# CAPACITY FOR CUMULATIVE EFFECTS ASSESSMENT IN THE LOWER FRASER WATERSHED, BRITISH COLUMBIA, CANADA

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# ABSTRACT

Watersheds in Canada are under increasing stress as a result of the cumulating environmental effects from anthropogenic activities. Cumulative effects assessment (CEA) is a potentially useful tool in environmental assessment (EA) for addressing the stresses faced in watersheds, but is typically done on a project-by-project basis. This project-based approach to CEA is not sufficient to address the entirety of effects from multiple stressors occurring across a broad spatial and temporal scale. As a result, there is now a general consensus that CEA must extend from the project to a more regional scale, such as the watershed. The problem however, is that, while the science behind watershed CEA is progressing, the appropriate institutional arrangements to sustain watershed CEA have not been addressed.

This research attempts to work towards identifying the existing capacity for watershed-based CEA (W-CEA) through document review, a focus group, semi-structured interviews and qualitative data analysis. Twenty-six interview participants, including various levels of government, ENGO representatives, private consultants and academics, were queried on such capacity using eight interview themes, which are the requisites that are identified as necessary for W-CEA. The results of the research revealed that the existing capacity in the Lower Fraser River Basin could not accommodate the implementation of W-CEA. The eight requisites were 'graded' to better show individual capacities of each within the Lower Fraser. The inadequacies of these requisites, and thus, inadequate capacity for W-CEA in the Lower Fraser, was based primarily on the fact that CEA is not the primary tool for watershed management, a lack of leadership in the watershed, and fragmented political geography. The existing framework for watershed management and CEA in Lower Fraser River Basin would have to undergo significant change before W-CEA could successfully be implemented.

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TABLE OF CONTENTS

Chapter 4: Results



Chapter 5: Discussion

## LIST OF APENDICES



## LIST OF TABLES



## LIST OF FIGURES

## LIST OF ABBREVIATIONS

| | |
|---|---|
| ALR | Agricultural Land Reserve |
| BC | British Columbia |
| CEAA | Canadian Environmental Assessment Agency |
| CEA | Cumulative Effects Assessment |
| DFO | Department of Fisheries and Oceans |
| EAA | Environmental Assessment Act |
| EA | Environmental Assessment |
| EARP | Environmental Assessment Review Process |
| ENGO | Environmental Non Government Organization |
| FBC | Fraser Basin Council |
| FEARO | Federal Environmental Assessment Review Office |
| FREMP | Fraser River Estuary Management Program |
| ISWMP | Integrated Storm Water Management Plan |
| NEPA | National Environmental Policy Act |
| NRBS | Northern River Basin Study |
| NREI | Northern River Ecosystems Initiative |
| SSRB | South Saskatchewan River Basin |
| VEC | Valued Ecosystem Components |
| W-CEA | Watershed Cumulative Effects Assessment |

# Chapter 1
# Introduction

A watershed, also referred to as a river basin, is a catchment area for the drainage of water that is defined by a physical boundary on the landscape. Watersheds are ecologically rich areas that provide various natural goods and services for humans such as forestry, fisheries and fresh water resources (Clark et al., 2005; Schindler, 2001). In recent decades, however, these ecological goods and services have been subject to the pressures of over-exploitation and, as a result, Canada's watersheds, particularly Canada's western watersheds, are under increasing stress from the cumulative environmental effects of human development activities (Seitz et al., 2010; Schindler & Donahue, 2006). These development activities, including population densification, mining, agriculture and tourism (Rogers & Defee II, 2005; Piper, 2001), may seem inconsequential when considered individually; however, cumulatively, they have the potential to significantly alter watershed functions (MacDonald, 2000; Piper, 2001).

## 1.1 Managing Cumulative Environmental Effects

Cumulative environmental effects are a result of a combination of activities occurring and collectively engaging in a region from the past, present, and reasonably foreseeable future (Noble, 2010b; Eccleston, 2006; McCold & Sainsbury, 1996). Cumulative effects can be of an additive, interactive, synergistic or irregular nature (Noble, 2010*a*), making them exceptionally complex to manage (Seitz et al., 2011; Canter & Ross, 2010). It is generally agreed that cumulative effects are a pressing issue that needs to be addressed before irreconcilable damage is done to Canada's ecosystems (Noble, 2010*b*; Schindler & Donahue, 2006).

The primary tool for assessing and managing the cumulative effects of human actions to Canada's watersheds is environmental assessment (EA), which is mandated only at the project-level scale (Duinker & Greig, 2006; Therivel & Ross, 2007). Legislated federally under the *Canadian Environmental Assessment Act,* and provincially under the various laws and regulations of the provinces, the purpose of EA is to influence the decision to proceed with development, based on its potential effects to the environment (Noble, 2010*a*). The problem,

however, is that EA is performed largely on a project-by-project basis, and only for certain types or classes of projects (Gunn& Noble, 2009*a*; Duinker & Greig, 2006; Kennett, 2000). The result is many projects that are not subjected to EA and a wide range of activities going on in watersheds with limited to no consideration of cumulative effects to watershed processes (Gunn & Noble, 2009*a*; Eccleston, 2006; Schindler and Donahue, 2006). Although EA has the intention of protecting the environment, cumulative effects occur on a spatial and temporal scale that is much broader than the individual project (Gunn &Noble, 2009*a*; Noble, 2008).

### 1.2 Regionalizing CEA to the Watershed Scale

The challenge of cumulative effects in Canada's watersheds is widely acknowledged, and there is recognition that cumulative effects need to be addressed beyond the current scope and scale of project EA (Gunn & Noble, 2009*b*; Therivel & Ross, 2007; Dubé, 2003; Baxter et al., 2001). More specifically, recent literature suggests that successful cumulative effects assessment (CEA) needs to be done at a larger, more regional scale, such as eco-regions or watersheds (Seitz et al., 2011; Gunn & Noble, 2009*a*;Harriman & Noble, 2008; Duinker & Greig, 2006; Dubé, 2003). By advancing CEA to the watershed scale, where watershed processes are better understood, environmental planners and managers will be better positioned to determine the total effects of proposed projects and other disturbances on watershed processes, and make more informed decisions on potential cumulative environmental effects (Seitz et al., 2011; Dubé 2003; Baxter et al., 2001; Piper, 2001).

The problem, however, is that much of the research on advancing the practice of CEA and management in Canada's watersheds has focused on science-based initiatives (e.g., Kilgour et al., 2006; Dubé, 2003; Piper, 2001;Girts et al., 1997;Bedford & Preston, 1988;), with only limited attention to the institutional arrangements necessary to implement and sustain watershed CEA. Some studies exemplifying these science-based initiatives are the Northern River Basin Study (NRBS), the Northern River Ecosystems Study (NRES) and The Healthy Rivers Ecosystem Assessment System (THREATS) (see Dubé et al., 2006; Kilgour et al., 2006; Dubé, 2003). These collaborative studies involved multiple stakeholders in each watershed (e.g., academics, government, industry), and focused on outlining various biophysical parameters and

sources of cumulative aquatic effects. Watershed-based CEA, however, requires an interdisciplinary approach that considers both the science and the capacity for implementation (see Seitz et al., 2011; Cormier &Sutter, 2008; Mitchell, 2005). While the science aspect of CEA is well addressed, knowledge about institutional arrangements and the capacity for implementation of CEA in Canada's watersheds is lacking (Sheelanere, 2010; Duinker & Greig, 2006; Baxter et al., 2001).

### 1.3 Institutional Arrangements and Capacity for Watershed-Based Cumulative Effects Assessment

Watershed-based Cumulative Effects Assessment (W-CEA), if it is going to progress, requires adequate institutional arrangements and the capacity for its implementation (Genskow & Born, 2006; Hamedy et al., 1998). Institutional arrangements can be classified as the linkages and relationships among stakeholders (Genskow & Born, 2006; Mitchell, 2005); whereas capacity is referred to as the ability for a region to both encompass and utilize institutional arrangements (Noble, 2010*b*; Timmer et al., 2007). Institutional arrangements and capacity require strong policy objectives in water management, and thus work towards coordinating overall policies and practices in W-CEA and watershed management for more informed decision making (de Loë & Kreutzwiser, 2005; Mitchell, 2005; McPeak, 2005).

While it is accepted that the establishment of institutional arrangements and capacity for W-CEA (and for watershed management) is a necessary requirement, there is still little direction in this body of knowledge (Canter & Ross, 2010; Duinker & Greig, 2006). Work by Sheelanere (2010) has made an important contribution, proposing a framework comprised of eight requisites for CEA conducted at a watershed scale. These requisites, however, have only been conceptualized and not yet applied to evaluate current practice and capacity for W-CEA implementation.

## 1.4 Purpose and Objectives

The overall purpose of this research was to assess the current institutional capacity for implementation of watershed-based CEA. Based on a case study of the Lower Fraser River Basin in British Columbia, the objectives of this research were to:

i. validate the nature of and requisites for watershed-based CEA in the Lower Fraser basin;
ii. determine the current capacity to implement and sustain watershed-based CEA; and,
iii. identify lessons emerging to advance watershed-based CEA knowledge and practice.

This research was part of a larger SSHRC-funded initiative developed to advance the overall knowledge and practice of watershed-based CEA in Canada, specifically the institutional arrangements and the capacity for the implementation of CEA at a watershed scale. The first phase of this SSHRC initiative focused on the South Saskatchewan River Basin to identify requisites for watershed-based CEA. This project adapted and refined these criteria to the context of the Lower Fraser, and applied them to assess current capacity to implement and sustain watershed-based CEA frameworks and practices.

# CHAPTER 2
## Literature Review

The primary tool for assessing and managing the cumulative effects of human actions to Canada's watersheds is Environmental Assessment (EA). However, EA falls significantly short of ensuring 'good' CEA due to its piecemeal, project-by-project directive. At the scale of the individual project, the total spatial and temporal effects of a development within a watershed are not adequately managed. This leaves many projects either ill-assessed or not assessed at all and, consequently, cumulative effects unaccounted for. In addition, one of two key elements for successful CEA and management still lacks knowledge and understanding. Simply put, the science behind watershed CEA is advancing, but the same level of attention has not been applied to the institutional arrangements and capacity required to implement CEA at a watershed scale. The sections that follow review current CEA practice in Canada, the necessary requirements for 'good' CEA, and CEA in a watershed context.

### 2.1 Environmental Assessment in Canada

Environmental assessment is a systematic planning process used to identify, predict, assess and mitigate the potential impacts of proposed actions or project developments on the biophysical and human environment (Noble, 2010*a*). There exists a range of perspectives on the nature and purpose of EA. Cashmore (2004), for example, presents extant philosophical perspectives on EA, ranging from applied science to civic science. Initially conceived for assessment of impacts to the biophysical environment, focused primarily on such matters as ecological data collection and engineering design, Cashmore suggests that EA has undergone a paradigm shift. Presently, EA tends to draw also from the civic sciences, which represent practice based on participatory democracy and consideration of the socio-economic aspects of a given environment in addition to biophysical ones. In this thesis, the definition of EA draws from both theoretical perspectives, and falls in the centre of the spectrum of applied and civic science. In other words, EA is understood as a tool to inform decision makers about the acceptability of proposed development actions based on information provided about the impacts of development, and the mitigation of such impacts, to the social, economic and biophysical environment (see IAIA, 1999).

Environmental assessment was first introduced in 1970 in the United States under the *National Environmental Policy Act* (NEPA) as a means to regulate pollution resulting from the cumulating environmental effects of human activities. In 1973, EA was introduced federally in Canada as a Guidelines Order through the Environmental Assessment Review Process (EARP), and the Federal Environmental Assessment Review Office (FEARO) established to ensure its application. At the time, the reach of EA was broad and extended well beyond the individual development project – EA was applicable to any government-led initiative, including regional policies or plans or projects for which the federal government had decision making authority (Noble 2010*a*). The intention of EARP and FEARO were good, but unlike the US NEPA EA in Canada was a non-legislated process and held very little force against polluters who were not obligated to comply. After several court challenges that brought national attention to the relatively weak mandate of EA in ensuring an appropriate level of environmental protection, and after several instances where projects were initiated and nearly completed prior to commencement of the EA process (see Gibson & Hanna, 2009), EA was eventually transformed at the federal level to a legislated process. In 1992, the *Canadian Environmental Assessment Act* (CEAA) was created, and later the Canadian Environmental Assessment Agency created to administer the Act, holding proponents accountable for the negative environmental effects of their projects.[1]The scope of EA under CEAA, however, was restricted in comparison to EARP, with federal EA application narrowed to include only individual development projects (see CEAA, 1992).

Today, EA is the primary tool for managing the impacts of project development on the biophysical and human environment (Wood, 2008), and is legislated in each province and territory in Canada and at the federal level. EA is considered by some to be the most important legislation in Canada for ensuring environmental protection (Hickey et al., 2010; Hanna, 2009); however, because EA legislation is variable across provincial borders, standards for EA practice are not consistent and the efficacy of EA in managing the range of negative environmental effects associated with development, particularly cumulative effects, has been questioned (see Duinker & Greig, 2006). There are a number of environmental management tools and initiatives

[1] For an overview of the evolution of EA in Canada from EARP to the *Canadian Environmental Assessment Act*, see Gibson, R. 2002. From Wreck Cove to Voisey's Bay: the evolution of federal environmental assessment in Canada, *Impact Assessment and Project Appraisal*, 20(3): 151-9.

that work in harmony with the EA process to help ensure environmental protection under development pressure. In British Columbia, for example, such tools and initiatives include the Memorandum of Understanding Agencies responsible for forests, environment, lands and parks, and agriculture; and the Commission for Resources and the Environment (CORE), a province-wide strategy for land use and resource management (Veale, 2007). Various environmental planning and management tools exist all across Canada for managing land use and the impacts of development; however, there is still a considerable need for improvement in terms of the ability of such tools to capture cumulative environmental effects (Veal et al., 2003).

### 2.2 Cumulative Effects Assessment

Cumulative environmental effects are effects of an additive, interactive, synergistic or irregular nature, caused by often individually minor but collectively significant actions that accumulate over space and time (Eccleston, 2006; Baxter et al., 2001). Cumulative effects are recognized as one of the most pressing environmental problems in EA (Noble, 2010*b*); they are often difficult to contend with because of their temporally and spatially complex nature, and cumulative effects can arise from a combination of both point and non-point source stress (Culp et al., 2000; Schindler, 2001; Schindler & Donahue, 2006). In this regard, there are four conceptualizations of cumulative effects: linear additive effects that result from incremental additions or deletion from a fixed large storage, where each addition has the same individual effect; amplifying or exponential effects, where incremental additions are made to, or deletions from an apparently limitless resource base where each addition or deletion has a larger effect than the one preceding; discontinuous effects, where incremental additions or deletions have no apparent effect until a threshold is reached, at which a time components change rapidly with very different types of behavior and responses; and structural surprises, where changes such as those described above occur due to the combination of multiple drivers in a single environmental system – this is often the least understood type of effect and the more difficult to assess Noble (2010*b*, p. 199).

In Canada, at the federal level, and to varying degrees under provincial and territorial legislation, project proponents are required to consider the potential cumulative environmental effects of their project on valued ecosystem components (VECs). Under section 16 (1) of CEAA, for

example, proponents shall consider ". . . the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out." Arguably, however, cumulative effects cannot be fully accounted for at the project scale and are well beyond the scope of what is possible under project-based assessment (see Gunn& Noble, 2009*b*). As a result, and for various reasons as discussed below, the current state of CEA practice in Canada has been described as 'doing more harm than good' (Duinker & Greig, 2006).

