ATTITUDES AND PERSPECTIVES TOWARD WATER AND WATER MANAGEMENT IN THE TOWN OF GIBSONS, BRITISH COLUMBIA

by

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ABSTRACT

Water management is increasingly important to Canadians, especially in communities where water shortages, aging infrastructure, and contamination threats are occurring or imminent. Increasing urbanization and climate change may exacerbate these problems, highlighting the need for local governments to address water challenges currently. Recently, water research has incorporated questions about governance and policy, but little research exists on peoples' attitudes toward water in Canada. Attitudes influence peoples' support for water policies, and a better understanding of attitudes could lead to improved water policy. This study uses Q methodology to explore participants' attitudes about current water supply and management, and alternatives for improving water management, in Gibsons, British Columbia. Three distinct viewpoints about current conditions and three distinct viewpoints about preferred alternatives are identified. These viewpoints differ from the attitudes frequently described in Canadian water policy literature. Areas of consensus among views suggest options for future water policy in Gibsons.

Keywords: water conservation; demand-side management; attitudes; perspectives; Q methodology; stakeholder engagement

Subject Terms: water supply; water use; water management; water policy; water conservation; Q methodology

I dedicate this work to Mum and Dad.

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LIST OF ACRONYMS

CRD	Capital Regional District
DSM	Demand-Side Management
GVRD	Greater Vancouver Regional District
HDNR	Human Dimensions of Natural Resources
OCP	Official Community Plan
OECD	Organisation for Economic Co-operation and Development
SCRD	Sunshine Coast Regional District

CHAPTER 1: INTRODUCTION

1.1 Research rationale

Freshwater resources and water management are growing priorities for Canadians (Simpson, 2003). Challenges associated with providing safe drinking water, preventing water shortages, and responding to increased international interest in Canada as a supply of marketable freshwater have been, and will likely continue to be, important issues for Canadians. Climatic changes and global population growth are likely to add to the challenges.

The unfortunate water contamination incidents in Walkerton, Ontario (2000), North Battleford, Saskatchewan (2001), and Kashechewan, Ontario (2005) resulted in thousands of illnesses - and seven deaths in the case of the Walkerton tragedy - due to outbreaks of *E. coli* and *Cryptosporidium* (CBC News, 2002, 2004, 2006). These incidents and their associated inquiries played a significant role in moving water quality issues onto provincial policy-making agendas.

In the face of climate change, concern has mounted regarding the potentially severe impacts of summer droughts in the western Prairie Provinces on water quantity, water quality, and food production (Schindler & Donahue, 2006). On a smaller scale, water shortages are also a reality for some Canadian municipalities. For example, the community of Tofino, a popular tourist destination on the west coast of Vancouver Island, British Columbia, ordered local businesses to cease operation at the end of the summer in 2006 when the Town ran out of water. In an Environment Canada survey,

roughly 14 percent of 510 responding Canadian municipalities indicated that they experienced some type of water shortage in 2004 (Environment Canada, 2007). Planning for water supply security is therefore an immediate challenge facing many municipal water managers.

Canadians have been worried about the possibility of exporting water to the United States since at least the 1960's, and this apprehension still exists today. In April 2007, the federal government of Canada was accused of having closed-door talks with the United States and Mexico about the possibility of bulk water export (Troster, 2007). Concerned groups of Canadians, including the federal opposition party, voiced their fears, and in response the government publicly restated its position that it was not intending to enter negotiations regarding bulk water export (Troster, 2007). Collectively, the water issues described above demonstrate that the future of Canada's freshwater resources is important at all levels of government in Canada, as well as within the civic domain.

Although each level of government has jurisdiction over some aspect of water policy in Canada, local and regional governments are primarily responsible for the provision of water to their residents. As urban populations continue to rise, and climate change begins to affect seasonal water supply availability in some parts of Canada, municipalities and regions are being forced to make choices between social, economic, and environmental objectives in order to supply water to residents.

For example, as a community grows from 4000 residents to 8000 residents, it may need to find additional water supply. One solution would be to tap another water source to provide for the additional residents, but this may come at a cost to various non-human

species, such as fish, that need a certain amount of water to survive. Another solution might be to try to reduce water consumption among current residents so that the existing water sources could provide additional residents with sufficient water; however, this option may be economically costly for communities and individuals as they try to implement water conservation measures such as universal water metering. Often, easy solutions for supplying more residents with water do not exist. Each solution has benefits and costs that may be quantified differently by different community members, depending on their values. Therefore, not only are communities attempting to balance social, economic, and environmental factors in their water supply decision-making, they are attempting to balance multiple interests and perspectives about how best to proceed.

Very little systematic research exists in Canada on human attitudes toward water supply and water management (Janmaat, 2007). However, academics, experts, water managers, and policy makers frequently make assumptions about what people think when advocating for, or implementing, various water management strategies. For example, some researchers believe that people in Canada think water is abundant, and that water management strategies that send signals about water scarcity, such as demand-side management measures, are necessary to combat this perception of abundance (e.g., Brandes & Ferguson, 2004). Prior to developing effective water management strategies, practitioners and researchers alike need more empirical evidence about what people actually think about water management, and why. Water policies that take account of people's attitudes and expectations are more likely to be broadly supported, making implementation smoother and potentially more successful. A specific understanding about aspects of water management that residents both agree and disagree with could

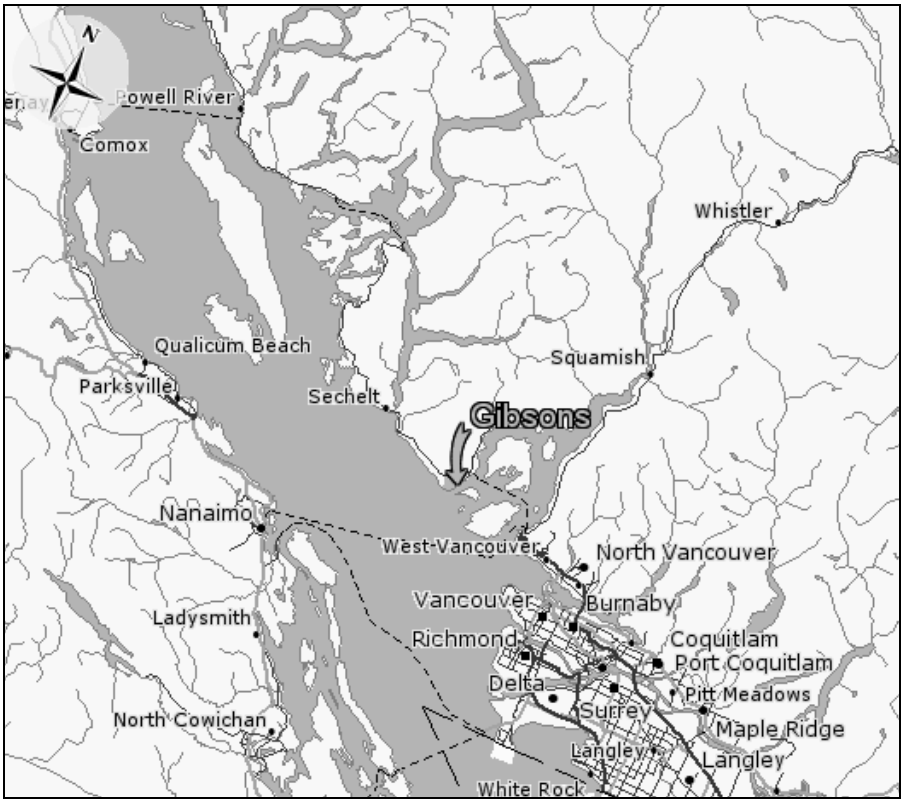
provide a starting point for policy evaluation and development that incorporates multiple interests. Rather than developing policy about a highly contentious component of water management, it may be more effective to start by tackling an issue where a greater degree of consensus exists, in order to build trust in the policy and decision-making process.

The purpose of this study is to use Q methodology to conduct exploratory research on attitudes toward current water supply and management, and possible future water management strategies, in a Canadian municipality. This research focuses on peoples' attitudes toward municipal water management, and in particular, water quantity and water conservation. Other water management issues, such as water quality, are not the main emphasis of this study, but are touched upon due to their relevance in understanding peoples' overall perspectives about water.

Practically and academically, the Town of Gibsons, a Canadian municipality located in south-western British Columbia (Figure 1.1), is a suitable site for this research. First, because full-time residents predominantly inhabit Gibsons and residential water consumption is the primary water use, some of the complexities of water supply that might exist in other communities, such as the presence of agricultural water use or a large number of second-home owners, are not present. Second, because Gibsons is a small municipality – 4182 residents in 2006 (Statistics Canada, 2007) – local leaders have had the opportunity to directly interact with many of the residents, so obtaining a diverse range of perspectives through targeted, non-random sampling techniques is perhaps easier than in a larger municipality. Third, because Gibsons manages its own groundwater supply source and anticipates future water management challenges due in part to population growth and seasonal climate changes, there is an incentive for the

Town to evaluate its current water management practices, and to consider possible future alternatives, such as water conservation. Currently, the Town has few water conservation measures in place, but is interested in moving in a conservation direction, making Gibsons an ideal community to examine potential challenges and barriers to such measures. Fourth, because Gibsons wishes to include community members' perspectives in water supply planning, the Town is supportive of research that examines water supply and management issues in the community.

