

# Factors Facilitating and Constraining Source Water Protection in the Okanagan Valley, British Columbia

R. Patrick, R. Kreutzwiser and R. de Loë

**Abstract:** This paper reports the results of research undertaken between August 2004 and July 2005 into factors that facilitate and constrain source water protection based on four case studies from the Okanagan Valley, British Columbia. The research reveals that power relations operating between and among various actors either facilitate or constrain source water protection. Semi-structured interviews and document analysis provided evidence for this research. Factors facilitating source protection tend to concentrate at the local scale and include water purveyor relationship-building with other watershed users, the formation of multi-purveyor joint water committees, water purveyor opposition to provincial initiatives perceived as contradictory to source water protection, and broad-based education and dissemination of watershed information to water ratepayers. Factors constraining source protection tend to concentrate at the provincial scale and include fragmented roles and responsibility of multiple and overlapping provincial agencies, lack of provincial power-sharing with local purveyors respecting watershed activities, and poor communication from provincial agencies. Attention to power relations helped to reveal that local water purveyors within the Okanagan Valley remain limited in their capacity and frustrated in their efforts to advance source water protection. Ways in which these circumstances can be improved are identified in the paper.

**Résumé:** La présente communication fait état des résultats d'une recherche entreprise entre le mois d'août 2004 et juillet 2005 sur les facteurs qui facilitent et freinent la protection de l'eau à la source, résultats tirés de quatre études de cas pour la vallée de l'Okanagan, en Colombie-Britannique. Les recherches révèlent que les relations de pouvoir qui s'exercent entre et parmi les divers intervenants peuvent soit faciliter, soit freiner la protection de l'eau à la source. Des entrevues semi-dirigées et des analyses documentaires ont permis de dégager des faits pour cette recherche. Les facteurs qui facilitent la protection à la source tendent à se concentrer à l'échelle locale et englobent la création de liens entre les fournisseurs d'eau et les autres utilisateurs du bassin, la formation de comités mixtes composés de fournisseurs multiples, l'opposition des fournisseurs d'eau aux initiatives provinciales perçues comme allant à l'encontre de la protection de l'eau à la source et la sensibilisation à grande échelle ainsi que la diffusion de données sur le bassin hydrographique auprès des contribuables qui règlent les tarifs d'eau. Les facteurs qui limitent la protection à la source tendent à se concentrer à l'échelle provinciale et englobent la fragmentation

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des rôles et des responsabilités des organismes provinciaux multiples dont les activités se chevauchent, le manque de partage du pouvoir provincial avec les fournisseurs locaux en ce qui concerne les activités liées au bassin et une piètre communication de la part des organismes provinciaux. L'attention accordée aux relations de pouvoir a contribué à mettre en lumière le fait que les fournisseurs d'eau à l'échelle locale dans la vallée de l'Okanagan demeurent limités dans leur capacité et frustrés dans leurs tentatives de faire avancer le dossier de la protection de l'eau à la source. L'étude cerne divers moyens d'améliorer ces aspects.

## Introduction

Source water protection (SWP) is broadly defined as watershed and aquifer management for the protection of drinking water supplies. It is operationalized through water and land management programs that typically have the specific goal of protecting drinking water supplies (National Research Council, 2000; Harrigan-Farrelly, 2002; Gullick, 2003; Ivey *et al.*, 2004). In their effort to identify factors facilitating and constraining SWP, water resource researchers have drawn on the "capacity" and "capacity building" literature. This literature identifies a range of financial, institutional, political, social, and technical factors facilitating and constraining capacity, particularly at the local level, for effective water management generally and SWP specifically (Litke and Day, 1998; de Loë *et al.*, 2002; Ivey *et al.*, 2002; Peckenham *et al.*, 2005). These factors include, but are not restricted to, lack of legal authority for watershed management as well as limited financial and human resources to initiate SWP, particularly for small water operators (Peckenham *et al.*, 2005). More recently, Ivey *et al.* (2006) explored the ways in which local capacity building initiatives are influenced by power differentials that exist among local governments, stakeholders and residents.

Building on that literature, this paper explores ways in which relationships of power existing between and among various stakeholders or actors may facilitate or constrain the practice of SWP in British Columbia. Power, defined as the overarching authority or capacity

to undertake action, may play an important role in SWP, particularly where power is distributed unevenly among actors at different institutional levels (Adger *et al.*, 2005).

This paper reports on research conducted between August 2004 and July 2005 in British Columbia's Okanagan Valley. The Okanagan Valley was chosen for this study because of long-standing concerns for water quality and quantity and rapid population growth and economic expansion (Canada-British Columbia Okanagan Basin Agreement, 1974). More recent attention has focused on climate change impacts on water management generally (Cohen *et al.*, 2004) as well as vulnerability and adaptation to regional water stress (Belliveau *et al.*, 2006; Shepherd *et al.*, 2006). Meanwhile, attention to source water protection in the Okanagan has been absent in the literature.

The provincial government has acknowledged the importance of SWP, as part of a multi-barrier approach to safeguarding public drinking water. However, it is unclear how and to what extent SWP is being practiced at the local level by water purveyors and, importantly, what factors facilitate and constrain the practice of SWP. The Province's largest metropolitan areas, Greater Vancouver and Greater Victoria, enjoy "protected" mountain storage watersheds by virtue of historical land tenure arrangements that legally prohibit public access. However, this arrangement is the exception rather than rule given that 92% of the provincial land base in British Columbia is Crown-owned and managed as "integrated use" areas (Cameron, 1998). This paper reports factors facilitating and constraining the protection of drinking water sources within Crown-owned areas of the Okanagan Valley.