Several authors have identified numerous challenges and limitations to CEA in Canada. First, the EA community itself has grappled with determining a universally accepted definition of 'cumulative effects' (Noble, 2010*b*). Legislated forms of CEA, often ill-defined, are vague and uninformed, and do not take the holistic needs of CEA into consideration (Canter & Ross, 2010) and, consequently, CEA is often indistinct from conventional project-specific EA analysis (Duinker & Greig, 2006). Second, when assessed, cumulative effects assessed at the individual project scale are most often, and falsely, deemed negligible (see Noble, 2010*b*). This is partly because project proponents assess cumulative effects from the perspective of an individual stressor (see Seitz et al., 2011). In other words, the focus of CEA under project EA is often on 'cumulative stresses' as opposed to 'cumulative effects.' As a result, the individual contribution of a single project to environmental change, in comparison to the contributions of all other stressors in the project's environment, is too easily dismissed as 'insignificant (Seitz et al., 2011). Third, EA legislation and processes across Canada are being increasingly streamlined to ensure more cost effective and timely EA, with greater certainty for proponents in securing project approval (see Noble 2010*b*). This streamlining is largely at the expense of meaningful CEA for informed project environmental management (see Duinker & Greig, 2006). Fourth, project-based CEA is disconnected from larger-scale regional development plans and priorities, where thresholds or limits for development in specific ecological regions are more appropriately established, monitored, and managed (Gunn & Noble, 2009*b*). Fifth, project proponents, whose primary mandate is to secure project approval, are responsible for conducting their own CEA; contrary to existing practice, however, Canter & Ross (2010) argue that effective CEA requires integrative, stakeholder collaboration and individual project proponents are ill-equipped and

have too narrow a mandate to deal with cumulative environmental change. Finally, there has been inadequate investment from the EA community to advance CEA as a means to environmental management. This is evidenced by the lack of scientific baseline knowledge to establish thresholds for regionalized CEA (Canter & Ross, 2010), the often disregard for long-term and broad-scale assessment approaches, and the lack of integration of CEA into broader strategic environmental assessment and land-use planning frameworks (Gunn & Noble, 2009*b*).

To address the current limitations of CEA at the project level, it is now widely recognized that CEA needs to occur also at a broader, more regionalized scale to adequately account for and manage the accumulating environmental effects of anthropogenic disturbance (Noble 2010*b*; Therivel & Ross, 2007; Duinker & Greig, 2006; Dubé, 2003;Kennett, 2002; Leach & Pelkey, 2001).It is argued that if CEA is performed at a more regional scale, it will ideally relate the total effects of a project to its surrounding environment, in addition to all other projects within the defined region, and capture other drivers of cumulative effects that are not typically subject to any form of legislated EA. Broadening CEA outward is considered by many to be a more scientific and spatially relevant approach to addressing cumulative effects (Gunn & Noble, 2009*b*) and, though sometimes perceived by proponents as an additional obstacle to project approval, a means to support, focus and strengthen CEA considerations and mitigation at the level of the individual development project (CCME, 2009; Duinker & Greig, 2006). Noble (2010*b*) argues that the regional scale for CEA must be defined by ecologically meaningful boundaries, such as watersheds or eco-regions, rather than those often created by political divides. The definition of a watershed boundary as the boundary by which water resources management occurs has been an ongoing transition; this is true in spite of circumstances where social and political boundaries coincide with ecological ones (Blomquist & Schlager, 2005). The watershed then can be argued as an ideal boundary definition for regionalizing CEA.

### 2.3 Cumulative Effects Assessment in Watersheds

A watershed is a topographically defined area that acts as a drainage divide for the input of water into a catchment. Watersheds provide a diversity of ecological goods and services, such as natural resources for harvest, fresh water resources, recreational environments and biodiversity and are especially vulnerable to human impact (Schindler & Donahue, 2006; Mitchell, 2005).

The need for adequate watershed management has been evident in Canada for over forty years. In 1968, for example, the Canadian Water Resources Association (CWRA) was founded. Their mandate was, and still is, to promote sharing knowledge in all relevant fields of water management in Canada, including both private and public sectors, in hydrology, irrigation and drainage, biology, climate change and education (Fitzgibbon, 2006; CWRA, 2004). Effectively managing watersheds requires, at a minimum: stakeholder cooperation including the cooperation of regulators, watershed agencies, developers, scientists and other interests; an integrated water resources management plan (Genskow & Born, 2006; Mitchell, 2005); and a watershed-based framework for the assessment and management of the cumulative effects of human development (Hegmann & Yarranton, 2011) - the latter has yet to be pursued comprehensively in Canada (Seitz et al., 2011).

Cumulative effects, in the context of watersheds, are broadly understood to encompass changes to surface runoff, channels, sediment production and species function as ecosystem components; all of which result in changes from vegetation, soils, topography, and chemicals (Reid, 1993). Currently, amongst all management tools and frameworks, federally and provincially, EA is the key legislative instrument for assessing the cumulative impacts of development to Canada's watersheds (Harriman & Noble, 2008; Veale, 2007). However, as discussed above, this is problematic because EA is performed largely on a project-by-project basis, and is too narrowly applied to either capture cumulative effects (see Noble 2010*b*) or to represent the broad scale integrated approach characteristic of adequate watershed management (see Genskow & Born, 2006; Mitchell, 2005). Watersheds are complex ecosystems that function holistically; current project-focused management practices are counterproductive to ensuring the sustainability of freshwater systems and in dealing with the cumulating effects of human activities at the watershed scale and over the long term (Gunn & Noble, 2009*b*; Harriman & Noble, 2008; Dubé et al., 2007).

An understanding of watershed cumulative effects is necessary if land-use activities in watersheds are to be managed for the purpose of ensuring watershed sustainability (Reid, 1998). The watershed is argued by many to be an appropriate frame for regionalizing cumulative effects assessment for watershed processes (Seitz et al., 2011; Dubé et al., 2007;Schindler & Donahue,

2006; Reid, 1993). At this scale, a naturally occurring physical boundary for large scale management is delineated (Serveiss, 2002; Schindler, 2001; Collins & Pess, 1997), which satisfies the need for CEA to be conducted at a scale beyond that of the individual development project and to conform to natural boundaries (see Beanlands and Duinker, 1983)

To advance CEA from the project to a regional scale, such as a watershed, Peterson et al. (1987) have outlined two important components: first, the scientific input, which provides the necessary research and technical components to do CEA; second, the institutional arrangements, which provide the management framework necessary for the implementation of CEA. While these two components have been outlined as requisites for successful CEA, the reality is that only the first, scientific input, has been the focus of attention in recent watershed CEA research. In the past decade, for example, there has been a growing emphasis on advancing research in the natural sciences and modeling of cumulative effects in watersheds (e.g., Seitz et al., 2011; Squires et al., 2009; Dubé et al., 2006; Dubé 2003;Piper, 2001), but comparatively little attention on the institutional frameworks and the capacity requirements to implement and sustain CEA for watersheds. This is seen in recent examples of large-scale scientific CEA initiatives for watersheds, such as the Northern River Basin Study (NRBS) and the Northern River Ecosystems Initiative (NREI).

The NRBS was a four-and-a-half year, $12-million project that examined the relationships between industrial, agricultural, municipal and other developments in the Peace, Athabasca and Slave River basins and the ecological conditions of the river systems (Alberta, 2002). The NREI was a follow up to the NRBS, which, in partnership with the NRBS, aimed to create a comprehensive body of science for river systems in Canada's north (Lumb & Healie, 2006). The NRBS and the NRES both worked towards identifying the biophysical changes in the aquatic environment as a result of multiple sources of stress. Collectively, the two studies examined changes in such variables as water quality, contaminant distribution, fate and effects, benthos, fish and fish habitat, riparian vegetation/wildlife, hydrology/hydraulics, drinking water quality, nutrients, dissolved oxygen, and aquatic indicators for enhanced environmental monitoring (see Dubé et al., 2006). Following the success of the NRBS and NERI in establishing basic scientific understanding of aquatic systems and accumulative environmental change, The Healthy Rivers

Ecosystem Assessment System (THREATS) initiative emerged as a 'living system' designed to integrate databases on a watershed's biophysical and aquatic health characteristics to support the science behind watershed CEA (THREATS, 2010; Dubé et al., 2006). In sharp contrast, however, research on the institutional arrangements for CEA in Canada's watersheds, as well as on the capacity to implement and sustain such CEA science initiatives described above, continues to be scarce and underdeveloped in both the academic and professional practice literature (Kilgour et al., 2006; Piper, 2001; Girts et al., 1997).

### 2.4 Institutional Arrangements and the Capacity to Implement Watershed CEA

Constraints to institutional arrangements, more so than scientific ones, often pose the most significant challenges to scaling up from point specific to broader regional scale environmental management (Imperial, 1999; de Loë et al., 2002). Further, the lack of adequate coordination between management approaches for water resources is considered a leading problem in watershed management (Borre et al., 2001). This is due in part to the complexity of regional environmental management initiatives and the diversity of interests involved, which requires a dynamic integration of stakeholders to ensure effective management practices (see Genskow & Born, 2006; de Loë & Kreutzwiser, 2005; Mitchell, 2005;).

Institutional arrangements are an essential component for an emerging body of modern approaches to watershed management (Genskow & Born, 2006). Hamdy et al. (1998) argue that establishing and strengthening institutional frameworks is the next logical step from the initial creation of policy objectives in water management. Weak institutions whom are most often ill-resourced, then, are considered a leading cause to failures in water resource management (Hamdy et al., 1998). Institutional arrangements are commonly defined as the linkages and relationships between different stakeholders, formal and informal, and including also laws, regulations, and standards, for the purpose of effective and holistic resource management (Bartra, 2007; Borre et al., 2001). Stakeholders in a watershed can represent various groups such as community members, industry players, government, academics, and watershed agencies. Strong institutional arrangements attempt to combat the 'silo-effect' in a watershed, and in CEA in particular (Noble 2010*b*), where independent institutions are often seen as operating

autonomously (Mitchell, 2005). Institutional arrangements thus work toward coordinating policies and practices among stakeholders with an end goal of effective decision making for water resources management (Bartra, 2007; McPeak, 2005; Borre et al., 2001) or, in the context of this research, for implementing and sustaining watershed-based CEA.

Imperial (1999) identified several common themes that underlie institutional arrangements research. These include: approaching problems from an integrated or systems perspective; improving institutional performance; improving the integration of government policies; enhancing the coordination of various governmental and nongovernmental organizations; ensuring broad public participation and the involvement of key stakeholders in government decision making; and developing a stronger scientific basis for government policies. These themes are integral to establishing the strong, holistic approach necessary to encompass institutional arrangements in a region to support watershed CEA; but because of their costly and extensive requirements for development, it is rare to see institutional arrangements considered and improved upon in practice (see Genskow & Born, 2006; Mitchell, 2005; Borre et al., 2001; Hamdy et al., 1998). The problem often arises where institutional arrangements can be manifested in cooperative agreements or partnerships that allow proponents to skirt away from a mandate that is not necessarily legislated (Borre et al., 2001). This is of particular concern to regionalizing CEA at a watershed scale, an initiative that falls outside the legislative framework of project-based EA.

Further, there must exist the capacity within and among institutional arrangements to support the *in situ* execution of CEA. Concerns for capacity in watershed management have existed for decades (Franks, 1999; Hartvelt & Okun, 1991).Capacity is recognized as a major constraint to developing a water management strategy, and to implementing effective CEA (see Noble 2010*b*), but is necessary for the sustainable development of water resources (Hamdy et al., 1998). The Delft Declaration (1991), for example, outlines three basic elements for capacity building: i) creating an enabling environment with appropriate policy and legal frameworks; ii) institutional development including community participation; and iii) human resources development and strengthening of managerial systems. To parallel these basic components, Timmer et al. (2007) have identified five components essential to capacity building in a

watershed, namely: financial, human resources, institutional, social, and technical. Based on the Delft Declaration (1991) and Timmer et al. (2007), it is evident that emphasis for successful capacity building is placed on the strong integration of all aspects within a regional environment or, in the context of this research, a watershed. Though generic guidelines for capacity and capacity analysis do exist, in practice there is a much more complicated formula when evaluating capacity in a particular regionalized context, and when the focus of attention shifts from watershed management to watershed CEA. Attention must focus not only on institutional frameworks and capacity, but also on nature and capacity of CEA science.

De Loë et al. (2002) describe organizational capacities at various scales in a region as both important and essential in terms of accomplishing management tasks. Capacity for CEA, more specifically, refers to the ability for CEA to be carried out in a particular location, and is usually dependent on the institutional frameworks in place, which includes CEA science and the capacity to support it (Timmer et al., 2007; Ozerol & Newig, 2008; Seitz et al, 2011). Sheelanere (2010) undertook perhaps the first analysis of capacity requisites for watershed-CEA based on a case study of the South Saskatchewan River watershed, a trans-boundary watershed spanning the provinces of Alberta and Saskatchewan. In her work, Sheelanere identified eight requisites to watershed-CEA, namely: the need for a *lead agency* in a watershed with the authority and mandate to implement and regulate CEA, as well as to guide regional plans and influence decision making about development plans; *multi-stakeholder collaboration,* where stakeholders have well defined roles and responsibilities within themselves, and all stakeholders are up to date on CEA practices; *CEA baselines, indicators and thresholds,* where watershed baselines, thresholds and ecological indicators are established for the purpose of implementing and maintaining CEA; *multi-scaled monitoring,* where monitoring within the watershed, at various scales, is used to inform over-arching plans, policies and programs; *data management and coordination,* where sharing of data among stakeholders is facilitated to maximize successful execution of watershed-based CEA; *vertical and horizontal linkages,* where there is valuable partnership among all stakeholders, as well as among various scales of plans within the watershed region; *enabling legislation* and an enabling body to enforce and ensure that CEA is being carried out in an efficient and meaningful manner; and *financial and human resources* to ensure meaningful facilitation of CEA.

The extent to which these requisites exist in practice may be interpreted as an indicator of the capacity or 'degree of readiness' to implement and sustain watershed CEA. However, and notwithstanding advances in CEA science, there has been little analysis of the degree of readiness for CEA implementation in Canada's watersheds. If CEA is to advance beyond the project scale, to capture watershed cumulative effects, then arguably there is a need to understand the capacity to implement and sustain watershed-based CEA in any given region.

## 2.5 Conclusion

The current, project-by-project approach to CEA under EA practice does not adequately capture the escalating problem of cumulative effects in Canada's watersheds. As various scholars have outlined (see Dubé, 2003; Duinker & Greig, 2006; Therivel & Ross, 2007; Harriman & Noble, 2008; Gunn & Noble, 2009*b*; Seitz et al., 2011), there is a need to move towards a larger, more regionally-based watershed CEA framework. However, this shift will only take place if strong institutional arrangements are in place to facilitate the integration of CEA science and watershed planning, along with the regional collaboration of watershed stakeholders. The problem is that despite advances in the science of CEA for watersheds, there is a lack of knowledge and understanding of the institutional frameworks and capacity for the implementation of watershed CEA.

# Chapter 3
# Research Methods

## 3.1 Study Area

The study area for this research is the Lower Fraser River Basin, delineated by the District Municipality of Hope, and encompasses the Fraser River and its tributaries as the river flows west into the Strait of Georgia (Fig.1).The Lower Fraser River basin encompasses a multitude of anthropogenic land use activities, the most significant being urbanization, agriculture and resource extraction. Urbanization in the region is dense. The Lower Fraser is British Columbia's most productive watershed, and is home to 66% of the population of British Columbia or approximately 2.9 million people; all of whom occupy just 26% of the total land area within the Lower Fraser River Basin. The population is projected to increase by 41% over the next 25 years (Fraser Basin Council, 2009). According to the 2006 census (Statistics Canada, 2007), over 33% of employees in agriculture and resource extraction in British Columbia are located in this region of the province. In terms of agriculture specifically, the Lower Fraser sub-basin is the most productive region of the watershed. The Fraser Basin Council (2009) reported that in 2005 the Lower Fraser produced $1.7 billion in agricultural products, which accounted for 3.2%, or 55, 000 hectares of the total land area. This level of production puts tremendous stress on the resources provided by the Lower Fraser River Basin.

