COMMUNITY-BASED WATER MONITORING: BRIDGING CITIZENS AND DECISION-MAKERS

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ABSTRACT

Community-based water monitoring (CBWM) is an activity that can bridge citizens with decision-makers in a partnership of shared responsibility for planning and managing a sustainable water system. Water quality and quantity is critical to every aspect of life. Citizen groups in the Canadian Columbia Basin, British Columbia, are actively gathering water data monitoring the health of local rivers and streams. As their knowledge increases citizens can be involved in meaningful dialogue and government decisions regarding their future.

This explanatory case study interviews eight community-based water groups and sixteen decision makers to examine how citizen-generated data might be utilized when planning and managing for water sustainability in the Basin. The findings of this study are directed at members of the Columbia Basin Watershed Network, made up of twenty-three community-based water groups, agencies and individuals. Specific recommendations are made from the research findings to increase the legitimacy and quality of community-based water science, methods for sharing data collected through improved communication, and suggested strategies for collaboration that strengthen relationships between community members and decision makers inside and outside the Network.

ACKNOWLEDGEMENTS

DEDICATION

I dedicate this thesis to all of the people in the Columbia Basin who work tirelessly to ensure a healthy environment for today and future generations.

Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has. Margaret Mead, Culture and Commitment

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LIST OF ACRONYMS AND ABBREVIATIONS

CABIN   Canadian Aquatic Biomonitoring Network

CBM   Community Based Monitoring

CBT   Columbia Basin Trust

CBW   Columbia Basin Water

CBWM   Community-based Water Monitoring

CPRN   Canadian Policy Research Network

EMAN   Ecological Monitoring and Assessment Network

Network   The Columbia Basin Watershed Network

NGO   Non-government organization

SHIM   Sensitive Habitat Inventory and Mapping

UBC   University of British Columbia

WQMP   Water Quality Monitoring Project

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MAKERS

CHAPTER 1 INTRODUCTION

Water is life. We are born from water and require this elixir daily to sustain our largely

aquatic structure. Water on Earth sustains all life, not only humans. As our population increases,

there is unparalleled demand on water to meet our needs and wants, usually at the expense of the

survival of other living things. As demand grows, humans are faced with the reality that water is

a limited resource demanded by an ever-increasing population and their impacts on the

environment. Society has reached a crisis point; how are we going to supply our growing

demands, use it effectively and efficiently, without compromising the quality and quantity of the

environment for future generations? The answer to this question lies not in understanding the

science of water, but through wrestling with the human context of planning and managing for

water sustainability. Ultimately to solve a problem created by people will require unprecedented

levels of public participation and public dialogue.

My interest in this subject was peaked by attending a Water Quality Monitoring

Workshop hosted by the Columbia Basin Watershed Network (hereafter called "the Network") in

the fall of 2006. As an environmental educator with twenty-five years experience I recognized

that the individuals attending this workshop represented model citizens actively engaged in

environmental citizenship for water. To date, my entire career as an educator and community

facilitator has been dedicated to inspiring citizens to move up the ladder rungs from non-

participative citizens to full involvement as citizens who demonstrate active care for the

environment. At the same time as I was inspired, I wondered what happens when citizens'

knowledge and understanding, attitudes, skills and action lead them to the top of the

environmental citizenship ladder. What then? The view from the top of any ladder can be a very

scary place and few are brave enough to risk staying up there for long.

Members of the Network are embarking on the challenging journey of the Water Quality

Monitoring Project (WQMP), an innovative three-year water quality-monitoring pilot project in

partnership with the Columbia Basin Trust, and federal and provincial agencies. These

watershed groups are forging the pathway for citizens to better understand their watersheds and

use this knowledge to take a more active role in the decision making process to ensure water

sustainability in the Columbia Basin. What was unclear was how do decision makers perceive

the efforts of these community-based water groups; are they valued, appreciated or respected? Is

there interest in sharing information between community and decision makers and a willingness

to collaborate on decision-making? If so, where are the entry points in the water governance

process for citizens to participate effectively?

That weekend workshop provoked an analogy. Rather than the ladder rungs of

environmental citizenship climbing vertically, perhaps citizens could place the ladder

horizontally, spanning the proverbial waters of the Columbia Basin with the purpose of

providing a passage or conduit for transfer of knowledge/information, making collaborative

decisions and sharing power with the decision makers on the sometimes distant shore.

Transformed into a bridge and shored up by strengthening legitimacy, trust and communication,

the heavy weight and burden of planning and managing for a sustainable water future could be

connected and shared, and through proper engineering, bring together the citizens and decision

makers, under which sustainable waters might flow. The bridge is a metaphor for building a

foundation for trust, which might start out shaky but if it is relevant and meaningful strengthened

by integrity and commitment, community-based water monitoring might be one of the many solutions necessary for water sustainability.

This thesis is about building bridges connecting citizens and decision makers under which sustainable waters flow. Now flowing, Chapter 2 provides a context for discussing community-based water monitoring and begins to answer the question "how might decision makers in the Canadian Columbia Basin use citizen generated data when planning and managing for a sustainable water future"? The beginning of this chapter explores our human connection to water and the issues facing this natural resource. Fundamental to this connection is why citizens care about water sustainability, what is it and what paradigm shift is required to achieve this vision.

Chapter 2 then navigates the rough waters and rapid turbulence of water governance addressing 'who' and 'how' decisions are made about water and where there might be entry points for citizens gathering data to participate in a meaningful dialogue about the future of our water. As citizens collect data about water, they develop an understanding of what is required to achieve water sustainable development. What happens when their local and regional ecological literacy, in some cases, can be equal to or greater than decision makers and the scientific community, and how does this knowledge impact planning and management of water? The chapter concludes with an examination of how decision makers might use citizen gathered water data and where community-based water monitoring program fits into a framework of shared governance with regards to water. When is it appropriate to use citizen data, what are the benefits and risks of using citizen-generated data and where might it be most useful in the process of local and regional water governance?

Chapter 3 describes the research methodology used to scrutinize this topic, the explanatory case study. Chapter 4 then presents the results of the interviews with eight community-based water groups and sixteen water decision makers organized into themes. Six themes emerged describing perspectives on water sustainability, existing relationships, examples of collaboration and partnerships, water planning and management perspectives, monitoring and reporting activities and views on the current water decision making processes. Looking for similarities and differences, I compare and contrast the responses of the citizens and the decision makers. Chapter 5 makes recommendations for how decision makers might use community-based water monitoring as an integral component of sustainable water development in the Columbia Basin. Reflecting on the original thesis question, this final chapter offers a summary on the success of the research project, lessons learned and considerations for future research.

Water is our most precious natural resource. Rachel Carson (1962), in her seminal book, *Silent Spring*, observed that North Americans were "in an age when man has forgotten his origins and is blind even to his most essential needs for survival, water along with other resources has become the victim of his indifference". Nearly fifty years later a group of citizens and decision makers are taking decisive action to reverse this indifference to such a basic and essential resource in the Columbia Basin. They both recognize that water is valuable to the ecological, social and economic well being of residents and the health of ecosystems. Grassroots participation in monitoring water quality and quantity may be a catalyst for the necessary social change to stimulate both individual and community leadership in sustainable water development.

CHAPTER 2 CONTEXT FOR RESEARCH

The first section of this chapter discusses the issues facing water, substantiating why people are interested in water sustainability and the principles needed to achieve a vision of protecting our water supply while reducing demand on a limited resource, all the while conserving the ecological system. Section two addresses water governance, in particular how water has been managed and who the decision makers are. Section three looks at a proposed new water governance model that increases community access to information about the water resource, facilitating an opportunity for community water monitoring and civic participation in the decision making process.

2.1 Water Sustainability

This section discusses the issues facing water resources globally, nationally, and in British Columbia, specifically the Columbia Basin. Understanding and awareness of these issues stress the importance of water planning and management to balance supply and demand by humans, while ensuring water is available to meet ecosystem needs. Appreciating the limits of this natural resource is a key motivator for citizen water monitoring involvement. Participation in a water sustainable future requires citizens understand the hydrological cycle, water sustainability and the necessary principles that will navigate us through the rough waves toward a desired, calmer sustainable future.

2.1.1 The Global Water Dilemma

Although our planet is nearly three quarters water, this natural resource is one of the limiting factors for life, given only 2.8 percent of it is fresh (Project Wet, 1998). Of this small

percentage, less than one percent is available as fresh water, stored on the surface in lakes and

rivers, available for all terrestrial life to share (Project Wet, 1998). The global supply of fresh

water is a drop in the bucket yet we treat it as if the tap will never shut off.

The Earth's water is facing tremendous pressure and the statistics are alarming. Elizabeth

Mygatt (2006) of the Earth Policy Institute reports these facts on this global water crisis:

freshwater use tripled in the second half of the 20th Century while population doubled; improved

technology allowed pumping increased amounts of groundwater from greater depths while at the

same time building more and larger dams; and soaring demand is pressuring aquatic systems to

the point that rivers are running dry, lakes are drying up and water tables are dropping as we

withdraw water for irrigation, industry and household use. The problem is simple; 6.8 billion

(United States Census Bureau, 2009) people on the planet and increased water development

demands. In war torn parts of the world like the Middle East, water is taking over for oil as the

most likely cause of conflict (Darwish, 2004).

2.1.2 Canada, British Columbia and Columbia Basin Water Illusion

Canadians are some of the greatest water wasters of all the developed nations, partly

because we live under an illusion of water abundance. Contrary to popular belief, Canada has

only 6.5 percent of the world's renewable fresh water supply, in a virtual four-way tie with

Indonesia, the United States and China, behind Russia with 10 percent and Brazil with 12.4

percent of global fresh water (Bakker, 2007). The true picture of Canada's water supply noted

by Environment Canada's "The Nature of Water" website is that approximately 60 percent of our

freshwater flows north to arctic or sub arctic regions, while 85 percent of the populations lives

along the southern border with the United States, where most of the people live, work and farm.

Canada is second only to the United States in global per capita water use (Brandes & Brooks, 2007). Not only are we wasteful, Canadians adversely affect natural water storage and filtration systems. Ducks Unlimited Canada report on their website (2009) that as much as "70 percent of wetlands have been lost in some areas of Canada", mostly near urban communities. Brandes and Brooks (2007) in "The Soft Path for Water in a Nutshell" note that: in Canada we waste more water than we use productively (p.2); new forms of pollution, such as pharmaceuticals, pose unknown future challenges (p. 2) to animals, including humans; 13 percent of municipal water is lost due to leakage (p. 7) in an aging national infrastructure; and, of our entire household use of water, 65 percent is flushed and drained from our bathrooms (p. 7). Drier regions such as the Prairies and the British Columbia's Southern Interior, particularly the Okanagan and Columbia Valleys, are particularly influenced by geography, climate and weather patterns that affect the distribution of fresh water available for agricultural, industrial, recreational and domestic use.

Provincially, British Columbia is richly endowed with a quarter of all the fresh flowing water in Canada (Government of British Columbia, Water Stewardship Division, 2009). But demand for this quarter share in the nation's supply is growing as we move into the 21st Century. British Columbia's population is expected to increase by almost 36 percent by 2031, putting pressure on our urban community water infrastructure, our environment and government resources, although the Kootenay region impact will see less than expected provincial growth at just over 6 percent (British Columbia Stats, 2004). In addition to population growth, other threats to British Columbia's water are expansion of industry and agriculture, and, not least, potential climate change impacts and the enormous pressure they will have on water (Government of British Columbia, Water Stewardship Division, 2007).

Worse than the British Columbia average, Columbia Basin communities are real water wasters. The average daily per capita water use in Canada is 638 litres. In British Columbia it is 678 litres, and in the Columbia Basin twelve of the eighteen (67 percent) municipalities that provided exact water use rates, exceeded both national and provincial averages (CBT, n.d.).

Being lulled into a false sense of security about water abundance has economic, social and ecological implications for residents of British Columbia. A shortage of water can limit growth of both communities and industry. Increased population and the potential impacts of climate change puts pressure on existing community water supplies and ecological systems. In the British Columbia Southern Interior, scientists predict warmer, drier summers during the season when the demand for water is greatest for recreation, agricultural and household use (Columbia Mountains Institute of Applied Ecology, 2005). To live within the limits of available water and protect its quality, society must map out a sustainable water future.