Figure 1.1 Map showing the location of Gibsons in British Columbia, Canada



Source: Natural Resources Canada, 2006, by permission

In this report, I use many terms to refer to peoples' subjective ideas about water and water management, such as attitudes, perceptions, views, viewpoints and perspectives. Therefore, I will briefly describe what these concepts mean. In the social

psychology literature, relatively common definitions exist for the words "attitudes", "values", and "ideologies". Attitudes are positive or negative evaluations about an object (Eagly & Chaiken, 1993); values are abstract ideals that serve as guiding principles (Rokeach, 1973); and ideologies are systems of attitudes and values based on a common, abstract theme (McGuire, 1985). The terms "perceptions", "views", "viewpoints" and "perspectives" are not commonly defined in social psychology textbooks; however, some of these terms are used informally, and sometimes inconsistently, in human dimensions of natural resources (HDNR) research (Manfredo, Vaske, Bruyere, Field, & Brown, 2004). Ewert and Stewart (2004) use the word "perception" in reference to an identified opinion that natural resources are limited and finite. They also define the phrase "philosophical perspectives" as "a set of beliefs, precepts, or principles that underlie a particular evaluation or behaviour regarding how natural resources should be used and how they should be managed" (Ewert & Stewart, 2004, p.10). Therefore, based on the definitions from social psychology, and the informal use of concepts in HDNR research two groups of definitions emerge: 1) concrete evaluations of an object or current circumstances (i.e., attitudes and perceptions); and 2) abstract ideals or sets of beliefs about a particular topic (i.e., values, ideologies, perspectives, views, and viewpoints). By using Q methodology, I am able to describe peoples' attitudes toward an object, such as a negative evaluation of a particular water conservation measure, and their overall perspectives toward water management in the Town of Gibsons, such as a preservationist approach to managing water demand.

1.2 Research objectives

To accomplish the goals of 1) improving understanding of Canadian attitudes and perspectives about water and water management, and 2) presenting peoples' attitudes and perspectives in a way that is useful for decision-making, I developed the following four research objectives:

- to describe presently-held attitudes and perspectives about water and water management in the Municipality of Gibsons, British Columbia;
- to explain why people hold particular attitudes and perspectives about water and water management in Gibsons;
- to determine if the attitudes and perspectives held by residents, policy makers, and water managers in Gibsons exist in the form articulated by some water experts and environmental activists in Canada; and,
- to make recommendations about the water conservation policy implementation process in Gibsons, based on attitudes and perspectives identified in this study.

1.3 Report outline

In Chapter 2, I provide background information on water use and availability to highlight current water management challenges in Canada, British Columbia, and Gibsons. I also discuss possible approaches to water management, barriers to certain approaches, and previous research on human attitudes toward water management in Canada. In Chapter 3, I describe how I used Q methodology to gather data about participants' attitudes and perspectives toward water and water management, and how I analyzed the data. In Chapter 4, I discuss participants' attitudes and perspectives about current water supply and management and how water management might be improved in Gibsons. I reflect on differences between dominant viewpoints and also describe areas of agreement. In Chapter 5, I comment on the policy implications of this research for

Gibsons. Furthermore, I compare attitudes and perspectives identified in this study to those assumed to exist in Canada, and suggest opportunities for future research.

CHAPTER 2: BACKGROUND

2.1 Canadian water trends overview

2.1.1 Water availability and water use trends in Canada

With approximately 20 percent of the world's fresh water, and roughly one percent of the global population, Canada is typically viewed as a water-rich country (Brandes & Ferguson, 2003). However, Canada only contains about seven percent of the world's renewable fresh water – water that is replenished each year by rain- and snow-fall (Environment Canada, 2004). Due to the country's population distribution (which is concentrated near the southern border), the majority of Canadians only have access to about 40 percent of Canada's renewable fresh water (Brandes & Ferguson, 2003).

Studies of international trends show that while several industrialized nations, including the United States of America, have been able to decrease overall water use since 1980, Canada has increased water use by roughly 25 percent over the same period (Boyd, 2001). Environment Canada (2005) reported that average residential water use in Canada was 335 litres per day per person in 2001, making Canada one of the highest water consumers among countries in the Organisation for Economic Co-operation and Development (OECD). However, in 2004, average residential water consumption in Canada dropped to 329 litres per person per day (the second lowest average out of six Environment Canada surveys since 1991) (Environment Canada, 2007). Although it is too early to determine whether this reduction in water use is a one-time event, or the start of a longer-lasting trend, Environment Canada (2007) speculates that the decrease is due

to an increase in the use of appropriate water conservation incentives. Despite these reductions in residential water use in 2004, Canadians are still among the largest consumers of freshwater for residential use among OECD countries (Environment Canada, 2007).

Due to Canada's high water use relative to other countries, some Canadian water researchers imply that the Canadian public undervalues water and that a lack of recognition of the severity of water issues in Canada will make water challenges even more difficult to deal with in the future (e.g., Bakker, 2007). However, because water availability and management vary greatly across Canada, and even within provinces and territories, narrowing the discussion of water availability and water use to the provincial, regional, and local levels is essential.

2.1.2 Water availability and water use trends in British Columbia

British Columbia (BC) contains roughly 25 percent of Canada's freshwater (British Columbia Ministry of Environment, 2007). About 88 percent of the total amount of water used for all purposes in BC is supplied by surface water, and the remaining 12 percent is supplied by groundwater (Environment Canada, 2007). However, 23 percent of BC's drinking water is obtained from groundwater (British Columbia Ministry of Environment, 2007).

Seasonal climate changes strongly affect the availability of water supply in parts of British Columbia. In the coastal areas of south-western British Columbia (where the Town of Gibsons is located), heavy rainfall and high stream discharge contribute to increased winter water availability (Wade, Martin, & Whitfield, 2001). Summers, in this

same area, experience low amounts of rainfall and low stream discharge (Wade et al., 2001). Therefore, water supply in winter months is abundant, and water shortages in the summer are not uncommon. Climate change models predict that south-western BC will experience increased temperatures throughout the year, in the future, causing greater precipitation in the fall and winter, and less precipitation in the summer (Whitfield, Wang, & Cannon, 2003). Furthermore, the spring freshet – runoff from snowmelt in the mountains – is expected to occur earlier in the year, resulting in longer, drier summers (Whitfield, Reynolds, & Cannon, 2002). Changes to runoff and stream discharge timing are already taking place, and even greater changes to climatic conditions and water availability are expected to occur with a doubling of atmospheric carbon dioxide, which is likely to happen in this century and possibly within a few decades (Whitfield et al., 2002). Differential seasonal distribution of water availability and anticipated climate changes therefore pose a unique water supply challenge for some communities in BC.

While the national average for residential water use decreased in 2004 relative to 2001, residential water use in British Columbia was roughly the same in 2004 (426 litres per person per day) and in 2001 (425 litres per person per day) (Environment Canada 2007, 2005). In 1999, the province stated that roughly 17 percent of surface water sources in BC had reached, or nearly reached, their extractive capacity (British Columbia Ministry of Environment, 1999). Due to anticipated population growth, expected climate changes, and increased competition for water use, the province created a *Water Conservation Strategy for British Columbia* to guide water management and sustainable water use (British Columbia Ministry of Environment, 1999). While the conservation strategy may have contributed to a temporary stabilization of residential water

consumption between 2001 and 2004, it did not help the province to reduce the total amount of water used by the residential sector.

2.1.3 The water supply context in Gibsons

Data from the 2006 Canadian census indicates that the population of the Town of Gibsons was 4182 people in 2006 (Statistics Canada, 2007). As stated in the Town's Official Community Plan (OCP), Gibsons plans to supply clean potable water to 10, 000 people in the long-term (Town of Gibsons, 2005). The Town does not specify what timeframe the "long-term" refers to, but population projections under a high growth scenario, where the population increases by 4 percent a year from the 2001 population of 3906 people, would result in a population of 10, 413 by 2026 (Town of Gibsons, 2005).

The Town's water supply comes from two water sources: an aquifer managed by the Town of Gibsons and surface water from the Chapman and Gray Creek watersheds provided by the Sunshine Coast Regional District (SCRD). As described by some participants during interviews in this study, many residents consider the aquifer water to be of superior quality to the SCRD water, in part because the aquifer is untreated while SCRD water is chlorinated. Furthermore, in February 2005, the Town of Gibsons entered water from its aquifer in the Berkeley Springs International Water Tasting Competition in Berkley, California, and won an award for the "Best Tasting Municipal Water in the World" (Town of Gibsons, 2007).

Gibsons is divided into three zones for water supply. Zones one and two are supplied by aquifer water, and zone three is supplied by SCRD surface water. According to Gibsons' Town staff, the aquifer is already at its maximum withdrawal capacity and

the Town is currently negotiating water supply security with the SCRD (B. Shoji, personal communication, June 30, 2006). In its OCP, Gibsons committed to the preservation of an unchlorinated groundwater supply for zones one and two (Town of Gibsons, 2005).

As part of Gibsons' long-term growth planning, the Town intends to upgrade and expand its water distribution system, as well as adhere to provincial drinking water legislation in order to maintain water quality and minimize health risks (Town of Gibsons, 2005). The Town also plans to study its aquifer to better understand water quantity and quality issues, and the potential of the aquifer to supply expected growth in Gibsons (Town of Gibsons, 2005).

The majority of water use in Gibsons is residential; there is no agricultural water use, and industrial water use is minimal. In 2004, the average residential water consumption in the Town of Gibsons was determined to be 549 litres per person per day (B. Shoji, personal communication, September 5, 2007), well above the Canadian average of 329 litres. However, in 2007, a water audit was completed in Gibsons, which estimated that water losses, due to leaky infrastructure, represented approximately 152 litres per person per day (B. Shoji, personal communication, September 5, 2007). Therefore, true residential water consumption was probably about 397 litres per person per day in Gibsons in 2004. However, this newly determined average is not comparable to the national average from 2004, because at the time of the national survey many communities likely reported residential consumption without adjusting for water loss. Environment Canada's municipal water statistics for 2007 will likely better represent communities' water savings, because leak detection and repair in the past three years,

allows for more accurate assessment of residential water consumption averages at the national, provincial, and municipal levels.

One of the objectives in the Gibsons OCP is to "continuously work to reduce water consumption rates through education, water restrictions, requirement for low flush toilets, water conservation incentives, metering, etc." (Town of Gibsons, 2005, p. 88). During interviews in this research study, participants identified a number of water conservation measures that have been implemented in the Town over the last ten years:

- the provision of water conservation information;
- minor social marketing initiatives;
- flat rate pricing structure;
- water audit;
- summer lawn-watering restrictions; and
- the requirement to install (but not hook-up) water meters in new developments.