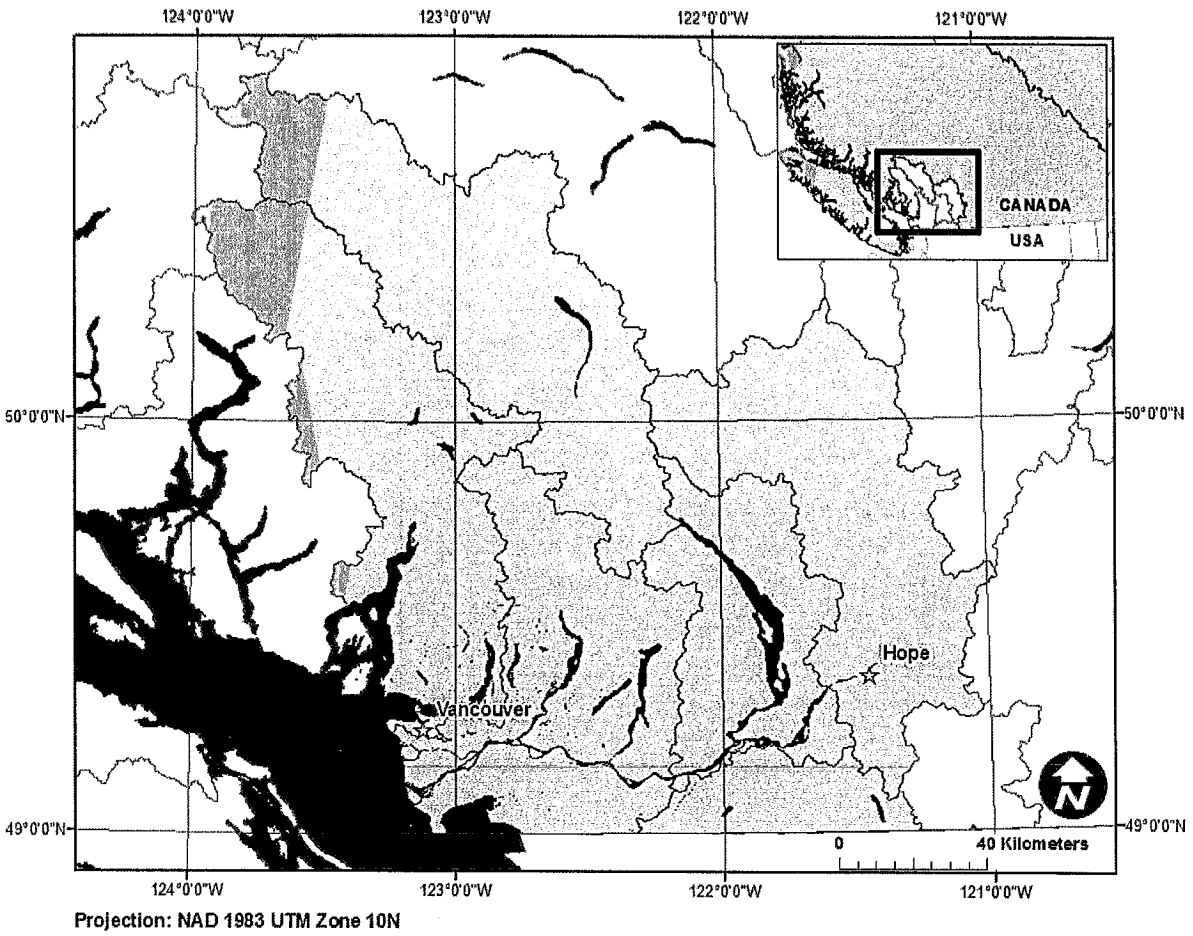


**Figure 1. Lower Fraser River basin.**

### 3.2 Environmental Assessment in the Lower Fraser, B.C.

The Lower Fraser consists of approximately 25 municipal governments, two regional governments, several provincial institutions, and various federal agencies (Table 1). Environmental assessment in the Lower Fraser is largely project-driven, which is typical of most watersheds across Canada (see Schindler and Donahue, 2006), and is carried out under either federal or provincial legislation depending upon the nature of the proposed development and whether a federal authority is involved. Under the *Canadian Environmental Assessment Act,* the assessment of cumulative effects is a requirement for certain projects under section 16(1)(a) (CEAA, 1992). The Act is triggered when all of the following requisites are met: the proposed undertaking is a project as defined by the Act's list-based regulations; the undertaking is not included in the federal *Exclusion List* regulations; there is a federal authority involved (e.g., a

federal department, agency or crown corporation proposed project, issued federal funding, or has granted land to enable the project). Based on the Canadian Environmental Assessment Registry[2], 214 federal EAs have been completed in the Lower Fraser drainage basin since the registry's implementation in October 2003. Of these 214 EAs, 211 were either screening or class screening assessments carried out for routine or 'small projects', meaning that for each project no assessment of cumulative effects was likely required.

At the provincial level, EA is carried out under the legislative authority of the British Columbia *Environmental Assessment Act* (EAA). Part 3, Section 11(2)(b) of the EAA includes provisions to specify "the potential effects to be considered in the assessment, including potential cumulative environmental effects (BC EAA, 2002)." However, as Rutherford (2009) explains, the EAA applies only to 'major projects', meaning that many smaller projects, including small scale hydroelectric projects, do not typically trigger the EAA. Rutherford reports that although CEA can be required based on project-specific terms of reference, "neither the EAA nor the 'Guide to the British Columbia Environmental Assessment Process' require those individual projects that do trigger the BC assessment process to assess cumulative effects" (Rutherford, 2009, pg. 315). Further, as with most provinces in Canada, EA in British Columbia is applied primarily to development 'projects'. Between 1995 and 2011, 72% of all EAs were for mining and energy projects; 9% of EAs (19 assessments) were for water management projects, including dams, reservoirs, or diversions.[3] Broader land uses and disturbances due to urbanization, storm water runoff and agricultural activities are not typically subject to any form of assessment. There are, however, initiatives for regional planning based on jurisdictional boundaries within the watershed, via Metro Vancouver and the Fraser Valley Regional District; as well as regional planning on a larger scale with the establishment of the Fraser Basin Council in 1997 (Calbick et al., 2004), which may serve as a foundation for proposals towards watershed-based regional planning and CEA.

[2]The Canadian Environmental Assessment Registry provides access and information on past and active EAs being conducted under federal legislation. See http://ceaa.gc.ca/050/index-eng.cfm.

[3] Based on Government of British Columbia, Environmental Assessment Office, EA statistical reports available at http://www.eao.gov.bc.ca/Statistics.html.

**Table 1: Regulatory influences for land use planning in the Lower Fraser River Basin**

| Responsible Authority | Responsible Institution | Respective Legislation | Institutional Mandate |
|---|---|---|---|
| Federal | Department of Fisheries and Oceans (DFO) | Fisheries Act (1985) | Fish habitat protection for natural habitat and aquiculture operations |
| | Environment Canada | Species at Risk Act (2002) | Prevent extinction of wildlife |
| | | Migratory Birds Convention Act (1994) | Protection for migratory birds |
| | | Canadian Environmental Protection Act (1999) | Pollution control, protection of human health and environmental for sustainable development |
| | Canadian Environmental Assessment Agency | Canadian Environmental Assessment Act (1992) | Informed decision making for sustainable development |
| Provincial | Ministry of Environment | Environmental Management Act (2004) | Combines provisions from both the *Waste Management Act* and the *Environmental Management Act* |
| | | Water Act (1996) | Protection of quality and quantity of fresh water and drinking water |
| | Ministry of Agriculture | Agricultural Land Commission Act (2002) | Dedicated to protect the supply of agricultural land to meet the needs of the local population |
| | Ministry of Energy and Mines | Ministry of Energy and Mines Act (1996) | Govern and regulate all mining activities |
| | Ministry of Forests, Land and Natural Resource Operations | Land Act (1996) | Govern and regulate activities regarding Crown Land |
| | Environmental Assessment Office | Environmental Assessment Act (2002) | Informed decision making for sustainable development |
| Regional | Metro Vancouver | Solid Waste (1996) | Regulate and control the introduction of solid waste to the environment |
| | | Source Control Sewer use (N.D.) | Regulate and control discharge into sewage systems, prohibiting all but domestic waste |
| | Fraser Valley Regional District | Local Government Act Authority Regulation (1996) | Providing power and authority to local governments for planning and land use management |
| Municipal | | Local Government Act (1996) | Providing power and authority to local governments for planning and land use management |

Sources: Government of British Columbia (2011); Fisheries and Oceans Canada (2011); Metro Vancouver Regional District (2011); Ministry of Environment (2011).

### 3.3 Data Collection and Analysis

Three methods were used for data collection, namely document analysis, a focus group, and semi-structured interviews. First, a document analysis was conducted to understand the existing regulatory and institutional environment of CEA and watershed management practices specific to the Lower Fraser River Basin. Document analysis involves analyzing and interpreting data after the process of examining documents and records related to a particular study (Schwandt, 2007). Document analysis was a useful tool in this study for evaluating the most current perspectives in the literature applicable to the topic of interest (see Marshall & Rossman, 1999).

In the Lower Fraser River Basin, there is an extant body of literature to provide insight into the regulatory environment. Documents reviewed include watershed plans, provincial and federal legislation and regulation, as well as relevant academic literature, thus providing an overview of the current structures in place for watershed management and CEA frameworks. More specifically, the regulations analyzed (Table 1) include those from municipal, regional provincial and federal bodies of governance and were analyzed in detail. Additionally, research was conducted to examine the presence and mandate of several environmental NGO groups in the area who have a significant influential role in land use planning and decision making. These groups include the Fraser Basin Council, the Fraser River Estuary Management Plan – Burrard Inlet Environmental Action Plan, Ducks Unlimited and the Langley Environmental Partners Society. Finally, a growing body of literature in the field of CEA, EA and water management provided an overall knowledge base to identify areas where research and development is needed.

Second, a focus group exercise was conducted in May 2010, at the Fraser Basin Council in Vancouver. A focus group is a group typically of 6 to 12 individuals in a related field that have come together for the discussion and analysis of qualitative data, with the purpose of gaining an increased understanding of the particular topic of interest to the researcher (Asbury, 1995). Morgan (1988) suggests that a focus group can be used as preliminary research to prepare for specific issues of a larger research endeavor. In the context of this research, selection of participants for the focus group was founded with the help of Drs. Noble and Patrick, as well as on the essential input by the SSHRC-project key collaborator for the Lower Fraser River Basin,

Dr. Hans Schreier, a Professor with the Institute for Resources, Environment and Sustainability and the University of British Columbia in Vancouver, and expert in watershed analysis, modeling, and cumulative effects. Participants within the focus group included representation from a select group of seven experts from fields of academia, government agencies in environment and water management, watershed agencies and private sector environmental consultants.

The purpose of the focus group was to validate the criteria to be used for evaluating current capacity for watershed-based CEA in the Lower Fraser River Basin (see Table 2).These criteria, discussed in Chapter 2, were derived from previous research in the South Saskatchewan River Basin by Sheelanere (2010) and identified the necessary requisites to implement and sustain watershed-based CEA. Discussion during the focus group was centered around provoking questions as presented in Appendix A1, and intended to identify the relevance of these eight requisites within the context of the Lower Fraser Basin. Dialogue within the setting of the focus group encouraged the framework put forth by Sheelanere (2010). Through discussion and dialogue during the focus group, there was no objection to the agenda put forth; additionally, there was a consensus that all eight requisites were necessary for W-CEA (see Sheelanere, 2010), and are applicable to the Lower Fraser Basin. The primary concerns that arose in the focus group discussion were issues facing the Lower Fraser Basin relating to fragmented political geography and competing bodies of governance, and the subsequent problems these issues would cause relating to the presence of W-CEA in terms of capacity.

Semi-structured interviews are casual, verbal exchanges between an interviewer and an interviewee, where the interviewer intends to obtain information on a certain subject. The liberal nature of a semi-structured interview, as compared to that of a structured interview, allows for a more broad exchange of information (Clifford et al., 2010). A wide range of interviews and interviewees can result in a representation of differing opinions and a general consensus in regard to the subject matter (Dunn, 2000). Further, semi-structured interviews can offer structure to the interview, without restricting any opportunities to probe for additional information (Flowerdew & Martin, 2005).The semi-structured interviews were constructed informally around the necessary requisites for watershed-based CEA in Table 2. A complete list of interview

questions is provided in Appendix A2.

**Table 2. Requisites for watershed-based CEA.**

| | Requisite | Definition/ explanation |
|---|---|---|
| 1 | Lead Agency | A lead agency with the authority, mandate and the capacity for CEA, including the means to direct monitoring programs and influence decisions about land use and project development to ensure long-term sustainability in the watershed |
| 2 | Multi-Stakeholder Collaboration | Roles and responsibilities of various stakeholders in watershed management and science are well defined and stakeholders are represented in impact assessment and decision making about development. |
| 3 | CEA Baselines, Indicators and Thresholds | W-CEA requires data from a variety of sources for the establishment of adequate baseline information, scientific indicators and watershed thresholds specific to the region of interest to represent the scientific aspects of W-CEA. Strong foundations of scientific understanding represent a significant aspect to understanding W-CEA and required processes. |
| 4 | Multi-Scaled Monitoring | Monitoring programs are mandated at both the individual project and watershed scales, and are focused on monitoring VEC conditions. Monitoring is essential to understanding and managing cumulative effects, and should be done at both the project and the watershed scale. |
| 5 | Data Management and Coordination | When monitoring is done, it is important that there be some mechanism in place to share that data and make it available/accessible to end users. |
| 6 | Vertical and Horizontal Linkages | Effective WCEA requires linkages between both watershed and project-based assessment, monitoring and decision-making initiatives to ensure adequate watershed management from both the top-down, as well as the bottom-up. |
| 7 | Enabling Legislation | There is a means to implement WCEA initiatives, enforce monitoring programs and compliance, and to ensure influence over development decisions taken at the individual project level. |
| 8 | Financial Resources | Sufficient financial and human resources must be available to implement and sustain, over the long term, WCEA programs and requirements (e.g. monitoring programs, landscape modeling, reporting, communication, data management and coordination); as well as to ensure healthy progression in development of W-CEA over the long term. |

Source: Based on Sheelanere (2010)

*3.3.1 Selection of Interview Participants*

In general, EA involves a range of stakeholders, including the proponent, the regulator, and affected communities (e.g., academic, general public, etc.). As with the focus group, potential interviewees were identified with the help of Drs. Noble and Patrick. Additional interviewees were also identified from those participating in the focus group, as well as using a snowball technique (see Goodman, 1961) where an interviewee would suggest additional relevant candidates in the field. Overall, 33 potential participants were contacted and 26 individuals agreed to participate. A total of 24 interviews were conducted.[4] Upon agreement of participation by the interview candidate, a package was sent to provide information regarding the scope of the project and the nature of the interview, in addition to ethics consent forms.

Potential interview candidates contacted that declined to participate represented predominately industry and First Nations. First Nations contact information was provided by an interview participant who worked closely with some individuals. However, several attempts to contact these individuals via telephone calls and emails were not successful. Industry candidates represented groups from hydroelectricity production, aggregate mining and agriculture. All interview candidates contacted insisted they did not have any valuable input, in spite of an attempt to convince otherwise. Because the Environmental Assessment process is rarely triggered in BC for these sorts of development, it is speculated that these industry representatives were less inclined to participate in a process in which they have a minimal stake..

All interviews were conducted between the months of June and August in 2010. In order to capture a representation of the range of stakeholders in the local watershed, interview participants for this research were selected from the principle categories of land use planning and watershed management in the basin, and included government (e.g., Ministry of Environment, Department of Fisheries and Oceans, British Columbia Environmental Assessment Office, municipal representatives) (n = 16), academics (e.g., watershed and CEA experts) (n = 2), NGOs (e.g., Langley Environmental Partnerships Society, Pacific Salmon Foundation, Ducks Unlimited) (n = 4), and private sector environmental consultants (n = 4). The intent was that,

[4]Two of the 24 interviews incorporated two participants; hence 24 interviews with a total of 26 participants.

collectively, the participants from these groups represent a range of stakeholder views on, and experiences with, watershed planning and CEA in the Basin.

Of the 24 total interviews, 19 were conducted in person, in the Lower Fraser River Basin, and the remaining five interviews were conducted over the phone from outside the area. For those who agreed to participate, interview times ranged from 20-70 minutes in duration. All face-to-face interviews took place in the respective offices of the participants. When consent was obtained from the participant before the interview began, the interview was audio recorded to facilitate analysis.