2.1.3 Defining Water Sustainability

In his paper "Water in Crisis: Paths to Sustainable Water Use" (1998), Peter Gleick, an internationally recognized water expert and founder of the Pacific Institute in California, defines sustainable water use as "the use of water that supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it" (Gleick, 1998, p. 574). Gleick believes we need a fundamental social change concerning water use. Rather than projecting current demands into the future and then trying to find the water to meet these demands, he recommends an approach where we determine what kind of water future we desire and 'backcast' a strategy for realizing it. Backcasting permits society to develop a future vision for both human and ecosystem needs with

the water presently available, determine how they want to use the water and how to satisfy this desire within available limits of the resource.

Water is intrinsic to sustainable community development, the human imperative of the 21st century (Dale, 2001). As a limited essential resource water must be shared equitably by all life in natural ecosystems to achieve Bruntland's (1987) globally agreed upon definition of sustainability: "to meet our needs today and not compromise the ability of the resource to meet future generations needs". Sustainable development involves choices by people of what to sustain (nature, resources, cultures) and what is to be developed (people, economy, society) (Kates et al, 2001). It is a series of value-based choices, in this case placed on water. "Values are expressions of, or beliefs in, the worth of objects, qualities, or behaviours and as such they overlap with sustainability goals and indicators" (Kates et al., 2005, p. 16). Few people would dispute the need for clear, clean, available water, which is not always the case for other areas of environmental concern e.g. protected area conservation.

Gunderson and Holling (2002) note three key changes required for a sustainable development shift affecting water. The first is political and personal will. Second is scientific understanding of the relevant linkages within and between systems and across scales. Third, as a result of our narrow scientific view compartmentalizing our perception of reality, we have insufficient capacity to take action. To achieve the necessary sustainable development capacity we must first explicitly state the problems, identify solutions and implement action. This requires willing and wise individuals (Gunderson & Holling, 2002).

For this thesis, I assume that water sustainability is achieved when there is a renewable and economical water supply and human activities are environmentally benign to the water resource. With sustainability of water comes a moral obligation to pass on to future generations

a world with as many opportunities as we inherited (Capra, 2002). Capra also notes that the first step to operationalizing sustainability requires communities to become "ecologically literate" by engaging in activities like water monitoring. By acquiring the fundamentals of water-literacy, citizens begin to understand the impacts of development on water and their connection to the hydrological cycle.

2.2 Water Governance

Water governance is as complex and diverse as the geopolitical boundaries and governmental jurisdictions it crosses. Decision-making about water happens on many levels, from the terms and conditions of international water treaties to daily personal use, some being wasteful others more sustainable. Water is a common resource and government agency staff guides collective decisions about its use and protection. These people are qualified with the necessary technical expertise for planning and managing water. Other actors who come to a conclusion or resolution to take future action about water include democratically elected representatives, industry representatives and non-profit organizations.

Between provinces and territories there is a high degree of variation respecting laws, regulations, policies, standards and norms as they relate to water. Better understanding of governance tools and the opportunities for citizen participation in water governance requires a review of these mechanisms and the delegative authority responsible for water management, accountability and transparency in the decisions made.

2.2.1 Water Governance Tools

Environmental law is the body of statutes, common law principles and judicial or tribunal decisions governing environmental matters. The legal responsibility of government is providing

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fairness in administrative decision-making complying with the Charter of Rights and Freedoms

(Haddock, 2008). The Constitution passed in 1867 is relevant to water because it is the supreme

law of the land giving law-making authority to both federal and provincial governments

(Haddock, 2008). The Constitution, Federal and Provincial statutes and regulations are all

legally enforceable, but government policies are not (Haddock, 2008). Laws are passed by

Parliament or a Legislature. The Constitution Act of 1867 did not specify environmental

responsibility, the result being considerable jurisdictional overlap and uncertainty (Bakker,

2007).

Section 91 of the Constitution Act (1867) sets out federal powers. In relation to water in

the Columbia Basin, these govern navigation and shipping, inland fisheries, Indian reservations

and additional law making powers for peace, order and good government. Section 92 of the

Constitution Act (1867) sets out exclusive Provincial powers regarding the management and sale

of Provincial public lands and the timber and wood on them, property and civil rights and the

development, conservation and management of non-renewable natural resources, forestry

resources and electrical energy (Haddock, 2008). Jurisdiction of local governments comes

through delegative authority from the province through the Local Government Act in British

Columbia (Haddock, 2008).

Provincial governments create water legislation and water policies relevant to water

supply, resource management and water governance (Bakker, 2007). Provincial governments are

therefore responsible for water licensing, environmental protection for water, and water

potability ensuring safe drinking water (Bakker, 2007). Within the province the British

Columbia Ministry of Health administers the Drinking Water Protection Act and water source

protection through its Regional Health Authorities, while the Ministry of Environment plays a

supporting role in detrimental environmental impact affecting the quality of water through the

Watershed Protection Act (Casselman, 2004).

Regarding British Columbia's water rights, prioritizing water uses are on a 'first come,

first serve' basis and these rights can be transferred. Water use in British Columbia follows this

order of priority: domestic, waterworks, mineral trading, irrigation, mining, industrial, power,

hydraulic, storage, conservation, conveying, and land improvement. "Currently, water rights are

granted for surface water but not for groundwater in British Columbia" (Bakker, 2008, p. 384).

2.2.2 Other Water Governance Tools

In addition to water legislation, the British Columbia provincial government utilizes other

governance tools for sustainable management of freshwater include policy, where government

effort is translated into action (Thompson, 2008). This effort includes regulations and guidelines

ensuring safe drinking water and acceptable municipal sewage discharged into a water body or to

the ground (Caselman, 2004). Municipal governments enforce compliance with building codes,

bylaws regulating domestic watering and meeting drinking water quality guidelines. Provincial

wide government policy aimed at increasing water efficiency includes greening of the building

code to reduce water use (Government of British Columbia, April, 2008) and comprehensive

plans like "Living Water Smart". Regionally the Columbia Basin Trust in partnership with local

governments has launched the "Columbia Basin Water Smart Initiative" to help communities

reduce water consumption by 20 percent by 2015 (CBT, April, 2009). To encourage water

efficiency local governments use financial charges like water metering and bylaws that restrict

domestic watering days.

2.2.3 Shortcomings of the Water Decision Making Process

Historically water management focused on storing, diverting and moving water from where it was to where and when it was needed. Our focus has been on modifying the hydrological cycle to fit our needs rather than adapt our needs to meet the available resource. "Accountability and transparency in water governance can be assessed by examining: enforcement of water laws and associated penalties for contraventions, initiatives to achieve regulatory compliance, public access to information and opportunities for public oversight. Transparency is linked to accountability, as it enables citizens to attempt to achieve redress for violations if governments fail to do their jobs as regulators" (Bakker, 2007, p. 385 & 387). Bakker's (2007) survey showed that although British Columbia provided information on websites, it was not always easy to locate and often difficult to understand, nor was public reporting on an annual basis for drinking water quality required, leaving citizens without knowledge of where their drinking water comes from and whether or not it is subject to contamination" (p. 387). "The fragmentation of water legislation, policies, and practices is overwhelmingly evident" (Bakker, p. 388). To remedy this, Bakker (2007) recommends an integrated approach to water resource management, departmental/interjurisdictional data collection and knowledge sharing about existing approaches, as well as enhanced transparency and accountability.

Some key points from Bakker's (2007) summary of Canada's water governance are helpful within the context of this thesis:

- the federal government's role in water management and research has been described as "in retreat" (p. 375);

- variation in requirements for monitoring water and standards may lead to monitoring and enforcement laxity (p. 377);

- the Ministry of Healthy in British Columbia administers the Drinking Water Protection Act through its Regional Health Authorities, while the Ministry of Environment plays a supporting role in source water protection (p. 380);

- "coordination in an environment of devolved responsibility can be time-consuming and relatively slow, resulting in backlogs of listing known water contaminants because of the length of time to update the guidelines (p. 380);

- more attention should be paid to surface water than ground water; and

- a stronger regulatory framework for drinking water governance and a strong enforcement and reporting regime with enforceable quality standards and compliance is needed.

Governance is a process through which a group of people make decisions toward a collective effort, in this case water planning and management (Institute on Governance website, 2009). The Institute on Governance, an independent, Canadian, non-profit think tank founded in 1990 promoting better governance for public benefit, clarifies the complexity of governance. The Institute notes that when any group, for example governments, become too large to efficiently make all necessary decisions, some decision making is delegated to other levels of government, industry and citizens. This delegation makes the process messy, tentative, unpredictable and fluid, and increasingly difficult for the multiple actors or stakeholders involved.

Dale (2001) sees governance as one of the major barriers to implementing sustainable community development, and by extension, to water. "Governance can be defined as the sum of many ways individuals and institutions, public and private, manage their common affairs. It is a

continuing process through which conflicting or diverse interests may be accommodated, and cooperative actions may be taken" (Dale, 2007). The key reasons for failing to respond to sustainable development are: over reliance on hierarchical decision-making; the exceedingly complexity of information required to reach decisions, the science-public policy interface, and the vertical silos or divisions between the various sectors such as research and business/research and government policy-makers, the science public interface and well-entrenched vertical silos antithetical to implementing the broad horizontal issues (Dale, 2001).

Contributing authors Rob de Loe and Reid Kreutzwiser in Bakker's (2007) "Eau Canada" believe that water governance is important in that "contemporary water problems relate to 'people issues' more so than lack of scientific knowledge or adequate technology. They note the consequence of poor water governance: degraded water quality, exposure to waterborne diseases, inadequate financial resources to resolve issues, weak standards erode public confidence, lack of skilled staff, rivalries among agencies, and insufficient political will.

2.2.4 Water Policy Required to Achieve Sustainability

It is clear that good water governance in the Columbia Basin will be shaped by the cultural norms and values of the people who live and work here. Currently there is a growing, passionate populace in the Columbia Basin interested in many aspects of environmental conservation, while at the same time a fragmented jurisdictional framework regarding water planning and management.

To bridge the gap between interested citizens who want to be stewards of water with decision makers challenged to manage the resource in a fragmented, cumbersome system, good governance will require public involvement and transparency with a clear outline of what this looks like (Brandes and Nowlan, 2008). De Villiers (2000) recommends that Canadian decision-

makers develop water policy based on three imperatives that: water be priced to mandate thrifty use and conservation; water users be obligated to maintain the water passing through their systems in as pristine a state as possible and be penalized for not doing so; and unsustainable withdrawals from water systems be prohibited. A sustainable water future requires deep reflection on these imperatives as well as thinking differently about water. Water sustainability requires a completely new perspective inspired by the hydrological cycle itself. We need to change our current straight-line 'take-make-waste' production to a circular 'borrow-use-return' system (Doppelt, 2003). This change must reflect 'good governance' principles in an effort to benefit both society and its citizens.

Good governance is about both achieving desired results and achieving them in the right way (Institute on Governance, 2009). The United Nations Development Program (UNDP, 1997) lists five characteristics of good governance that can be applied to water decision making:

Table 1: *UNDP Five Good Governance Principles*

The five good governance principles	The UNDP Principles on which they are based:
1. Legitimacy and Voice	**Participation** providing all people with a voice in decision-making **Consensus orientation** mediating differing interests on what is in the best interest of the whole, suggesting appropriate policies and procedures.
2. Direction	**Strategic vision** – leaders and the public have a broad and long-term perspective on good governance and human development, and what is needed for such development, including an understanding of the historical, cultural and social complexities in which that perspective is grounded.
3. Performance	**Responsiveness** of institutions and processes to stakeholders. **Effectiveness and Efficiency** where processes and institutions produce results that meet needs while making the best use of resources
4. Accountability	**Accountability** of decision makers to public and stakeholders **Transparency** built on the free flow of information
5. Fairness	**Equity** for all men and women to have opportunities to become involved in a process oriented toward consensus where differing interests are mediated to reach a broad consensus on what is in the general interest

These five principles recognize that instead of the old-style patriarchal, hierarchical approaches, sustainable governance sees all members, both internal to the organization and external stakeholders, as important parts of an interdependent, interactive system. For an organization to make the kind of transformation required to become truly sustainable, power and authority must be skilfully distributed among internal agencies and external stakeholders through effective information generation-sharing, decision-making and accountability, and the distribution of resources and wealth (Doppelt, 2003). For organizations to begin the journey to sustainability Doppelt (2003) suggests implementing these five dominant principles, which I have applied specifically to water sustainability: 1) follow a (water) vision focused on conserving the environment and enhancing socieo-economic well-being; 2) continually produce and widely distribute information (about water) necessary for expanding the knowledge base and for measuring progress forward; 3) engage all those affected by the (water) decisions; 4) equitably share (water) and wealth generated by (water); and 5) provide people with the freedom and authority to act within an agreed-upon framework with clear goals, rules, roles and responsibilities resulting in (water) strategies with implementation plans (Doppelt, 2003). The end result is decentralized authority with the people having both the freedom and responsibility to act (Doppelt, 2003). Inhibiting achieving water sustainable governance will be inconsistencies between vision and practice; and to overcome this hurdle requires exemplary leadership, as well as long-range, systems-oriented thinking (Doppelt, 2003 & Gunderson et al, 2002).