## Background

The Okanagan Valley is located in the southern interior of British Columbia (Figure 1). The valley is roughly 160 km in length, averages 50 km in width, and encompasses approximately 8,200 km<sup>2</sup> of land surrounding Okanagan Lake and Okanagan River (Cohen and Kulkarni, 2001). Located in the rain-shadow of the Coast (British Columbia) and Cascade (Washington State) mountain ranges the Okanagan Valley has a semi-arid continental climate

receiving approximately 30 cm of precipitation per year; of this 85% is lost annually to evaporation and evapotranspiration (Cohen *et al.*, 2004).

The Okanagan Valley is divided politically into three regional districts, 11 municipalities, 40 improvement districts, and the Okanagan Nation Alliance comprising seven Indian Band Reserves (Cohen *et al.*, 2004). For the purposes of this study, case study research was conducted within the Regional District of North Okanagan and the Regional District of Central Okanagan. Each case study area operates mountain storage reservoirs on highland plateaus well above the valley bottom lakes. The four case study areas are Lakeview Irrigation District, South East Kelowna

Irrigation District, District of Lake Country, and Greater Vernon Water Utility (Figure 1).

Mountain valley tributary streams are a main water source for water users in the Okanagan Valley. For example, within the Regional District of North Okanagan approximately 70% of potable water supplies have their source in mountain areas. The percentage for the Regional District of Central Okanagan is lower at 40%, owing mainly to Okanagan Lake supplying most of Kelowna. These mountain watershed sources have historically provided adequate water quantity for irrigation and potable supply through gravity-fed systems.

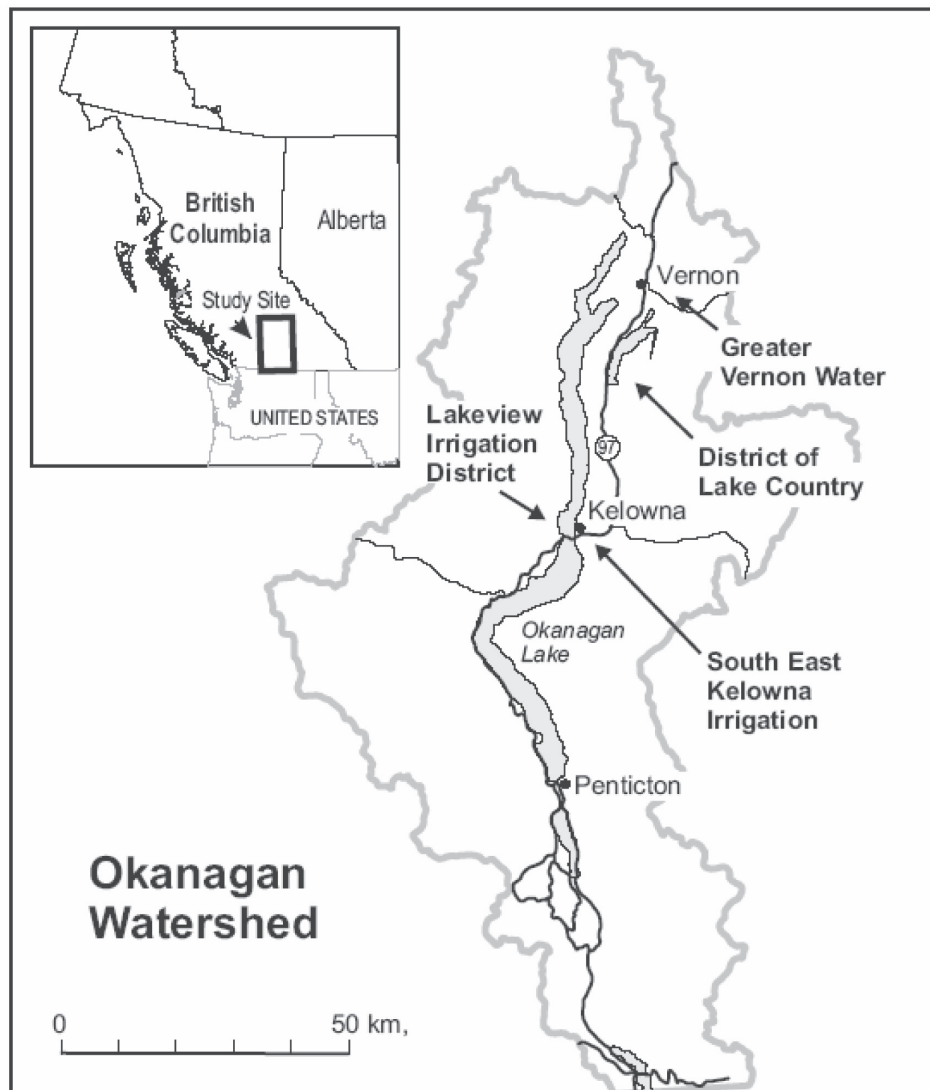


Figure 1. The Okanagan Valley and case study areas.

### Source Water Protection in British Columbia

One year prior to the tragic events of Walkerton, Ontario (seven deaths and 2,300 reported illnesses), a report by the Auditor General of British Columbia entitled *Protecting Drinking Water Sources* (British Columbia, 1999) [hereafter referred to as Auditor General's Report] was released to the BC Legislature. The rationale for the report was "signs of strain" in the Province's drinking water sources measured by BC's high rate of reported enteric diseases (highest in Canada 1987-1997) and "well-publicized water-related disease outbreaks" within BC communities (Auditor General's Report, p.7). The Auditor General's Report asked whether the level of source water protection provided by the Province from human-related impacts appropriately balanced the costs and benefits of drinking water and other resources. The scope of the report extended to the management of Crown land and water sources supplying 1.7 million British Columbians living outside the two largest metropolitan areas comprising 45% of the provincial population (Auditor General's Report, p.12). The report concluded that in the absence of "an effective, integrated approach to land-use management, the Province is not adequately protecting drinking water sources from human related impacts", a condition resulting in "less than optimal choices being made between the need to protect source water and the need to allow other (land use) activities" (Auditor General's Report, p.12). The report acknowledges the high financial cost of neglecting source water protection in favour of exclusive water treatment technology and instead supports the multi-barrier approach to safe drinking water.