Based on participants' assertions during interviews, it is evident that community members in Gibsons differ in opinion about how effective previous and current water conservation measures have been. Specifically, some elected officials interviewed in Gibsons (elected in November 2005) believe that existing conservation measures are generally ineffective and all elected officials believe that reducing per capita residential water consumption in Gibsons is necessary.

Regionally, new water management initiatives are taking place across the entire Sunshine Coast. In 2004, the SCRD began operating a new water treatment plant to improve water quality through the use of chemical injection and rapid mixing, coagulation and flocculation, clarifying by floatation, filtration and disinfection

(Sunshine Coast Regional District [SCRD], 2007). In 2006, the SCRD launched a bathroom fixture replacement program, under which it installs high efficiency toilets and showerheads, and faucet aerators in up to two bathrooms in a household. Fourteen hundred households were retrofitted in 2006 (SCRD, 2007). In March 2006, the Ruby Lake Lagoon Society hosted the first Sunshine Coast Water Summit, which brought together stakeholders to discuss water issues and to develop strategies to tackle water problems. Subsequent to the Water Summit, dialogue has continued with the release of a summary report and a Water Fair held in September 2006.

Regardless of whether water management initiatives are coordinated at the regional or municipal level, the local context dictates the nature of the water supply challenges faced by local governments. To overcome these challenges various approaches to water management may be suitable.

2.2 Local water management strategies

2.2.1 Options for addressing water supply challenges

Three commonly promoted approaches to address water supply challenges are: supply-side management, demand-side management, and the soft path approach (Brandes & Brooks, 2005; Brandes, Ferguson, M'Gonigle, & Sandborn, 2005; Wolff & Gleick, 2002). Traditionally, supply management has dominated water management practices. However, in recent years, communities have more commonly incorporated demand strategies into their management regimes to achieve various social, environmental, and economic objectives. Although the soft path approach, which attempts to achieve major reductions in water use by viewing water as a service rather than a product, is considered

an ideal approach for managing water resources, it is still largely in the conceptualization phase.

2.2.1.1 Supply-side management

From a supply-side perspective, water is considered an abundant resource, available for human use, as needed. Therefore, social and economic demands drive the amount of water that managers supply (Brandes et al., 2005). In order to meet forecasted demand, water managers must overcome four challenges: 1) accessing water supplies, 2) building sufficient storage, 3) ensuring appropriate treatment, and 4) establishing adequate distribution (Gleick, 2000). These challenges are typically overcome by using large, centralized, engineering approaches that use infrastructure, (e.g. dams, reservoirs, treatment plants, and pipelines) to capture, store, treat, and distribute water (Brandes et al., 2005).

Technical, supply-side solutions have had both global and local benefits. On a global scale, water supply has allowed food production to parallel population growth, and increased use of hydropower available from water storage infrastructure has resulted in fewer greenhouse gas emissions (Gleick, 2000). On a local scale, many communities in developed nations have achieved supply reliability and safer drinking water (Gleick, 2000).

Technical solutions are not without costs. Supply-side projects typically require a great deal of infrastructure, and usually result in serious augmentations to natural environments. Economically, large-scale infrastructure projects are costly, and may result in an overinvestment in raw water supplies and infrastructure for the sake of reliability (Howe & Smith, 1993). Socially, projects such as dams often result in the

displacement of human populations and contamination of water sources (Gleick, 2000). Historically, environmental considerations have been underweighted in supply planning decisions, resulting in the destruction of ecosystems and the loss of species (Brandes et al., 2005; Gleick, 2000). Due to these negative impacts, many water experts argue that a transition to demand-side management is necessary (Brandes & Ferguson, 2004; Brandes et al., 2005; Gleick, 2000).

2.2.1.2 Demand-side management

Whereas freshwater is perceived as abundant from a supply-side perspective, water is perceived as a finite resource from a demand-side perspective. Rather than automatically supplying more water, a demand-side management (DSM) approach recognizes that water use efficiency can be improved with changes to technology, incentive structures, and institutional arrangements (Gleick, 2000). Brooks and Peters (1988, p.3) define DSM as "any measure that reduces average or peak withdrawals from surface or ground water sources without increasing the extent to which wastewater is degraded." Therefore, unlike supply-side management solutions, which are usually technical, DSM solutions include socio-political, economic, and structural-operational strategies, such as bylaws, alternative pricing structures (e.g., charging for each unit consumed, rather than charging a flat rate for unlimited consumption), and leak detection and repair (Tate, 1990).

The most commonly cited benefits of DSM are economic, because water management decisions are often influenced more heavily by economic considerations, rather than social and environmental concerns (Brooks, 2005). Potential economic benefits include: decreasing operation and maintenance costs, postponing infrastructure

upgrades, and deferring the need to locate additional supply (Gleick, 2000). However, a demand-side approach can also help communities achieve social and environmental goals, such as increased awareness and appreciation of water, and maintenance of ecosystems for non-human species.

Like the supply-side approach to water management, the demand-side approach is not perfect. First, because it is difficult to measure the true influence of conservation measures on water consumption, water managers must rely on estimates of water use reductions to determine which measures to implement. Estimates of water savings from DSM vary greatly (de Loë, Moraru, Kreutzwiser, Schaefer, & Mills, 2001), which means that managers may compromise water reliability if relying solely on DSM strategies. Second, because conservation measures extend beyond technical solutions into the realm of political decisions, decision makers may avoid some DSM strategies, such as strategies that result in people paying more for their water, because such policies can be politically contentious (Maas, 2003). Third, DSM may only be a temporary water management solution in some regions because potential reductions in water use may not be enough to accommodate projected population growth for the future (Brooks, 2005). Therefore, many water experts believe that the entire idea of water management should be reconceptualized. The soft path approach to water offers an alternative way of thinking about resources beyond simple supply and demand.

2.2.1.3 Soft path approach

Like the demand-side management approach, reducing consumption is also a priority in the soft path approach. However, under a demand management regime, traditional cost-benefit analysis and economic considerations typically drive decisions

about when and what efficiency gains should be achieved (Brooks, 2005). In a soft path approach, ecological demands for water are recognized as well as human demands, and decisions about water use are based on social and environmental criteria, as well as economic criteria (Brandes et al., 2005; Brooks, 2005). Whereas demand management increases the efficiency of existing water systems, the soft path approach challenges how we currently think about, and use, water resources (Brooks, 2005; Wolff & Gleick, 2002). Rather than thinking of water as an end product for human consumption (as supply and demand management perspectives do), the soft path perspective regards water as a means to achieve various service goals, such as the removal of human waste (Brandes et al., 2005). Using a soft path approach, these same services are still provided to humans, but using less water (Wolff & Gleick, 2002). For services that cannot be provided without water (e.g., irrigation) soft path solutions would consist of small-scale, decentralized sources of supply, such as rainwater capture and storage, and improved technology, such as drip irrigation. For services that do not necessarily require water (e.g., human waste disposal), soft path solutions would consist of alternate means of achieving end goals, such as by using a composting toilet. Brooks (2005) states that in order to move toward a soft path approach, society will need to make tough decisions about water use, such as how much water is acceptable for households to use in the first place. Decisions about freshwater will no longer be made solely by water managers and planners; decisions about resource use will require input from all stakeholders (Brandes et al., 2005).

2.2.2 Barriers to water demand-side management

Although a soft path approach to water management might be ideal, and soft path principles such as collaborative planning are already being incorporated into current

water management practices, many communities are finding it difficult to even make the transition from supply management to demand management. Brandes and Ferguson (2003) identify a variety of DSM tools that are available for communities to use (Table 2.1). Using a mix of tools to create an overall strategy suited to local conditions and values is considered to be most effective (Maas, 2003). However, few Canadian municipalities have adopted comprehensive DSM strategies that rely on the use of multiple tools to reduce water consumption (Brandes & Ferguson, 2004).

Table 2.1 Demand-side management measures

Categories	DSM Tools
Socio-political strategies	▪ Information and education ▪ Water policy ▪ Water restrictions ▪ Plumbing codes for new structures ▪ Appliance standards ▪ Regulations and by-laws
Economic strategies	▪ Rebates for more efficient technologies (e.g., toilets, showers, faucets, appliances, drip irrigation) ▪ Tax credits for reduced use ▪ Full-cost recovery policies and life-cycle analysis ▪ High-consumption fines and penalties ▪ Pricing structures (e.g., seasonal rates, increasing block rates, daily peak-hour rates)
Structural and operational strategies	▪ Metering ▪ Leak detection and repair ▪ Efficient landscaping technology (e.g., cisterns, soil moisture sensors, watering timers, efficient irrigation systems) ▪ Efficient household technology (e.g., dual flush toilets, low-flow faucets, efficient appliances) ▪ Recycling and reuse (e.g., grey water for toilets or irrigation, treating and reclaiming wastewater for reuse)

Adapted from: Brandes & Ferguson, 2003, by permission

Both human attitudes and current economic and institutional structures can act as barriers to implementing demand-side management measures. Brandes and Ferguson

(2004) provide a more detailed discussion of categorized DSM barriers, but some overarching barriers include:

- Lack of political will to implement contentious measures (Brandes & Ferguson, 2004; de Loë et al., 2001; Maas, 2003);
- Resistance from the public toward implementing certain measures (Brandes & Ferguson, 2004; de Loë et al., 2001);
- Entrenched engineering approaches that guide water management (Brandes & Ferguson, 2004; Gleick, 2000; Maas, 2003)
- Insufficient resources (e.g., staff, money) to implement DSM measures (Brandes & Ferguson, 2004; de Loë et al., 2001);
- Fragmented jurisdiction over water management (Brandes & Ferguson, 2004; Maas, 2003); and
- Inappropriate economic and institutional structures that encourage inefficient water use (Brandes & Ferguson, 2004; Brooks, 2005; Gleick, 2000).