2.3 Where Community-based Science fits in to Sustainable Water Governance

2.3.1 Government Needs Community Involvement in Water Sustainability

In 2007 a group of concerned scientists and citizens with a deep interest in Canada's escalating water crisis came together to develop "Changing the Flow: A Blueprint for Federal Action on Freshwater". This document presents a clear direction for federal action and renewed national capacity that is intended as a guide for our federal government in taking the priority actions that are urgently required to avert a water crisis (Morris et al, 2007, p. ii). Calling themselves the "Gordon Water Group" they are united by three principles that form their perceived foundation for sustainable water management in Canada. Principle 1 is a conservation ethic that satisfies human needs for water in a way that respects and protects our environment, directing us away from historical reliance on increasing water supply, instead reducing our demand with non-structural solutions such as planning, education and economic instruments (Morris et al, 2007, p. v). Principle 2 requires a citizen-centered vision, with governments respecting the rights of people to have access to safe, clean water for fulfilling basic personal and domestic needs, while fulfilling their duty to protect and preserve water resources for the use and enjoyment of the entire population (Morris et al, 2007, p. v). When this duty is not met, citizens may insist on the full consideration of the public interest through effective mechanisms such as public trust (Morris et al, 2007, p. v). Principle 3 requires society to think like a watershed and recognizing that water knows no political boundaries. This complexity means future management approaches need to be more integrated, precautionary and adaptive than in the past (Morris et al, 2007, p. v).

One of the greatest challenges in water governance is that the governments making decisions about the use and management of water simply cannot do everything. As a result governments recognize that non-government actors like citizens, non-government organizations, and business are essential to effective water management. Ensuring transparent decision making, effective and fair stakeholder participation, and integration of water management with other sectors are universal challenges" (Bakker, 2007, p. 87-88).

The United Nations Development Program (UNDP) (1997) policy document on governance for sustainable human development states that: "governance includes the state, but transcends it by taking in the private sector and civil society. Noted by UNDP (1997) all three are critical for sustaining human development: the state creates a conducive political and legal environment; the private sector generates jobs and income; and civil society facilitates political and social interaction, mobilizing groups to participate in economic, social and political activities. Because each has weaknesses and strengths … good governance promotes constructive interaction of all three". The World Resources Institute (2003, p. viii) suggests "governance is good when decision making is transparent, when all stakeholders participate, when full accountability exists, and when environmental decisions are integrated with economic and development decisions."

2.3.2 Engaging Community to Participate in Water Decision Making

To go beyond the obvious government tools of regulation, land purchase into protected areas and command and control strategies, decision makers must develop effective ways of listening, understanding, and interacting with human communities of stakeholders (Meffe et al, 2002, p. 219-220). A stakeholder is more than a group with an economic interest in a decision. It includes a person who wants to participate in a decision because the decision is important to

his or her personal interests (Meffe, et al., 2002, 301), including members of a community-based

water group. Engaging community-based participation in the process has a greater chance of

success through collaboration (Meffe et al., 2002). Meffe (2002) asserts that for the process to

be effective and guide good decision-making three aspects are required: substance, process and

relationships; yet he cautions that their relative importance varies with each stakeholder

involved.

Meffe's (2002) first aspect, substance, is a highly relevant component to water planning

and management. Substance refers to the technical and factual information about water in the

region, mainly available water data and analysis. What is of concern is how accurate is the water

data and is there sufficient information to show long term trends, whether it is gathered by

government staff or community-based water groups.

The second aspect is process, referring to the steps required in water planning and

management. Is there a process in place, does it follow established steps and is it open to all

stakeholders (Meffe, 2002)? Is the process fair particularly when it is about a public resource

like water, is there a well-designed public involvement process that enables stakeholders to hear

and understand one another's concerns and needs, review facts, generate alternatives, and then

recommend a course of action (Meffe, 2002, p. 222)? The best decisions emerge when the

process is open and inclusive and ensure that the full substance of the issue is revealed (Meffe,

2002).

Usually last to be considered, but essential to successful outcomes, is the third aspect,

relationships or the networks developing and influencing the water decision. This can include

anyone who wishes to know, trust and have access to decision makers (Meffe, 2002, p. 222).

Relationships occur outside the formal process but develop through frequent, informal, non-

specific communication (Meffe, 2002). Relationships build interpersonal trust and credibility, necessary for mutual understanding and effective management decisions (Meffe, 2002).

Human relationships can be challenging and Brown (2003) outlines three problems in moving to this more people-centered or community-based conservation conversation. To achieve a paradigm shift away from protecting areas from human impact requires different understanding, meaning and value of biodiversity, the environment and nature. The first shift requires an integrated and applied model of conservation priorities and fusion of knowledge-in-action (Brown, 2003, p. 90). The second challenge is to find a fair and just means of including the plural values, knowledge and interests of different stakeholders to move from token participation that can be passive and coercive to deliberate, inclusionary process that is open to a co-management framework that allows for learning and collective action (Brown, 2003, p. 90). This new process must include all the relevant stakeholders, and work towards building trust in a process that is transparent and accountable, with a focus on consensus and agreement by developing strategies for dealing with disagreement and conflict (Brown, 2003, p. 91). Thirdly, these challenges require a new institution for conservation that is flexible and adaptable, able to manage complex ecological systems like watersheds and at the same time accommodate diverse stakeholder interests and values (Brown, 2003, p. 91).

These new institutions will need to work across spatial and social scales, link broad global concerns with local needs and development priorities, evolve and adapt based on social learning in order to cope with ecological and social complexities, be flexible and facilitating, and demonstrate concern for both social and environmental justice (Brown, 2003, p. 91). These huge challenges and lofty solutions are what communities face around issues of watershed management. Ultimately success in the human dimensions of watershed management relies on

the dynamic interface between substantive water facts, a clear, open, transparent and inclusive decision-making process and strong relationships founded on trust and credibility.

2.3.3 Where Citizens Might Contribute to Water Sustainability

Community-based science is part of a growing trend reversing the age old reductionist view to a systems view of the world reintegrating science with society and the human experience (Bradshaw &Bekoff, 2001, p. 460). This new model integrates social and biophysical sciences of the interactions between humans and their environment within the complexity of societal processes and relationships (Bradshaw & Bekoff, 2001). This new trend requires interdisciplinary collaboration between traditional science fields and the people in communities, and in interest of this thesis, the residents that depend on water for their well-being. By joining the human experience with the environment, this innovative approach bridges our understanding of how to achieve healthy, sustainable relationships between human and non-human nature (Bradshaw & Bekoff, 2001, p. 464).

Community-based water groups are involved in what is called civil, participatory, citizen, stakeholder, or democratic science (Backstrand, 2003) which denotes a science that is developed and enacted by the citizens, rather than conventional scientists. "Civic science harbors many ambitions, such as increasing public participation in science and technology decisions, securing a more adequate representation in science, vitalizing citizen and public deliberation in science or even installing a democratic governance of science" (Backstrand, 2003, p. 28). The three dimensions of civic science, participation, representation and democratization, increase pubic participation in decision-making by improving their scientific literacy in a process developed and enacted by grassroots community groups (Backstrand, 2003).

Community participation in science making it democratically accountable has many benefits to the water decision making process: 1) involvement can restore trust in decision makers through improved communication, scientific literacy and outreach; 2) since the knowledge of the global environmental situation is fraught with uncertainty, a more pragmatic and open-ended decision process is needed; 3) citizens want to and should be able to have a say in decisions that affect their everyday lives and positively contribute to complement professional scientific expertise (Backstrand, 2003).

Along with benefits come risks against this democratic version of science: 1) verification and control of authoritative knowledge is questioned if the peer review process is dethroned; 2) citizen deliberation in science is time-consuming, ineffective and slow and challenges the 'elite' scientific system currently in place; 3) participation works more effectively on a local level yet many of the bigger questions are global in nature and outside the grasp of many citizen scientists; 4) resistance to the current decision making framework threatens the risk assessment paradigm toward a precautionary approach (Backstrand, 2003). A balance is needed between civic participatory expertise and professional, technological decision making to achieve sustainability (Backstrand, 2003). A more inclusive science-policy relationship is grounded in participation, transparency, partnership and dialogue (Backstrand, 2003).

2.4 Summary

In summary, communities realize that water is key to human health, environmental integrity and economic prosperity. To balance these three imperatives for water sustainability requires both political and personal will and vision from both decision makers and citizens. A common purpose must be agreed upon to meet water demands by respecting and managing use

with current supply either through technological improvements or conservation strategies, with a

commitment to protect the environment. Legislation and traditional water planning and

management strategies appear to be ill equipped to deal with the water challenges ahead

downstream. Citizens are willing and able to participate actively to shape a water sustainable

future, in fact they are key to achieving this desired future state.

CHAPTER 3 RESEARCH METHODOLOGY

A relevant research strategy for examining contemporary events like water sustainability is the case study (Yin, 2003). Case studies follow the research philosophy of analysing an existing, real-life situation in all its complexity, exploring it as close to the people concerned as possible, describing the situation in detail, and finally explaining the findings in a clear and comprehensible way (Kyburz-Graber, 2004, p. 54). Yin (2003) recommends an explanatory case study as an appropriate research method for addressing "how" questions, that trace decision-making over time, within a real-life context, examining contemporary events. Kyburz-Graber (2004) notes that case study research builds on understanding a phenomenon by gaining access to the phenomenon through data collection in a descriptive way and present the relevant situations as objectively and free from prejudices as possible (p. 54).

Pertaining to water sustainability and decision making in the Canadian Columbia Basin, case study research lends itself to the direct observation of the structure of how decisions are made about water and the persons involved directly in these decisions (Yin, 2003). The application of the case study method is used to explain the presumed causal link between community-based water monitoring programs and possible points of intervention where citizens can participate in a meaningful way in the planning and management of a water sustainable future.

The greatest concern in case study research is the perceived lack of rigor, that it provides little basis for scientific generalization and that they take too long and the result is massive data and unreadable documents (Yin, 2003). To combat these stereotypes requires comprehensive research design, carefully constructed data collection and thorough data analysis. Following a systematic procedure reduces bias views that could influence the direction of findings and

conclusions (Yin, 2003). The goal of this case study is to arrive at broad generalizations, not enumerating particular frequencies of response. In an effort to keep the case study manageable, I selected a specific geographic region (the Canadian portion of the Columbia Basin), and a general criterion of watershed groups with a minimum of three years operating experience as well as decision makers currently involved with water planning and management who know of and have worked with these groups. I then apply my findings and results to identifying recommendations for integrating community-generated data into an effective, efficient and equitable water governance structure in the Columbia Basin watershed targeted specifically at members of the Columbia Basin Watershed Network.

3.1 Research Design

To begin the investigation of this topic required a literature review of relevant documents in three main topic areas. The first topic addressed was understanding water issues of concern to communities and the principles required to achieve a vision of water sustainability. Secondly, who is responsible for and how are decisions made about water, where might citizens work together with decision makers effectively and efficiently in the existing governance structure planning and managing for a water sustainable future. Thirdly, how are citizens involved as advocates and stewards of the water resource and when might community-generated data be useful for the existing and future governance structure. I also assumed that the members of the Columbia Basin Watershed Network would likely be interested in my research questions, as they are in the very early stages of formalizing the organization. Some members of the Network are currently engaged in a water monitoring pilot, and some groups are already more or less working in collaboration with a range of decision makers, participating in regional water planning and

management in the Basin. To adequately address this topic required not only the examination of community-based watershed groups, but as well water decision makers ranging from government agencies (federal, provincial, local level), elected officials from local/regional government; and representatives from Crown corporations and the private sector.