Within two years, the BC Provincial Health Officer (British Columbia, 2001) echoed the Auditor General's Report regarding unacceptable high incidences of enteric illness, waterborne disease outbreaks, and community boil water advisories. And, like the Auditor General, the BC Provincial Health Officer emphasized the importance of the multi-barrier approach including "better protection and management of the land that surrounds the water sources" (British Columbia, 2001, p.3). Provincial concern for drinking water safety culminated in the *Drinking Water Protection Act* [SBC 2001] and the *Action Plan for Safe Drinking Water in British Columbia* (British Columbia, 2002).

### Methodology

The four case studies central to this paper (described below) are all located in the Interior Health Region of BC and share similar climates, economies, development pressures, and regulatory frameworks. Criteria used for their selection included surface water sources, mountain storage systems, demand for potable water quality, and a mix of jurisdictions (e.g., irrigation districts and municipalities) from within the Okanagan region.

Semi-structured interviews were conducted with a range of participants from inside and outside the Okanagan Valley. The majority of the key informant interviews were conducted in the central and north Okanagan. A total of 31 semi-structured interviews between August 2004 and July 2005 targeted multiple actors at the local and provincial scale. Local-scale respondents included private consultants, regional district officials, water authority staff, local government planners, and locally-elected representatives. Provincial-scale respondents included staff from provincial agencies such as Ministry of Health Services, Ministry of Environment (formerly Ministry of Water, Land and Air Protection, and Ministry of Sustainable Resource Management), Ministry of Forests, and Interior Health Authority.

The rationale for using a broad spectrum of interviewees was the inextricable link between land use and water quality (Peckenham *et al.*, 2005; Kundell and DeMeo, 2000). In light of this link, soliciting responses from land use planners, range managers, foresters and water purveyors was necessary to invoke multiple perspectives. As well, it was necessary to interview a broad range of actors at different scales (local and provincial) to identify possible power relations operating between actors.

Analysis of about 50 documents provided a second source of data for this research. Both technical and non-technical documents pertinent to each of the four case studies were reviewed using content analysis techniques. Technical documents included provincial acts and regulations, professional consultant reports, water purveyor reports, as well as local and regional planning documents. Non-technical documents included water purveyor newsletters and trade association documents. Document analysis incorporated both qualitative and quantitative techniques. The principal purposes for undertaking document analysis were to corroborate interview findings and to assist in identifying possible

power relationships. Content analysis was applied to interview transcriptions to detect the presence or absence of key concepts and definitions. This involved the compilation of a simple keyword count, sometimes called *manifest* content analysis (Tonkiss, 2004; Cope, 2005). Manifest content analysis was also undertaken on text documents. This approach was particularly helpful for comparative purposes to enrich the research evidence of the study. For example, simple keyword searches of engineering documents revealed a strong bias toward water treatment over source protection.

The collection and analysis of interview transcripts and text document material provided an empirical, data-led approach to theory construction known as “grounded theory” (Glaser and Strauss, 1967; Seale, 2004; Cope, 2005). By identifying themes or trends from data, refining those themes, and conducting additional data collection, it was possible to build generalizations grounded in real events (Seale, 2004; Cope, 2005). For the purpose of this research, key concepts and definitions were selected as themes to help reveal power relations between multiple actors. Checking through the interview transcripts and text document material for the presence or absence of key themes helped reveal power relations. In this way, data reduction and data exploration were used to draw inferences specific to power relations as a facilitating or constraining factor in SWP.

### Case Studies

Lakeview Irrigation District (LID) is located on the west side of Okanagan Lake northwest of the City of Kelowna. LID has a service population of just over 10,000 persons with over 3,400 water connections consisting of residential, commercial, industrial, institutional, and irrigation users. The source of supply for LID is the Lambly Creek watershed. The district was created in 1951 through a provincial Order-in-Council to support an expanding orchard industry and to provide potable water. The primary legislation governing irrigation districts and improvement districts is Part 23 of the *Local Government Act* [RSBC 1996]. This statute governs the way improvement districts are administered, and it defines powers and operations and prescribes procedures for taxation and borrowing.

South East Kelowna Irrigation District (SEKID) is one of five public water utilities serving the City

of Kelowna. The service area of SEKID encompasses almost 3,550 hectares of land and accounts for over 20% of the area of the City of Kelowna. Most of the land in the SEKID water service area is agricultural land. The main water supply for the district is Hydraulic Creek draining McCulloch Reservoir. This reservoir is located to the northeast of Little White Mountain at 1,260 m elevation. The watershed covers 65 km<sup>2</sup> and is heavily laden with organic material, including large peat meadows, forests and wetlands.

The District of Lake Country (DLC) is located midway between Vernon and Kelowna within the Regional District of Central Okanagan. DLC contains four distinct neighbourhood communities: Oyama, Winfield, Carr’s Landing, and Okanagan Centre. The DLC water system services 2,400 homes and businesses, and 500 agricultural properties with 1,375 hectares of irrigated land. DLC was incorporated as a municipality in 1995, with the southern boundary of the municipality coincident with the northern boundary of the City of Kelowna. As a result of the incorporation, DLC operates five water systems, four of which are served by surface sources and one served by groundwater. Immediately to the east of DLC is the major watershed of the community consisting of Oyama Lake, Swalwell (Beaver) Lake and Dee Lake Chains and ancillary watercourses.