**Table 3. Types and quantities of stakeholder interviews**

| Stakeholder Type | Number of interviews |
|---|---|
| Academia | 2 |
| Municipal Government | 4 |
| Regional Government | 4 |
| Provincial Agencies<br>• Ministry of Environment<br>• Ministry of Agriculture<br>• Ministry of Mines<br>• Environmental Assessment Office | <br>5<br>1<br>1<br>2 |
| Federal Agencies<br>• Department of Fisheries and Oceans<br>• Environment Canada | <br>2<br>1 |
| Private Consultants | 4 |
| ENGOs<br>• Fraser Basin Council<br>• Langley Environmental Partnerships Society<br>• Ducks Unlimited<br>• Pacific Salmon Federation | <br>1<br>1<br><br>1<br>1 |
| Total Number of Interview Participants | 26 |

*3.3.2 Data Analysis*

Results of recorded interviews were transcribed and subjected to qualitative data analysis. Qualitative data analysis is an effective method of approaching a research subject with minimal previous research (Creswell, 2003). Therefore, in the context of this research, qualitative data analysis provided significant benefits, given the research base for institutional requirements of

watershed-based CEA are not well explored. Interview transcriptions were inputted to the NVivo © software program for qualitative data analysis. The purpose of this software program is to facilitate easy handling of a large volume and variety of primary, qualitative research results. The software was used to thematically code and organize and facilitate the evaluation of results from the interviews. Initial coding was based on and organized by the eight requisites for W-CEA. The next level of coding was based on the questions asked for each requisite during the semi-structured interviews concerning capacity, and the subsequent yes or no responses concerning current, available capacity. It was at this point where common themes among various interview participants and among the various requisites began to surface. The coded and analyzed interview results were then used to understand the status of current institutional capacity of watershed-based CEA in the Lower Fraser River Basin, and to identify potential areas of consent or disagreement amongst participants.

# Chapter 4
# Results

Results of the semi-structured interviews are presented in this chapter. The results are presented based on the eight interview themes, or requisites for watershed-based CEA, as identified in Chapter 3 and validated by focus group participants. Common sub-themes that arose in the interview results are presented where applicable. Interview results include responses from both government and various non-government representatives, including academics, NGOs, and the private sector. There was no significant dissent amongst responses between study participants, including government and non-government, or amongst the various levels of government; responses across participant groups were largely reinforcing, indicating consent on the majority of requisites in the Lower Fraser River Basin.

## 4.1 Lead Agency

There was general consensus amongst participants when asked about the presence of a lead agency for implementing and regulating CEA in the Lower Fraser River Basin. While the details of responses varied, the interviews revealed a general absence of any adequate example of a lead agency. Participants cited three primary characteristics in the Lower Fraser River Basin obstructing the establishment of such a regulatory body: i) the Lower Fraser River Basin spans a large geographic area generating an overall watershed with fragmented and often independently operating jurisdictions; ii) for such a large region there lacks adequate legislation to guide a lead agency through the challenges of diverse land-use planning; iii) in absence of a single lead agency there are several fragmented agencies resulting in inadequate watershed management.

### *4.1.1 Jurisdictional Fragmentation*

When asked to identify a lead agency in the Lower Fraser River Basin for watershed CEA, interview participants emphasized that in light of the many jurisdictions that span the watershed, overall there was no lead agency identified for the Lower Fraser River Basin. Rather, as two government employees responded, "there are many players in the Lower Fraser," and "there isn't

one specific agency that oversees watershed development." Within the watershed there are several jurisdictional boundaries represented by various levels of government, including the federal and provincial governments, two regional districts and approximately twenty-five municipalities. One consultant explained that "there are regional districts, municipalities and the provincial government, and none of them are in the lead" with respect to CEA or otherwise. An ENGO participant added that "the responsibilities are very widely distributed, depending on, for example, if it deals with water or crown land...there is no one lead agency that oversees all potential impacts." An implication of the fragmented nature of this area, explained one government representative, is that "often to have initiatives [environmental or otherwise] go forward, you have to convince a lead agency, as well as potentially several other [agency, government] partners to buy in." Another government employee elaborated, "the ability to regulate land use is a local government issue, and they're very protective over this right; senior governments have a more indirect authority, such as DFO whose mandate is to protect fish and fish habitat," but not necessarily to manage activities that occur on the landscape in the watershed that are often the source of cumulative effects.

While the regional districts aim to coordinate municipalities within a regional scope, another government representative explains the reality, "...their [regional district's] hands are tied; they're dealing with all the municipalities, but they lose their grip in the upper watershed [within the Lower Fraser River Basin], where forestry takes over - this is problematic because, of course, the upper and lower watersheds are interconnected." The reality is, as one academic summarized, "there is a huge debate on who should be responsible for watershed-based management." Further, while the upper and lower areas of the Lower Fraser River Basin appear to have interests aligned with each other, a consultant explained, "...they are fragmented in jurisdiction, but also fragmented in terms of interest; when one agency is interested in fish habitat or species at risk, and another is interested in agriculture, there can be conflicts among these." The participant went on to explain that the reality is "the Lower Fraser [consists of] dozens of watersheds, and many of them are multi jurisdictional; they cross several boundaries and often there is tension; a lead agency must be a level above municipal and regional levels of government."

*4.1.2 Inadequate Legislation*

In describing the absence of a lead agency for watershed CEA, all interview participants expressed concern about the inadequacy of legislation to support such a regulatory body. There are many diverse land use and in-stream activities in the watershed. For example, there is agricultural use, urban expansion, and hydro-electric development; and there is a lack of legislation for watershed-based management that encompasses all land use activities. In the upper region of the Lower Fraser River Basin, where agriculture is most prevalent, there is the agricultural land reserve. This restricts the amount of development in the area, which was deemed problematic for two reasons, both of which were elaborated by two non-government representatives. First, as a consultant explained, "...their focus isn't really environmentally driven;" and second, "there is a self-policing environment - farmers are supposed to hold other farmers responsible; a system that is susceptible to abuse," described an academic participant.

The Lower Fraser River Basin is significant for agricultural production, and is heavily reliant on ground water supply for irrigation. This is also problematic for watershed CEA, as participants expressed, because there is little in the way of agricultural regulation and nothing in the way of ground water legislation. "Legislators are hesitant to infringe on the practices in agriculture," described one government representative, and "agriculture is necessary to maintain food supply, but they're really struggling...so in a sense, they're almost untouchable." Further, "B.C. is the last province in Canada with unregulated ground water," explained a consultant, "so we are in a situation where water users drill their own wells and we have no idea how much they're extracting." An ENGO participant added that "[because of cutbacks] the government doesn't implement stream side monitoring and protection, and they've changed the riparian regulations, so they're losing the ability to know what's going on in the watershed." As a result, "riparian regulations are alone in regulating streamside protection", described one consultant.

Also within the Lower Fraser River Basin is an extraordinary amount of urban activity. Interview participants painted a picture where government regulators do not have the resources to keep up with growth rates. An academic explained that in light of the burdening load, "regulations are lacking amongst various levels of government, and they are beginning to privatize some aspects,

such as septic systems." Inspiring change and bridging this gap could pose difficulties, as two government representatives explained, "the regulations here are piece meal among the different ministries," and "it takes a long time to do anything here in terms of change - minimum three to five years, and there is a high turnover within government, so the long term commitment to watershed planning and management is missing."

*4.1.3 Too Many Lead Agencies?*

In the described absence of a lead agency, many interview participants gave examples of existing entities that could be, should be, and/or have attempted to be a lead agency. The results of participant interviews showed that there have been several efforts to establish environmental protection groups and watershed agencies, in addition to the existing federal and provincial government agencies whose mandate is environmentally charged. Two government representatives explained: "I would say there is a partnership and collaboration among the various groups," and "we've got all kinds of lead agencies that could do it, but when it comes to taking action, that's where it crumbles." The combined forces of these various entities have resulted in some successful collaboration, but it has also resulted in unnecessary overlap, uncoordinated monitoring and inconsistent and under-resourced attempts at watershed management.

Of the fifteen interviewees who identified a lead agency, seven identified the lead agency as either the FBC or FREMP, and eight responded by identifying a government agency, either the regional districts or the provincial government. "The closest thing [to a lead agency]," explained one government representative, "is the Fraser Valley Regional District or Metro Vancouver as umbrella structures over the municipalities; they both have land use planning and decision making authority in the areas." These two regional districts, together, cover the entire Lower Fraser River Basin; however, another government representative identified a problem: "there's very little crossover between the two regional districts," making them two very separate, disconnected entities. Other participants identified the provincial government as a lead agency for watershed CEA. "I think the province is the most likely candidate," explained one government representative. Two other government representatives agreed saying, "the Ministry

of Agriculture and Lands is ultimately responsible - all other agencies operate under the Land Act [and] the Ministry of Environment, for example, does monitoring and environmental work, but ultimately, they operate under this Act...[which] governs crown land development and oversees land use planning in the watershed." However, another government representative went on to say, "you can't just say there is one lead agency - there are Ministries for mining, environment, forestry, agriculture, transportation, and more, all of these agencies have a duty to make decisions in the area."

Aside from government agencies, the most significant of the non-government watershed organizations noted by participants was the Fraser Basin Council (FBC) and the Burrard Inlet Environmental Action Program- Fraser River Estuary Management Plan (FREMP) - identified by almost half of those who responded. This suggests these two ENGOs have a significant role in environmental management in the Lower Fraser River Basin. For example, one academic explained that "FREMP has looked at the river shore as an entire unit; they monitor and they coordinate across the region; they're a one stop shop for groups to get together and review." The FBC works similarly to FREMP, described two ENGO representatives, "[the FBC] operates at a watershed scale, and they bring together a lot of agencies - I know they do monitoring and give status reports," but, "ultimately, all of the decision authority remains with the government authorities."

That said, three interview participants identified what they perceived to be a significant problem: even though there have been attempts to coordinate the various agencies in the watershed, especially by the FBC and FREMP, ultimately they work in silos. One consultant explained that "we've had a long standing problem in the area with nutrient contamination of ground water. I think agencies are finally coming together on this, but it's been a 20 year process, so you may think they're not collaborating at all. They have their own agendas." Two government representatives elaborated by noting: "the regional districts, for example, are independent from one another - in my ten years working for the district, I've only ever contacted them a handful of times;" and, "they are leading entities, but they go about things in a very different way - priorities are different among the regional jurisdictions, and that makes it difficult to coordinate their mandates."

## 4.2Multi-Stakeholder Collaboration

Under the requisite 'multi-stakeholder collaboration', interview participants were asked two questions: first, they were asked about mechanisms for collaboration, or the presence of an entity or governing body that works towards collaborating stakeholder involvement within the Lower Fraser River Basin; second, they were asked about how well defined are stakeholder's roles are in the watershed with respect to impact assessment, planning and management.

### *4.2.1 Mechanisms for Collaboration*

Participants noted that the large geographic region, fragmented jurisdictions, and the presence of many agencies hindered the task of collaborating stakeholders. In addition, interview results revealed additional obstacles for stakeholder collaboration, namely the lack of legislation and resources for doing so. "At the watershed scale," explained one government representative, "there is definitely nothing formal set up that would act as a collaborative power." Interview participants emphasized that while organizations within the watershed were not at the point of collaboration across the whole watershed, there are efforts that exist at the smaller scale. For example, one ENGO participant noted that "there are small groups that deal with specific aquifers and more localized regions," and another ENGO representative elaborated: "The Fraser River is so big, and goes through all the municipalities. We try to work with other municipalities, but they tend to often work only within their own boundaries."

There is disconnect throughout the area, described a government representative, "the area is too large; people here [in Vancouver] don't care what's happening in Hope." There is nothing formal established, so there are no standards for a coordinating body to engage stakeholders across the watershed. As one government representative explained, "in this region there are different committees that are responsible for stakeholders...I think they exist in other areas of the province too; these committees can be led by various different collaborators, like DFO, or some other group." An ENGO representative described emphatically, "the river, I think, is just so much bigger than everybody."

Interview participants pointed out that while there are some efforts to collaborate at the smaller scale, these efforts are inconsistent across the larger watershed. "There is no collaboration at the watershed scale," explained one government representative, "but there are examples in some of the sub watersheds for specific needs, such as the Chilliwack River, where extensive efforts exist to work with nutrient loading in the stream." Another government representative expressed that "while there are provisions in the Water Act to enable this, there is nothing to enforce it across the watershed." As explained by one government representative, "we are missing that formal process or mechanism that relates [stakeholder collaboration] to the watershed."

For example, interview participants described a situation in the Lower Fraser River Basin where there have been several attempts at stakeholder collaboration, and there are watershed agencies that have attempted to do this; but they have no governing power and there is no formal legislation that requires stakeholder collaboration for watershed planning initiatives. In addition, participants described problems of severe cut backs to both non-government agencies, as well as to government agencies, resulting in severe handicaps in the process of coordinating stakeholders.

The inadequacies in government oversight were recognized early on in the watershed, described one government representative:

> "There is this body, FREMP, it's an interesting body because it was set up to recognize the unique qualities of governmental voids in managing such a large watershed like the Lower Fraser, with so many different interests and organizations. So it was set up with that common mandate."

Both FREMP and the FBC have similar mandates in terms of watershed management and coordinating stakeholder interests and "they sort of play that role," explained a consultant, "but they are basin wide, not just the Lower Fraser." These two groups are the most prominent of several but, as the interviewee explained, "they don't cover the whole watershed area," they "tend to look at more localized areas, some larger than others," and "they tend to leave a lot of groups out."

While the likes of these groups may seem like the answer to governmental voids in watershed approaches to CEA, the problem, as many participants pointed out, is that these agencies do not have any legislative power. "They have no authority, and no regulatory power," explained a government representative, "they make recommendations or suggestions in policy direction and research initiatives." The reality is "the only enforcing powers are the federal and provincial governments. The rest of us just bring knowledge to the table." The participant went on to explain that this was problematic, particularly because there is an inconsistent presence at round table discussions as organized by these groups – "but this could be because of a lack of resources to participate consistently, not because of a lack of interest." "The provincial government is essentially responsible for organizing community efforts," explained one academic participant, "but they have virtually no financial resources behind it, so many of these communities attempt to do it without the province." As a result, explained one government representative, "there just isn't a watershed management approach [in the Lower Fraser]."

At the same time, there were some responses that suggest the ability to organize stakeholder collaboration in the watershed is evolving, and the need for this is increasingly recognized. "We have not quite got to this level yet," explained an academic, but, as one consultant noted, "this is changing [and] I think people are starting to realize that water is an important resource that we don't fully understand, and we're starting to experience some scares, such as the one in Ontario." An ENGO representative explained that, in response, "we see these groups, such as the FBC and FREMP, who organize a couple of workshops every year, and these do bring in a wide variety of stakeholders." Another ENGO representative was more confident, explaining that "there are pilots for this type of thing on the smaller watersheds, and it's only a matter of time before it's brought up to the larger scale;" however, a government employee was more pragmatic, noting that "there are mechanisms for this, but I don't think there is that collaborative body we're looking for just yet - there is nobody to initiate technical panels with agencies to provide holistic and comprehensive advice for watershed changes, it's not broad enough yet."

*4.2.2 Defined Stakeholder Roles*

Interview participants generally agreed that stakeholder roles in the Lower Fraser River Basin were indeed well defined. The problem was not in the definition of roles, but rather that these roles do not necessarily coordinate with each other in support of a watershed based approach to managing cumulative effects. Two non-government representatives explained: "I think they're fairly well defined..." and "I think they're fairly well defined in the legislation..." However, these descriptions did not come without caveats. Many of the participants emphasized that roles, while well defined, were not well coordinated with each other. "Different levels of governments have different roles and responsibilities, and I don't think they ever consider each other's acts - they often tend to clash with each other," explained one consultant. Two government representatives supported this in saying, "separate agencies take their own activities into consideration. What we don't have is a unifying lens in the watershed," and "the municipalities are fragmented and could use better coordination. They're all on their own agendas."