In an effort to maximize the quality of the case study, I considered four tests used to establish the quality of any empirical social research: construct, internal and external validity, and reliability, as recommended by Yin (2003, p. 33-34). To improve the external validity, I looked at the points of view of both community-based water groups and water decision makers, realizing that the multiple case studies would present compelling and convincing data that is more robust (Yin, 2003). Reliability and construct validity was improved by following consistent, yet distinct interview protocols for community-based groups versus decision makers, transcribing interviews and having interviewees review their results via email to ensure verification of the data thereby reducing error and biases (Yin, 2003). Internal validation of data occurred as a result of the analysis of the data by building an explanation about the case, with the goal being not to arrive at a definitive conclusion but rather to develop ideas for future study (Yin, 2003, p. 120). To "explain" the phenomenon of decision makers engaging with community around water governance, the narrative uses pattern matching to reflect theoretically significant propositions. For example, data was analysed by pattern matching using simple variables of similarities and differences based on recurring patterns or themes like water issues/vision for sustainability, operations and activities pertaining to water governance, research protocols followed, communication of results and the challenges and enablers integrating citizen-generated data into a participatory process of water governance.

Research design is the logical sequence followed to connect the empirical data to the initial research question and ultimately its conclusions (Yin, 2003, p. 20). To collect the data, I choose to use the instrument or method of the structured interview.

3.2 Data Collection

The heart of an interview is the person-to-person interaction through a set of substantive questions reflecting a line of inquiry (Yin, 2003, p. 73). In my structured interview, a set of predetermined open-ended questions was used to guide conversation in person-to-person interaction, face-to-face with community groups and by telephone with decision makers (See Appendix A – Community-based water groups questions and Appendix B – Water decision maker questions). By following a line of inquiry with specific questions asked in an unbiased manner, uniformity of information assured the comparability of the data (Kumar, 1999).

Two distinct sets of interviews were conducted. One set questioned eight community-based water groups actively collecting water data, and who were also involved in restoring riparian and aquatic habitat, as well as community outreach and education The second set of questions was only slightly modified for sixteen decision makers involved in water planning and/or management in the Canadian Columbia Basin on a day-to-day level. My interview goal was to gain personal insights about a singular topic of mutual interest to both groups – water, more specifically its sustainability. The key difference between the two study groups is that one has legitimate power and authority directly over water, the other has the capacity to make personal decisions but also wishes to influence long-term, community-based water planning and management leading toward sustainability.

Limitations of this research are constrained largely by time and human resources, given that the research was conducted over a limited time frame of several months between May and December 2008. Communities within a the geographic area of the Columbia Basin watershed were selected and narrowed by area of interest some with a focus on lakes, others focused on streams and rivers, some with an entire watershed perspective, while others were dedicated to urban watershed issues. When asked to give examples of decision makers that citizen group's work with on water planning and management, they would recommend individuals to interview. When contacted by telephone, these individuals either put me in touch with more appropriate people with direct contact on a citizen level and/or recommended more water decision makers to speak to. These leads were investigated which snowballed with water decision maker interviewees doubling from the number of the initially proposed interviews.

Dates were negotiated via email, with face-to-face interviews conducted and audio-tape recorded with eight citizen groups during May and June, transcribed and verified July to September 2008. Interviews with decision makers were conducted over the phone, as I took notes. As with the citizen groups, the interview was transcribed, emailed to the decision maker, asking for clarification in some cases and validation of responses. All participants promptly emailed tracked changes ensuring a more accurate reflection of their point of view. In some cases, valuable, missed but relevant information to the research topic was added. The transcribed text of the interview was then emailed back to the interviewee for clarification. I wanted assurance that the essence of the interview and remarks were captured accurately. In most cases, changes were tracked and returned within a matter of days with this stage of data collection completed by January 2009.

3.3 Case Study Description

3.3.1. Columbia Basin Watershed Network

In the fall of 2006 I attended a Water Quality Monitoring Workshop hosted by the Columbia Basin Watershed Network (hereafter called "the Network"). Funded by the Columbia Basin Trust (CBT), this Network is a partnership between twenty-three watershed groups (non-government organizations NGOs, municipalities, and industry), agencies (Environment Canada, B.C. Ministry of Environment and Interior Health Authority), and education institutions (UBC Institute for Resources and Environment, Selkirk College, and College of the Rockies). CBT provides direct funding and support to the Network and the water-monitoring pilot being carried out by some of the community-based water groups in the Basin. Arising from a 2005 symposium for groups interested in water stewardship and watershed management in the Canadian portion of the Columbia Basin, the Network is a capacity building and networking initiative designed to share experiences and resources, and build knowledge and expertise around water issues (CBT website, 2009). By supporting the Network, CBT acts as a funder, facilitator and convener that is helping watershed groups to achieve their own goals by helping them to work cooperatively around water issues in the Basin (CBT website, 2009). At this workshop I was introduced to the groups that would later form the basis for my thesis research, and fundamentally were the catalyst for taking my Masters at Royal Roads University in Victoria.

I attended a second workshop with the Network called the Columbia Basin Watershed Network 2008 Symposium, held at Selkirk College in Castlegar, perched strategically above the confluence of the mighty Columbia and its major tributary, the Kootenay River. The vision of this symposium was "building our collective wisdom around water and watershed issues in the Columbia Basin" (CBT website, 2009). The goals were to bring together watershed groups,

agencies and local governments throughout the region to start a discussion on the shared challenges and opportunities for watershed management in the region. This was a forum for information sharing and partnership building for community groups engaged in watershed level work. Building on the collective knowledge and capacity of the participants, whether governments, agencies or watershed groups, collectively they could move to a higher standard of water and watershed management. Part of my data gathering to support my interviews were notes from the sessions on Network members sharing key watershed issues and ideas for how the Network might support priority next steps for regional watershed planning and management. These notes also influenced the recommendations at the conclusion of the thesis.

3.3.2. Community-based Watershed Groups

Eight of the community-based watershed groups with a history and established presence in the Columbia Basin, many of whom attended the 2006 Workshop and 2008 Symposium, were approached and asked to participate in a face-to-face interview. To be invited to participate, groups had to meet a minimum of three of the following selection criteria:

- be actively collecting water quality/quantity data for a minimum of three years;

- have a willingness and enthusiasm to participate in the interview process;

- be part of the Columbia Basin Watershed Network;

- demonstrate a partnership exists within the community to incorporate results into watershed or land use planning;

- have water quality, quantity, and conservation as key outcomes of their initiative;

- possess a vision of broader sustainability in the community, and

- represent a broad range of geographic location and community characteristics (e.g. monitoring streams, lakes, watersheds).

One hundred percent of the groups contacted not only met the criteria, they were eager and excited about participating in the process. A contact person was identified as a representative of the watershed group and a letter of consent was emailed. This letter acted as an introduction to myself, the Royal Roads University Masters in Environment and Management program, the main purpose, objectives and relevance of the study. The letter indicated that participation was voluntary, assured respondents of anonymity of the information provided by them, contact information in case they wished to verify the research with my thesis advisor or committee members or simply ask questions of the researcher. If they replied that they were interested, a cover letter/letter of consent was emailed. The last part of the letter apprised them that participation in the interview provided consent to use information gathered.

3.3.3. Water Decision Makers

In the face-to-face interviews with community groups, they were asked who they communicate with regards to their results and with whom do they work on water planning and management. These names provided a first point of contact but many decision makers referred me to more specific people with direct links to community-based water monitoring groups which had a 'snowball effect' leading to double the intended 8 to 16 interviews with decision-makers from the following sectors:

- private industry or crown corporations;

- federal government: Department of Fisheries and Oceans Canada;

- provincial government: Interior Health Authority; Ministry of Environment - Water Stewardship Division and Environmental Protection Division;

- local government: staff from municipalities and regional districts, and elected officials.

3.4 Data Analysis

The strategy that I relied on to analyse the qualitative data gathered is based on the theoretical proposition that led to the design of the case study (Yin, 2003). The research question "how might decision makers use community-generated water data when planning for water sustainability in the Canadian Columbia Basin" guided the research objectives, which was translated into review of literature and interview questions. To meet the objectives of the research project, a detailed proposal and plan was designed and approved by both Royal Roads University – Ethical Review Committee and my thesis sponsor, the Columbia Basin Trust, Water Initiatives. Results of the interviews were categorized into the three themes of water sustainability, water governance and community-based water monitoring. Each of these categories guided data collection and guided appropriate supportive literature review.

To compare the two distinct interview groups, responses of citizens and decision makers were grouped according to pattern matching techniques. Replies from each of the two sets of interviews were compared and contrasted looking for similarities and differences. I tended to use a more general interpretative approach to the data highlighted by Berg (2007), organizing and reducing the data in order to uncover patterns of human activity, action, and meaning. Decision makers form a separate and distinct unit of analysis. Although they had a specific set of questions that clarified the water decision-making process, these interviews probed into their perspectives on water issues, challenges and processes that assist management and planning for water sustainability, the data they collect and research protocols they follow, communication methods for sharing their information with citizens and finally their perceived value and usefulness of data collected by citizen-generated science.

3.4.1. Analytic Technique

My goal is to contribute a case study revealing recommendations that will assist in building a bridge between community groups and decision makers with an interest in collaborating to achieve water sustainability in the Canadian Columbia Basin. The analysis attempts to give the reason for the phenomenon of community-generated water data and through narrative form link citizen action to water sustainability. The causal links may reflect critical insights into public policy process, which could lead to recommendations for future policy actions (Yin, 2003). By explaining theory of what could be happening to support water sustainability based on the literature review with what is happening presently in the Basin, what will emerge are insights stated in the recommendations that could improve effectiveness, build efficiency into the process, thereby ensuring a more equitable relationship of water governance.

Yin (2003) warns researchers that the explanation building approach to the case study analysis is difficult and fraught with dangers. I am cognizant of his warnings that as the process progresses, the investigator may slowly begin to drift away from the original topic of interest. Constant referral back to the thesis question will help to reduce this potential problem. Safeguards included clear questions of interviewees linked to analysis themes, design of interview techniques, transcription, management of data collected and a clear chain of chronological events.

High quality analysis is a critical element of building a compelling case study. Yin (2003) recommends four key principals to ensure the highest quality of analysis that underlies all good social science research, requiring vigilance and attention. I feel that I accomplished these key principles with my thesis research. Firstly, be exhaustive in your research. Second, address all major rival interpretations that may offer alternative explanations and follow up evidence to

address the question from both the citizen and decision makers' point of view. Thirdly, address

the most significant aspects by focusing on the most important issues water, water sustainability

and democratising science with citizen engagement. Lastly, use and build on my previous

knowledge of environmental education and civic engagement in the environmental movement.

In writing this thesis I had two primary target audiences in mind. The first was

community-based water groups, many of whom are members of the Columbia Basin Watershed

Network. Second, were decision makers charged with the management of water in our region

and the challenging task of planning for a water sustainable future, many whom are invited to

join the Network. I made a commitment to email all of my interviewees a link to the published

thesis, so that they could benefit from the results and recommendations. The research culminates

into five recommendation areas designed to enhance the effectiveness, efficiency and equity for

community-based water monitoring for the *Columbia Basin Watershed Network*, as well as,

ideally other participating citizen science environmental monitoring initiatives.

Recommendations are directed at operations, practical tips and strategies for increasing their

effectiveness and communication with decision makers pertaining to sustainable water planning

in the region. This thesis reflects the Corcoran et al. (2004) perspective that case-study research

is a reflective collaborative learning process aimed to improve institutional practice, primarily to

benefit the public involved in the process.

CHAPTER 4 RESULTS AND FINDINGS

The anonymity of the participants was the pre-condition of the interviewee's agreement to participate in this research project. Throughout the narrative of this thesis, quotes from community-based water groups are referred to as "groups" and their quotes are preceded by the letter "C", while decision makers quotes start with a "D", or are noted directly in the text.

4.1 Description of Community-based Water Science in the Columbia Basin

This study reveals that citizens across the Columbia Basin are actively participating in community-based water science through monitoring, conservation, restoration and education activities. Of the eight community-based water groups interviewed one has existed since 1969, three formed in 1996-97 and three more in 2003-2004. Their achievements and accomplishments are noted in Table 2. The primary catalyst for community groups forming is the protection of watersheds. In the case of one group "formation of the society coincided with the depletion of stands (of forests) province wide. Salvation of the industry lay with individual communities taking charge of forestry in their environs, rather than have the community sit and wait for corporate interests to come and perform in a traditional way … to see how they would do if they took over the running of forests" (Interview C1, pers. comm., May 23, 2008). Three groups formed to be eligible to apply for grants available through agencies like the now defunct Forest Renewal British Columbia.