Operating under the Greater Vernon Services Commission, Greater Vernon Water (GVW) oversees the supply and distribution of water to domestic, commercial, industrial, institutional and agricultural customers in the designated service area. The service areas include the City of Vernon, District of Coldstream, and the area formerly served by the North Okanagan Water Authority, all located within the Regional District of North Okanagan. The service population of Greater Vernon Water (GVW) is 42,000 with approximately 3,500 hectares of irrigated land (Associated Engineering, 2002).

### Results

Results of the case study evaluation are reported in this section. To set the context for findings regarding factors that facilitate and constrain source water protection, three contextual considerations are discussed at the outset and are presented in the following subsection. Scale (local versus provincial) can be a critical

determinant of power relations (McCarthy, 2002; Swyngedouw *et al.*, 2002; Robbins, 2004). Therefore, local- and provincial-scale findings are presented separately throughout this section.

### Contextual Considerations

*Main Threats to Drinking Water Quality:* Respondents were asked to identify what they perceived to be the main threat to their drinking water quality. This question was posed to generate some indication of the perceived source, or origin, of water quality deterioration with the intent of identifying activities and actors responsible for water quality deterioration. In addition, this question provided a means of assessing whether impacts were viewed differently by local and provincial actors.

The results shown in Table 1 indicate that, taken as an aggregate, recreational uses are perceived, correctly or incorrectly, as having the greatest potential to negatively affect drinking water quality. Excluding recreation uses, threats to drinking water were perceived rather differently between local and provincial actors. For instance, cattle grazing was consistently reported at the local scale as a major problem (33%). However, at the provincial scale cattle grazing was not commonly viewed as problematic (11%). Moreover, forestry was seen as a relatively minor threat at the local scale (6%), yet provincially forestry was perceived as a greater threat to drinking water quality (22%). In many instances local water purveyors were quick to point out their positive relationship with the forest sector. In fact, often the water purveyor and other local-scale actors (consultants, elected officials) viewed the forest companies as watershed stewards. As stated by the water quality technician for Greater Vernon Water: “We have a fairly good relationship with the licensees, they’ve listened to my thoughts on a lot of issues. Because forestry is changing the land base they’ve put in a lot of fencing in the past to keep cattle away from streams. I’m seeing some cooperation there”.

**Table 1. Perceived main threat to drinking water quality (% of interviewees).**

Perceived Main Threat	Local-Scale Interviewees	Provincial-Scale Interviewees
Cattle-grazing	33	11
Recreation	25	33
Lease lot sales	20	—
Wildlife, birds	10	—
Forestry	6	22
Crop agriculture	6	17
Climate change	—	17
TOTAL (%)	100	100

*Lead Watershed Agency:* Respondents were asked to identify the lead agency with overall responsible for watershed issues. This question was inspired, in part, by comments made in the Auditor General’s Report suggesting one agency should be assigned the role of the “voice of water” within government.

Table 2 indicates a broad range of responses to this question. At the local scale, nearly half (45%) of all respondents indicated uncertainty regarding the identification of a lead agency with watershed management authority. The remaining responses were divided among four provincial ministries and agencies. At the local scale, water purveyors expressed considerable frustration in not being able to clearly identify a lead agency with watershed authority. However, there seemed to be agreement that the over-riding responsibility rests somewhere within the provincial government. For example, the Director of Engineering for District of Lake Country stated that “I think *authority* is the keyword we are looking for. Who has the *authority* in the watershed to deal with the drinking water issue? In my opinion they [the provincial government] are not there yet” [emphasis added]. More surprisingly, at the provincial scale 55% of respondents voiced frustration regarding the lack of an identifiable watershed authority. In the words of a provincial government SWP specialist, “[t]here are a whole range of people that oversee watershed activities, therein lies some of the problem”. These responses confirm observations made originally in the Auditor General’s Report respecting inter-agency overlap of responsibility.

More recently, the Fraser Basin Council (2005) produced a research paper listing the authorities affecting SWP in BC. The research paper identifies a non-hierarchical structure of nine provincial acts representing four provincial ministries each with a role in protecting British Columbia water (Fraser Basin Council, 2005). No lead agency for SWP is identified in the Fraser Basin Council research paper.

**Table 2. Agency identified by interviewees as lead watershed agency (% of interviewees).**

Agency identified as lead watershed agency	Local-scale interviewees	Provincial-scale interviewees
Fragmented, no single agency	45	55
Interior Health Authority	20	18
Ministry of Forests	15	9
Land and Water BC Inc.	10	18
Water, Land and Air Protection (currently BC Environment)	10	—
TOTAL (%)	100	100

*Clarity of Roles of Provincial Agencies Respecting SWP:* Interviewees were asked to comment on whether the roles of the various provincial agencies were clearly defined respecting SWP. Many respondents qualified their response to the question by highlighting the presence of both multiple agencies and (perceived) overlap of agency responsibilities. For example, an elected trustee for South East Kelowna Irrigation District stated: “the role of the provincial agencies is not clear: too many agencies, too much overlap of responsibilities”. All local-scale interviewees were unanimous in reporting that the role of the provincial agencies was not clearly defined to their satisfaction. Even at the provincial scale there was considerable doubt (64% of respondents) regarding clarity of the role of the provincial agencies respecting SWP. This doubt has turned into uncertainty regarding responsibility between agencies. For example, a public health engineer for the Interior Health Authority stated:

“[n]o, the role is not clear, because amongst the agencies there are fuzzy lines between our areas of jurisdiction. It used to be quite clear, source protection used to be the responsibility of one agency, Water Land and Air Protection. But now there is a fuzzy line because the authority of the Health agencies extends into every aspect of drinking water protection. So no, the role of the provincial agencies regarding drinking water is not clearly defined.”

