understand how natural areas can be used by watershed residents. This index could also incorporate the extensive work that CVC has already completed related to recreational fishing opportunities in the watershed.
- *Aesthetic index by subwatershed*: an index of how people perceive the aesthetic quality of their surroundings would be an interesting way to monitor the aesthetic contributions of the natural environment to well-being. This would require developing a survey, likely with the use of photographs, administered at regular intervals and correlated density of forest cover. This would be a subjective measure of well-being. Alternatively, an objective approach would involve the use of aerial photography to quantify the amount of viewscales or measures of water clarity.

To completely capture the role of natural areas in the provision of human well-being, it will be important to capture both objective and subjective measures of well-being. However, objective measures are typically more straightforward to measure. Therefore, a strategic approach might be to begin capturing more objective based measures that can be calculated using existing data and build in the subjective measures slowly over time.

Further work related to indicator framework design, stakeholder based consultation and indicator measurement are needed to refine and estimate indicators that CVC might use for watershed level socio-economic monitoring. This work is recommended as follow-up research (Phase 2) to this work.

#### 7.4. IMPLICATIONS OF THIS RESEARCH FOR WATERSHED MANAGEMENT

- **Communications should be targeted and properly framed**: Many watershed residents are cognizant of threats to watershed health as well as its role to sustain human well-being. As such, CVC should consider these values and beliefs when developing communications to residents. This can involve communicating the scarcity of species or natural areas or making appeals to get residents involved in new programs or activities in the watershed.
- **Utilize collective action research and programs**: One third of watershed residents indicated that they would devote time and money to improving the environmental quality of the watershed. Leveraging the desire of residents to get involved in the management of the watershed may be a constructive means for CVC to establish more buy-in for the work that is being done by its staff but also to further reinforce the collective action in the watershed. There

is an opportunity to explore options for what residents might be able to do with respect to their key concerns for environmental quality from industrial pollution and municipal development.

- **Establish more natural areas adjacent to residential communities:** The findings of this research suggest that one area that CVC can focus on, in terms of improving the well-being of residents in the watershed, is to protect (or restore) more natural areas near residential communities. Those that live close to natural areas are more likely to use them and to further enforce the relationship between human well-being and environmental quality in the watershed.

## 7.5. RECOMMENDATIONS FOR FUTURE RESEARCH

- **Focusing on the value of key ecosystem services to the well-being of residents in the watershed.** This research identified those ecosystem services that are most important to the residents of the watershed. However, it was limited to identifying key linkages between environmental quality and human well-being and did not identify how changes in the quantity and/or quality of the ecosystem services translates into incremental changes to the watershed residents' well-being. The key step is to explore how trends in forest cover, water quality/quantity and the health effects of natural areas might improve or take away from the well-being of residents in the watershed.
- **Developing an indicator-based framework to monitor and communicate the direct and indirect links between human well-being and environmental quality in the watershed.** The well-being of watershed residents is contingent on a number of elements and sub-elements, as this research points out. Identifying which elements or sub-elements contribute most critically to the well-being of watershed residents requires an understanding of the broad range of factors, the weights of these factors and for planning purposes the trends in these factors. In addition, it will be important for residents to be able to understand the real tradeoffs between optimizing ecological functions/health of the watershed and the economic benefits from municipal and industrial development that affect their economic lives. In this regard, future research should focus on the development of a well-being indicator set for the watershed. Further, through work with a watershed-based focus group, this research could use a well-being indicator framework to weight those indicators of highest importance to residents in the watershed and to collect historical and current data on the trends in these indicators.
- **Institutional analysis of the watershed.** A growing body of research in the field of political economy has unveiled the importance of collective action in addressing many of the most pressing environmental issues faced by society. In the Credit River Watershed, the pressure placed on ecosystem services

from urban development requires a broad suite of stakeholders to be reflexive of the issues the watershed is facing. As a starting point, CVC should consider conducting an institutional analysis to better understand the political, economic and cultural drivers of change in the watershed. In this regard, through a facilitated stakeholder driven process a map of the linkages between environmental and human systems is constructed to identify where key social and economic pressures are being exerted on the environment and what policies or institutions are responsible for driving these pressures<sup>12</sup>.

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<sup>12</sup> For more on this type of analysis see: Elinor Ostrom. 1990. "Governing the Commons: The evolution of institutions for collective action" Cambridge University Press, New York, NY.