The priority for formation identified by the majority of groups was the overall sustainability of their community, of which water quality and quantity plays a significant role. Two groups had as their primary mandate protection and restoration of streams, streambeds, and riparian zones that foster stream dependent biodiversity. One group formed specifically to

facilitate water education and conservation projects. One decision maker remarked that, "in the Kootenays, at first they (citizens) were interested in forestry and logging cut blocks; now they are interested in the effects of a range of activities on their water and watershed" (Interview D1, pers. comm., October 3, 2008).

The Columbia Basin has a long-standing history of people diametrically opposed and groups working together. The Lake Windermere Project (LWP) emulates a positive working relationship with the District of Invermere. LWP data has been incorporated into the Lake Windermere Official Community Plan, guidance document for shoreline development, to update Ministry of Environment water quality objectives in exchange for use of the District's boat including gas, delivery and picky up, access to water intakes, in-kind office space with photocopier access and assistance with special events (Interview C8, pers. comm., May 28, 2008). Similarly Christina Lake Stewardship Society has a close working relationship with the Regional District of Kootenay Boundary. They coordinate an annual tour of the lake on the "Tintanic" a barge with invited regional district directors, planning committee, along with Ministry of Environment representatives, and Selkirk College staff to discuss lake ecology, issues and joint concerns (Interview C4, pers. comm., May 20, 2008). Not all community-based water groups are listened to (Interview C7, pers. comm., May 29, 2008). The perception of community groups depends on "the individual managing the operation, their profile, level of respect and if they are deemed a positive asset, and only then will they be listened to; if they are seen as zealots, they can cause more conflict " (Interview D1, pers. comm., October 3, 2008).

Table 2: *Community-based Water Group Stated Achievements*
          (denotes the number of groups involved in this activity/achievement out of 8)

- Bring grant dollars into the community to do restoration activities that employ local individuals and students (7)
- Catalysts for community involvement and engagement which have changed community behaviour e.g. through Stewardship Centres (7)
- Participate in fish surveys (7)
- Offer living laboratories outside for water education/community awareness and conservation programs (6)
- Participated in processes resulting in improved industrial models and standards (5)
- Sponsor community stream and lake clean ups and celebrating water stewardship events (5)
- Members of local Advisory Planning Council for Official Community Plans and affect operations e.g. cosmetic bylaws, setbacks for snow removal, divert compostable waste from landfill (5)
- Participate in watershed planning and implementation strategy (4)
- Watchdogs advocating for compliance of legislation, socially unacceptable harm to water, receive anonymous tips from residents, advocate for government to clean up abandoned mine sites and monitor mine decommissioning (4)
- Managing long term water monitoring projects that produce enough data to show trends to base decision making judgements (4)
- Riparian restoration and tree planting (3)
- Produce annual reports on water results (3)
- Review permit applications for development, variance applications, foreshore alterations and monitor tenures e.g. marina, forest practices (3)
- Produce community brochures and signs (2)
- Operate a Stewardship Centre providing a central location for dissemination of information and a staffed phone (2)
- Mapping and assessment of habitat types, river channel characteristics, vegetation and human uses
- Develop management techniques e.g. engineer roads, so as not to affect water quality thereby managing forests and watersheds sustaining water and jobs.
- Negotiated with British Columbia Ministry of Forests and Range a 25 year Community Forest Agreement that will use ecosystem based management assuring other values of the forest are protected e.g. water quality
- Get political to get things done

Community-based water groups are investing countless hours and personal resources to collect water quality and quantity data. As models of environmental citizenship, their awareness of water results in greater appreciation, understanding of the issues, value for the resource, which in turn results in behaviour directed at protecting water and a willingness to lead communities

down the path of a sustainable water future. These citizens emulate the necessary steps required

to go from acquisition of environmental knowledge along the path toward adopting true

environmental behaviours. Understanding of water science, governance framework, and

sustainability solutions required has resulted in a community of people formulating a vision for

the future and desire to take action towards planning and managing for a sustainable water

future. Decision makers in the Basin see value in getting citizens involved. Involvement is seen

as a community education program about water and once a community understands and

identifies problem targets, they can put effort in the right location to find solutions (Interview

D6, pers. comm., October 20, 2008).

4.2 Relationship between Water Decision Makers and Community-based Water Groups

Community-based water groups and decision makers are forging relatively new territory

in establishing meaningful dialogue about future water decisions. Human relationship building

takes time and energy but the end result is priceless: an association or connection founded on

trust and credibility. "Working with community groups is the way of the future", states one

decision maker, "it is a mutually beneficial relationship that helps us get the job done" (Interview

D3, pers. comm., December 19, 2008). All of the community groups interviewed are working to

establish relationships with decision makers. Conversely the majority of decision makers have a

mandate for outreach with community, with the exception of three specifically responsible for

water licensing and management related to hydroelectricity production. One such decision

maker noted "they were aware of citizen groups generally but not specific groups", and stated

that "although it is a positive effort to see citizens involved, they were sceptical of the quality of

data collection and motive for collection, noting there is a possible role for citizen science but

don't oversell it" (Interview D6, pers. comm., October 20, 2008). Perhaps the reason for lack of

interest from this decision-maker may be due to their focus "on providing power to an energy-

hungry market, and are tapping existing water resources to produce clean, green and constantly

renewable electric power", not water quality, quantity or watershed health per se (Interview D12,

pers. comm., October 17, 2008). Even so, this same decision maker uses a local community-

based water group to enhance rainbow trout habitat as part of their Fish Compensation Program

for trout entrainment mortality. A third hydro electric decision maker was not aware of any

formal groups but expressed value in having more potential observers, and more potential data

for scientific analysis (Interview D14, pers. comm., December 18, 2008).

    The remaining decision makers are at various stages of building relationships with their

communities of influence. Peppered throughout the interviews are suggestions from both

community groups and decision makers that are enablers and obstacles to strengthening

relationship founded on mutual respect, trust and credibility (See Table 3).

Table 3: *Enablers and Obstacles for Building Relationships between Community-based Water*
Groups and Decision Makers

Enablers	Obstacles
• Working together to share information and discuss issues • Support each other e.g. joint training and collaborative efforts, loan equipment • Community invited to work along side agencies providing input into planning processes • Legitimizing community efforts by referring other agencies to community-generated data e.g. awarding the group a 25 year community forest agreement • Mutual respect for knowledge and listen to each other when concerns are raised advocating for government action • Integrated approach to watershed monitoring and data management	• Citizen access to government data denied • Lack of openness and willingness to deal with the citizen group • Identify the 'right' people at the table for dialogue to be productive • Historical pattern of not involving community in the decision making process • When community groups are seen as partisan and obstruct development • Community groups that are reactive • When decision makers are not there to protect water, especially when citizens are working hard to monitor and implement stewardship efforts

• Proactive pressure from grassroots; embraced by agencies • Community understands problem and put effort in the right location • Channel the dedication of citizens who are motivated and care; they feel useful and help their community and watershed • Social choices do not interfere with environmental processes	• Citizens with good intentions but misdirected • Recognition that community-based water monitoring is not a panacea for everything, but is an important piece of the puzzle.

Community groups are actively building relationships with decision makers. One group recognized that it was essential to "know who to call and trust because nurturing relationships is like insurance for the future, but were frustrated because government is always changing and it is a challenge to transition their own credibility and legitimacy to new civil servants" (Interview C3, pers. comm., May 28, 2008). To build trust, a professional ethic, continual presence, local knowledge, accountability and community involvement is essential, along with openness and honesty (Interview C4, pers. comm., May 20, 2008). A senior local government official told one of the community groups that they "can build the confidence and inertia with the community and channel that; it needs to be from the grassroots up, not top down" (Interview C7, pers. comm., May 29, 2008). Trust can be built by working together using agreed upon research standards and methods (Interview D2, pers. comm., November 6, 2008), but more time and resources are needed to realize the benefits for both sides (Interviews D3 & D4, pers. comm., December 19, 2008 & November 3, 2008).

Relationships can be a challenge at any time, especially when decision makers disagree with community concerns. Sometimes groups appear to be stubborn to some agencies pertaining to our issues and concerns but overall they see the groups as a good thing for educational purposes, as a watchdog, getting people together, getting the information out there, and getting political to get things done (Interview C4, pers. comm., May 20, 2008). If the motive of a

community group is unclear, this can cause distrust, putting the groups' legitimacy under

question (Interview D11, pers. comm., October 3, 2008). Some community groups are building

a legacy partnership with government agencies, First Nations, and local citizens by building

community value, respect and understanding since 2005 (Interview C7, pers. comm., May 29,

2008).

"It is beneficial for all of us to maintain partnerships and support regionally because there

is a lack of continual provincial representation", (Interview C4, pers. comm., May 20, 2008).

This same group noted that, "with a lack of agency presence in their community, local

knowledge and many volunteers keep their eyes and ears open to what is happening within our

watershed". Decision makers have demonstrated support for community groups and are willing

to work further at supporting their efforts. While some decision makers have provided year-end

funding contributions and grants (Interviews D1, D3, D4, D6, pers. comm., October 3, December

19, November 3 & October 20, 2008), most are prepared to assist community group's access

outside funding sources (Interviews D2, D3, D5, pers. comm., November 6, December 19 &

December 9, 2008). Decision makers are willing to loan equipment, provide less expensive

access to lab services, print brochures, provide office space, pay for facilitator for a joint

meeting, provide in-kind expertise, as well as agency staff support (Interviews D10 & D3, pers.

comm., October 20 & December 19, 2008).

4.3 Collaboration and Partnerships when Managing for a Watershed

There is both a need and effort being put towards collaborating on water planning,

scientific research, regulations, enforcement and restoration (Interview D1, pers. comm., October

3, 2008). The need comes from the fact that data gaps are huge and agencies lack the funding to

do a good job (Interview D2, pers. comm., November 6, 2008). Working with communities has

the added benefit of cost sharing opportunities (Interview D3, pers. comm., December 19, 2009).

Both decision makers and community groups working on the East Kootenay Integrated

Lake Management Plan, are proud of the collaboration and partnership in this example of

working together, with citizens contributing to change policy and practice (Interviews C8, C3,

D3, D4, D7, D9 & D10, pers. comms., May 28, May 28, December 19, November 3, October 16,

December 9 & October 20, 2008). Groups like the Okanagan Basin Water Board who is charged

with taking a basin-wide approach and building collaborative solutions (Okanagan Water Board

website), were referred to by decision makers as a possible model for the Columbia Basin

Watershed Network to follow. Another example for the Network to follow is the Fraser Basin

Council, a non-partisan organization with a track record of getting people together to find

practical, common sense solutions to long-standing issues (Fraser Basin Council website, 2009).

4.4 Water Sustainability Planning and Management

Citizens and decision makers have different ideas about what are the priority water issues

facing the region (see Table 4). Citizens are primarily concerned with water quality and

quantity. They see a direct correlation to water quality and economic well-being. Degraded

water or lack of availability can decrease recreational home value and limit growth. Decision

makers see the major issues as governance and cumulative impacts but agree that people seem to

rally around water, as it is essential (Interview D1, pers. comm., October 3, 2008). Communities

have a sense that water is a big problem, so they want to protect it and be involved in sustaining

it in a positive way because they see that each stream adds up to a bigger water picture

(Interview D2, pers. comm., November 6, 2008). Another decision maker acknowledges that

water quality and quantity tells us how well the overall environment is doing (Interview D3,

pers. comm., December 19, 2008). Decision makers recognize that citizens want to influence

decisions that affect them directly and see collaboration with other agencies as a solution

(Interviews D6 & D5, pers. comm., October 20 & December 9, 2008).