Although communities may contend with all of the barriers mentioned above, certain barriers may play a larger role in preventing the successful implementation of DSM strategies. For example, Brandes and Kriwoken (2006) suggest that the most significant challenge for communities in the Okanagan Basin, British Columbia, is to overcome the perception that there is an abundance of water in the Okanagan region. Due to the emphasis placed on attitudinal barriers in some water DSM literature (e.g., Brandes & Ferguson, 2004; Brandes & Kriwoken, 2006; Maas, 2003), human attitudes toward water management warrant further empirical exploration in order to better understand the constraining factors limiting DSM.

2.3 Attitudes toward water in Canada

2.3.1 Why study attitudes?

For over a decade, researchers in the field of conservation psychology have studied attitudes and behaviour toward water conservation in order to determine predictors of conservation behaviour (e.g., Corral-Verdugo, Bechtel, & Fraijo-Sing, 2003; Corral-Verdugo, Fraijo-Sing, & Pinheiro, 2006; Corral-Verdugo & Frías-Armenta, 2006; Corral-Verdugo & Pinheiro, 2006; de Oliver, 1999; Gregory & Di Leo, 2003; Lapinski, Rimal, DeVries, & Lee, 2007; Moore, Murphy, & Watson, 1994; Trumbo & O'Keefe, 2001; Watson, Murphy, Kilfoyle, & Moore, 1999). These studies have predominantly taken place outside of Canada, and are mainly directed toward theoretical development, rather than applied resource management. However, recently in Canada researchers have identified practical reasons why it might be important to study human attitudes toward water. First, studying residents' attitudes can help communities provide water services that meet the needs of their consumers (Dupont, 2005). Second, by exploring community members' perceptions about water issues, municipalities can determine the level of support for proposed water policies (Janmaat, 2007) or determine how best to design policies in the first place (Cantin, Shrubsole, & Aït-Ouyahia, 2005). Third, studying attitudes permits communities to evaluate both the efficacy of water programs and policies, and peoples' satisfaction with programs and policies that have been implemented in their community (Atwood, Kreutzwiser, & de Loë, 2007). Studying attitudes, as well as perspectives toward water and water management are useful ways to find out not only what community members' think, but also why they think the way they do. Obtaining a deeper understanding of community perspectives, beyond simple

evaluation of objects or events, is also an effective way to begin to engage residents in shared decision-making and planning – a process gaining popularity in natural resource management in Canada.

In accordance with the supply-side approach, water management decisions in the past were often seen as technical decisions that should be made by water managers. However, from an alternate perspective, water management is viewed as an issue of governance, where stakeholders representing multiple interests participate in decisions, rather than just technical experts (de Loë & Kreutzwiser, 2007). The role of public participation in water decision-making has evolved since its introduction in the 1970's in Canada (Shrubsole & Draper, 2007). Currently, meaningful stakeholder engagement is achieved by incorporating competing interests, values, and attitudes into water resource decisions for which tradeoffs must be made (Sinclair & Hutchison, 1998; Brandes et al., 2005). By including multiple perspectives and interests, it is assumed that social, economic, and environmental goals will be represented in decision-making, leading to sustainable water policy (Plummer & Stacey, 2000).

2.3.2 Empirical evidence

There is little published research on attitudes and perspectives toward water quantity and water management in Canada. The Walkerton Tragedy most likely influenced the overall direction of research since 2000, causing researchers to focus predominantly on attitudes towards water quality and public perception of risk (e.g., Dupont, 2005; Janmaat, 2007). However, even before the Walkerton incident, research tended to focus on water quality rather than quantity (e.g., McDaniels, Axelrod, & Cavanagh, 1998). Perhaps this emphasis on water quality research is a reflection of the

importance of water quality to the public, relative to other water issues, or perhaps it reflects historical perceptions that water supply was a not a major concern in Canada.

McDaniels et al. (1998) found that participants in the Lower Fraser Basin, British Columbia expressed a moderately high degree of concern about the quantity of water supply, but a higher and more consistent degree of concern about water quality. Furthermore, participants believed water sources were less healthy than technical data indicated (McDaniels et al., 1998). In contrast, research on the east coast of Canada (in the Annapolis Valley, Nova Scotia) determined that despite non-point source pollution threats to water quality (e.g., household septic systems), participants were not that concerned about contamination risks or water quality issues (Janmaat, 2007). Janmaat (2007) suggests that these participants are therefore unlikely to support policies designed to reduce contamination risks if they require using local tax dollars. More broadly, in a review of Canadian consumer studies about tap water, Dupont (2005) made three conclusions regarding Canadian perceptions: 1) Canadians want safe and reliable water on tap; 2) Canadians are less confident about public water supply safety; and 3) Canadians are increasingly turning to tap water substitutes such as bottled water, because of their perceptions of risk. Public risk perception is also an area of interest to those considering the use of water recycling technology and greywater or stormwater for irrigation (e.g., Hwang, Valeo, & Draper, 2006). In general, residents in Calgary, Alberta, did not oppose the idea that stormwater be used to irrigate a city park, as long as it did not pose any health risks (Hwang et al., 2006).

These studies offer insights into public perceptions about very specific aspects of water supply (i.e., water quality and risk perception) that may assist decision-making in

specific regions of Canada. In some of these studies, researchers included survey questions that briefly explored perceptions toward water shortages and climate change (e.g., Hwang et al., 2006); however, water quantity and water management have not been the focus. Due to current and anticipated water management challenges resulting from climate change and increasing urbanization, water quantity issues should be included in the scope of water research.

Recently, as a part of a larger research project that explored the implications of various future climate change scenarios on water management in the Okanagan Basin (Cohen & Neale, 2006), Shepherd, Tansey, and Dowlatabadi (2006) described two cases of water meter implementation and people's attitudes toward metering throughout the implementation process. In one case, residential water metering was implemented in the City of Kelowna in order to facilitate volume-based pricing. In the other case, agricultural metering was implemented in the South East Kelowna Irrigation District to monitor water use in order to enforce volume-based pricing for license holders that exceeded their allocations. During interviews, stakeholders that either played a direct role in water meter implementation, or that had a considerable understanding of the issues in each case, identified attitudes that emerged during the implementation process. In the residential metering case, consumers expressed a diverse set of attitudes, but did not engage in serious local lobbying. Some people were not in favour of metering, but they understood why it was necessary (Shepherd, Tansey, & Dowlatabadi, 2006). In the agricultural metering example, growers were very negative about the prospect of introducing water meters, and coordinated a petition in opposition (Shepherd, Tansey, & Dowlatabadi, 2006). Growers believed a metering policy was an effort to direct water

resources away from agriculture in order to accommodate growing residential demand, which they felt threatened their independence, flexibility, and perceived sense of ownership over water (Shepherd, Tansey, & Dowlatabadi, 2006).

As Shepherd, Tansey, and Dowlatabadi's research study (2006) demonstrates, in order to develop an inclusive understanding of local perspectives toward water, attention to the broader context of water management and policy-making is required. To gain a comprehensive understanding of people's attitudes and perspectives toward water management and water supply in general, single components of water supply, such as water conservation alternatives, must be considered relative to all water issues relevant to the particular context. Furthermore, rather than simply exploring attitudes and perspectives of the consuming public, attitudes and perspectives of all parties that influence policy (policy-makers, water managers, and water users) will offer a better understanding of local contexts (Howe & Smith, 1993). Finally, simply identifying what attitudes or perceptions exist is not enough. An understanding about *why* certain perceptions exist is required to develop effective policies that incorporate multiple interests.

2.3.3 Assumptions about attitudes

Currently, because there is little empirical evidence demonstrating how people think about water quantity in Canada, water researchers and experts often make assumptions about what people think. For example, one frequently cited perception is the "myth of water abundance" (Brandes, Brooks, & M'Gonigle, 2007; Brandes & Ferguson, 2004; Brandes et al., 2005; Brandes & Kriwoken, 2006; Maas, 2003; Plummer & Stacey, 2000; Sprague, 2007). Researchers suggest that the Canadian public falsely believes that

Canada is a water abundant country, and that consequently Canadians undervalue and abuse water. High water use trends in Canada relative to other countries (Bakker, 2007), resistance to changing water use habits (Brandes et al., 2005), and statements derived from the media (Sprague, 2007) are all cited as reasons why this perception is assumed to exist.

Although it may be true that some Canadians undervalue water, generalizing this perception to the entire Canadian population based on national water use trends and statements made by some Canadians may be inaccurate. I am not suggesting that the myth of abundance does not exist. However, the prevalence of this perception in Canada has not been empirically determined, and contextual circumstances may shape attitudes and perspectives toward water. For instance, some people have advocated for environmental rights in Canada, including rights to "instream flow" and other supplies of water to ecosystems (e.g., Marshall, 2004; Pacific Fisheries Resource Conservation Council, 2008). Furthermore, Pleasance (2004) indicates that roughly 20% of Canadian municipalities have developed DSM programs (as cited in Cantin, Shrubsole, & Aït-Ouyahia, 2005). These examples provide evidence of an understanding, in some contexts, that water is a scarce resource.

Assumptions that exist about peoples' attitudes toward water are not limited to the public domain; other groups are also presumed to hold specific attitudes. Reports prepared by the POLIS Project on Ecological Governance at the University of Victoria, BC, state that the attitudes of the public, water managers, and policy makers all act as barriers to the successful implementation of DSM strategies (Brandes & Ferguson, 2004; Brandes et al., 2005; Maas, 2003). Table 2.2 outlines the attitudes attributed to these

groups in reports by the POLIS Project on Ecological Governance. If in fact the attitudes described in Table 2.2 are accurate for a particular local context, then gaining a better understanding about whether, and why, these attitudes exist may lead to more successful DSM implementation, because decision makers can gain a better understanding about peoples' expectations and demands for water management. However, if existing attitudes differ from those assumed, then decision makers might be missing more subtle, but key information, that could inform contextual decision-making. The attitudes described in Table 2.2 are highly generalized, and although those views might exist, the groupings of people who hold those views may differ from the groupings mentioned in Table 2.2.