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## APPENDIX A: CHARACTERIZING ECOSYSTEM FUNCTIONS

The ecosystem services provide value to humans are a direct result of ecosystem composition, structure and function. This means that the variety of elements, the physical and biological components and the complex interactions between various organisms and the physical environment in an ecosystem combine to provide goods and services that humans use everyday. For example, the composition, structure and function of a healthy wetland ecosystem can provide water purification, flood control and ground water recharge services, all of which provide value to humans.

In order to discuss ecological goods and services, it is important to have an understanding of each of these terms and how they differ. Table 10 outlines a number of ecosystem functions, processes and services.

- Ecosystem functions are the manner in which natural assemblages process resources, affect the physical environment, and interact with other species.
- Ecosystem processes are the biophysical activities, which occur as a result of ecosystem functions. This includes things like water cycle, mineral cycle, solar energy flow, and community dynamics (succession).
- Ecosystem services are the aspects of ecosystem functions that are useful to humans. They include providing clean water and air for human consumption.

**Table 10. Ecosystem function, processes and resulting ecosystem services**

<b>Ecosystem Function</b>	<b>Ecosystem Process</b>	<b>Ecosystem Services</b>
Water regulation	Role of land cover in regulating runoff and river discharge	Provides natural irrigation, drainage, channel flow regulation and navigable transportation
Water supply	Filtering, retention and storage of fresh water (e.g. in aquifers)	Provides water (quality and quantity) for consumptive uses (e.g. drinking and irrigation)
Gas regulation	Role of ecosystems in bio-geochemical cycles	Provides clean, breathable air, disease prevention and a habitable planet
Climate regulation	Influence of land cover and biological mediated processes on climate	Maintains a favourable climate which leads to improved human health, crop productivity, recreation and other services
Disturbance prevention	Influence of ecosystem structure on dampening environmental disturbances	Prevents or mitigates natural disturbance events generally associated with storms or other severe weather (e.g., flood risk reduction)
Soil retention	Role of vegetation root matrix and soil biota in soil retention	Maintains arable land and prevents damage from erosion
Soil formation	Weathering of rock and accumulation of organic matter	Maintains agricultural productivity and integrity of natural soils
Nutrient regulation	Role of biota in storage and recycling of nutrients	Regulates soil gases, climate and water and promotes healthy, productive soils

<b>Ecosystem Function</b>	<b>Ecosystem Process</b>	<b>Ecosystem Services</b>
Waste treatment	Role of vegetation and biota in removal or breakdown of xenic nutrients and compounds	Controls pollution; filters dust particles; dilutes effluent, reduces ambient noise pollution
Pollination	Role of biota in movement of floral gametes	Pollinates wild plant species and commercial crops
Biological control	Population control through trophic-dynamic relations	Provides pest and disease control and reduces crop damage
Habitat	Role of biodiversity to provide suitable living and reproductive space	Preserves biological and genetic diversity and provides habitat for migratory species
Food	Conversion of solar energy into edible plants and animals	Enables hunting/gathering of fish, game, fruits, etc., and facilitates small scale subsistence farming & aquaculture
Raw materials	Conversion of solar energy into biomass for human construction and other uses	Provides materials for building and manufacturing; fuel and energy; fodder and fertilizer
Genetic resources	Genetic material and evolution in wild plants and animals	Improves crop resistance to pathogens and pests
Medicinal resources	Variety in (bio)chemical substances in, and other medicinal uses of, natural biota	Provides materials for drugs, pharmaceuticals, chemical models, tools and test and assay organisms
Aesthetic information	Attractive landscape features	Grants emotional enjoyment (e.g., of scenery)
Recreation	Variety in landscapes with (potential) recreational uses	Provides opportunities for travel to natural ecosystems for eco-tourism, outdoor sports, etc.
Cultural and artistic information	Variety in natural features with cultural and artistic value	Enables use of nature as motive in books, film, painting, folklore, national symbols, architecture, advertising, etc.
Spiritual and historic information	Variety in natural features with spiritual and historic value	Enables use of nature for religious or historic purposes (e.g., heritage value of natural ecosystems and features)

Source: de Groot, R.S., M.A. Wilson, and R.M.J. Boumans (2002). "A Typology of the Classification, Description and Valuation of Ecosystem Functions, Goods and Services." *Ecological Economics*, 41 (3): 393–408.