Table 4: *Priority Water Issues Identified in the Columbia Basin*

Community-based water groups	Decision makers
- Protection of water quality, especially drinking water - Recognize the important relationship between healthy water and healthy communities, especially those dependent on the tourism industry - A holistic approach is required to protect watersheds, balancing human use with ecological needs like flow requirements - Addressing the cumulative impacts of the many impacts on water. - Improving the current governance tools that are not adequately protecting water e.g. legislation is not enforced resulting in continued foreshore/riparian alteration, federal government no longer monitoring water to the same degree	- Current governance tools do not support water sustainability - Current planning and management of water is not addressing the cumulative impacts of all the activities in the watershed due to a lack of integrated management. - Decreasing human and fiscal government resources including loss of intellectual capital with senior staff retiring and fewer staff enforcing, regulating, reporting and communicating with the public. - Protection of water quality, in particular drinking water. - Lack of information and trend data to guide decisions.

Community groups and decision makers each have a vision (Table 5) for water

sustainability and what it looks like in the Columbia Basin. Each group has a unique perspective

on water sustainability and what indicators (Table 6) will ensure they are on the water

sustainable path. Both groups are working independently toward their own defined course of

action to ensure a positive path is mapped out.

Table 5: *Vision for Water Sustainability in the Columbia Basin*

Community-based water groups	Decision makers
• Region uses a proactive approach to water sustainability. • Water is used efficiently in all respects. • The primary priority is protecting water quality and quantity, superseding all other aspects of development. • Employ the precautionary principle planning and managing water. • Use an ecosystem, holistic approach to water management recognizing human extraction of water affects aquatic ecosystems. • The region thinks and acts like a watershed. • Operation of the economy sensitive to community health dependence on water. • Healthy aquatic ecosystems = water sustainability (quantity/quality/economy)	• Water users comply with laws, regulations, permits and licenses. • Drinking water is safe, clean and reliable. • Able to balance competing interests with societal objectives e.g. subdivisions, economic demand for hydro, wildfire needs. • Meet license demands for hydro etc. while at the same time maintaining ecosystem needs • Community does not notice change in water due to industrial activity. • Diverse network of active organizations working together to improve and protect water values. • Use water supply data to perform analysis and manage for water variability over time.

Table 6: *Indicators of Water Sustainability*

Community-based water groups	Decision makers
• Absence of complaints and fewer water quality advisories. • Water quality and quantity secures economic investment. • Increase water quality due to better management of storm water sedimentation • Data shows meeting water quality objectives • Data substantiates quality and quantity trends • Community understands the principles of water sustainability • Industrial activity does not disrupt water sources by using sustainable forest practices and eco-based industrial activities • Balance industrial activities with watershed protection • More people participating in community-water group activities	• Fewer public complaints • Decrease in water scarcity • Quality assurance/quality control on data about water • Ongoing water monitoring is occurring • Integrated management system exists between agencies, stakeholders and community organizations • Implement a water sustainable governance structure • Remove social barriers to participate in water decision making • Protect sources of watersheds; manage watersheds more holistically • Water use decreases over time with an improvement in community water ethic and conservation efforts • Condition of drinking water is high • Condition of aesthetic and recreational water quality is high

• Drinking water sources are protected • Quality of lake water is high year round • Management strategies are meeting fish needs • Water footprint is a tool used to approve development proposals. See more site treatment of toilet waste and more appropriate developments indicative of regional climactic conditions • Proactive water planning utilizing tools like building codes that favour water conservation • Damaged foreshore, riparian areas and flood plains are restored and further protected. See increased successful restoration of wetlands • Identification of trouble spots and proactive solutions • Change community thinking of water from linear to closed loop	• Development proposals use full cost accounting using a triple bottom line accounting for water resource protection and impact

4.5 Water Monitoring and Reporting

It was clear from the interviews that community citizens are stakeholders that want to be involved in decisions about water that affect them directly. Citizens want their concerns to be understood and need confidence in decision makers that their values will be considered. Citizens expressed concern when there is a lack of enforcement of government's own legislation such as the British Columbia Water Act, which leaves perpetrators and community with the opinion that rules are meant to be broken and creative interpretation is permissible to suit select situations (Interview C3, pers. comm., May 28, 2008). This same community group noted that "if people get away with breaking rules, others see it and we now have majority wanting to break the rules e.g. ATV's altering the foreshore of a lake which transfers to dirt bikes ripping up rare, threatened grassland ecosystems". Lack of enforcement encourages non-compliance. At the

same time decision makers recognize that citizens know that governments are not doing the job

they should be so they are filling in the gaps (Interview D2, pers. comm., November 6, 2008).

Due to cutbacks since 2001, government is struggling to conduct ongoing monitoring and

analysis of data so citizens are doing it for themselves (Interview D6, pers. comm., October 20,

2008). At the same time citizens want to see decision makers accountable managing resources

now and into the future (Interview D4, pers. comm., November 3, 2008). Despite governments

best efforts they admit that environmental problems are getting worse in the current management

structure (Interview D1, pers. comm., October 3, 2008). Recognizing cumulative impacts and

degrading environmental conditions, "community groups recognize that sometimes they have to

get political to get things done" (Interview C4, pers. comm., May 20, 2008). The risk of

community water groups going off on a tangent without technical support is their data may not

meet the criteria of scientific rigor, lack quality control and quality assurance, and they may be

duplicating efforts of government, so it is imperative to optimize resources (Interview D3, pers.

comm., December 19, 2008).

Throughout the Basin both community groups and decision makers are involved with

water monitoring and reporting, yet they do not follow the same protocol (see Table 7). For

example, the federal government uses the CABIN protocol. Members of the Network involved

with the monitoring pilot are using the CABIN protocol, but not all community-based water

groups are part of the pilot initiative. Department of Fisheries and Oceans staff, employs

Sensitive Habitat Inventory Mapping (SHIM) using high-end global positioning system to map

watercourses. This broad mapping effort is valuable but there is a huge gap in accurate

information mapped at the 1:5000 scale, which is often required by decision makers working

with urban developers (Interview D2, pers. comm., November 6, 2008). Some of the community

groups have the capacity to produce the level of detail required and are producing accurate maps.

"At the annual (lake) review ministry staff come in and say we have better maps than they do.

We use a collaborated effort involving all partners, resulting in a data exchange agreement so we

can use their TRIM maps" (Interview C4, pers. comm., May 20, 2008).

Table 7: *Research Protocols Followed when Monitoring Water*

Community-based water groups	Decision makers
• Canadian Aquatic Benthic Invertebrate Network protocol (CABIN) • Physical and chemical parameters for water quality (to meet recreational water quality not drinking water guidelines), some in partnership with UBC • British Columbia Lake Stewardship Society water standards • British Columbia Ministry of Environment protocol • Streamkeepers, Lakekeepers and Wetlandkeepers • Fish and aquatic wildlife data e.g. bull trout survey, map kokanee redds • Extensive mapping with Selkirk College, SHIM with Department of Fisheries and Oceans and Ministry of Environment • Baseline data • Continuous temperature loggers • Photo point monitoring • Spring bird surveys • Riparian vegetation plots	• CABIN • British Columbia Ministry of Environment protocol • Physical and chemical parameters • Federal and provincial hydrometric data • Broad scale information/inventory of watersheds • Municipal water meter data • Municipal monitoring at pumping station and operation of systems in accordance with operational certification protecting drinking water • In-depth studies on Regional District water districts • Snowpack analysis • Monitor reservoir source and levels • Municipality monitoring at tap, leak detection, water metering, drinking water samples to lab • Hydrological assessment to develop prescriptions • Sample every watershed where active logging occurs – pre/post harvesting to assess changes in base levels • Climate change modeling • Impacts of industrial operations on fish • Sensitive Fish Habitat Mapping • Studies done by proponents proposing developments, ordered by governments • Problem identification and monitoring of hot spots e.g. industry, agricultural impacts

Citizens are using scientifically defensible research protocols to gather data about water, aquatic wildlife, mapping, etc. "We use protocols that are being used and are acceptable to the scientific community (Interview C4, pers. comm., May 20, 2008). One group noted "1999 was the last year Ministry of Environment conducted in-depth monitoring on our lake so now we follow their protocols and are audited each year on our techniques" (Interview C8, pers. comm., May 28, 2008). The purpose for communities gathering data can sometimes be largely out of self interest and is stored away for a 'rainy day' acting like insurance, in case it is needed (Interview C3, pers. comm., May 28, 2008). One group stated that monitoring is not the end, but part of the aquatic puzzle, recognizing that "we know we are in trouble in terms of water quality and quantity so need to move from gathering information to action oriented restoration" (Interview C5, pers. comm., May, 20, 2008). Decision makers also recognize that there is a lack of data on not only water quality but risks assessment of watershed activity and resulting impacts (Interview D5, pers. comm., December 9, 2008). This same decision maker noted that the data citizens collect would only be valuable if they use standard protocols, a central database and auditing of their techniques.

A common challenge of community groups is not collecting but the management of data (Interview C4, pers. comm., May 20, 2008). Some have office space and a system of where data goes, how it is accessed and by whom (Interview C4, pers. comm., May 20, 2008) while others have a simple system stored in their home office (C3, C5, C7, C8, pers. comm.), while others have separate office space. The intent of some community groups is to have the data posted online and updated on a regular basis useable and readable for the public (Interview C7, pers. comm., May 29, 2008). Other groups find it a problem compiling long-term data sets, keeping data current, updating it and providing it to agencies (Interview C4, pers. comm., May 20, 2008).

"It is important for us to make our data available when requested from Interior Health, the Regional District or Ministry of Forests; this helps nurture our relationship and is insurance for cooperation in the future" (Interview C3, pers. comm., May 28, 2008). It is also important that the data is managed with a long-range vision since the value is in reflecting data that shows trends over time (Interview C5, pers. comm., May 20, 2008).

Data management is not only a challenge for community groups but is also challenging for decision makers. "We are good a collection of data but compiling data, report writing and recommendations for decision making, less so. We need to focus more on report writing" (Interview D3, pers. comm., December 19, 2008). This same decision maker noted that "communication with the public has been difficult after the cutbacks in 2001".

Analysis of data is a challenge for both community groups and decision makers. As one community group spokesperson replied "data is lovely but it needs analysis" (Interview C1, pers. comm., May 23, 2008). "Because we do not have the technical expertise to analyze data in-house, Ministry of Environment has hired a limnologist to do a complete analysis of our data. When analysis is complete and reports are written we send decision makers the published reports. " (Interview C7, pers. comm., May 29, 2008). Community group see a need for results to be free and open to the public yet it is hard for them to access government data.

One of the key data gap areas recognized by both the decision makers and community groups is cumulative impacts. "Since no one is doing this, perhaps community-based water groups under the umbrella of the Network could fill this role"(Interview D5, pers. comm., December 9, 2008).

4.6 Decision Making Process Affecting Watersheds

Joint decision making processes that involve community groups and decision makers are rare, yet two examples were noted in the interviews: the East Kootenay Integrated Lake Management Plan and the Christina Lake Watershed Management Plan and Implementation Strategy. In these examples, community-groups work side-by-side with decision makers, in a mutually respectful relationship, sharing their knowledge, agreeing on parameters for monitoring, joint publishing reports, etc.

At best community groups only have the capacity to deal with their specific watersheds. Citizen groups tend to be very local with their concerns and efforts, breaking off a manageable piece of work for themselves. Their localized work is only a small piece of the 'jurisdiction puzzle' while decision makers have dozens of sub-watersheds under their area of responsibility. Presently there is no definition or defining boundary about the scope of the watershed that planning and management could occur.

A big gap with regards to water decision-making is who to talk to about what issue of concern. Many of the community groups involved with water in the Basin have acquired informal PhD's in water management (Interview C3, pers. comm., May 28, 2008). This local knowledge is in jeopardy since few of these groups have viable succession plans to replace the capable leadership presently at the helm. Not only is leadership replacement difficult, they are challenged to find volunteers, especially from the seasonal resident population, and many of the full time residents have had to relocate, squeezed out by increasing property values and taxation rates (Interviews C3 & C4, pers. comm., May 28 & May 20, 2008).

Throughout the interviews with both community groups and decision makers, both group refer to the same water governance tools of legislation, regulation, guidelines and licenses.

Community groups see a particular problem with this system; governments are not enforcing their own legislation (Interview C3, pers. comm., May 28, 2008). Decision makers admit that they do not have the human and fiscal resources to be in all places, all the time, and that the system is not entirely effective, but it is not from lack of will to make good water decisions. In some cases local governments value the community groups to such a degree that they allocate taxation or grants to support their efforts (Interviews D9 & D10, pers. comm., December 9 & October 20, 2008). Other local governments provide in-kind contributions of office space and access to photocopy services (Interview D10, pers. comm., October 20, 2008). Some community groups though feel disenfranchised. Local government has not listened to some of the concerns and recommendations of groups, even though they have scientific support (Interviews C6 & C7, pers. comm., May 29 & May 29, 2008). Decision makers have expressed concern over historical linkages with advocacy groups that have opposed development and lack confidence that the group is not simply collecting water data in an effort to stop certain activities (Interview D7, pers. comm., October 16, 2008).