Table 2.2 Descriptions of different stakeholder groups' presumed attitudes toward water and water conservation

Stakeholder Group	Presumed Attitude
General public	Because Canada is perceived as a water-rich country, and due to the low cost of water, Canadians believe that there is an abundance of water. Excessive water use habits are deeply entrenched, and using less water is associated with a reduced standard of living. Ultimately, the public does not understand the need to conserve water.
Water managers	Securing water supply has traditionally been the focus of water management in a field dominated by engineers. High visibility projects, such as dams and reservoirs, demonstrate to the public that action is being taken to secure more water. This engineering bias influences water management, such that water managers are focused on securing future supply, and they lack the time, will and finances to consider conservation strategies.
Water policy-makers	Although policy-makers could institute water-pricing reform, charging more money for a service that has been inexpensive for years is a politically contentious issue. This would likely lead to adverse reactions from the public, resulting in reduced popularity for the politicians implementing such legislation. For the sake of remaining in power, politicians are likely to avoid economic strategies for conserving.

Based on: Brandes & Ferguson, 2004; Brandes et al., 2005; Maas, 2003

My goals in this study are both of a theoretical and applied nature. From a theoretical perspective, I intend to empirically investigate attitudes and perspectives toward water and water management, while comparing identified attitudes with presumed attitudes cited in water literature. From an applied perspective, I intend to explore what attitudes and perspectives exist and why, in order to identify areas of agreement and disagreement that could contribute to multi-stakeholder planning and decision-making in Gibsons.

CHAPTER 3: METHODOLOGY

3.1 Methods for studying human perspectives

To better understand public preferences, both quantitative and qualitative methodologies are used to study human attitudes in natural resource management. Some commonly used methods include survey questionnaires, focus groups, and interviews. Quantitative methods used for data collection, such as survey questionnaires, often employ the use of scales where participants are required to rate individual items on a continuum; for example, from strongly agree to strongly disagree. Responses to a battery of items are either combined to produce a single score representing a participant's evaluation toward an object (Fishbein & Ajzen, 1975), or clustered to produce groupings of items that describe attitudinal dimensions (Manfredo, Teel, & Bright, 2004). Qualitative methods, such as focus groups and interviews, typically generate in-depth responses to the topic under study, and some form of thematic analysis can be used to identify the emergent themes in participants' viewpoints (Babbie & Benaquisto, 2002).

These methodological approaches to studying attitudes are not without criticism. Brown (1980, p.191) states that in using scaling techniques "the meaning of the subject's response is assumed to be dependent on the a priori meaning of the scale". Therefore, scales are designed to give priority to the researcher's perspectives rather than to accurately depict attitudes in a way that is meaningful to the participant. Brunner (1982) furthers this notion by stating that scales systematically divert attention from alternate perspectives. Although scaling instruments are useful for obtaining information from a

large number of people and for making generalizations about the preferences of various segments from within that population, they are less useful for conducting exploratory research where a comprehensive description of variability is the goal. Qualitative techniques used for data collection are useful for conducting exploratory research; however, they lack systematic procedures to elicit relevant information, and they lack statistical rigor (Addams, 2000; Keeney, von Winterfeldt, & Eppel, 1990). Therefore, an ideal method for studying attitudes would combine the systematic data collection procedures of quantitative techniques with subjectively driven data produced through qualitative techniques. Q methodology is one method that has emerged to achieve both these objectives.

Criticisms of attitude research are not simply restricted to particular methodologies; Manfredo et al. (2004) have questioned the entire direction attitude research is taking in resource management. Although attitudinal research is theorized to offer descriptive, predictive and explanatory information about attitudes in order to influence behaviour, the majority of approaches offer little more than descriptions of attitudes (Manfredo et al., 2004). Minimal effort has been made to test and advance theories. Manfredo et al. (2004) argue that as a result, existing research has limited applicability to resource managers because of its inability to accurately reflect human behaviour. Resource managers are also increasingly looking to researchers for accurate attitudinal data that can be applied in collaborative decision-making processes. However, researchers are challenged with finding tools that systematically analyze participants' perspectives (Steelman & Maguire, 1999). Thus, Q methodology is recommended as a

tool that can translate attitudinal data into useful decision-making information (Clement, 2006).

Q methodology combines positive components of both qualitative and quantitative methodologies to examine human subjectivity (events that take place in the mind, rather than in the external world). Participants model their viewpoints in a systematic way by arranging statements of opinion in a distribution according to particular conditions of instruction, such that researchers can analyze this data using the statistical techniques of correlation and factor analysis (Brown, 1980). Q method studies can provide a richer understanding of subjective views than typical descriptive attitude studies, if they are designed to solicit explanations for why participants hold particular views and under what circumstances they hold such views. Finally, Q methodology is applicable to resource management decision-making because participants consider individual items within a wider context. This holistic or 'gestalt' approach better imitates true decision-making processes in which individuals are forced to make tradeoffs between what they agree with or disagree with the most.

3.2 Q methodology

3.2.1 History

Q methodology was developed in the 1930s by physicist-psychologist William Stephenson (1935a, 1935b, 1953). Although William Stephenson and Sir Godfrey Thomson (both British factor analysts) wrote independent documents in 1935 discussing the theoretical innovation underlying Q method – correlating persons, rather than correlating traits – Stephenson pursued the technique further, while Thomson, who was

pessimistic about the practical utility of Q technique, did not (Brown, 1980; Stephenson, 1953). Q methodology is a means of studying human subjectivity. Q helps describe the dominant viewpoints within a group of people, while drawing comparisons between differing viewpoints. Q method has been used in a range of disciplines including: psychology (e.g., Brownlie, 2006; Richards, Papworth, Corbett, & Good, 2007), public health (e.g., Logan, 2007; van Exel, de Graaf, & Brouwer, 2006), communications (e.g., Farquhar & Meeds, 2007; Popvich & Masse, 2005) and environmental policy analysis (e.g., Ellis, Barry, & Robinson, 2007; Webler, Tuler, Shockey, Stern, & Beattie, 2003). The fundamentals of Q methodology are described in Stephenson's work (1953) and the method is further described in literature written by Brown (1980), McKeown and Thomas (1988), and others.

3.2.2 Core concepts

Q methodology differs from traditional survey research, known as R methodology, in three ways: by how it is conceptualized, by how it is statistically analyzed, and by the type of results it produces. One theoretical difference between the two methodologies is that the R approach considers viewpoints from an external and presumed objective standpoint, whereas Q seeks to describe viewpoints from a subjective perspective (Stephenson, 1953). In R methodology, the researcher assumes that some particular attitude structure or perspective exists, and a scale is created as an operational definition, to measure the extent to which groups of participants fit the presumed structure (Robbins, 2005). Therefore, the meaning of a participant's response depends on the prior meaning assigned by the researcher to the scale (Brown, 1980). In Q methodology, the researcher seeks to determine what particular structure of subjectivity

exists from the internal standpoint of the participant (Brown, 1980; Robbins 2005). Therefore participants' map their points of view by rank-ordering statements of opinion, creating their own operational definition of a view about a given topic (Stephenson, 1963). In Q methodology there is no right or wrong way to rank-order statements, and "validity has no place since there is no external criterion for a person's own point of view" (Brown, 1980, p. 191).

A further theoretical distinction between Q and R methodologies leads to differences in statistical analyses, in that people rather than traits are correlated and factor analyzed. In R method a population of *n* individuals is measured with *m* tests, whereas in Q method *n* different tests are measured by *m* individuals (Stephenson, 1953). Therefore, in Q method people are the variables, not the tests, and tests or measures are the study sample, not people (Stephenson, 1953). Hence, in a Q factor analysis, people who sort statements in a similar way load onto factors to reveal a type of viewpoint (e.g., an environmental viewpoint toward water), whereas in an R factor analysis, tests or items that are rated in a similar way load onto factors to reveal a grouping based on a common theme (e.g., a grouping of economic reasons for advocating for water conservation).

These theoretical distinctions not only lead to procedural differences between Q and R method, but also to differences in the data that emerge. Because R method compares patterns of opinion between groups, it is useful for determining proportions of groups that support or oppose particular items or statements (Robbins, 2005). Large, representative sample sizes are used in R methodology to generalize results to the entire population under study. Q methodology, however, explores what these patterns of opinion are to begin with, and therefore produces data that describe the variations of

opinions about a particular topic (Robbins, 2005). Hence, Rohrbaugh (1997) states that the goal of a Q study is to analyze the variability within cases, rather than to generalize the results to the entire population (as cited in Steelman & Maguire, 1999).

3.2.3 Application of Q methodology

Q methodology has been used to explore social discourse about a wide range of environmental issues. In *Social Discourse and Environmental Policy*, Addams and Proops (2000) draw together several studies that use Q methodology in environmental research to demonstrate that Q method is not just another way of looking at attitudes, but that it is a useful tool for deconstructing polarized positions in controversial debates. While some methods drive debates further into "for" and "against" positions, Q method can be used to explore stakeholders' underlying interests, resulting in a clearer understanding of their viewpoints and why they are advocating for a particular position. This clarification of interests is practically useful for stakeholders who engage in collaborative decision-making to find solutions that meet the needs of all parties, and theoretically useful for researchers who attempt to answer "why" questions related to human behaviour.

One example of a Q study used to address water-related controversies was completed in Colorado, where water is considered a scarce commodity and where ongoing debates about water challenges, strategies and associated issues have ensued (Colorado Institute of Public Policy, 2006). Because stakeholders were firmly entrenched in their positions, Q methodology was used to achieve the following five outcomes (Colorado Institute of Public Policy, 2006, p. 8):

- clarify the interests
- recognize the commonalties
- understand the differences
- face the challenges, and
- work toward innovative strategies.