The agendas of these agencies tend also to be in alignment with EA practice in that they are based on project-level assessment. "[Roles] are fairly well defined on a project-to-project basis," explained a consultant. "Other than the government, everyone else, developers, they are only looking at specific sites, and they don't consider what everyone else is doing," explained a second consultant. As one ENGO participant described, "the problem hereis that roles and responsibilities are not enforced; I think people are very clear, but who monitors to make sure?" A consultant explained that "government people have way too much on their plates, and the problem is that they can't really rely on un-appointed substitutes to fill the voids they leave."

**4.3 CEA baselines, indicators and thresholds**

Under this requisite, the presence of adequate scientific knowledge in watershed-based CEA was explored. Scientific understanding is the basis for comprehending the overall impact of watershed cumulative effects. Baseline data are required to differentiate the effects of a development on the receiving environment, indicators are required to identify physical changes

to the receiving environment as a result of anthropogenic changes over time, and thresholds are required to establish the capacity for change to a receiving environment.

### *4.3.1 Baseline Data*

Nineteen of the twenty-six participants interviewed identified a general lack of data to adequately watershed characterize baseline conditions in the Lower Fraser River Basin. Interview participants described weak legislation to initiate and enforce better data collection, and overall poor, unorganized and fragmented data storage. While these serious shortcomings were discussed, there was some optimism, as discussed by the other five interview participants, who emphasized that while there is a lot of room for improvement, data availability is improving.

One of the most significant challenges identified was the lack of adequate legislation to ensure quality baseline data is available. "There is no standardized regional assessment program," claimed one consultant, and "you might see DFO or the Ministry of Environment doing monitoring, but that will only be site specific." Another consultant noted that "getting data in agriculture is often difficult as well because it relies on cooperation from farmers, which can be conflicting, without regulation." These examples are considered guidelines and fall short of having the girth to support regulated submission of baseline data. "There are federal guidelines, but those only go so far," explained an academic participant, and a government representative went on to say, "if you look at what's being collected, it probably wouldn't meet your needs in terms of providing a holistic overview for the state of the watershed."

With regard to data on groundwater, "B.C. is one of the last jurisdictions in Canada to have legislation governing ground water," explained an ENGO representative, and "this is a major issue for watershed management." An academic participant explained that "you need a license for surface water, but not for ground water; there are regulations for surface water and only guidelines for ground water." Two government representatives went on to say, "essentially anyone can drill a well and extract as much water as they want within the limit defined by the EA office," and "we have absolutely no idea how much water is being used." "The Agricultural

sector," explained an academic participant, "is dependent on well water, but they are politically powerful. No one wants to rock the boat."

Participants also identified an inability for stakeholders to store and obtain collected and available data. "There are a number of different data sets," explained an ENGO representative and, according to one academic, "ground water alone is housed in three different databases by the province." A consultant, involved in watershed science, explained that "data is difficult to come by - you have to know where it is, and what to ask for to get it, and some of it is privately owned and not available; data searches are expensive and don't guarantee results" A government representative similarly noted that "there are formal and accessible data sets, but they're incomplete in terms of geographic and temporal coverage." "The FBC, for example," explained an ENGO representative, "puts out a score card every couple of years, but it again, it is not holistic, and doesn't cover the spatial scale you're looking for." Two government representatives summed it up emphasizing the situation regarding fragmentation of available baseline data: "data sets do exist, but they're not consistent," and "some of the data is available in various locations, but it's not a formal, consolidated and easily accessible data set."

While many shortcomings were expressed in terms of available baseline data for the Lower Fraser River Basin, eight interview participants highlighted a silver lining, whereby availability of baseline data was seen as improving and evolving. "It's coming," explains an ENGO representative, "there's Hectares B.C., community mapping in B.C., and a process developed by the Nature Conservancy of Canada...so the need for these data bases is being recognized." In addition, a government representative discussed a new monitoring program to collect data in the Lower Fraser River Basin, explaining "we will start with Delta, Richmond and Langley, and then continue on with the rest of the basin. The program is based on agricultural mapping, in hopes of modeling climate change, but the data base will house data on water, soil, and land use. More generally speaking, a government representative explained, "we are getting better about monitoring what we're using and what our demand is going to be in the future."

*4.3.2 Science-based Indicators*

The majority of participants, nineteen in total, explained that science-based indicators are either missing or inadequate, and still in the development stage. Participants were able to identify some smaller scale programs for watershed-based monitoring, and hence cumulative effects monitoring, but they emphasized that the area is missing a holistic program and plan for watershed managers to rely on. "I know there are some indicators," said a consultant, " that are monitored to identify the health of a watershed, such as salmon." Another consultant noted that benthic invertebrate monitoring is being conducted in some smaller streams, but a government participant explained that such monitoring, "apart from water quality monitoring, is really piece-meal[and] really more applicable to the smaller tributaries more so than to the Fraser River itself."An academic participant elaborated that "we are working on some of these [indicators for CEA], but as far as I know, there are no provincial guidelines."

On the other hand, some participants argued that more progress has been made than what some might think. But, as one government representative explained, "there is no agreement on what the science-based indicators should be - they're there, but they're not common, and they're not agreed upon." Four participants explained more gravely that this information remains only in the literature, and is not at all seen in practice, noting that "academically, this has been looked at, but I've never seen it make that leap into management, or used in any sort of systematic way."

*4.3.3 Monitoring Indicators for Project EA*

Participants described infrequent and inconsistent practice with regard to standard indicators for monitoring across project EAs. This could be the result, as interviewees explained, of inadequate legislation to support better EA practice. As one academic expressed, "I don't think we have done too many impact assessments in the past few years," and two ENGO representatives commented, "I'm not really sure, because I don't really think there are any [EAs] and I'm not actually aware of anything that's going on in the Fraser Basin." Two government representatives further explained that EA practice varies by project and "different programs tend to look at different parameters, depending on the receiving environment." A consultant supported this in

saying, "we look at them very specifically, and not at the broader scale", and a second consultant noted that "monitoring could be done differently, at different times of the year, they might do land cover, they might not, they might do water quality, they might not, there is just so much variability." This interviewee went on to explain that "most of the scrutiny is on big projects, and even then, they are only steered by guidelines, which are still flexible." Indicator use in EA tends to be communicated through project-specific terms of reference or best management practices, which act only as guidelines. Generally speaking, participants identified no standard method or protocol for indicator use in EA from a CEA perspective, with many noting that too few impact assessments are done, there is no single mandate for EA in the region, and EAs that have been done are too site specific.

### *4.3.4 Watershed Thresholds for Cumulative Effects*

Interview participants explained that while there is an extensive list of environmental thresholds available in the literature, these are not consistently being used in practice. Interviewees noted several piece-meal examples, mostly at the sub-basin level, and were unaware of any well known, and well developed thresholds implemented for the entirety of the Lower Fraser River Basin for the purpose of cumulative effects management. Participants gave extensive examples of thresholds, both land-based and in-stream, that could be used, such as percent of impermeable surfaces, turbidity in the river channel, maximum number of cattle per area, and percent of clear cut area. However, as a government representative explained, "that there aren't really identified thresholds for development." In the words of an ENGO participant, "you could consider the water quality objectives and the drinking water guidelines the only thresholds for development that we actually implement on a watershed scale." Though most participants identified a void in thresholds for development in the Lower Fraser River Basin, others suggested that thresholds are being realized before they can be established. As one academic participant explained, "we are getting to the point where we are reaching thresholds; you can see this because we are experiencing crisis situations, like when we see extreme declines in fish population."

## 4.4 Multi-Scaled Monitoring

Monitoring is an essential component to watershed CEA, and is necessary at both the watershed and project scales. Participants were asked to comment on the substance of project-level monitoring in the watershed, as well as on any regional, or watershed-based monitoring programs that may support CEA.

### *4.4.1 Monitoring at the Project Level*

Responses describing monitoring practices varied slightly in detail, however there was a consensus that showed monitoring to be generally present at project level in those instances where EAs were conducted or where annul permitting and compliance reporting required. One government participant explains that "monitoring is required...every project that receives an EA has monitoring required, and then a report is produced - it's tailored to the project." Another government representative agreed saying, "project EAs are required to provide monitoring reports regarding biological impacts, minim flow requirements being met, etc., depending on the project, these parameters vary."

That said, the site-specific nature of this monitoring itself was identified as problematic in a CEA context. Monitoring is generally restricted to larger projects, and, as one government participant noted, "it's not really applied with any bigger picture." Ten interview participants expressed considerable inadequacies in the process of monitoring in EA. "It's often required, but it's seldom being done in a satisfactory way," explained a consultant. "The big challenge," described one academic, "is how frequent it should be done in terms of time and where, because monitoring is very expensive". A consultant noted that "a lot of the work done by DFO to meet compliance of the Fisheries Act is abysmal - large percentages of project reports are never submitted because they're never completed [which] is problematic for supporting holistic monitoring processes." Government participants validated these claims, with one saying, "yes monitoring is required but it's so limited; there are so many gaps in the data because we just can't afford to do complete monitoring, and we don't have the resources to enforce proper monitoring by proponents."

*4.4.2 Monitoring at the Regional Scale*

Monitoring at the regional scale in the Lower Fraser River Basin was described by interview participants as extremely limited. Participants were able to identify some regional scale monitoring programs, but none within the specific boundaries of the Lower Fraser River Basin. "The Ministry of Environment does province wide water quality monitoring based on standards set by the drinking water guidelines," explained an academic, "but I'm not really aware of anything else." An ENGO representative supported this saying, "stream flow and water quality are the most 'high profile' aspects to monitor in the watershed, but these would be province wide." The province wide monitoring programs have shown more success in the past, however at present, a government representative described them to be lacking: "there are water monitoring programs initiated by the province, but they're not uniform or consistent across the province; they tend to ebb and flow; they used to be heavy in water quality, now it's air quality."

Within the Lower Fraser River Basin itself, interview participants describe several regional-scale programs initiated by the respective districts. For example, there are programs by Metro Vancouver for air shed monitoring, in addition to their water monitoring. A government participant explained that "there are some programs going strong; DFO has several programs for fish monitoring, and Environment Canada has the CABIN program, which looks at benthic invertebrates in the smaller streams." Of all the monitoring programs in the area, perhaps the most successful has been the Integrated Storm Water Management Plan (ISWMP). The program was initiated by Metro Vancouver, and required all the municipalities to provide comprehensive planning for managing storm water runoff within a five year deadline. A government participant explained: "We've seen enormous success with the ISWMP; the municipalities are obligated to comply - this is a good example of what we're capable of [but] the regional districts tend to look at specific monitoring components and certain values...it's not holistic."

Participants noted that current monitoring programs could use significant improvement. One of the leading problems, as interview participants described, is that there are simply so many different initiatives led by various levels of government and different government departments

and agencies, which are not coordinated. "I've never seen the two regional districts collaborate with each other," added a government representative, "the monitoring programs are usually lead by the municipalities, which is more site specific." A consultant summed it up by saying that "we have monitoring going on, but it could be so much more effective if the programs and coordinators worked together."

## 4.5 Data Management and Coordination

In order to perform CEA at the watershed scale, data must be coordinated and made available in such a way as to allow for access to identify and work with baseline data, indicators and thresholds. Interview participants were asked to comment on the accessibility of data collected to watershed stakeholders, and the status of technical capacity for making data available to those who require it.

### *4.5.1 Accessibility of Data*

Participants noted that public data (i.e. government data) was generally available to watershed stakeholders, but not necessarily accessible. Participants noted several problems, where not all data is made available online, and when it is published online there is often a lag time of up to several years before it makes its way to a public data base. The data online may or may not be up to date," explained a government representative, and "it's a problem because when data finally becomes available, it could be obsolete." In addition, participants described the issue of proprietary data, or cases where private industry, who pays to collect data, often protects it.

The Lower Fraser River Basin faces several problems in improving available data. Data collected by the public sector was considered by participants to be extremely fragmented. An ENGO representative explained that "in some cases there is really good data and information available...lots of the time, you cannot even get access to it." A government representative elaborated, "we have lots of work to do in making it readily available in an easy to use tool like the internet," but right now "it's not really in a form that useful to anyone." Another government representative continued, "we do annual reports for the watershed, which become public; but the

actual data sets themselves, no they're not." An ENGO participant described the situation as the data simply is not available: "it's so piece-meal; you have to know that the data exists, and you have to know where to look for it, and what to ask for in order to get it." Another government representative emphasized that "the province really needs to develop a standardized data collection store, something holistic for all data that been collected [and] it needs to be available to everyone."

Several participants looked to the U.S. as an example to follow in data coordination and sharing. "The USGS is a perfect example of what we could have," explained a consultant, "any river you're interested in is on that data base." An academic agreed saying, "we have a bit going on here, but for the most part we've had cut back, like hydrometric monitoring, for example, it's frustrating and it's not very practical, [whereas] the USGS has over 7000 real-time hydrometric stations to support their data base." But, as one consultant cautioned, "we need something like the USGS has, but realistically we seem to lack the political will that they had for this, plus their budget is probably equal to that of our entire province."

A final challenge that interview participants described was the issue between public and private data. Participants said that the private sector arguably has far greater resources for data collection, and they are often required to do so for gaining permits or completing an EA. However, data that is not required to be shared often is not. Two consultants explained that "a lot of data is proprietary," and "we try to make our data available to those who need it, but we are the exception." Another consultant elaborated, "proponents like to have the upper hand, so they will only share as much data as they're required to."

### *4.5.2 Technical Capacity for Data Sharing*

Response from interview participants did not show insufficiencies in technical capacity for data management and sharing, but rather inadequacies in the ability to utilize technology. Participants also emphasized that the most significant problem was the lack of resources and the lack of political will to initiate further development in data management and sharing. Several participants made reference to the value of the internet as a readily-available data-sharing tool,

with one government representative noting that certain agencies and organizations, including, DFO, FREMP, and the municipalities do have information readily available on the internet, but that "the task is not the ability to make information available, it's how to bring all this data together and make it *more* available - it needs to be more efficient."

The technology exists; the problem lies in the inability for agencies to use it. An academic explained that "the Ministry of Environment who is responsible for most of the data collection and knowledge has been decimated twice, they're spread so thin." Again, this is an area of CEA that is affected by the fragmentation of jurisdiction in the Lower Fraser River Basin, "this varies by organization," explained an ENGO representative, "some of the municipalities have the resources to participate in this, and many do not...you just can't expect some of the smaller districts to have the same resources as the bigger ones, like Vancouver or Surrey." But, as one consultant argued, "if they're not legislated to follow a protocol by collecting and submitting data, then they certainly aren't going to do it...we are just lacking political will."

### 4.6 Vertical and Horizontal Linkages

Strong linkages between agencies and between different levels of government are required to execute watershed-based CEA. Mechanisms must be present to connect watershed scale science, monitoring, and management practices to the project-level; and project-based monitoring and must feed back into broader watershed planning initiatives and understanding of cumulative effects. Participants were asked to comment on the linkages between the project and regional scales. Participants had the greatest difficulty commenting on this requisite compared to all others, with thirteen participants simply indicating "I don't know" in response to the various questions.

#### *4.6.1 Guide to Project EAs*

Interview participants were asked to describe how well project-based EA's are guided by other regional scale plans. Generally, participants described this link as lacking, citing the large geographic region and fragmented jurisdictions, as well as an inadequate EA process to be

responsible for the shortcomings. Many of the interview participants expressed serious doubt about the EA process to begin with, as one consultant noted: "the majority of development projects done here fall under the radar of EA, [and] the smaller they are the less monitoring that is done." For the EAs that are done, a government representative explained that "the EAs are pretty standardized, but I think there is a pretty big disconnect between these and the regional plans." Another government representative similarly commented that "the individual things are going on independently of the bigger picture," noting that a better job needs to be done in multi-scale, longer-term planning.