## APPENDIX B: SURVEY INSTRUMENT

Final Questionnaire: April 6, 2011

### Introduction at Site

[INSERT STANDARD PANEL INTRODUCTION]

### Screening

**S1.** How old are you?

*Please enter a whole number*

[NUMERIC FIELD] [RANGE: 18 TO 100]

**[TRACK AGE QUOTAS BASED ON S1]**

**S2.** What is your gender?

*Please select one response only*

Male

Female

**[TRACK GENDER QUOTAS BASED ON S2]**

**S3.** Which of the following best describes where you live?

*Please select one response only*

City of Brampton

City of Mississauga

Town of Caledon

Town of Oakville

Town of Milton

Town of Halton Hills

Town of Erin

Town of Mono

Town of Orangeville

Township of Amaranth

Township of East Garafraxa

None of the above

**[THANK & TERMINATE IF NONE OF THE ABOVE]**

**[TRACK REGION QUOTAS BASED ON S3]**

## **Environmental Quality and Human Well-being**

We all want a healthy environment that we can live in and enjoy. In many ways our well-being is closely linked to the environment around us. Good water quality, healthy wildlife habitat, excellent soil quality, and beautiful scenery are necessary for quality of life.

This survey focuses on the relationship between environmental quality and human well-being in the Credit River region, and seeks feedback on how best to invest public funds for protection and restoration.

Please, be assured that any information you provide will be treated confidentially. Your responses will be combined with those provided by other respondents and only a summary of the results will be made public.

Your feedback is important and we appreciate your help with this project. If you have any questions or concerns regarding this survey, please contact:

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## The Credit River Watershed

The Credit River watershed is home to a number of natural areas that are important to the well-being of all who live in and visit the watershed. Natural areas can include conservation areas, your local park, a forest woodlot or a wetland. For reference, the map below shows the location of the Credit River watershed.

[INSERT MAP OF WATERSHED]

### LINKING ENVIRONMENTAL QUALITY AND HUMAN WELL-BEING

There are a number of factors in our lives that contribute to our well-being. These factors can include things like physical health, social relationships, status and quality of employment, and leisure time.

1. Considering all the factors that contribute to your well-being, how important is it for your well-being to be near natural areas?

*Please select one response only*

1 – Not at all important

2

3

4

5 – Of the highest importance

2. Natural areas provide a number of services to society that can contribute to human well-being. Thinking about the natural areas in the Credit River watershed, please indicate how important you feel **each service** is to your overall well-being.

*Please select one response for each item*

[ACROSS TOP OF GRID]

1 – Not at all important to my well-being

2

3

4

5 – Of the highest importance to my well-being

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

The ability of the watershed to provide clean water

The ability of trees to clean the air

The scenic beauty of natural areas

Provision of firewood and food by natural areas (e.g. berry/mushroom picking)

The ability of wetlands and treed areas to help prevent floods and regulate water flows

Opportunity for recreation in nearby natural areas **[HEADING – NO RESPONSE]**

- Fishing in nearby natural areas

- Hiking, biking, skiing or snowshoeing

- Photography or bird watching

- Picnicking, sun-bathing or swimming

- Opportunity for motorized recreation in nearby natural areas (e.g. power boating, snowmobiling)
- A sense of place (or feeling of community belonging) generated from spending time in nearby natural areas
- Protecting and restoring natural areas for the well-being of future generations
- Opportunity provided by natural areas for educational activities or spiritual enjoyment
- Ability of natural areas to improve your health, including: **[HEADING – NO RESPONSE]**
  - Ability to relieve stress
  - Ability to help with recovering from illness
  - Ability to restore concentration/productivity
  - Ability to improve overall physical ability and fitness

3. How satisfied are you with the current state of these services provided by the natural features within your community?

*Please select one response for each item*

[ACROSS TOP OF GRID]

- 1 – Not at all satisfied
- 2
- 3
- 4
- 5 – Of the highest satisfaction

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

- The ability of the watershed to provide clean water
- The ability of trees to clean the air
- The scenic beauty of natural areas
- Provision of firewood and food by natural areas (e.g. berry/mushroom picking)
- The ability of wetlands and treed areas to help prevent floods and regulate water flows
- Opportunity for recreation in nearby natural areas **[HEADING – NO RESPONSE]**
  - Fishing in nearby natural areas
  - Hiking, biking, skiing or snowshoeing
  - Photography or bird watching
  - Picnicking, sun-bathing or swimming
- Opportunity for motorized recreation in nearby natural areas (e.g. power boating, snowmobiling)
- A sense of place (or feeling of community belonging) generated from spending time in nearby natural areas
- Protecting and restoring natural areas for the well-being of future generations
- Opportunity provided by natural areas for educational activities or spiritual enjoyment
- Ability of natural areas to improve your health, including: **[HEADING – NO RESPONSE]**
  - Ability to relieve stress
  - Ability to help with recovering from illness
  - Ability to restore concentration/productivity
  - Ability to improve overall physical ability and fitness