The Q study explored participants' beliefs about water and priorities for current and future challenges. Researchers identified six different factors (i.e., distinct viewpoints) representing participants' beliefs about water and three different factors representing current and future priorities (Table 3.1). Five of the six belief factors identified the "balancing of consumptive use needs" challenge factor as a priority, while three of the six belief factors identified the "water sustainability" challenge factor as important. Only one belief factor identified the final challenge factor, "institutional streamlining" as important. This demonstrates Q method's ability to identify differing viewpoints within a group while illustrating that people with unique viewpoints may share views about the future challenges and solutions associated with water-use planning.

Table 3.1 Factors identifying beliefs about water and water challenges in a Colorado water study

Belief Factors	Challenge Factors
1. State-wide economic growth	A. Balancing consumptive use needs
2. Environmental concerns	
3. Living within our limits	B. Water sustainability
4. Stay the course	
5. Broken system	C. Institutional streamlining
6. State rights	

Data source: Colorado Institute of Public Policy, 2006, p. 12-13, 15

Q method is useful for collaborative decision-making because of its ability to define participants' underlying interests. This is precisely why it is preferable to use Q

method instead of R method if the research goal is to describe why people hold particular views. For comparison, in an R study that examined people's perceptions about water quality in the Lower Fraser Basin in British Columbia, researchers determined that perceptions about water quality were somewhat negative, and that water quality was thought to be worse than the available technical data suggested (McDaniels et al., 1998). However, in explaining these data, researchers were merely able to speculate why people had this negative perception about water quality, as the study provided no strong empirical evidence for why this perception existed.

3.3 Application of Q methodology to explore attitudes toward water and water management in Gibsons, BC

3.3.1 P sample

To generate the group of participants (person sample or p sample) for this study I used a non-random, targeted sampling technique. I selected participants of theoretical interest, based on their connection to water planning, management, and use in Gibsons. Participants were members of one of the following three groups:

- water policy makers (locally elected government officials for the Town of Gibsons),
- water managers (staff members involved in managing the water supplied to the Town of Gibsons from one of the following organizations: the Town of Gibsons, the Sunshine Coast Regional District, or the Vancouver Coastal Health Authority), or
- water users (people who either reside or work in the Town of Gibsons, and use Gibsons' water, but are not policy makers or water managers).

I selected all possible policy makers and key water managers to participate. To select participants with diverse views from the 'water user' group, I considered demographic

information (sex, age, employment position, and residing neighbourhood), as well as the type of concerns (environmental, economic, and social) that people had previously expressed with respect to water-related issues. In total, 21 people participated in the study. Five were policy makers, five were involved with water management and eleven were water users. Seventeen of these participants completed preliminary interviews and subsequently completed Q sorts (the rank-ordering of statements of opinion), while four participants just completed Q sorts. I asked these four additional participants to join the study to complete Q sorts once the interviews had been completed, so that various demographic categories would be better represented in the P sample.

Unlike in R method where small samples of tests are used with relatively larger samples of people, in Q method, larger samples of tests are employed with relatively smaller samples of people (Brown, 1980). The role of variability is reversed between the two methods; tests are the variables in R method and people are the variables in Q method. Therefore, Q method often employs small person samples and single case studies (McKeown & Thomas, 1988). As mentioned earlier, the goal of the Q study is to identify the variety of views about a given topic. "[A]ll that is required are enough subjects to establish the existence of a factor for purposes of comparing one factor with another" (Brown, 1980, p.192). Q is not concerned with the proportion of a population that belongs to a particular factor – this can only be determined by using large, representative samples.

3.3.2 Q sample

I developed the Q sample (the set of statements for participants to rank-order during the Q sort) in two stages. First, I conducted semi-structured interviews with

participants to generate a population of statements from the communication concourse (the set of all possible opinions about a topic). Second, I transcribed components of the interviews and selected the Q sample from the population of statements using a structured Q sample design. These processes are described in more detail below.

I completed 16 in-person interviews and one phone interview during June and July of 2006 to generate a population of statements about peoples' attitudes toward water and water management in Gibsons. McKeown and Thomas (1988, p. 25) refer to Q samples developed in this way as "naturalistic", because they are taken from participants' own communications. In contrast, "ready made" samples are drawn from other sources, such as from the media or academic literature. The advantages of using naturalistic samples are that "they mirror the opinions of the persons performing the Q-sorts, and…they expedite both the Q-sorting process and the attributions of meaning" (McKeown & Thomas, 1988, p. 25). I purposely completed interviews during the summer months (when water use is highest and rainfall lowest) because I suspected that people would be more likely to think about water quantity issues at this time of year.

To develop an interview questionnaire, I created a thematic research framework from the literature on urban water demand-side management, and in particular the work by the POLIS Project on Ecological Governance (Brandes & Brooks, 2005; Brandes & Ferguson, 2003; Brandes & Ferguson, 2004; Brandes et al., 2005; Maas, 2003). I based my interview framework on the POLIS Project work because the group has conducted extensive research and published numerous reports on water demand-side management in Canada, providing a comprehensive understanding of this topic. Water supply, water management, and water use/conservation are three main themes in the POLIS Project

literature. I created interview questions to investigate each of the three thematic categories. To ensure that I asked questions that included all aspects of participant perspectives I consulted Lasswell's (1971) policy sciences framework. The policy sciences framework breaks down various social processes (such as human perspectives) and decision-making processes into components to guide inquiry (Clark, 2002). The three components identified for participant perspectives include: identification, expectation, and demand (Lasswell, 1971). Identification considers how participants perceive themselves; expectation considers how participants view past, present and future events; and demand considers what participants would ideally like to see happen (Lasswell, 1971). The purpose of considering social processes, and in particular perspectives, from the standpoint of a policy-oriented inquiry is to accurately map out the range of perspectives about a given issue in order to sort out the complexity of those perspectives (Clark, 2002). To explore participants' identities, I asked demographic questions, including questions about their affiliations, as well as questions about personal water use and costs. To explore the expectation and demand components of participant viewpoints, I asked the questions listed in Appendix A. I pre-tested various iterations of the interview questionnaire with three graduate students and one undergraduate student at Simon Fraser University, as well as one non-student in Vancouver, before conducting interviews with study participants. Based on this pre-testing, I edited interview questions to achieve greater clarity.

With the assistance of digital recordings, I identified 328 statements from the interviews that either characterized how participants defined issues about water or characterized alternatives or strategies to deal with water issues. Using this population of

statements, I selected two distinct Q samples. The first Q sample included statements about current water supply and management in Gibsons, which I refer to as the "current conditions" Q sample or Q sort. The second Q sample included statements about how water management might be improved in Gibsons, which I refer to as the "preferred alternatives" Q sample or Q sort (see Appendix D).

To select particular items from the population of statements, I used a structured Q sample design. To do this, I designed two sampling frameworks (Table 3.2 and 3.3) based on key themes that emerged from the interviews, and then I selected between two to five statements from each sub-theme, which I refer to as a "dimension". A structured design typically avoids the weaknesses associated with an unstructured design, such as introducing an unintended bias due to over- or under-sampling a particular component (McKeown & Thomas, 1988). Brown (1980) suggests that the process of selecting statements for a Q sample is more of an art then a science, and the ultimate goal is to represent the population of statements in miniature. A representative sample of statements is achieved by applying the principles of variance design (Fisher, 1960) where the population of statements is organized according to a theoretical framework (Brown, 1980). Both deductive and inductive designs can be used (McKeown & Thomas, 1988). A deductive design organizes the population of statements based on a priori theoretical considerations (i.e., assumptions, theories or hypotheses). An inductive design organizes the population of statements based on themes that emerge throughout the statement collection process. Because this research is exploratory, and because I wanted the subjectivity from the interviews to guide the statement selection, I used an inductive design to avoid imposing my a priori assumptions on the Q sample.

Table 3.2 Framework used to derive the current conditions Q sample

Theme	Dimension	Statements Sampled (#)
Human Attitudes and Behaviour	Attitudes about water in general	4
	Attitudes about conservation	5
	Water use behaviour	5
The Biophysical System	Quantity requirements	5
	Quality and protection	4
The Technical System	Infrastructure	4
	Supply	3
Economics	Economics	5
Governance/Decision-Making	Political will	4
	Planning for the future	5

Table 3.3 Framework used to derive the preferred alternatives Q sample

Theme	Dimension	Statements Sampled (#)
Governance/Decision-Making	Public involvement in decision-making	3
	Command and control decision-making	2
	Planning	3
	Data collection	2
Reducing/Limiting Water Use	Maintaining ecosystems	3
	Conservation in general	5
Educational Programs	Soft-sell approach	3
	Education	3
Economic Incentives	Metering	4
	Pricing	3
	Valuation	2
Efficiency	Efficient fixtures	2
	Soft-path	4
Supply-Side Strategies	Supply and infrastructure	5

The size of a Q sample is determined in part by the number of dimensions in the theoretical framework, and in part by what is considered manageable for participants (Brown, 1980). In general, using between 40 and 80 statements is considered satisfactory (Curt, 1994; Stainton Rogers, 1995). The process of selecting specific statements is considered to be "impressionistic" (Brown, 1980, p. 189). As suggested by Stephenson

(1953) the principle of heterogeneity is used to select statements from each category that are most unalike in order to best represent the variation within the category and the complexity of the issue under study (Brown, 1980). In applying the principle of heterogeneity, I selected a different number of statements from the various dimensions (rather than selecting an equal number from each dimension) because the diversity of the content in the statements listed under each dimension varied greatly between dimensions. For the current conditions Q sample I chose three to five statements from each dimension for a total of 44 statements, and for the preferred alternatives Q sample I chose two to five statements from each dimension, again for a total of 44 statements. Within each dimension, I chose the statements that were most unique. Each statement was printed on a three inch by five inch index card to be used in the Q sorts.