This response echoes earlier comments made by the Auditor General’s Report regarding “inter-agency turf-wars” around the area of watershed jurisdiction. Some hint of inter-agency resentment and competition respecting agency roles was evident in the remarks of a hydrologist employed by the Ministry of Water, Land and Air Protection, “[T]he fragmentation of agencies and the fact that Ministry of Health has the mandate to do SWP, but maybe not the expertise, is a direct constraint to SWP. Drinking water officers are public health inspectors, they do not have the expertise to be doing SWP”.

### **Factors Facilitating Source Water Protection**

*Local scale:* Twenty interviews at the local level produced 25 factors perceived by interviewees to facilitate SWP (some interviewees identified more than one factor) that were grouped into six themes (Table 3). The most commonly cited factor perceived to facilitate SWP was partnering with industry (42%), namely the forestry sector. Specific activities from the forestry sector included good working relations and communication, field inspections, and land use referrals. These activities are mostly informal and voluntary on the part of industry and the purveyor. Water purveyor initiatives, in most cases, were the catalyst for establishing relationships with industry. In the case of the District of Lake Country, a dedicated staff position, Watershed Coordinator, specifically targets relationship building with other watershed users. Conversely, the absence of partnership and communication between watershed users was held by local purveyors as a significant constraint to source protection.

Interestingly, the second most commonly cited factor perceived by interviewees to facilitate SWP was

the coordinated opposition of purveyors to provincial initiatives deemed by the purveyors as having negative water quality impacts (26%). Examples of multi-purveyor lobbying of provincial authorities included opposition to the motorized recreation designation within the Lakeview Irrigation District watershed (LID, 2004), opposition to the sale of Crown lease lots surrounding upland reservoirs (Water Supply Association of BC, 2002; 2003; 2004), and concern over source protection omissions in the *BC Drinking Water Protection Act* [SBC 2001] (Water Supply Association of BC, 2001; SEKID, 2002). In all cases letters of protest cited contradiction between source water protection discourse of provincial policy and specific provincial initiatives. A strong voice of discontent at the local level was the Water Supply Association of BC (WSABC). In a letter dated June 2002 the WSABC voiced strong opposition to the proposed provincial government sale of 141 Crown foreshore leases on 16 reservoir lakes in the Okanagan highlands for reasons of potential negative impact on drinking water quality. The WSABC is considered a local-scale organization given that its membership consists of local water purveyors. In the letter, the WSABC alleges that the revenue-motivated recreational Crown lot lease sales program contradicts the public health priorities outlined in both the Action Plan for Safe Drinking Water in BC (British Columbia, 2002) and the *BC Drinking Water Protection Act* [SBC 2001].

The third most cited factor perceived by interviewees to facilitate SWP was public education (22%). Evidence of public education included watershed signage principally in the SEKID watershed, the now defunct watershed awareness program of the 'E-Team', watershed stewardship committees (Greater Vernon Water), and water purveyor newsletters. Newsletters enabled the purveyors to report their struggles to advance source protection in the face of specific provincial initiatives and provincial court directives deemed by the purveyors as contradictory to SWP. An example of the latter is the provincial court decision blocking SEKID's attempt to acquire ownership of McCullough Lake Resort (SEKID, 2004) thereby limiting private development in a community watershed.

*Provincial scale:* Eleven interviews at the provincial scale identified 14 factors perceived by interviewees to facilitate SWP. These factors were grouped into six themes (Table 3). The two most commonly cited factors

perceived to facilitate SWP were determining sources of outbreaks (40%) and monitoring water quality (40%). This response largely reflects the emphasis placed on human health impacts from potable water consumption by the provincial health authority. The third most commonly cited factor perceived by interviewees to facilitate SWP was education and communication, or what one provincial official in Victoria termed "soft" approaches (20%).

**Table 3. Main factors stated by interviewees to facilitate SWP (% of citations).**

Main Factors Stated to Facilitate SWP	Local-Scale Interviewees	Provincial-Scale Interviewees
Partnering with industry	42	0
Oppose contradictory provincial initiatives	26	0
Public education	22	20
Water quality coordinator staffing	10	0
Determine source outbreak	0	40
Monitoring water quality	0	40
TOTAL (%)	100	100

### **Factors Constraining Source Water Protection**

*Local scale:* Twenty interviews at the local scale identified 64 factors perceived to constrain SWP. The 64 factors were grouped into 12 themes (Table 4). The most commonly cited factor perceived by interviewees to constrain SWP was the presence of multiple provincial agencies (32%). The second most commonly cited factor perceived to constrain SWP was lack of purveyor control over watershed activities (17%). Poor or non-existent communication between levels of government was the third most cited factor (16%). Numerous other factors were also cited, including inappropriate and competing watershed uses (12%), rapid population growth (6%), and inadequate funding to undertake SWP (6%). Importantly, the fact that 7% of interviewees had no opinion, or suggested that they were not involved in SWP, can be seen as a factor



constraining SWP. Over 80% of SWP constraining factors reported by local-scale respondents concerned perceived deficiencies within provincial areas of responsibility.