**[ASK Q4 IF ANY ITEM RATED 1 OR 2 IN Q3, ELSE SKIP TO Q5]**

4. You indicated that you were not very satisfied with the current state of at least one service provided by natural areas in your community. Keeping in mind the service(s) with

which you are dissatisfied, what do you see as the most obvious threats to the quality of natural areas in your area?

*Please select all that apply*

- Urban and Industrial development
- Agricultural practices
- Forestry practices
- Fishing practices
- Pollution and waste from industrial or commercial activities
- Spread of species from other countries or regions that cause environmental, social, and economic damages locally (i.e., invasive species)
- Over use of areas for recreation
- Climate change
- Other (please specify)
- Don't know/ not sure

5. What do you think is the most valuable natural area or feature associated with the Credit River Watershed (natural areas or features can include conservation areas, your local park, a forest woodlot or a wetland)?

*Please be detailed and specific in your response. You may respond 'don't know' or 'not sure'.*

[VERBATIM RESPONSE]

6. Are you prepared to undertake any actions to ensure that natural features in the Credit River watershed are protected?

*Please select all that apply*

- Restore natural area on my property
- Volunteer time to community restorations projects
- Donate money to local conservation organization
- Other (please specify)

7. Please indicate how often you use the following types of natural areas.

*Please select one response for each item*

[ACROSS TOP OF GRID]

- Never
- Less than once a month
- 1 to 3 times a month
- Once a week
- 2 times a week or more
- Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

- Privately owned forested or wetland areas
- Parks/trails within a natural area that are within walking distance of your home

Parks/trails within a natural area that you can easily drive to from your home  
Conservation Authorities Parks (Conservation Areas)

8. Thinking about the reasons why you visit natural areas in the Credit River watershed, please indicate how often you visit natural areas for each purpose.

*Please select one response for each item*

[ACROSS TOP OF GRID]

- Never
- Less than once a month
- 1 to 3 times a month
- Once a week
- 2 times a week or more

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

- Enjoy the scenic beauty from a house or vehicle
- Collect food (e.g. mushrooms, berries)
- Fishing
- Hiking, biking, skiing or snowshoeing
- Photography or bird watching
- Picnicking, sun-bathing or swimming
- Motorized recreation (e.g. power boating, snowmobiling)
- Participate in the community or educational events
- Religious practices and spiritual enjoyment
- To relieve stress
- To recover from illness
- To restore concentration or productivity
- To improve overall physical ability and fitness

9. Do you have any further comments about natural areas in the Credit River watershed?

*Please be detailed and specific in your response. You may respond 'don't know' or 'not sure'.*

[VERBATIM RESPONSE]

## PROFILE OF VAUES

10. The following statements represent **guiding principles** that may or may not matter to you. Please indicate how important each principle is to you.

*Please select one response for each item*

[ACROSS TOP OF GRID]

- 1 – Not at all important
- 2
- 3
- 4
- 5 – Of the highest importance

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Leading an exciting life filled with stimulating experiences  
A world free of war and conflict  
Having an impact on people and events  
Safety for my loved ones  
Leading a varied life, filled with challenges, novelty and change  
Existing in harmony with other species  
Showing self-discipline, self restraint and resistance to temptations  
Protecting the environment and preserving nature  
Having the right to lead or command  
Equal opportunity for all human beings  
Having material possessions and money  
Social justice, and caring for the weak  
Unity with nature and fitting into nature  
Honouring parents and elders and showing respect  
Being curious, interested in everything and exploring

## VIEWS ON NATURE

11. Listed below are statements about the relationship between humans and the environment. Please rate the extent to which you agree or disagree with each statement.