CHAPTER 5 RECOMMENDATIONS

Water is an essential ingredient for achieving community sustainability. Sufficient quality and quantity of this aqueous substance is required for citizen health, economic interests and for ecological integrity. Presently there is talk in the Columbia Basin about the issues, a need for increased conservation and stewardship and effective planning and management of water. They are at a critical fork in the river. Which channel will lead the discussion from talk to action?

The UN Rio Declaration, Principle 10 (1992) states that "environmental issues are best handled with the participation of all concerned citizens, at the relevant level". The method by which decisions effecting watersheds are made, should be defined and accepted as a standard Basin wide process. The application of this process should become a regular management tool and include an effectively designed public involvement procedure, sufficient time for review and comment, an open-minded approach, and an inclusive method of follow-up and reporting.

Based on the literature review and evidence from interviews in this explanatory case study with both community-based water groups and decision makers, what follows are five recommendations required to move toward a more sustainable water future in the Basin, utilizing the organizational structure of the newly formed Columbia Basin Watershed Network ("the Network"). These recommendations reflect specifically how decision makers might use community-based water monitoring (CBWM) in a collaborative partnership of shared responsibility and united strategy to plan and manage for water sustainability in the Columbia Basin. Each recommendation provides examples of existing initiatives to enhance and where improvements are needed.

5.1 View CBWM as a strategic investment in social capital

Dale (2009) identifies that sustainable community development strengthens social capital over time with increased engagement, building trust, cooperation, development of collective norms, knowledge diffusion, building toward a shared future. Social capital is the combination of bonding and bridging ties found in a network of actors (Newman & Dale, 2005, p. 478). Bonding refers to social networks that bring people together, leading to greater levels of trust, an essential lubricant for effective relationships (Newman & Dale, 2005). Bridging on the other hand allows actors to connect across diverse social cleavages, accessing outside information and support from outside local networks (Newman & Dale, 2005). In relation to this thesis, social capital is the bridge that connects community citizens with decision makers on the sometime distant shore, while bonding ties, or ladder rungs, provide trust to move safely across the chasm under which sustainable waters flow.

Interviews with both citizens and decision makers reveal varying levels of trust and confidence in the current planning and management process. Community-based water groups express their distrust through examples of lack of enforcement and compliance of governments' own legislation (Interviews C3, C4), decision makers not considering information provided with regards to development approvals (Interviews C3, C4, C7, C8), and lack of meaningful community involvement in an acceptable sustainable water planning and management process (Interviews C1, C3, C5, C7); all diverting hope for citizens trusting a sustainable water future. Decision makers distrust for community-based water groups collecting data stems from perceived bias that some groups have personal agendas and ulterior motives to use the water information collected (Interviews D5, D8, D10, D11, D13) and that some lack rigor in the scientific methodology to collect and analyze data (Interviews D1, D2, D9).

This research also reveals a distinct spirit in the Columbia Basin with a willingness to unite under a single natural resource management focus, water quality and quantity. Citizens may not always agree with decision makers, nevertheless, they want a voice, be heard and see something done about their concerns (Interview C4). Decision makers appreciate when citizens support their efforts, recognizing that advocacy in the political realm is sometimes required to get things done (Interviews C5, C8). Perception of community groups is based largely on the individuals involved (Interview D8), and to gain credibility citizens need to be clear about who they are, build reliability and responsibility based on utilizing agreed upon research protocols (Interview D7).

This issue of community-decision maker trust is not indicative of just the Columbia Basin. Low level of trust was expressed in the Canadian Policy Research Networks (CPRN) (2005) research on accountability with more than 1600 Canadians. Canadians want to play a greater role in holding others to account by actively contributing to decisions (CPRN, 2005).

Lack of trust in water planning and decision making in the Columbia Basin may stem from perceived lack of transparency in the decision making process leading to community suspicion of the benefits and risks of decision made about water and decision makers wondering about community interest in the resource. Lax enforcement of governments' own laws and regulations erodes community confidence. Both sides recognize decisions result in cumulative impacts that ultimately degrade water quality and quantity. It seems that water sustainability is thwarted by small 'social capital' leakage, similar to the analogy of 'water loss' by a thousand drops. To prevent sustainability washing down the drain, this conundrum requires investment in relationship to squelch the qualms of government mistrust and suspected civic self-interest.

Groups like the Columbia Basin Watershed Network can foster reciprocity, facilitate

coordination and communication and amplify information, but first require trust as the lubricant

for this social interaction (Putnam, in Dale, 2001, p. 160). Trust in leaders is integrally related to

the capacity to predict and affect their behaviour (Granovetter, 1973, p. 1374). Trustworthiness

of decision makers can increase in the eyes of community groups when they can assure

community that they are trustworthy by interceding with them on the communities behalf, if

required (Granovetter, 1973, p. 1374).

Citizen engagement is an important form of accountability, and accountability will not

happen with out transparency (CPRN, 2005). "Transparency means the public has easily

accessible, understandable and meaningful information that makes clear what is being achieved

for society with public funds and where the gaps are" (CPRN, 2005, p. 1). This dialogue must

occur two ways with the government giving the public a role in determining what constitutes

meaningful information and facilitating its use to influence policy (CPRN, 2005), in this case

water sustainability action. To engage citizens, government must make space for the public to

participate in crafting public policy (CPRN, 2005).

Trust through accountability starts by establishing and nurturing relationships between

citizen and government decision makers. Building social capital results in more effective

collaborative stewardship and citizenship (Cortner, 2000). Following are specific suggestions

from this research to strengthen the relationship between community and decision makers:

1. Identify who needs to be involved and invite key individuals to participate in the

   Network. Who are the stakeholders and decision makers positioned to have influence on

   water decisions? Decision makers should include elected and appointed officials and

   agency staff members with the technical skills and legal authority to determine the fate of

the community watershed.   This list should include representatives from all three levels

of government. Representing the federal government, a staff person from the Department

of Fisheries and Oceans British Columbia/Yukon Region.   From the British Columbia

provincial government Ministry of Environment, representatives from divisions of

Environmental Quality Section, Water Stewardship Division as well as Interior Health

Authority Source Protection Office. Local government representatives would be from the

engineering/environmental services or planning departments as well as elected officials

from town councils and regional district representatives. Other stakeholders could

include people who work in natural resource industries like mining, tourism and forestry,

as well as water-based recreation enthusiasts who live in the area, affected taxpayers,

citizen led watershed management groups, and others with an interest in exploring water

stewardship. The Columbia Basin Watershed Network provides a forum for a cross

section of stakeholders and community to network and build working relationships;

thereby improving dialogue and discussion related to the development of water

sustainability solutions.

2. Build trust on the foundation of a professional ethic, continual interaction, respect for

local knowledge, and accountability of decision makers. Avoid adversarial,

confrontations, eased by providing the necessary information needed by decision makers,

that CBWM is able to generate (Vaughan, 2007).

3. Decision makers continue to offer and expand their training and auditing of community-

based water group efforts in an effort to increase the validity of data collected.

Governments should continue and if possible, increase support to community-based

water groups through in-kind contribution of equipment, fee for service contracts for

information gathered or maps produced, access to grants, as well as assigned staff
support.

4. Develop regular opportunities for dialogue in meetings, workshops, and water forums.

5. Decision makers should respect the legitimacy of groups to participate in the water
governance process. Explore increased opportunities to engage in meaningful
community dialogue and participation in decision-making. Decision makers recognize
the role of community as on-the-ground 'watchdogs' and 'whistleblowers', with a distinct
role and a right to raise issues of legal non-compliance, infraction of permits and licenses,
and contamination of watersheds.

6. Celebrate collective partnership success by planning events that showcase water
sustainability and restoration/stewardship e.g. Shoreline Cleanup, Tintanic tours on
Christina Lake, water through the arts, etc.

5.2 Work with CBWM groups to identify, assemble and consider all technical and factual
information about the watershed.

To develop an integrated sustainable community plan, from which water decisions will
flow, requires community collaborative effort through participatory techniques allowing for full
involvement and engagement with the socio-economic life of the community and the natural
system upon which the community depends (Ling, Dale & Hanna, 2007, p. 1). Essential to this
understanding of place or the watershed is the collection and assembly of all significant
information.

Community-based water groups collect data for a variety of reasons ranging from self-
interest insurance for 'a rainy day' to identify trends in spring freshet resulting from intuitive

changes they see related to suspected climate change impacts. Some water data is used to hold

decision makers accountable for compliance and enforcement of governments' own laws.

Generally, community groups see better water information as important to guide more

sustainable water decisions.

Decision makers identify a retreat from former government responsibilities monitoring

water by removing components like the "Water Survey Canada" water quality and quantity

stations. They identify ongoing funding challenges as financial and human resources decrease,

while at the same time recognizing information gaps, especially in light of climate change

uncertainty. Decision makers recognize the need for agreed upon, standardized research

protocols for gathering important water data, even though there is no consistent research

protocols followed between government agencies responsible for water planning and

management. A startling result of this research indicated the majority of decision makers

recognize that environmental problems are getting worse under our present management

structure, and citizens recognize since government is not doing the necessary job, they are

stepping in to fill the gaps.

Hague Vaughan (2007), Director from the Ecological Management and Assessment

Network (EMAN) Coordinating Office of Environment Canada encourages citizens to dialogue

with decision makers to determine first what information they need and how to package this

information so that they have a better foundation for decisions and policies. Decision makers in

the Columbia Basin express support for working with community-based water groups using

agreed upon research standards and methods. Missing data and gaps in information should be

identified, and novel partnership methods established to collect the data. When a strong working

relationship exists between citizen groups and decision makers to collect data, create maps and collaborative on decision-making, the results are mutually beneficial.

Consideration of long term effects resulting from the direction watershed development takes should be a component of the process defined under this recommendation. A holistic or integrated approach to decision making can only occur when all significant information is assembled and used effectively within the process.   The following recommendations will assist in this effort:

1. Establish agreed upon chemical, physical and biological research protocols to be used by both community-based water groups and decision makers.

2. Identify gaps in the water information required by decision makers and work backwards to identify which information can realistically be collected by CBWG.

3. Align agency data with community data and make it accessible through the Columbia Basin Watershed Network database.

4. Utilizing some of the key data from both groups, design generalized feedback reports available to community residents generating basic 'state of the water' information available though the Network.

5. Use a third party analysis for both government and community data to obtain objective interpretation of water data results. A third party analysis of water data provides an independent, non-biased review.

6. The Network should participate in the dissemination of water information to key decision makers, in particular elected officials, through collaborative reports like the "State of the Basin Water Report".

7. Decision makers are encouraged to continue to train community groups to collect water data and audit their performance periodically. Knowing the validity of the data, decision makers can advocate for the reliability of its use by others.

5.3 Share information through the Network to foster collective support for water sustainability

Sharing of information between members of the Columbia Basin Watershed Network arise from strengthening social capital and norms of reciprocity and trustworthiness (Putman 2000 in Newman & Dale, 2005). Without a cohesive network and critical mass of strategic partnerships and alliances, the environment is never consistently and persistently high on the political agenda of the day (Dale, 2007, p. 1). The Network could provide the coordination of a critical mass collecting and disseminating water information.

Methods of publishing and sharing information may vary from case to case because stakeholders may have differing values and preferences in accessing information. To be more inclusive of citizens participating in water governance during the stakeholder meetings, the process for the dissemination of information should be clearly defined. From the decision makers perspective community-based water groups should identify a single, central contact person appointed to act as the focal point for information dissemination.

Decision makers have indicated varying levels of support for citizen groups ranging from access to equipment, office space, grant dollars, assistance with funding proposals, etc. Citizen groups have taken up these offers and have utilized decision makers. Some have found the additional resources to establish stewardship center. Decision makers have utilized these centers to disseminate information, which assists them in compliance of regulations.

Citizen groups can play a critical role as community educators about water issues. They can provide a context and means by which community members can participate in water monitoring, thereby increasing their water literacy. Together communities can understand, learn, develop skills and celebrate water, while changing behaviours necessary for achieving water sustainability for a particular region.