Participants explained that the chances for improvement are hindered by the vast and fragmented political geography of the watershed, as discussed in earlier sections. As one consultant put it, "under the Metro Vancouver umbrella, there are so many jurisdictions, and they are not coordinated with regards to participation in environment and sustainability." Further, although the municipalities fall under the regional growth strategies, one ENGO participant explained that the growth strategies are more like guidelines, and the municipalities have varying levels of resources to comply with those guidelines." Regional growth strategies in the watershed are "not linked," described a government participant, and though "there is often an exchange of information...we're not privy to information from other districts unless they make it available."

In spite of these significant deficiencies, two participants emphasized some evolution on the horizon, with one academic noting that the current situation "is going to change very quickly - we're already seeing examples of this in Alberta." A government representative explained that "a new section in the modernized water act that could allow for watershed planning in a geographic region - this would be a step in the right direction."

*4.6.2 Regional Support Provided by Project EA*

Responses to linkages from project-level EAs in support of regional scale plans showed an overall disconnect between the project and regional scales. Interview participants described some instances where these linkages could be found; however, they described a general lack of initiative and weak legislation in the Lower Fraser River Basin to improve these or to formally

establish them. Participants explained that EA practice and its link to the broader picture are insufficiently guided by weak legislation. "There are environmental reviews with the province," explained an ENGO representative, "these are supposed to encompass CEA reviews on a regional basis, but they just haven't really hit the pavement yet." An academic elaborated using hydro dams as an example, explaining: "The energy is clean, and this is how they're sold. But we seem to forget all of the external effects, roadways and such, that are not accounted for in the EAs." "We need stronger legislation if we're going to connect these dots," explained an ENGO participant.

Watershed planning does occur, explained one consultant, often "using baseline data and past EAs, but that's the extent of it; they really fail to make proper links within for long term planning." A government representative similarly noted that "with the large scale projects, like a big hydro dam or large mining operation, you get some larger process attached to them, like an EA or on site monitoring, but I think void is that this information tends to remain in silos...we're missing the linkages."

*4.6.3 Consistency Among Land Use and Watershed Plans*

Responses describing the linkages between land use plans and watershed plans showed, in alignment with previous results, serious inadequacies. Participants attributed problems such as poor legislation and lack of an overall watershed plan as reasons for the meager linkages between these two types of horizontal planning initiatives. But, five interview participants expressed some optimism, noting that the evolution of these types of linkages is beginning.

The most common issued raised by interviewees was the lack of an overall watershed plan, meaning that there is little means to link watershed cumulative effects to land use decisions. A government representative explained: "we don't have too many watershed scale plans; plans tend to exist on their own for different purposes on an individual basis." Another government participant added that "the geographic scope of a lot of these decisions that are made are so limited in the context of the overall watershed scale," with others noting that there are individual plans for specific issues, but "there is no agency that has any reason to legislate one [a watershed

plan]." Plans in place administered by more local jurisdiction were identified as largely ineffective, and they are not enforceable...these are just guidelines for decision makers." The interviewee went on to explain that "if a watershed plan was established, the hardest thing would be getting everyone to buy in: there are so many players in the area, it would have to be legislated by a lead agency...as much as they try to link up to the regional and watershed scale plans, the municipalities tend to operate independently." One ENGO participant felt that "the Lower Fraser boundaries don't really mean anything to anyone; everything is governed by jurisdictional and political boundaries."

Contrarily, five interview participants expressed some level of optimism for the Lower Fraser River Basin. "Yes this is starting," explains one academic, "we can see examples of this in the Okanagan and the Columbia basins...We're starting to look at watershed regions for planning...We're aware here, but we're lacking the leadership." Similarly, a consultant noted that there has been some assemblage of horizontal linkages between land use and larger-scale watershed planning. The example of the ISWMP was raised as a successful case of integration, but it was not at the watershed scale.

### 4.7 Enabling Legislation

The recognition of regulatory or policy-based support for watershed CEA is considered a key aspect for establishing and advancing the capacity to sustain and maintain CEA over the long term. Under this requisite, interview participants were asked to describe the existing regulatory tools in place to support watershed-based CEA, as well as the means available to ensure and regulate the linkages between the project and regional scales.

#### *4.7.1 Legislative Support for Watershed-Based CEA*

Interview participants emphasized the lack of legislation for watershed-based CEA, and expressed concern about environmental legislation in general. Further, participants stressed that in the absence of a lead agency, there is a far lesser chance of establishing a mandate to improve CEA legislation. Firstly, for identifying the watershed scale as the ideal scale for land-use

planning; and, second, to identify more specific and more stringent CEA practices within legislation.

In speaking to the void of legislation, an academic noted that "there isn't any legislative support for this kind of thing in B.C., there is no agency, no comprehensive program, and there's no possibility for enforcement." Environment Canada and the Ministry of the Environment, and their respective policies and regulatory frameworks were noted, but deemed by participants to be inadequate. Participants emphasized the need for better and stricter legislation for environmental management, especially if cumulative effects are to be assessed at the watershed scale. "There is legislation for land use planning," explained a government representative, "but it is most certainly not tied to any watershed boundaries." An academic participant noted: "there is no legislation that delineates or emphasizes the importance of ecological boundaries", rather, as a government representative described, "legislation is tied to the municipal boundaries [and] they are very protective about governance in their regions."

Interview participants were aware of CEA and its significance in making the EA process more meaningful, and did make reference to its presence for doing so in the EA Act of B.C. "I know there are people in the EA office who are more concerned with cumulative effects than others," described a government representative, "but I think the big question is how to approach them." "The provincial EA act does contain provisions for CEA," explained another government representative, "we try to consider cumulative effects in planning, so it's about time that it has been formalized in legislation." The problem, however, as explained by one consultant, is that "EAs are so infrequent, and this is the only formal legislation that takes cumulative effects into consideration." Though having CEA formally legislated is generally deemed a positive step, one government representative said that it is often "so vague, it's ludicrous to think that cumulative effects are actually assessed; there is no direction or parameters for how this is to be done." In reality, "CEA is just another hoop a developer has to jump through to gain approval," explained a consultant, "most of the time cumulative effects are considered negligible because they're not done properly...it's not really even worth doing as it is."

Three interview participants identify another challenge to legislation in support of watershed CEA – that of ground water legislation. As mentioned earlier, participants identified legislation concerning groundwater as inadequate, with one academic participant explaining that in the absence of legislation to support groundwater management, "we're missing 50% of the picture." A consultant reported that "using ground water is a way for many to escape bureaucratic processes of obtaining a license for stream water...so we really have no idea how much is being extracted." A major issue noted by many participants was that with so many users with private wells, there would be significant upheaval about going to strictly regulated practices over night.

*4.7.2 Legislation to Link Projects with Regional CEA*

Interview participants were asked to comment on existing legislation or regulations to ensure a link between the project and regional scales. Participants discussed several vehicles for which this linkage could be carried out; but ultimately the primary handicap identified was the fact that there is nothing legislated, and therefore nothing required. There are several watershed agencies and non-profit groups in the Lower Fraser River Basin, and interview participants stressed their importance in playing a role in collaborative planning; however, as one consultant noted, "without legislation or legislative power, these ENGOs need other agencies to get people to buy in."

A major challenge lies in the there being limited legislative support for both the watershed agencies, as well as legislation to support environmental management from the project up to the watershed scale. An academic explained, "I don't think this link exists; if we don't have any legislation guiding smaller projects, then it's unlikely they would be taken into consideration" at the larger watershed scale. A government representative explained that "this kind of initiative would fall under the respective legislation that the watershed plan answers to, depending on the agency responsible such as forestry, fisheries, transportation, etc." Participants alluded to the importance of these agencies, which each have the power to authorize or prohibit various activities within their jurisdictions, but, as explained by one consultant, "...we're not seeing anything from the big picture." "We've got so many guidelines for land use and planning,"

described another consultant, "but it varies throughout the watershed, and these guidelines are pretty individualistic; there is a real disconnect between guidelines all over the watershed."

### 4.8 Financial Resources

Without question, meaningful watershed-based CEA is a demanding and rigorous process, as demonstrated by the list of previous requisites; and fulfilling these does not come without a price tag. Participants were asked to comment on the extent and sufficiency of financial resources available to support watershed-based cumulative effects assessment. Descriptions throughout the interviews of all other previous requisites indicated that both financial and human resources were extremely scarce for carrying out watershed-based CEA. However, speaking specifically to this subject, participants indicated that in light of severe financial cut backs to the Ministry of Environment over recent years, anything that was not mandated or legislated was subsequently not a priority. Participants emphasized that if it was legislated and mandatory, then stakeholders would adapt to making it happen.

A significant issue that came up throughout the interviews was the extent of government cut backs to support environment. One government representative explained that "the federal and provincial governments used to do a lot more, but they've cut back significantly [now] municipalities are expected to take over but they don't have the resources either." Other stakeholders reported challenges as well. As one consultant explained, "when it comes to environment and research the government doesn't spend near enough money; as a practitioner data is important, and the lack of government interest is alarming, because the private sector is all about money - they're interested in short term only." But, as an academic participant pointed out, it would be difficult to know who would finance such a watershed CEA initiative as "many of the river systems cross one or more jurisdictional boundaries, it would have to be handled by the province."

At the core of financial constraints is the fact that watershed-based CEA is simply not prioritized. "Right now," explained an ENGO representative, "I don't think there's enough, CEA is not totally defined and it's certainly not prioritized." A government representative, however, noted

that "the resources are there, but it's a matter of making [watershed-based CEA] a priority [and] if there were changes to legislation, of course we would have the resources to do it, because it's required." Another government representative agreed, and added that "this type of effort requires broad collaboration if it's going to be at the watershed scale; with more agencies and stakeholders on board, monies can be allocated in a much more efficient manner." At this point, however, as one consultant cautioned, CEA is simply not a priority.

### 4.9 Synthesis

Overall, participants were able to shed light on the current capacity for implementing W-CEA in the Lower Fraser River Basin, and highlighted some important bridges and barriers specific to this watershed. Participants noted some optimism by describing the importance of the existing and largely populated area for supporting such an immense watershed initiative. The overall interest in sustainable development in the area presents a significant advantage towards developing a more integrated and sustainable watershed management plan. More gravely, though, participants emphasized two major barriers to W-CEA: first, the lack of a lead agency for implementing and regulating W-CEA in a region where there are many levels of competing governments; and second, the lack of an overall watershed plan to guide holistic planning process at various levels and scales of development and decision making. Without a lead agency to coordinate the various initiatives in the watershed, the fragmentation of the area is especially felt. In addition, there is a lack of watershed conceptualization, where watershed planners have failed to incorporate the whole watershed into any of the existing watershed planning initiatives. Equally problematic is the presence of project-based EAs, or lack thereof, where individual development decisions are made in isolation of watershed baselines or planning priorities. The resulting effect is several silos in the Lower Fraser River Basin – each of which is individually doing good things, but these individual and isolated initiatives are offset by uncoordinated actions and a disconnect over both spatial and temporal planning, assessment and decision making scales. The results here showed an interesting variety of hurdles to overcome before watershed-based CEA could be implemented.

# Chapter 5

## Discussion

This thesis set out to assess the capacity for implementing and sustaining watershed-based CEA in the Lower Fraser River Basin. This was done firstly by validating the nature of and requisites for CEA in the Lower Fraser River Basin through a key informant focus group; second, by identifying the current capacity for sustaining and maintaining watershed-based CEA through semi-structured interviews; and, finally, by identifying overall lessons emerging in regionalized or watershed-based CEA by contextualizing this research in the overall body of knowledge.

Cumulative effects assessment in the Lower Fraser River Basin, like most of Canada, is seldom done, and when done seldom done well. Environmental assessment in the Lower Fraser River Basin is formally legislated federally under the CEAA, and provincially under the B.C. EA Act. Environmental assessment has been described as the most important legislative tool for managing cumulating environmental effects (Hickey et al., 2010); however, under the current project-based mandate, the potential for an effective assessment of cumulative effects is inherently restrictive (Noble, 2010*b*). A diverse range of activity in the Lower Fraser River Basin means that there is both point source and non-point source pollution stress to water quality and quantity, which requires an integrated and regionalized approach to CEA to better account for the effects to watersheds from such diverse anthropogenic activity (Culp et al., 2000; Schindler & Donahue, 2006). Currently, with lenient regulations, the majority of disturbances to the Lower Fraser River Basin goes undetected and falls under the radar of project-based EA legislation, resulting in cumulative stresses and risks to watershed health. To mitigate risks and stresses to the watershed environment, it has been suggested to expand the scope of CEA to the watershed scale to better assess and manage cumulative effects over space and time (Canter & Ross, 2010; Harriman &Noble, 2008; Dubé et al., 2003).

### 5.1 Requisites for W-CEA in the Lower Fraser River Basin

This research adapted eight requisites for W-CEA, identified initially in the South Saskatchewan Watershed, and validated their relevance to the Lower Fraser River Basin

context using a key-informant focus group. The set of requisites were then applied to the Lower Fraser River Basin, using semi-structured interviews with government representatives, watershed agencies, and other interests, to assess the current capacity, or 'degree of readiness', to implement and sustain a W-CEA based approach. The interviews yielded some very interesting results, shedding light on the current CEA environment in the Lower Fraser River Basin, and the current capacity to implement a watershed-based approach. Results indicate that, at this point, the Lower Fraser River Basin falls short on all eight W-CEA requisites in terms of existing capacity to implement 'meaningful' W-CEA. The requisites were graded on a 'report card (see Table 3),' whereby capacity is identified with a grade of Low, Medium or High. Requisite scores were based on the following criteria, low meaning that there is insignificant evidence to show a presence in the region, or it is already a recognized problem; medium meaning the requisite is not fully developed, or is just in the beginning stages of development, but some evidence of existence is in place; and high meaning there is adequate presence to measure some level of capacity of the requisite.

### *5.1.1 Low Scoring Requisites*

Recognized problems or gaps were identified in several requisites, including lead agency, CEA baselines indicators and thresholds, vertical and horizontal linkages, and enabling legislation (see Table 3). The presence of a lead agency fared poorly, with limited initiatives from a single authoritative body towards directing and guiding CEA at the watershed scale from government agencies, watershed authorities and ENGOs. A kind of lead agency resembling an appointed body for implementing and regulating W-CEA is required to ensure that matters in resource management are addressed holistically, and considered in the decision-making process (Mitchell, 2005). Kennett (2000) supports this, arguing that in order to facilitate adequate CEA, there must be a body or agency with the wide ranging abilities required to influence decision-making towards assessment of cumulative effects beyond the immediate scope of the project level.

Similar to lead agency, the presence of CEA baselines, indicators and thresholds, fared particularly low, with minimal consistency in both activity and methodology across the watershed region. The results showed there to be no regulated practice in the way of steady data

collection for baselines, no standardized use of scientific indicators for watershed health, and no common thresholds to guide development planning and decision making in the watershed. Seitz et al. (2011) have emphasized the importance of these components for W-CEA, and being able to quantify cumulative interactions (e.g., baseline data, watershed threshold and aquatic indicators) is necessary for improving CEA practice in river systems. More specifically, Dubé et al. (2003) emphasize the significance of good baselines for W-CEA, citing baseline data as a requirement to further develop indicators and thresholds for a more integrative CEA practice in river systems. Scientific indicators are then required to monitor the effects of anthropogenic activity on the receiving environment to establish any change in watershed health and productivity (Kilgour et al., 2006). Finally, watershed thresholds are required to establish maximum capacity for development in a watershed, before watershed health and productivity begin to decline, resulting from an unsustainable level of anthropogenic activity (Hegman et al., 1999; Ried 1998).

Comparable to other weakly developed requisites, the watershed also fared low in terms of vertical and horizontal linkages to connect project-specific EAs with broader watershed plans, to ensure linkages across project assessments, and to ensure that broader watershed planning and policy objectives actually influence project-specific development decisions. Such vertical and horizontal linkages are identified in the literature in support of regionalized CEA as core to relating and connecting the project scale with the regional scale to tie in to an overall, regional, or in this case, a watershed scale plan for CEA and management (Gunn & Noble 2009*b*).