*Please select one response for each item*

[ACROSS TOP OF GRID]

Strongly disagree  
Mildly disagree  
Unsure  
Mildly agree  
Strongly agree

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

We are approaching the limits of the number of people the earth can support  
Humans have the right to modify the environment to suit their needs  
When humans interfere with nature it often produces disastrous consequences  
Human ingenuity will ensure that we will NOT make the earth unliveable  
Humans are severely abusing the environment  
The earth has plenty of natural resources if we just learn how to develop them  
Plants and animals have as much right as humans to exist  
The balance of nature is strong enough to cope with the impacts of modern industrial nations  
Despite our special abilities humans are still subject to the laws of nature  
The so-called "ecological crisis" facing humankind has been greatly exaggerated  
The earth is like a spaceship with very limited room and resources  
Humans were meant to rule over the rest of nature  
The balance of nature is very delicate and easily upset  
Humans will eventually learn enough about how nature works to be able to control it  
If things continue on their present course, we will soon experience an environmental catastrophe

## DEMOGRAPHIC PROFILE

Finally, for purposes of comparison, we would like to know more about you and members of your household. Please be assured all information will be kept completely confidential.

12. Do you live within walking distance of a natural area?

*Please select one response only*

Yes  
No

13. Do you have a view of a natural area from any windows in your home?

*Please select one response only*

Yes  
No

14. For how many years have you lived in Canada?

*Please select one response only*

Born and raised  
More than 20 years  
11 to 20 years  
6 to 10 years  
3 to 5 years  
1 or 2 years  
Less than one year  
Prefer not to answer

15. As you know, we all live in Canada, but our ancestors come from many different ethnic backgrounds. What is the **main** ethnic background of your ancestors?

*Please select one response only*

**South Asian** (from India, Pakistan, Sri Lanka, Bangladesh, or other)

**Southeast Asian** (from Philippines, Vietnam, Malaysia, Indonesia, Cambodia or other)

**East Asian** (from China, Hong Kong, Korea, Japan or other)

**West Asian or Middle Eastern** (from Iran, Afghanistan, Iraq, Lebanon, Israel, Saudi Arabia, United Arab Emirates, Syria, Kazakhstan, or other)

**Northern European** (from the United Kingdom, Ireland or Scandinavia)

**Southern European** (from Italy, Greece, Portugal, Spain, Albania, Croatia, Bosnia, Serbia, or other)

**Western European** (from Germany, Netherlands, Austria, France, Belgium, or other)

**Eastern European** (from Poland, Romania, former Soviet Republics, Hungary, Czech Republic, Slovakia, or other))

**African**

**Central or South American** (from Mexico, El Salvador, Guatemala, Guyana, Colombia, Argentina, Brazil, or other)

**Caribbean** (from Jamaica, Trinidad and Tobago, Barbados, Granada, or other)

**Canadian**  
**Aboriginal/First Nations/Métis**  
**Other** (Please specify)  
Prefer not to answer

**16.** Do you live with a spouse or long-term partner?

*Please select one response only*

Yes  
No  
Prefer not to answer

**17.** Which category best describes your employment status?

*Please select all that apply*

Employed full time (35 hours a week or more)  
Employed part time (less than 35 hours a week)  
Self-employed  
Student  
Retired  
Caregiver (unpaid)  
Unemployed  
Other (please specify)  
Prefer not to answer

**18.** Which is the highest level of education that you have completed?

*Please select one response only*

Grade school or some high school  
High school diploma or certificate  
Some college or post secondary technical school  
Apprenticeship, trades or technical diploma or certificate  
Non-university diploma (e.g. college, CEGEP)  
Some university, not completed  
University undergraduate degree (Bachelor's)  
Graduate university degree, not completed  
Graduate university degree  
Prefer not to answer

**19.** Which category best describes your total household income (before taxes) in 2010?

*Please select one response only*

Less than \$40,000  
\$40,000 to \$79,999  
\$80,000 to \$119,999  
\$120,000 to \$159,999  
\$160,000 or more

Prefer not to answer

**20.** Please provide the first three digits of your postal code.

*Please enter in **letter number letter** format with no spaces*

TEXT BOX **[ENSURE INPUT IS ALPHA-NUMERIC-ALPHA FORMAT]**

Prefer not to answer

**[DO NOT MAKE MANDATORY]**

**21.** If you would like to receive the results of this study and be kept informed of other ongoing news and activities at Credit Valley Conservation please provide your e-mail address.

Email address: **[ENSURE EMAIL ADDRESS IS IN PROPER FORMAT]**

**Thank you very much for your time and feedback!**