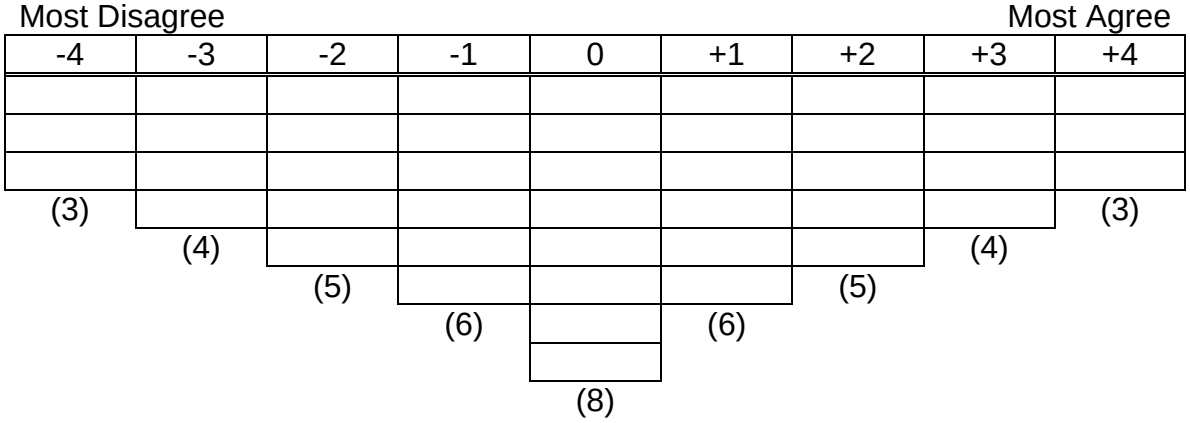
3.3.3 Q sort

During the Q sort, participants model their viewpoint by rank-ordering the Q sample statements. To complete this procedure I met with participants individually, and provided the two sets of statements printed on index cards. A sorting template assisted them in arranging the first set of cards to represent their views about current water supply and management in Gibsons, after which they arranged the second set of cards to represent their views about how water management might be improved in Gibsons (Figure 3.1). The sorting template is quasi-normal in shape, with a scoring continuum ranging from -4 to +4. There are fewer spaces for participants to place statements at the extreme ends of the continuum, which forced them to make tradeoffs about which statements they felt most and least strongly about. This type of distribution is known as a "forced-free" distribution, because only a certain number of items can be placed under

each rank, but participants are essentially free to place items where they choose (McKeown & Thomas, 1988, p. 34).

Figure 3.1 Template used to arrange statements during Q sorts

Template shows ranking scale for statements (-4 to +4). The number of statements permitted in each column is shown in brackets.



Forced distribution is a controversial issue in Q methodology and it has been criticized for restricting participant decisions because participants may not conceptualize the issue under study according to the provided sorting template (Brown, 1980; Watts & Stenner, 2005). However, Brown (1980) asserts that Q sort results are substantially the same regardless of whether a forced-free distribution or free distribution (where participants arrange statements as they choose) is used. Asking participants to adhere to a given distribution "encourages them to make distinctions that they might not otherwise volunteer but of which they are generally capable" (Brown, 1980, p. 203). Furthermore, Watts and Stenner (2005, p. 77) state that using a forced distribution omits unnecessary work for the researcher and is convenient for participants.

In one-on-one meetings, I presented participants with the two Q sorts sequentially. The current conditions Q sort was presented first, followed by the preferred alternatives Q sort. Although participants' responses in the second Q sort could have been influenced by completing the current conditions Q sort first, participants' viewpoints about preferred alternatives expressed in the Q sorts did not differ substantially from the preferences they expressed during initial interviews. I introduced the current conditions Q sort with the following conditions of instruction:

> These statements are about current water supply and management in the Town of Gibsons. Please sort these statements from those with which you "most agree" to those with which you "most disagree".

In a general explanation of how the sorting process would proceed, I told participants they would be sorting statements in an array from those with which they "most agreed" (+4) to those with which they "most disagreed" (-4). I asked participants to try to adhere to the sorting template provided (Figure 3.1), but gave them permission to deviate from the distribution if they felt that it prevented them from accurately reflecting their viewpoint. To assist participants in the sorting process I suggested two possible ways for approaching the task. First, I briefly outlined the following step-by-step instructions as suggested by Brown (1980) and McKeown & Thomas (1988).

1. Read once through all 44 statements and then sort them into three piles: 1) those with which you agree; 2) those with which you disagree; and 3) those that you are uncertain about, or find unclear, contradictory, or neutral.
2. From the statements that you agree with, read through the pile and select three statements that you agree with most strongly and place them under the +4 rank.
3. From the statements that you disagree with, select three statements that you disagree with the most and lay them out under the -4 rank.

4. Return to the statements that you agree with and select four statements out of the remainder that you next most strongly agree with and place them under the +3 rank

5. Return to the statements that you disagree with, and select four statements that you next most strongly disagree with and place them under the -3 rank.

6. Continue working back and forth between the positive and negative sides of the distribution, moving towards the middle (0) until all statements have been arranged.

The purpose of having participants work back and forth in this manner is "to help them think anew the significance of each item in relation to the others" (McKeown & Thomas, 1988, p. 33).

Second, I explained that some participants prefer to tentatively layout the statements along the distribution as they read through them for the first time. Following this initial layout, participants return to the positive (or agreement) side and the negative (or disagreement) side independently to compare statement rankings and to shuffle statements around to match their viewpoint. Finally, participants consider the distribution as a whole and shuffle statements from column to column to adhere to the provided sorting template. Although this second method for sorting is not a documented technique, it is a procedure that many participants in this study adopted (even when I only provided the specific instructions for the first method). Due to a demonstrated preference for this technique by some participants, I began to offer this technique as an option to the remaining participants.

Throughout the sorting process, participants were encouraged to move items to an alternate position in the template if they thought they had previously misplaced certain items. Upon completion of the sorting process, I asked participants to review the final arrangement and make any necessary changes that would more appropriately express

their point of view. Once this final review was completed, I recorded each participant's statement arrangement on a sorting template score sheet (similar to Figure 3.1).

Brown (1980, p. 200) states that an important step often overlooked in Q studies is the follow-up interview. In this step, participants are asked to comment on why they arranged statements in a particular way. Based on suggestions from Watts and Stenner (2005, p. 78) I asked each participant the following three questions in a post-sort interview:

- Why did you place the particular items that you did at each of the extremes (+4, +3, -4, and -3)?
- Are there any particular items that you wish to comment on, such as items that you found confusing?
- Are there any additional items that you would have included in the Q sample? Why?

Participants then repeated the Q sorting process with the second Q sample. The conditions of instruction for this second Q sort were as follows:

> These statements are about how water management in the Town of Gibsons might be improved. Please sort these statements from those with which you "most agree" to those with which you "most disagree".

The general instructions and the post-sort interview questions for the second Q sort were identical to those in the first sort.

In order to accommodate participant availability, I conducted Q sorts with the 21 participants over the course of two visits to Gibsons. Seventeen participants completed Q sorts between August 21-25, 2006 and the remaining four participants completed Q sorts on September 15 and 16, 2006. During the time between these two visits, a highly publicized water shortage occurred on the west coast of Vancouver Island in Tofino,

British Columbia. Just prior to the Labour Day weekend (September 2-4, 2006), Tofino's water supply reservoir ran short of water and the Town council ordered lodging and food service businesses to close for the holiday weekend. This event received a great deal of media attention, because of the potential impacts to tourist-dependent businesses in the area, and because of the claim that water management practices of the Town had been neglectful. Due to the attention drawn to this event, and similarities between Tofino and the Town of Gibsons (small, coastal communities in British Columbia), I was concerned that the water shortage might have an impact on the views of the remaining four participants in this study who had not yet completed Q sorts. Therefore, I asked participants who completed Q sorts in September, 2006 the following question once they had completed both Q sorts:

> Do you think the recent events in Tofino have had any effect on your viewpoint? If yes, in what way?

In response to this question, participants explained that the Tofino water shortage had simply strengthened their views, but had not changed their views. Statistical analyses of the Q sort results provided further evidence that the events in Tofino likely did not influence participants' views. The four participants who completed Q sorts in September did not identify with a single perspective toward current conditions or preferred alternatives, as might be expected if a single external force was influencing their attitudes. Rather these participants identified with the complete range of views identified in this study. For these reasons, I did not treat the data provided by these participants differently than I treated the data provided by the participants who completed Q sorts in August.

3.3.4 Analytic methods

A typical Q method analysis includes three sets of statistical procedures: 1) correlation; 2) factor analysis; and 3) computation of factor scores (McKeown & Thomas, 1988, p. 46). Overall configurations (Q sorts) are analyzed such that people are correlated and factored analyzed and the emergent factors represent clusters of people who sorted statements in a similar way (Steelman & Maguire, 1999). The factor analysis draws out the "typological nature of audience segments on any given subjective issue" (McKeown & Thomas, 1988, p. 50) and those individuals who significantly load onto a factor are considered to share a common perspective (Addams, 2000, p. 24). Factor loadings are used to determine whether Q sorts load significantly onto a factor and hence determine whether the participant who completed that Q sort will be associated with the viewpoint expressed by that particular factor (McKeown & Thomas, 1988, p. 50-51). In order to distinguish one factor from another, factor scores are computed for the composite factor array as z scores based on the relative weights of the pure factor loadings associated with each factor (McKeown & Thomas, 1988). Pure factor loadings are Q sorts that are significantly[1] associated with only one factor.