Document analysis revealed a bias in favour of technical “treatment” as opposed to source water protection. For example, the *Winfield Okanagan Centre Water System Assessment and Response Plan* (DLC, April 2004) identified a water quality improvement budget of \$12.8 million that included \$9.9 million for disinfection and ultraviolet treatment facilities. The balance of funds was allocated toward distribution system upgrades and water conservation. There was no budget line for source protection. Only in the area of existing system improvements (\$4.9 million) was there funding allocated for watershed expenses for “dams and reservoirs” (\$570,000). This is evidence of an imbalance toward water treatment despite broad support in the literature for the multi-barrier approach to clean water (O’Connor, 2002), an approach aimed at balancing SWP, water treatment, distribution, and monitoring. Emphasis on treatment and distribution at DLC was also reflected in the comments from the Utility Manager who offered “[w]e only have a single barrier, chlorine” to describe how the multi-barrier approach is practiced at DLC. This technical bias is a barrier to source protection. Evidence to support this observation is contained in the *Winfield Okanagan Centre Water System Assessment and Response Plan* (DLC, April 2004). In a second example from Greater Vernon Water, the *Master Water Plan* (Associated Engineering, 2002) refers to “multi-barrier” in the following context, “[t]he regional water strategy strongly emphasizes a multi-barrier approach to drinking water quality”. However, the eight main components of this plan give exclusive attention to new infrastructure development and offer no direction regarding drinking water protection in the overall land use of the upland and valley watersheds. Further, a phrase search of this document using “source water protection” and “source protection” produced zero results while “water treatment” produced 101 results.

In the *Master Water Plan Addendum* (Associated Engineering, 2004), the term “multi-barrier” again was used only once and exclusively applied to water treatment in the hybrid phrase “*multi-barrier treatment*

*protection*”. Additionally, the only reference to drinking water protection in the *Master Water Plan Addendum* was in relation to water treatment, “[d]ue to advancements in water treatment technologies in the last few years, the GVW has been able to refine and improve... drinking water protection and system reliability...”. This quote shows that “drinking water protection”, according to GVW’s consulting engineers, is achieved through “water treatment technologies”. The concepts of “multi-barrier approach”, “source protection”, and “watershed protection” were not mentioned, while “water treatment” appeared frequently (34 times in this document). These examples point to a bias of the water industry toward water treatment, drawing attention away from SWP at the local level. This is significant because local water purveyor staff and elected officials with decision-making responsibilities look to water industry experts for guidance. In this context, the privileged position of technology within the water industry continues to validate an engineering approach to safe drinking water, itself a power relation recorded in technical documents and professional reports to elected officials and decision-makers.

*Provincial scale:* Eleven interviews at the provincial scale identified 40 factors perceived by interviewees to constrain SWP. These were grouped into 12 themes (Table 4). The most commonly cited factor perceived to constrain SWP was multiple provincial agencies with somewhat overlapping jurisdiction (33%). It is noteworthy that 18% of the provincial-level interviewees had no opinion, or did not believe that their activities were pertinent to SWP. The third most commonly cited factor perceived to constrain SWP was population growth and development (11%). The fourth most frequently cited factor was inadequate provincial funding to undertake SWP (8%). Other factors included poor communication between levels of government (7%) and the conflicting mandate of the Ministry of Forests respecting SWP (7%). Almost two-thirds of all factors perceived to constraint SWP reported by provincial-level respondents identified deficiencies within the provincial areas of responsibility respecting SWP.

**Table 4. Main factors stated by interviewees to constrain SWP (% of citations).**

Main Factors Stated to Constrain SWP	Local-Scale Interviewees	Provincial-Scale Interviewees
Multiple agencies	32	33
Lack of purveyor control	17	0
Poor communication in governments	16	7
Competing/inappropriate watershed uses	11	0
Rapid population growth	6	11
Funding inappropriate	6	8
Lack information, education	3	5
Climate change	2	0
Mandate of Ministry of Forests	0	7
Lack data management	0	6
Newness of program	0	5
No opinion, not involved in SWP	7	18
TOTAL (%)	100	100

Document analysis revealed the devolution of septic field inspection from provincial health authorities to the private sector. A new sewage system regulation took effect May 31, 2005, with the intent of shifting installation inspection and monitoring responsibility from provincial health authorities to private industry. This “results-based approach” is intended to “enhance industry effectiveness and accountability”. The new sewerage system regulation applies to site assessments, installations, and maintenance of onsite wastewater systems, from septic systems for single family homes to complex systems for multi-residential, industrial and commercial applications (*Blueprint for the Future: A New Regulation for Onsite Wastewater Systems*, BC Ministry of Health Services, 2004). During interviews, various actors including the Director of Development Services for DLC and several private consultants expressed concern that the devolution of sewerage regulations to the private sector may compromise potable water safety (Director of Development Services, DLC, pers. comm. May 31, 2005).

## Discussion

### Power Relations

Differential authority between and among provincial ministries and local water purveyors in BC is identified in this study as a source of power relations. Power relations exist by virtue of institutional arrangements set out in the *Constitutional Act* (1867), which designates ownership of all unoccupied Crown land to the provinces (Irvine, 2002). Decisions to designate areas for intensive motorized recreation (LID), or to sell or lease Crown-owned properties (SEKID; DLC), are all made at the provincial level, and can have serious implications for local water purveyors. Throughout this study local water purveyors strongly expressed concern regarding their limited voice in watershed land use decision-making, a condition reflective of the power imbalance between local and provincial actors and institutions. Moreover, the absence of a single, identifiable watershed authority is, in and of itself, emblematic of a power relation. Numerous local water purveyors expressed frustration, and powerlessness, in not knowing which provincial ministry held watershed authority.

One of the limiting factors in source protection is the financial capacity of the water purveyor, particularly for small and rural water purveyors charged with the provision of other basic services (de Loë *et al.*, 2002). In the absence of any watershed authority, all local purveyors expressed concern over their ability to cover the cost of watershed rehabilitation and protection. This was particularly the case where other watershed users, sanctioned by the Province, inflicted some watershed damage either through unregulated recreation activity (LID; SEKID), forestry and range use activity (GVW; SEKID), or expansion of private lodge and cottage development (SEKID; DLC). In all instances, the promotion of these activities provides economic benefits to both industry and the Province without monetary compensation to local purveyors charged with the responsibility for providing safe drinking water under the *BC Drinking Water Protection Act* [SBC 2001]. In recognition of the uneven power relations, local water purveyors have no legal means of undertaking proactive SWP planning.