### *5.1.2 Moderately Scoring Requisites*

The Lower Fraser River Basin fared better on multi-scaled monitoring, data management and coordination, and financial resources; but there were still noticeable deficiencies within each of these requisites. The results of this research suggest that the types of multi-scaled monitoring and data coordination arrangements needed to sustain W-CEA in the Lower Fraser River Basin are inadequately developed. For example, results showed that while there is minimal monitoring going on at the scale of the individual project level for the purposes of evaluating mitigation effectiveness and licensing/permitting requirements, and, albeit minimal, limited monitoring beyond the project, monitoring efforts are not being coordinated at the watershed scale, and lack

consistency in indicators over both space and time. As Ross (1998), explains, the widest possible scope of data obtained from individual projects and across an entire region is required to properly assess cumulative effects and to develop adequate knowledge for watershed baselines. However, this research also emphasizes the importance of consistency in such data, so as to ensure comparison at different spatial and temporal scales and, thus, to understand cumulative change. Furthermore, it is necessary that data collected from watershed monitoring programs be readily available to watershed stakeholders, which in turn, can better define the effects of activities, both direct and indirect, in the watershed, as well as the capacity of change to the receiving environment for future research and project proponents (Baxter et al., 2001).

Similarly, the state of available financial resources in the Lower Fraser River Basin to support W-CEA fared insufficient. The Lower Fraser River Basin has been subject to several significant cut backs in terms of resources, financial or otherwise, to both provincial and federal environment agencies, and therefore financial support was described as being extremely strained. However, this requisite was graded higher than the poorest, based on the optimism expressed by participants; should W-CEA be made a priority, financial resources could be reallocated to support it. Financial support from a governing agency is considered a necessary tool for implementing adequate legislation, and then enforcing W-CEA and subsequent programs associated with it (Hearne, 2007; Kennett 1999).

### *5.1.3 High Scoring Requisites*

Multi-stakeholder collaboration is the sole requisite to receive an 'acceptable' grade, from the results shown. While it is still in need of some improvement, it was evident that there are some significant programs in the Lower Fraser River Basin to facilitate this kind of collaboration across the watershed. Such collaboration is important for integrating all stakeholders in the watershed to participate in the decision making process; and that the decision making process is one that facilitates longevity in watershed resources (Bartra, 2007), and that stakeholder involvement is considered a key element to a watershed approach (Borre et al., 2001). However, because such collaboration is often 'informal', it lacks any real influence on the decision-making processes about development activities in the Lower Fraser River Basin. This may, in large part,

**Table 4. Report card on the capacity for W-CEA in the Lower Fraser River Basin**

| Requisite | Grade | Explanation |
|---|---|---|
| 1. Lead Agency | L | • There is no single appointed and/or recognized body responsible for regulating and enforcing W-CEA |
| 2. Multi-Stakeholder Collaboration<br>i.) Stakeholder collaboration | H | • There are attempted efforts to coordinate stakeholders, but this is unlegislated, and therefore inconsistent and lacks efficacy for the decision making process |
| ii.) Definition of roles | H | • Roles are well defined, but stakeholders are not coordinated |
| 3. CEA Baselines, Indicators, Thresholds<br>i.) Baseline data set | L | • Baseline data is lacking, and not widely available |
| ii.) Scientific indicators | L | • Scientific indicators for cumulative effects are piecemeal and not agreed upon |
| iii.) Monitoring indicators | L | • Monitoring indicators are inconsistent and unregulated |
| iv.) Watershed thresholds | L | • Thresholds exist primarily in the literature, but not used to guide watershed plans |
| 4. Multi-Scaled Monitoring<br>i.) Monitoring requirements | M | • Required for EAs, but not well regulated after project completion |
| ii.) Broad-scale monitoring | M | • Watershed-scale monitoring is limited at best; when done it is usually done at the scale of the regional districts, not the watershed, and not linked to project EA |
| 5. Data Management and Coordination<br>i.) Data accessibility | M | • Data is not easily accessible to stakeholders, and there is no centralized data base |
| ii.) Adequate technical capacity | M | • Technical capacity is not an issue, but the ability and capacity to use it with available resources is problematic |
| 6. Vertical and Horizontal Linkages<br>i.) Connecting project EA with watershed plans | L | • Area is too fragmented, legislation for regional development is weak and there is no watershed plan (applies to all linkages) |
| ii.) Influence of project EAs on watershed plans | L | • Area is void of long term planning and results of EAs remain disconnected from regional planning |
| iii.) Influence of watershed plans on project EAs | L | • Lacking an overall watershed plan to guide project development decisions |

| Requisite | Grade | Explanation |
|---|---|---|
| 7. Enabling Legislation<br>i.) Is there regulatory support for W-CEA | L | • Currently no legislation to support the needs of W-CEA, and this is unlikely to change without a lead agency. |
| ii.) Is there regulatory support to connect watershed plans to project EAs | L | • No legislation to connect watershed plans and project EAs; limited guidelines do exist, but they are restricted in their scale and mandate |
| 8. Financial Resources | M | • W-CEA is not a current government priority and the required monitoring and planning programs to support it are not funded; resources do exist, and could be reallocated should priorities change |

Legend: High (H) = clear evidence of capacity present; Moderate (M) = some evidence, but not fully developed or just beginning to develop; Low (L) = recognized problem/gap or no evidence/ non-existent

be a function of two things: first, the lack of a lead agency; second, the lack of supporting legislation to implement W-CEA. For example, Mitchell (2005) argues, where there is no lead agency to facilitate a required, and integrative program for watershed collaboration, there lacks meaningful support for a 'true' watershed scale plan. Further, Cortner & Moote (1995) maintain the importance of establishing legislation to support changing or evolving agendas, such as W-CEA and subsequent stakeholder collaboration, in order to make strides in achievement.

## 5.2. Recommendations for Advancing W-CEA in the Lower Fraser River Basin

The Lower Fraser River Basin has a long way to go before having all of the necessary requisites to implement and sustain W-CEA, and there are several challenges to overcome. First, W-CEA must be recognized as an integral component of development planning and environmental management frameworks in the watershed. This means that W-CEA, as an integrative program, cannot be simply guided by an add-on process to project specific EA. For W-CEA to achieve its full potential as a tool to guide sustainable watershed management, there needs to be an integration of existing silos within the Lower Fraser River Basin (see Noble & Harriman, 2009). Several concepts to integrate silos in watershed management pose a seemingly complicated network of options for regional scale management; however, as Harriman & Noble (2008) have put it, this is simply just a "one concept-multiple forms" situation, where progression in

implementing more integrative management systems is hindered by failing to integrate similar concepts of one idea.

Second, a lead agency must be established and then recognized and supported by watershed stakeholders as the authority to enforce and regulate W-CEA activities, including watershed-based monitoring, setting standards and thresholds, and contributing to the development of project-specific terms of reference for EAs (Noble, 2010*b*). Currently, the Lower Fraser River Basin is especially fragmented, with approximately 25 municipalities and two regional districts, all of which are not necessarily guided by a broad scale plan, but take a principal role in the decision-making process. This fragmentation was especially expressed as problematic in the existence and development of the eight requisites. In spite of the current, fragmented state in the Lower Fraser River Basin, there have been several efforts at initiating more broad scale management, suggesting there is recognition of the importance of broadening the scope of decision-making. Some of these past initiatives include the inception of groups such as the FBC, FREMP, and the Fraser River Action Plan (FRAP); all of which intended to improve the environmental health of the Fraser River, but have not fully succeeded (Calibick et al., 2004).

Establishing and mandating a lead agency to regulate W-CEA will be a key step to ensure that W-CEA is done in a meaningful and effective way over the long term. Based on results from this research and the political geography of the area, the most effective governing agency would likely be at the provincial level. The provincial government is responsible for the management of natural resources and holds a higher regulatory authority than municipal and regional governments. A provincial-level lead agency would be positioned to implement and regulate the regional scale assessment and management of cumulative effects, with the multi-stakeholder engagement of more sub-regional watershed agencies that would be primarily endorsed and coordinated by more local regional and municipal governments.

Finally, upon acknowledgement of W-CEA as the primary guide for watershed management and planning, and identification of a lead agency, there must be the inception of adequate legislation to enable implementing and sustaining W-CEA over the long term. In other words, legislative support is needed in order to ensure that monitoring occurs at both the watershed and project-

specific scales. In particular, there must be a supporting legislative framework to be able to require and enforce monitoring and reporting activities (Hays & Morrison-Saunders, 2007); to establish monitoring protocols and set terms of reference so as to ensure consistency in W-CEA indicators across project EAs; and to issue penalty for non-compliance (Noble, 2010*b*). Although CEA is currently legislated under both the CEAA and the BC EA Act; the legislation is effectively superficial, suggesting that cumulative effects must merely be considered, and then only for individual projects. Without more rigorous and detailed guidelines within the legislation, CEA will continue to be sub-par, falling short of its true potential as a tool for environmental management. Legislation would provide detailed procedural guidance for goals and standards for development and watershed health over space and time. Furthermore, legislation would provide the lead agency with the authority needed to implement and regulate W-CEA and monitoring and reporting programs throughout the region.

Once W-CEA is recognized as integral to land use planning and development decision making, a lead agency is mandated to regulate it, and supporting legislation enacted, further development of the W-CEA requisites will be possible. Figure 2 attempts to capture, schematically, the road towards implementing W-CEA for long-term, sustainable watershed management. With the power and mandate, a lead agency will have the resources to establish a regional, watershed-scale plan, coordinate stakeholders, make watershed monitoring more efficient, establish a centralized database, and coordinate watershed linkages. As previous chapters have highlighted, there currently exists some monitoring in the Lower Fraser River Basin, there are current databases, there are some regional plans, and there is some level of stakeholder collaboration. But, at this point, these efforts have been largely ineffective for adequate watershed management. W-CEA, then, is potentially a useful tool for initiating more effective endeavors towards better, overall results.

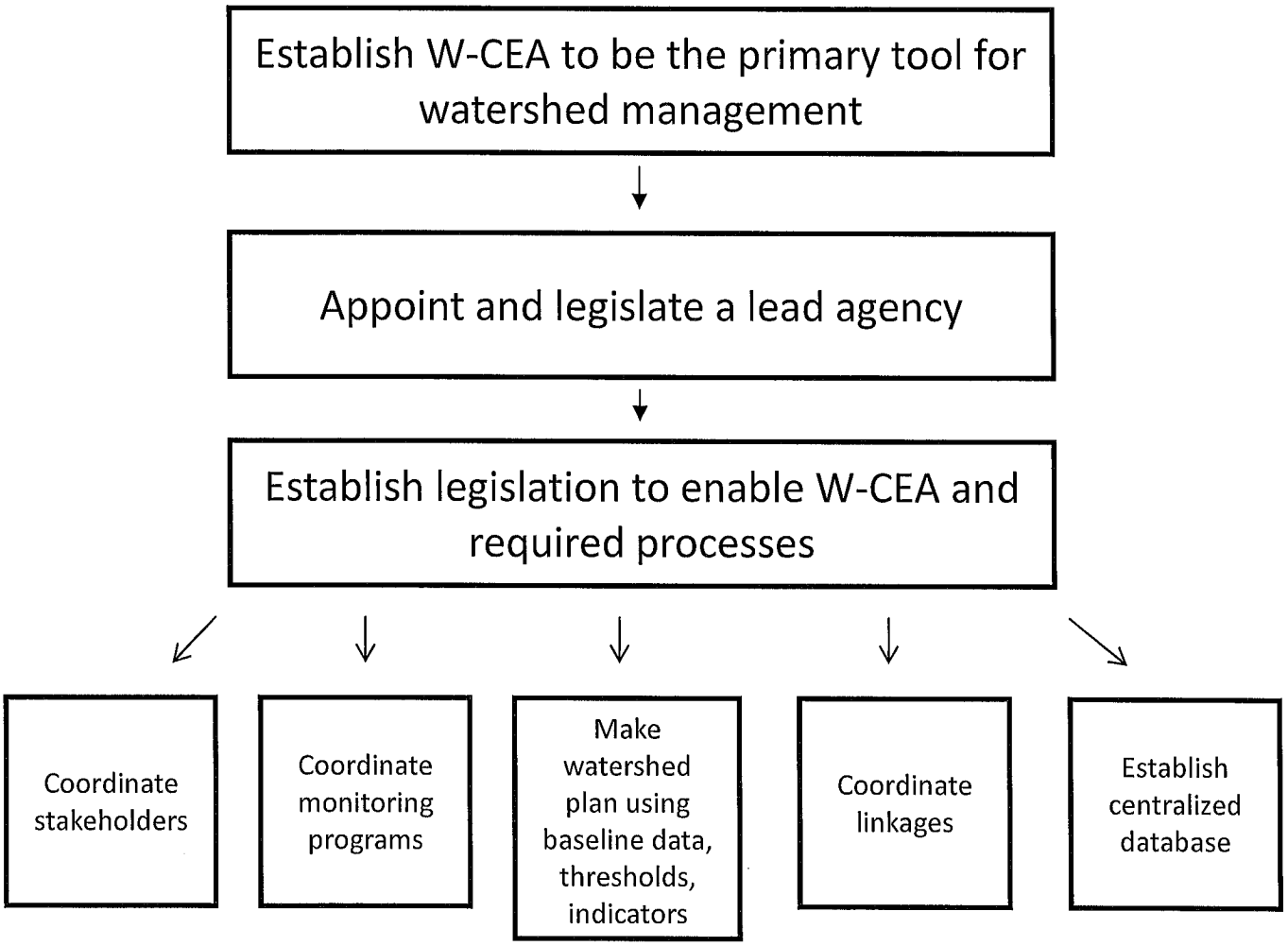


**Figure 2. Schematic diagram for improvements to capacity in the Lower Fraser River Basin for implementing W-CEA**

# Chapter 6

# Conclusion

The Lower Fraser River Basin is an area where methods in watershed management up to this point have been essentially ineffective in regulating development, while simultaneously maintaining watershed heath; a circumstance felt in many of Canada's watersheds. This research identified and validated eight requisites, presented by Sheelanere (2010), as key towards building and establishing a strong basis for W-CEA.

## *6.1 Lessons in W-CEA*

At the most basic level, the results of this research show that each of these requisites is in need of improvement, and that each of these is important towards achieving W-CEA. More specifically, the results of this research identify a hierarchy of importance among these requisites towards establishing and implementing a meaningful framework for W-CEA. As discussed above, results emphasize the importance of overarching regulatory support and a lead agency for W-CEA. Development of these two requisites, once W-CEA is recognized as a valuable tool for watershed-based planning and management, will give way to advancing subsequent requisites.

In addition to identifying a requisite hierarchy for W-CEA, this research further confirms the dire state of management in the Lower Fraser River Basin at the watershed scale; and highlights the shortcomings in CEA practice in the area. Schindler (2006) has argued that water quality and quantity in Canada's western watersheds are under threat, and the project-by-project approach to development planning is largely ineffective. Results from the Lower Fraser River Basin seem to confirm this. Environmental assessment has been considered, thus far, the most meaningful approach to assessing and managing cumulative effects but, at this point, as the declining state of the watershed illustrates, it has not been all that effective. Duinker & Greig (2006) have gone so far as to say CEA in its current state does more harm than good, meaning that there needs to be significant strides towards improving CEA practice, or get rid of it all together. As it stands, CEA is a potentially costly endeavor for project proponents, possibly deterring development and

economic activity, at the same time, not having any significant impact on actually capturing 'true' cumulative effects of a project.

Although the problems associated with current CEA practices are well documented, there has been much less attention on what is needed to move forward to an improved state of practice. It is here where this research makes an additional contribution, by focusing on the needs and requirements to do 'good' CEA at the watershed scale. By validating the necessary requisites for W-CEA, and then testing the capacity for implementing it in a watershed full of activity, this research then, provides guidance on improving CEA at the watershed scale, not just as a tool for the EA process, but also as a holistic framework for watershed management.

*6.2 Limitations of this Research*

This research has provided viable results and a valuable contribution to the growing body of knowledge and the evolving field of CEA; however this endeavor is not without limitations. The Lower Fraser River Basin, being so geographically vast, encompasses a very wide range of stakeholders. While this research does capture a broad range of stakeholders and their subsequent interests, the list of interviewees fell short of what was intended. Efforts to secure some or more representation from certain groups, such as First Nations and Industry, might have provided alternative results than presented here.