Some decision makers are partnering with community groups to identify and assemble water data. There are some agreed upon research protocols that both are following so that both parties can effectively compare each of their physical, chemical and biological parameters. This information needs to be made widely available across the province so that community groups can build upon and constantly refine the protocols.

Citizens collect data and tend to store it in their home-offices and rarely report on their finding. Neither to decision makers, they collect data and also struggle with the time and resources to publish reports. If all the information about water was consistent and published in a 'virtual' database like the one proposed by the CBWN, with data from not only citizen groups but also agency staff, the conclusive data set could generate substantiated reports.

Additionally the data could be synthesized into an annual state of the Basin water report where hot spots are identified, perpetrators of non-compliance, issues of concern, restoration efforts completed, water use figures publicized. Clearly not all community groups or decision makers follow the same protocol. The federal government uses the CABIN protocol. They are collecting information on SHIM. Members of the CBWN involved with the monitoring pilot are using the CABIN protocol, but not all community-based water groups are part of the pilot initiative. Neither do citizens have the chance to share information on a regular basis. The Network is designed to be a venue for citizens sharing data with each other and a range of the

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decision makers. Decision makers partner with community water groups to identify, assemble

and consider all scientifically defensible information about the watershed. This effort will result

in a more holistic watershed perspective.

There should be an agreed upon interactive method for adding to or making inquiries

about water information. This could take the form of a web site with appropriate interactive

features such as on-line 'webinars' or video conferencing, newspaper articles or other circulars

with built in feed back mechanisms. Regular informal opportunities for stakeholders including

relevant decision makers should be scheduled to discus updates and the progress of sustainable

water planning and management. Other recommended ideas to share water information and

build collective support for water sustainability are:

1. The Network needs a clear vision for water sustainability 'backcasting' from the change

   members seek. Translate this vision into a mandate with agreed upon goals and

   objectives, with indicators that will tell them they are flowing toward water sustainability.

   This should be translated into specific policy that guides the organization's actions.

2. *Utilize the Network as a conduit to disseminate water information to community groups,*

   agency decision makers and other interested parties. Facilitate face-to-face dialogue

   between community and decision makers.

3. Community-water groups will require funding support for their monitoring, restoration,

   stewardship and education activities. Governments that benefit from CBW data should

   contribute financially through grants covering fee-for-service. CBT could create a

   funding resource specifically addressing these areas.

4. Recognize that community-based water groups are champions in communities for the dissemination of information and education, and need encouragement to partner with decision makers to design and implement local solutions to water conservation.

5. Agencies collaborate with community-based groups to 'ground truth' assumptions of maps, often used by decision makers off-site in offices.

5.4 Once a decision has been made, engage CBW groups in the design of a monitoring and reporting process

Meaningful follow up is important to the long-term health of the watershed and to relationship building. Substantive data is needed to determine the effects of human actions on the watershed, and standardized monitoring protocols must be agreed upon at the outset. Monitoring is a key water management activity. Just as important as monitoring is how will the effectiveness of the decision be communicated? This 'feedback loop' of monitoring and assessment can be measured against the vision for a healthy watershed.

Involving CBWG may reduce the need for additional government fiscal and human resources, although monitoring even by citizens is not free. Financial or in-kind contribution should continue as a responsibility of government. Along with monitoring services, community groups through volunteer involvement and community relations, play an important role in helping to increase water literacy amongst residents. There is added benefit that environmental awareness and meaningful water based research activities will encourage water sustainable behavior. To design meaningful monitoring and reporting processes:

1. Decide on the most effective method for reporting data to each specific target group and who is the contact person is i.e. agency staff, elected officials, community residents, and managers of municipal water works.

2. Determine a reporting framework for decision makers monitoring permit applications and license requirements and reporting back to the community on results.

3. Once data is collected, verified, audited and substantiated, community and decision makers advocate for the quality of the data collected and use it to make more sustainable water choices.

4. Consider following EMAN direction in using ecological goods and services as the scale or currency exchange between science and decision makers (EMAN, 2007). Ecological goods and services are unsubstitutable and they link to systems dynamics and society, address watershed scales and can be measured through regional, provincial, national and international standardized results (EMAN, 2007).

5.5 Utilize the EMAN CBM Framework as an integrated, adaptive management strategy to make sustainable water development decisions in the Columbia Basin

CBWM should be a versatile, iterative and adaptive process that engages people to generate or use ecological monitoring information (Vaughan, 2007). This effort fills the gap between what existing monitoring science is doing and where further information is needed, what is changing both positive and negative as a result of human actions, flag emerging hot spots and provide feedback and on how ecological systems and human watersheds are doing.

Capitalizing on the lessons learned from the EMAN's network of 600 partners involved in various aspects of either monitoring or assessment, the Network should integrate EMAN's

(2003) "Community Engagement Spiral" into the early stages of planning and development of the organization. With its four key interrelated phases, this model is being applied across Canada and should be integrated with the Network' efforts to engage CBWM in dialogue with water decision makers in the Columbia Basin (Whitelaw, et al, 2003).   Their four ongoing, connected components, in no order of importance, recommended for consideration are:

1. CBWM participate in **community mapping** to better understand the connections between water, land, and community.

2. **Participation assessment** is required to identify all the stakeholders and partners with an interest and responsibility in water related issues and decisions.

3. **Capacity building** requires the identification of the steps required to make CBWM happen in the Columbia Basin.

4. **Information gathering and delivery** of this information in a feedback loop of accountability and transparency.

5.6 Summary

Water sustainability is more an issue that must be resolved by society than science. Human systems of water governance are bogged down by jurisdictional fragmentation determined by political boundaries, instead of geographical watersheds. Clearly all three levels of government have a role to play in the Columbia Basin. Federal government has an interest in fish and the impacts of development on fish habitat. The provincial government interest is mainly in pollution prevention, environmental degradation and source protection for drinking water systems. Local governments manage water and sewage waste systems and are monitored for discharge of effluence and use incentive programs like water metering to reduce

consumption. Industry is issued permits to pollute and must be monitored for compliance.

Agriculture holds licenses to withdraw for streams and rivers. Wise use of water by citizens is

encouraged through public water conservation efforts and education programs. Crown

corporations are involved with water planning to protect hydrological 'water use' strategies and

have licenses to remove water at periods of time, ensuring that the flow levels do not adversely

affect fish populations. Organizations like the Columbia Basin Trust advocate for an inclusive,

integrated water decision-making process leading the region toward best management practices

that will guide a sustainable water future. Non-government organizations advocate for the

protection of water by commenting on development proposals or as catalysts for citizen

opposition, taking legal action for governments not enforcing their own legislation. These same

groups provide community education and stewardship in action restoring riparian areas, planting

trees, building fish weirs, hosting clean ups, celebrating water with special events. All of these

efforts contribute to decisions concerning water sustainability in the Basin.

Despite all the good intentions of citizens and decision makers, a water sustainable future

is inherently unpredictable (Gunderson & Holling, 2002, p. 437). Community-based water

monitoring is not the panacea that will solve the dilemma of water sustainability. It is simply an

approach or an action in a quest for building a bridge spanning the chasm between traditional

decision making processes with an interested, dedicated civic society who wants to know more

about this fundamental resource and contribute in a meaningful way to its health and availability.

Gunderson & Holling (2002) are clear that for a sustainable development shift to occur will take

both political and personal will, and their collective wisdom.

Olson and Rejeski (2005) editors of the book "Environmentalism and the Technologies of

Tomorrow" note that in this era of pervasive scientific change we need scientific literacy (like

that awareness built by community monitoring water) amongst our public, press and policy-makers (p. 173). This is especially important since as complexity of issues increase, public understanding drops off precipitously (Olson & Rejeski, 2005, p. 173). Using humanities collective imagination to chart a water sustainable future using these recommendations intended to steer through the rapids of water sustainability.

In summary, for decision makers to use citizen generated data in planning and managing water sustainability in the Columbia Basin, CBWM must first be viewed as a strategic investment in social capital resulting in trust and accountability with decision makers. Secondly decision makers need to work with CBWM to identify, assemble and consider all the information about the watershed before decisions are made. Thirdly, by sharing information between citizens and decision makers, this will foster collective support and accountability for Basin wide water sustainability. Fourth, once decisions are made, citizens and decision makers must design and implement a monitoring and reporting process that involves CBWM. Lastly the Network is encouraged to consider the EMAN CBM Framework as an integrated, adaptive management strategy to make ongoing sustainable water development decisions in the Columbia Basin.

Further research required beyond this thesis is to better understand the role and relationship between CBWM groups and decision makers. How does this community effort meet the needs of decision makers? How is citizen generated data used and is the community satisfied that there views are considered? What are the best methods to inform and support decision makers in their efforts to plan and manage for a sustainable water future? Tracking the implementation of the recommendations contained in this research is basis for doctorate level research.

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Appendices

Appendix A: Interview Questions – Community-based Water Groups

1. Please state your name and the organization you represent.
2. What are the **biggest issues** facing water in your community?
3. What is your **understanding of water sustainability**? What is the sense of water sustainability within your organization more broadly? Can you describe the ideal vision you have for water sustainability in your community?
4. What **indicators** would you use to tell you that you were on the path to a water sustainable future?
5. In order for the necessary changes to occur for water sustainability to become a reality, what **helps or hinders** us from moving in that direction? What would be a **mechanism** that would move us in the direction of water sustainability?
6. What was the **catalyst for your organization forming and then gathering** water data? Please share a bit of **history** of your organization.
7. What **research protocols** do you follow for gathering data? Do you **partner** with anyone else in the collection of water data? How do you **contribute to better water management** in your community?
8. What is your **purpose for gathering data** about water? What do you **do with the data** you collect?
9. What methods do you use for **communicating the results of your data**?
10. **Who are the key decision makers that are your 'go-to' people that you communicate with** regarding the data collected or trends analysis? Why do you choose these decision makers over others?
11. How do you think decision makers **perceive** your organization and the work that you do?
12. What are your **greatest achievements/frustrations** with your water monitoring activities?
13. What **role do you see citizen science playing** in water sustainability management?
14. Is there the **capacity for volunteer** citizen groups **to sufficiently collect water data** in communities?
15. Can you give me a **specific example(s) of how your activities/data affected any decisions about water** in your community?
16. Does your organization have any **succession plan** in place to ensure its long-term viability?

Appendix B: Interview Questions – Water Decision Makers

1. I would like to start out by learning more about you, specifically could you explain your responsibilities related to water planning and management for your agency/business/organization.
2. What is your business/agency/perspective on water sustainability? Can you **describe an ideal vision of water sustainability** in your community? What **indicators** will you use that indicate you are on a path toward a sustainable water future?
3. What are the **key water issues** facing you as a whole in your day-to-day planning and management of water?
4. What are the **key governance tools** that guide your decisions about water? E.g. laws, regulations, policy, guidelines?
5. With regards to the process by which you make decisions about water, what are the **greatest challenges** you face? Conversely what aspects of the current process **assist you manage and plan** for long-term sustainability of the water resource?
6. What information do you rely on to make decisions about planning for a sustainable water future? Are there **any gaps in your information**?
7. What **water monitoring activities or research protocols** do you follow?
8. Are you **aware of any water-focused citizen science** or volunteer environmental monitoring initiatives in your community or jurisdiction? How are they perceived in the broader community?
9. What **value** do you see in an engaged citizenry gathering water data? What are the **risks** of citizens gathering water information?
10. How do you **dialogue with people about issues and impending decisions** about water specific to your jurisdiction?
11. Where might there be **opportunities for citizen science collecting water data to collaborate with you** about water related issues and solutions? Can you give me an example of where you used citizen-generated data on policies and practices related to water management and planning?
12. What **sources of support (financial, in-kind, etc.) are available** from your organization to support citizen science monitoring of water resources in your community?
13. How might you **strengthen your relationship, dialogue and mutual trust** with your constituents regarding water management and planning? Can you describe a scenario where you might want to use citizen science monitoring water?
14. **Why do you think citizens want to collect information about water?** How might this **help** you make decisions about a sustainable water future? How might this **hinder** you?
15. The purpose of this interview is to examine decision-makers perspective on the role of citizen scientists gathering data on water quality, quantity and allocation, and how might decision makers use this information when planning and managing for water sustainability. Is there anything else you would like to add?