One watershed program, the provincially-sponsored “E-Team”, was reported by SEKID to be a success. However, after running for two years the

cancellation of E-Team funding brought this watershed awareness program to a close in 2002. Without external cost-sharing for such programs, small(er)-budget water purveyors, such as most irrigation districts and small water users, are unable to fund watershed awareness.

Reports have been generated recently that link the future economy of the region to effective water management (Okanagan Partnership, October 2004; Summit Environmental Consultants, 2005). For example, the final report of the Okanagan Partnership (June 2004) states: "The economy of the Okanagan is limited by water availability and quality. All Okanagan Partnership Cluster working groups identified water resources (quality and quantity) as a significant limiting factor to sustainable Okanagan economy". Ironically, if water quality is truly a "limiting factor" to the Okanagan economy, those responsible for providing safe drinking water, the local purveyors, have very limited financial power to undertake SWP. Local government subsidization to repair watershed damage to Crown-owned areas, caused by provincially-sanctioned "integrate use" activities, is unlikely to be supported by local trustees and ratepayers. Without some sharing of responsibility in watershed areas local purveyors will be unable to dedicate resources toward SWP in Crown-owned areas. In the words of the director of engineering for DLC, "I have no budget line for source protection in our watershed because the District has no authority up there (Crown watershed)".

The capacity literature has identified the importance of institutional considerations as an important barrier to source protection (Litke and Day, 1998). An example includes interagency rivalry, or resentment, and fragmented responsibilities (de Loë and Kreuzwiser, 2005). Jurisdictional power relations extend the reach of this literature to examine how relations of power may act as a barrier to SWP.

Interviewees repeatedly expressed concern over their lack of authority to undertake SWP (DLC; SEKID). While the purveyors in this study expressed little interest in self-management of a "closed" watershed, they did voice interest in the possibilities of co-management of watershed areas with other users. Many interviewees felt excluded from provincial watershed decision-making, claiming local recreation interests, such as the off-road motor bike club, had a greater voice than the local water purveyor.

Inter-agency power struggles were reported in a number of interviews with provincial-scale stakeholders;

these highlighted the fragmented administrative structures that exist at the provincial level. At the water purveyor level, power struggles between provincial agencies raised uncertainty regarding the roles and responsibilities of the various agencies. From the perspective of the local water purveyors, fragmentation of provincial agencies was a direct barrier to SWP. Again, as early as 1999, the Auditor General's Report identified the multiple agency structure of water management in BC as a significant barrier preventing government from taking "a leadership role in (source) protection". The lack of clearly defined roles of the provincial agencies respecting watershed responsibility as well as inter-agency fragmentation illustrates a symptom of administrative structures unwilling, or unable, to share power.

Of potential significance to jurisdictional power relations respecting water management generally within the Okanagan region is the presence of Okanagan Basin Water Board (OBWB), a regional quasi-governmental entity created to implement the recommendations of the Canada-British Columbia Okanagan Basin Study (1974). The initial (1970s) focus of the OBWB was on reducing phosphorus and nitrogen inputs to the main valley (Okanagan) lakes and controlling the invasive aquatic plant, Eurasian watermilfoil. In response to rising public concern regarding water availability and water quality (Okanagan Partnership, June 2004, October 2004) the OBWB became 're-invented', both politically and organizationally, during the time of this research with support of all three Okanagan regional districts (Okanagan Basin Water Board, 2005). The re-invented OBWB holds significant promise to promote coordinated water management, not to exclude SWP, throughout the valley. Proportional funding from the three regional districts, in combination with broad representation of multi-stakeholder interests on the OBWB Water Stewardship Council, offer significant potential to reduce jurisdictional power differentials.

### **Source Water Protection Relationships**

At the local scale, the identification of multiple stakeholders revealed not only the shared nature of the watershed but also an understanding and acceptance that these are multi-use watersheds. In no single interview was it suggested that a single use, potable water supply, should trump all other uses such as

forestry, range, mining, or even recreation. This result was very surprising, particularly where a land use conflict existed. From the perspective of the water purveyor, there was an overwhelming understanding that these watersheds provide employment and recreation opportunities to the entire Okanagan region and beyond. Where land use conflicts occur, such as motocross (LID), cattle grazing (GVW), or recreation (DLC, SEKID), there was never any suggestion from the purveyors that a watershed should become an exclusionary zone set aside for water supply. Instead, the water purveyors consistently reported the need for a good working relationship (power sharing) with other watershed users. In several instances, the lack of a good working relationship was identified as the sole factor constraining watershed stewardship and SWP.

Relationships around watershed awareness were strongest among actors at the local scale. For example, at SEKID there was a brief history, under the E-Team program, of SWP within the Joint Kelowna Water Committee (KJWC). In the nearby community of Westside, there is optimism for SWP within the newly established Westside Joint Water Committee (modeled after the KJWC). Intra-organizational relationships were also cited as an important first step in watershed awareness. Additionally it was noted in several interviews that without political leadership and support of the elected officials, local initiatives aimed at SWP will not progress.

Relationship building between the water purveyor and the forest industry was considered very important to SWP and relatively well developed. Relationships with other watershed users, including cattle range operators and recreation interests, were also considered important but generally not well developed. Finally, the relationship most frequently reported as weakly developed was that of the water purveyor and the provincial agencies. Several interviewees reported a strengthening relationship with the Interior Health Authority, namely the Drinking Water Officer; however, relationships with provincial agencies and ministries remained weak at best and often strained.