In addition to a lack of stakeholder representation as a limitation, is the division of the Lower Fraser River Basin, a sub-basin, from the Fraser River Basin as a whole as a defined boundary for W-CEA. While much of the activity that goes on in the Fraser River Basin occurs in the Lower Fraser River basin, and for the purposes of this research it was the appropriate scale for a project of this nature, it is notable that the upstream activities of the Fraser River Basin affect the environment of the Lower Fraser River Basin, but are not taken into consideration when speaking of W-CEA within the boundaries of the Lower Fraser River Basin.

*6.3 Further Research*

This research set out to identify the existing capacity for implementing W-CEA in the Lower Fraser River Basin. Results offer only an approximate measure to gauge the capacity for W-CEA in the Lower Fraser River Basin, giving way to several future opportunities for research. Further research is needed to expand the knowledge of capacity in the Lower Fraser River Basin and, more specifically, there is a need to develop more explicative criteria for each of the individual components of capacity, the eight requisites, as provided in the work of Sheelanere (2010), in order to provide more concrete clarification in terms of their role and importance in implementing and sustaining W-CEA. Pres (2008), for example, emphasizes the nature and challenges of capacity building for water resources management, and the subsequent necessity for establishing a strong foundation of understanding in capacity requirements for, in this case, W-CEA. Especially for the case of providing a flexible framework that can be universally applied and contextualized to within a particular region.

W-CEA, and the requisites for implementing it, provide a means as an adaptive framework for water management to accommodate change in environment over space and time. These requisites are building blocks to establishing capacity for W-CEA. Resulting understanding of capacity requirements for W-CEA could then support more widespread implementation of W-CEA in more of Canada's watersheds. Further research is also required to better integrate both the management and scientific aspects of W-CEA in water policy. Since both of these aspects are key to understanding and implementing W-CEA, it is necessary to better understand both. Amalgamating these two silos will afford the opportunity for each to progress holistically, rather than the status quo, where the science is more developed than the requirements for management of W-CEA.

Additionally, there is also a gap in quantitative knowledge behind W-CEA, where more research is needed to better understand the biophysical environment of cumulative effects in an aquatic environment. Seitz et al. (2011) have argued this point, emphasizing that the current practice lacks a sound scientific basis, and therefore lacks in overall efficacy in assessing the impacts of

cumulative change to a watershed. Establishment of scientific baselines, indicators and thresholds in the watershed would facilitate better enforcement and adherence to the true capacity of the natural environment. Finally, and more broadly speaking, more analysis is required to determine where CEA fits within the realm of EA. CEA has fallen under scrutiny in recent years (see Duinker & Greig, 2006), and a primary criticism is its inadequate and vague mandate under the umbrella of EA. Further research is required to identify the overall benefits and challenges to reside CEA legislation within the realm of EA.

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APPENDIX A1

FOCUS GROUP DISCUSSION QUESTIONS

| | **Focus Group Discussion Questions** |
|---|---|
| 1. | Are the requisites/principles complete in terms of what is required to implement and sustain a framework/system for assessing and managing cumulative effects assessment at a watershed scale? If not, what's missing. |
| 2. | If one is assessing the capacity to deliver and implement W-CEA, are there other types of capacity issues or needs that are important to look for or to consider? |
| 3. | Are there any issues that are specific to the _____ watershed context? |
| 4. | Are you aware of any CEA-type initiatives being conducted in this watershed? |
| 5. | Are these requisites/ principles complementary to any existing regional land use plans? (i.e. are there specific plans or programs that I should be looking to?) |
| 6. | What do you see as the most significant challenges/ or opportunities to WCEA? |
| 7. | Who are some of the key people or agencies that I should be talking to? |

APPENDIX A2

THEMES FOR SEMI-STRUCTURED INTERVIEWS

| Requisites | Interview Questions |
|---|---|
| **1. Lead Agency**<br><br>Assessing and managing watershed cumulative effects require a lead agency with the authority, the mandate and the capacity to do so. This means guiding monitoring programs, and having some influence over decision about land use and project development in a watershed. | 1. Is there a lead agency, ministry, or institutional structure in the watershed or province mandated to coordinate development activities at a watershed scale?<br>a. If no, is there anything that approximates such a structure? Is there adequate capacity? Is there potential/perceived need to expand?<br>b. If yes, does this organization have the adequate capacity to coordinate watershed scale programs and initiatives required for WCEA? |
| **2. Multi Stakeholder Collaboration**<br><br>Watershed CEA also requires that the roles and responsibilities of various stakeholders are well defined and represented in impact assessment and decision making about development in the watershed. | 2. At the watershed scale, is there a mechanism or forum for facilitating multi-stakeholder collaboration, such as a stakeholder panel, committee, or council, in watershed planning, monitoring, making decisions about development, etc.?<br><br>3. Are the roles of government, watershed agencies, and project developers clearly defined in terms of managing impacts to the watershed and in making decisions about development in the watershed and water use? |
| **3. CEA baselines, Indicators and Thresholds**<br><br>There is also an important science side to doing good watershed CEA. The current state of the watershed needs to be know, and agreed upon indicators are needed for impact assessment and monitoring purposes. | 4. Is there a formal and accessible data set that provides a baseline on such things as surface and ground water quantity, quality and usage, as well as on various land uses affecting water resources?<br><br>5. Are there common science-based indicators for assessing the cumulative effects on the landscape or to water resources at the watershed scale?<br><br>6. Are there standard monitoring indicators or requirements across project EA?<br><br>7. Are there thresholds for development in the watershed or maximum allowable effects levels established for various water quality parameters? |
| **4. Multi-Scaled Monitoring** | 8. Is monitoring required in project EAs or for certain |

| | |
|---|---|
| Monitoring is of course essentical to understanding and managing cumulative effects, and should be done at both the project and the watershed scale. | developments? Is it being done?<br><br>9. Are there monitoring programs operating at the broader watershed scale?<br>a. If yes, do they include landscape as well as aquatic monitoring?<br>b. If no, is the monitoring done for projects compatible with what is being collected at the watershed scale? |
| **5. Data Management and Coordination**<br><br>When monitoring is done, it is important that there be some mechanism in place to share that data and make it available | 10. For those data that are collected in the watershed, is it accessible to all watershed stakeholders?<br><br>11.Is there adequate technical capacity for data capture, management and sharing? |
| **6. Vertical and Horizontal Linkages**<br><br>Effective watershed CEA requires that there is linkage between watershed and project-based initiatives. | 12. Are project based EAs guided by other regional or watershed-scale plans and policies?<br><br>13. Are the results of project-based EAs and monitoring used in any way to support broader watershed initiatives?<br><br>14. Are other land use and water policy plans and programs consistent with broader watershed scale plans? |
| **7. Enabling Legislation**<br><br>Regardless of the data and the linkages, there must be some means to implement watershed-CEA type initiatives. | 15. Does there exist legislation or any regulatory or policy-based support for CEA initiatives at the watershed scale?<br><br>16. Is there any means to ensure that the results of watershed-based programs are implemented at the individual project level? |
| **8. Financial Resources**<br><br>None of this is possible without the financial resources to support it over the long term. | 17. Currently, in this watershed, does there exist sufficient resources to initiate and sustain the types of broad scale and long-term initiatives required to support watershed-based CEA? |
| **Final Question** | 18. What are the most significant barriers and bridges to sustaining watershed CEA over the long term? |

APPENDIX B

INTRODUCTION PACKAGE FOR INTERVIEWEES: INTRODUCTION LETTER, CONSENT FORM AND INTERVIEW THEMES

UNIVERSITY OF SASKATCHEWAN

Dear Ted Van Der Gulik:

My name is Steph Kristensen, and I am a Master's student at the University of Saskatchewan. As part of my thesis, I am working on a project titled 'Watershed cumulative effects assessment and management.' This project is led by Drs. Bram Noble and Robert Patrick, Department of Geography and Planning, University of Saskatchewan. I am writing to request your participation in this research project.

By way of background, cumulative effects are effects of an additive, interactive, or synergistic nature, caused by often individually minor, but collectively significant actions that accumulate over space and time. The need to better assess and manage cumulative effects on Canada's watersheds is well argued, but there are constant and consistent messages that Cumulative Effects Assessment and Management (CEAM) in its current form is simply not working.

This research will attempt to identify the institutional arrangements and capacity-building requirements necessary to develop and support watershed-based CEAM. The research is guided by four objectives: i) to describe the current institutional environment, regulatory and non-regulatory, for CEAM in Canadian watersheds; ii) to identify the necessary institutional and capacity requirements to do 'good' watershed-based CEAM; iii) to evaluate the current state of institutional arrangements and capacity to effectively implement and sustain watershed-based CEAM; iv) to derive lessons across watersheds to advance knowledge and understanding of best-practices. This research will occur in four Canadian watersheds: Lower Fraser, BC; South Saskatchewan, SK and AB; Athabasca, AB; Grand River, ON. The research is funded by the Social Sciences and Humanities Research Council of Canada.

Specifically, I am working on objective (iii) of this study as part of my Masters thesis, and I am inviting you to participate in a semi-structured interview. You were identified as a potential participant based on your organization's involvement/ interest in watershed management and/ or cumulative effects assessment, or your contact information was provided by other study participants. You need not be an expert in cumulative effects assessment. Rather, I am interested in your views about the current capacity to implement and sustain a framework for watershed CEAM in the Lower Fraser River Basin.

I am attaching a standard University of Saskatchewan 'participant consent form' for your review. I will follow-up with you via telephone in the upcoming days to determine your interest in participating in this research, to schedule an interview and a time and location of your

convenience, and to send you in advance a list of discussion topics for the interview. Meanwhile, should you have any questions, please do not hesitate to contact me at 250-870-8286 (slk86@hotmail.com), or the project's lead researcher, Dr. Bram Noble, at 306-966-1899 (b.noble@usask.ca).

Sincerely,

Steph Kristensen

UNIVERSITY OF SASKATCHEWAN

## PARTICIPANT CONSENT FORM

**"Watershed cumulative effects assessment and management"**

Please read this letter carefully, and feel free to ask any questions you might have. I will review this information with you at the time of the interview.

**Researchers:** Dr. Bram Noble, Department of Geography and Planning, University of Saskatchewan, Saskatoon, SK, S7N 5A5, Tel: 306-966-1899, E-mail: b.noble@usask.ca

Dr. Robert Patrick, Department of Geography and Planning, University of Saskatchewan, Saskatoon, SK, S7N 5A5, Tel: 306-966-6653, E-mail: robert.patrick@usask.ca

**Student:** _____, University of Saskatchewan, SK, E-mail: _____

**Purpose and Procedure:**The purpose of this research is to evaluate the current institutional arrangements and capacity-building requirements to implement and sustain watershed-based CEAM. To achieve this, in part, you are invited to participate in an interview to discuss you views on the current capacity to assess and manage cumulative environmental effects in the _____ watershed beyond the scope and scale of the individual project, at the watershed scale.

The interview will take approximately 1 to 1½ hours, and will be audio taped so as to facilitate data analysis. Similar interviews are taking place with government representatives, watershed agencies, project proponents, and academic/ scientific experts across three other Canadian watersheds. Results of the interviews will be aggregated and used to evaluate the current capacity in Canada's watersheds to advance cumulative effects assessment and management from the project to the watershed scale. Overall, this study will contribute to a greater understanding of the institutional arrangements necessary to develop and support a more watershed-based approach to cumulative effects assessment and management and, to that end, may be of benefit to your organization when planning, regulating, or assessing the implications of development activities.

**Potential Risks:** There are no personal risks to participating in this study. Your affiliation, but not your name, may be identified in research reports in order to lend credibility to the research. Given the limited number of participants in each watershed, it may be possible to identify specific individuals based solely on organizational affiliation. However, you are being asked to provide your professional judgment and, as such, there is minimal personal risk. All data collected for this study will be reported in aggregate form only. Individual responses will not be revealed.

**Potential Benefits:** There are no direct benefits to you personally to participating in this study. The results will be used as part of a graduate thesis in the Department of Geography and Planning, and shared with various provincial and federal agencies, industries, and academics in order to advance institutional arrangements in support of watershed-based CEA.

**Storage of Data:** Interview tapes, notes and transcriptions will be stored temporarily on a hard drive (dedicated solely to this study) in the office of the lead researcher, and in the long term on CDs in a locked cabinet of the lead researcher for a minimum of five years and until all publications, conference papers, and research theses have been produced and disseminated. The lead researcher will be responsible for all data storage and management. The lead researchers will have access to all data.

**Confidentiality:** The information you provide to this study will be aggregated with information provided by other participants in this watershed and in three other watersheds, and used as the basis of discussion for a focus group to develop a normative model for watershed cumulative effects assessment. In addition, the information will be used to produce reports for publication in scientific journals and may be presented at conferences and workshops/meetings. Your personal identity will be kept confidential at all times. You will be identified only by your position or professional affiliation (e.g. 'organization x'). However, because the participants for this study have been selected from a relatively small group of people, some of whom may be known to each other, it is possible that you may be identifiable to other people on the basis of the information you provide. In other words, only aggregate data will be presented in the research results, but confidentiality of your involvement as a participant is this study cannot be guaranteed. If, within 30 days following completion of your interview, you have any second thoughts about your responses, you can contact me or one of the lead researchers, who will immediately remove your information from the data set and provide you with an opportunity to review your responses to determine whether you would like to withdraw it from the research. After 30 days, it is likely that some form of research dissemination will already have occurred.

**Right to Withdraw:** Your participation is voluntary, andyou may withdraw from the study for any reason, at any time, without penalty of any sort, up to 30 days following completion of the interview. You may also refuse to answer specific questions. If you withdraw from the research project, any information that you have contributed will be destroyed or returned at your request. Before and after your interview, you will be reminded of your right to withdraw.

**Questions:**If you have any questions concerning the study, please feel free to ask at any point. You are also free to contact me or one of the lead researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on 15 June 2009. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (306 966-2084). Out of town participants may call collect. When the study is complete, all participants will receive a short report that outlines significant research findings.

**Consent to Participate:** I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered

satisfactorily. I consent to participate in the study described above; understanding that I may withdraw this consent under the terms outlined above.

| | |
|---|---|
| (Name of the participant) | Date |
| (Signature of the participant) | Signature of Research student |

UNIVERSITY OF SASKATCHEWAN

**Requisites for Watershed Cumulative Effects Assessment**
**- Themes for Discussion -**

Please find below a number of themes to guide our discussion. These themes are proposed as 'requisites for watershed cumulative effects assessment' (WCEA). They were compiled based on experience with WCEA elsewhere, based on the academic literature, and were reviewed by various experts in the field. Our discussion will focus on the extent to which these characteristics or factors are present in your watershed, so as to understand the 'degree of readiness' to advance WCEA and the needed capacity building to do so.

**1. Lead agency**

- Assessing and managing watershed cumulative effects requires a lead agency with the authority, the mandate, and the capacity to do so. This means guiding monitoring programs, and having some influence over decisions about land use and project development in a watershed.

**2. Multi stakeholder collaboration**

- Watershed CEA also requires that the roles and responsibilities of various stakeholders are well defined and represented in impact assessment and decision making about development in the watershed.

**3. CEA baselines, indicators and thresholds**

- There is an important science side to doing good WCEA. The current state of the watershed needs to be known, and agreed upon indicators are needed for impact assessment and monitoring purposes.

**4. Multi-scaled monitoring**

- Monitoring is essential to understanding and managing cumulative effects, and should be done at both the project and the watershed scale.

**5. Data management and coordination**

- When monitoring is done, it is important that there be some mechanism in place to share that data and make it available to end users.

**6. Vertical and horizontal linkages**

- Effective WCEA requires linkages between watershed and project-based assessment, monitoring and decision-making initiatives.

**7. Enabling legislation**

- There must be some means to implement WCEA type initiatives, and ensure influence over development decisions.

**8. Financial resources**

- Sufficient financial and human resources must be available to implement and sustain, over the long term, WCEA programs and requirements (e.g. monitoring programs, landscape modeling, reporting, communication, data management and coordination)