### **Lead Agency for Watershed Activities**

The absence of a lead agency for drinking water in BC has been a concern for some time (British Columbia, 1999; Drinking Water Review Panel, 2002;

Christensen, 2003). While it was acknowledged during many interviews that the Ministry of Health was the lead agency for safe drinking water under the *Drinking Water Protection Act* [SBC 2001], there remained considerable uncertainty regarding a lead agency for overall watershed activities. Across all scales, the absence of a lead agency for watershed activities was viewed as a source of weakness with respect to SWP. This was especially the opinion of professional consultants such as engineers and biologists working for local water purveyors. In addition, purveyors themselves expressed strong concern over the absence of any lead watershed agency. This concern was often expressed as frustration over not knowing which agency to contact in the event of a water quality concern in a watershed.

At the provincial scale, interagency resentment was evident on several occasions when interviewees reflected on their loss of authority as a result of ministry re-organization. For example, the elevated authority of the Ministry of Health, as a result of the *Drinking Water Protection Act* [SBC 2001], created confusion and some defensiveness over roles among Ministry of Environment staff who believed they were better trained to undertake effective watershed management.

### **Conclusions**

This research set out to identify factors facilitating and constraining source water protection based on four case studies in the Okanagan Valley. The methodological approach of the research was to employ grounded theory to explore the role of power relations operating between and among various actors to either facilitate or constrain SWP. This inductive approach enabled key themes (concepts and definitions) to be identified from multiple interview transcripts and text document material from which empirical data were derived. Based on those themes, latent content analysis was applied to build theory respecting the relative role of relations of power as a factor facilitating and constraining SWP.

The analysis of key concepts and definitions from interview transcripts and text documents helped to reveal power relations in terms of watershed access and priority over land use, factors critical to SWP (Peckenham *et al.*, 2005; Ivey *et al.*, 2006). This research has shown that factors facilitating SWP appear to concentrate at the local scale with respect to power relations in at least three ways. First, water

purveyor cooperation with other watershed industries, in particular forest licensees, as well as the formation of multi-purveyor joint water committees was frequently reported as a significant factor facilitating SWP. Informal work agreements and the sharing of biophysical watershed information were commonly cited as factors facilitating SWP. Second, water purveyor opposition to various provincial initiatives perceived as contradictory to SWP was frequently reported as a factor facilitating SWP. Such local opposition was directed to various responsible agencies, and local ratepayers, in an effort to draw greater attention to SWP generally. In the absence of any shared authority over Crown-owned land, local purveyors adopted a reactionary role to an array provincial land use initiatives with potential to affect community watersheds generally, and SWP specifically. In this context, the absence of power (authority) necessitated watershed advocacy on the part of the purveyor to facilitate SWP. Finally, at both the local and provincial scale public education was reported as an important factor facilitating SWP. Purveyor information sharing with ratepayers, local watershed awareness campaigns, and information sharing between various purveyors was reported to facilitate SWP. Similarly, regional and provincial workshops as well as regional conferences were reported at the provincial level as means of facilitating SWP. Here, the sharing of information is regarded as a 'softening', or evening-out, of power relations in the interest of facilitating SWP.

In contrast, factors constraining source protection tended to concentrate at the provincial scale with respect to power relations in at least three ways. First, fragmented roles and responsibility of multiple and overlapping provincial agencies were cited by both local and provincial respondents as factors constraining SWP. The causal factors of this condition pointedly draw attention to relations of power manifest in inter-agency rivalry and resentment respecting SWP authority. Second, lack of provincial power-sharing with local purveyors respecting shared watershed authority over land use activities was cited as a factor constraining SWP. The lack of shared watershed authority, when viewed from the perspective of power relations, perhaps best illustrates the paradox facing local purveyors respecting SWP: legal responsibility for providing safe drinking water in the absence of watershed authority. Finally, perception of poor communication from provincial agencies to the purveyor was frequently cited

as a factor constraining SWP. Here, lack of information sharing is further evidence to support the claim that power is currently shared unevenly between and across jurisdictional scales of authority serving to constrain SWP on the ground.

By drawing attention to power relations this research identified that, from the purveyor's perspective, watershed land use activities, *per se*, were not the primary source of concern respecting barriers to SWP. In many instances, forestry, range use, mining, and even recreation were viewed by the purveyor as activities not incompatible with clean potable water. For example, the presence of forestry within a purveyor's watershed was often reported as being synonymous with watershed stewardship. This observation suggests that greater attention needs to be placed on the role of power relations operating between and among provincial agencies and local water purveyors. Attention to power relations in this research has helped to reveal that local water purveyors within the Okanagan Valley remain limited in their capacity and frustrated in their efforts to advance source water protection.

Institutional barriers, the result of uneven power relations, appear to place significant restriction on the advancement of SWP in the Okanagan Valley, and undoubtedly elsewhere in BC. Recommendations from this research suggest that provincial-scale attention should focus on the removal of multi-agency overlap contributing to a 'silo-effect' in provincial water management, reduced inter-agency fragmentation respecting water management, the creation of an identifiable, single agency as a "voice" for water, as well as improved communication and SWP funding to local water purveyors.

In the area of local-scale recommendations it is suggested that water purveyors continue relationship building with industrial watershed users. The formation of joint water committees, information dissemination to water users, and local purveyor representation on professional drinking water associations, such as the Water Supply Association of BC, offer effective tools for operationalizing SWP on the ground. At the same time, stronger and more coherent relations need to be established between local purveyors and the provincial agencies. As was often observed, local purveyors have been forced to expend valuable, yet limited, resources to oppose actions of senior government deemed threatening to potable water quality.

In light of the constitutional division of responsibility over natural resources that exists in Canada, it is unlikely that provincial and local actors ever will have equal power and authority—and this may not even be desirable. However, it is clear from the research reported in this paper that attention to the effects of uneven power distribution between the provincial government and local agencies with water management responsibilities is needed to enhance the prospects for successful source water protection in British Columbia.

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