To conduct the statistical procedures mentioned above, I entered the Q sort data into the PQ Method (2.11) computer software program (Schmolck & Atkinson, 2002). I analyzed the data for each Q sort separately; however, I followed the same procedures for both sets of analyses. First, I correlated and factored analyzed Q sorts using principal components analysis, which achieves greater mathematical precision than alternatives,

[1] Significance at the 0.01 level = $2.58(1/\sqrt{N})$, where N is the number of statements in the Q sample (McKeown & Thomas, 1988). Therefore, Q sorts with factor loadings above $2.58(1/\sqrt{44}) = 0.3889$ are significant at $p < 0.01$for both Q sorts in this study.

such as the centroid approach (McKeown & Thomas, 1988). Second, I extracted factors using varimax rotation. The purpose of factor rotation is to maximize the number of Q sorts that purely load onto the composite factor array – in other words, to maximize the number of Q sorts that only load onto one factor (McKeown & Thomas, 1988). Possible methods used to rotate factors include 1) statistical techniques, such as varimax, quartimax, and equimax; and 2) judgmental approaches. Varimax rotation mathematically maximizes the amount of variance explained by the extracted factors. Third, I manually flagged Q sorts that were pure factor loadings (i.e., significantly loaded onto only one factor and not highly loaded on any other factor) and the program uses these sorts to create a composite, or model, factor array for each view (Appendix C). Some Q sorts were only significantly loaded onto one factor (and hence might be considered pure factor loadings), but were highly loaded on another factor as well. For example, in the current conditions Q sort, participant 19 was only significantly associated with Factor II (0.43), but was still highly associated with Factor I (0.35), although not significantly associated. In order to minimize the correlation between factors, if the difference between two correlations with two different factor arrays was 0.27 or less, I did not flag the Q sort as a pure factor loading.

To establish a difference cutoff of 0.27, I calculated the difference between the highest factor loading for a given Q sort, and the next highest loading. When I examined the range of differences, I identified two distinct groupings – smaller differences that ranged between 0 and 0.27, and larger differences that ranged between 0.31 and 0.65. Several differences were just above 0.31 (i.e., 0.3164, 0.3236, 0.3320, 0.3598), and to establish a cutoff above 0.31, would have resulted in using fewer pure loadings to define

the model Q sorts. Because a similar clustering of differences just below the 0.27 cutoff did not exist (differences below the cutoff were 0.2682, 0.2094, 0.1625, 0.1336, 0.1149, 0.0778), 0.27 seemed like a logical cutoff point that would still maintain enough pure loadings, while minimizing correlation between factors. To verify this established cutoff, I analyzed the data both excluding and including the Q sort with the 0.2682 difference between factor loadings, and determined that correlations between factors were indeed higher when I included that particular Q sort.

A variety of statistical methods can be used to determine how many factors to extract to model a set of data (see Table 3.4). The most commonly used method is the Kaiser criterion, because of its simplicity and objectivity. However, a problem with the Kaiser criterion is that it may lead to over- or under-factoring (Fabrigar, Wegener, MacCallum, & Strahan, 1999). Using the Kaiser criterion in combination with Cattell's scree test (a more subjective approach) may produce a more accurate model of the data. Furthermore, factors of theoretical importance, but not statistical significance, may be missed using statistical criteria alone, which highlights the importance of taking both theoretical and statistical significance into account (Addams, 2000, p. 28). This is particularly important in Q studies, since the eigenvalue for a factor depends on the number of people with that particular view that participated in the study.

Table 3.4 Statistical criteria used to determine how many factors to extract to model Q sort data

Method	Criterion	Reference
Kaiser Criterion	Eigenvalue is greater than or equal to 1.00.	Kaiser (1960)
Cattell's Scree Test	Eigenvalue is above or at the break in the slope of a graph of eigenvalues against factors.	Cattell (1966)
Two significant loadings (0.01 level)	Two significant loadings at the 0.01 level.	Brown (1980)
Two significant loadings (0.05 level)	Two significant loadings at the 0.05 level.	Brown (1980)

To determine which factor solution provided the best model of the data, I compared two-factor, three-factor, and four-factor solutions for both Q sorts. I considered all of the decision criteria mentioned in Table 3.4; however, I gave particular weight to issues of theoretical importance. Ultimately, I selected the three-factor solution as the best model of the data for both Q sorts.

Support for each factor solution relative to statistical criteria is listed in Table 3.5. Although data for each Q sort were analyzed separately, the support for factor solutions (based on statistical criteria) was identical for both Q sorts. Therefore, the information in Table 3.5 is applicable to both Q sorts. However, I will discuss the Q sorts independently as I identify issues of theoretical importance that influenced my decision about how many factors to extract.

Table 3.5 Statistical criteria support for different factor solutions for both Q sorts

Method	2-Factor Solution	3-Factor Solution	4-Factor Solution
Kaiser Criterion	Supported	Supported	Supported
Cattell's Scree Test	Supported	NOT supported	NOT supported
Two significant loadings (0.01 level)	Supported	Supported	Supported
Two significant loadings (0.05 level)	Supported	Supported	Supported

For the current conditions Q sort, each factor solution that was considered was supported by all statistical criteria except for Cattell's scree test (Table 3.5). Cattell's scree test only supported the two-factor solution (Appendix B). The two-, three-, and four-factor solutions had 15, 11, and 15 pure factor loadings out of 21, respectively. The correlations between some of the factors in the four-factor solution were considerably higher (0.39 and 0.37) than the highest correlations between factors in the two- and three-factor solutions (0.32 and 0.33 respectively). I ultimately ruled out the four-factor solution for two reasons: 1) due to higher correlations between some of the factors; and 2) because the fourth factor did not offer a unique viewpoint about current water supply and management. The addition of a fourth factor simply divided water managers and water users onto two separate factors, perhaps as a result of the water managers' more accurate knowledge about actual water supply and management circumstances and practices taking place in Gibsons. For example, because water managers are directly involved in day-to-day operations, they were aware that the water delivery system was leaky at the time when they completed Q sorts, and that a leak detection study was underway in Gibsons. However, water users do not typically possess detailed information about specific water management operations, so they tend to rank some Q

sort statements based on their opinion, while water managers rank those same statements based on their understanding of fact. I also ruled out the two-factor solution of the data, because although it was a statistically cleaner model of the data than the three-factor solution, it offered a simplistic and polarized perspective on views toward water supply and management in Gibsons. The two-factor solution simply highlighted that some people in Gibsons believe that water is not managed properly and some people believe that it is managed properly. Like the two-factor solution, the three-factor solution demonstrated that one factor was dissatisfied with current water management, while two factors were not, but in addition, the three-factor solution drew out the different aspects of water management that each factor was most concerned about: governance, infrastructure, and water wasting behaviour. Therefore, the three-factor solution was the simplest model of the data that best distinguished the views that participants expressed in both the semi-structured interviews and the Q sorts.

Table 3.6 shows the correlations between the current conditions factors. There is a moderate relationship between Factor I and II and Factor I and III (0.25), and a slightly higher relationship between Factor II and III (0.33).

Table 3.6 Correlation of current conditions factors

	Factor I	Factor II	Factor III
Factor I	1.00	0.25	0.25
Factor II	0.25	1.00	0.33
Factor III	0.25	0.33	1.00

For the preferred alternatives Q sort, all statistical criteria except for Cattell's scree test (Table 3.5) supported each factor solution that was considered. Cattell's scree

test supported the two-factor solution (Appendix B). The number of pure factor loadings for each of the three factor solutions was 15, 10, and 11, respectively. The highest correlation between factors occurred for the two-factor solution (0.32). For the three-factor solution, the highest correlation between factors was 0.30, and the rest were much lower. For the four-factor solution, the highest correlation was 0.26; some of the other correlations were close to that value, and some were very low. I eliminated the option of using the two-factor solution to describe the data because although the factors highlighted participants' views about conservation in general, it was difficult to discern participants' attitudes about specific water conservation measures. I also eliminated the four-factor solution option due to an overlap in content between some factors. Factors in the four-factor solution supported different combinations of water conservation measures, such as, 'metering and education' or 'education and water efficient fixtures' or 'metering and planning', but it was difficult to determine an overall preferred approach to water management. However, factors in the three-factor solution demonstrated both preferences for specific conservation measures and broader water management approaches. As with the current conditions Q sort, the three-factor solution provided the simplest model of the preferred alternatives Q sort while still providing sufficient detail to accurately reflect participants' views.

Correlations between preferred alternatives factors are identified in Table 3.7. Factors A and B are barely related (-0.01); Factors B and C are minimally related (0.14); and Factors A and C are moderately related (0.30).

Table 3.7 Correlation of preferred alternatives factors

	Factor A	Factor B	Factor C
Factor A	1.00	-0.01	0.30
Factor B	-0.01	1.00	0.14
Factor C	0.30	0.14	1.00

3.3.5 Follow-up workshop

Conducting a post-analysis focus group is recommended as a technique for determining the accuracy of factor interpretation (Watts & Stenner, 2005). Not only does this type of feedback provide an assessment of the results by the participants, it also offers on-going interpretation of what the factors mean (Robbins, 2005). Approximately one year after the initial semi-structured interviews (and about nine months after the final Q sorts), I held a workshop for participants in which I presented a preliminary version of the findings. Prior to hosting the workshop, I provided participants with a written report of the findings to brief them on the results that I would present at the workshop. During the workshop, I presented each of the three factors that emerged from the two different Q sorts, and discussed the areas of agreement relevant to all three factors in each Q sort. I engaged participants in discussion throughout the workshop by asking them to comment on the following questions:

- Are your views accurately reflected by these results?
- Are there any views that are missing from the results?
- Do the statements seem to be interpreted correctly?
- Do you wish to discuss any particular statements?
- What do these perspectives mean for Gibsons?
- How should Gibsons move forward based on these results?

My intention in engaging participants in a collective interpretation of the results was to verify my initial interpretation of the data, as well as to receive further explanation about why some of the results appeared. Furthermore, I anticipated that this type of presentation of the findings would be non-threatening because I asked participants for assistance in interpreting the findings, rather than just telling them what I had found. All participants were invited to attend the workshop, and seven of twenty-one participated. At least one person attended from of each of the three different theoretical groups of interest (policy makers, water managers, and water users). The seven participants present at the workshop confirmed that my interpretation of the factors accurately reflected their own perspectives and corresponded with their beliefs regarding the views that exist about current conditions and preferred alternatives in the community.

CHAPTER 4: RESULTS

4.1 Factors

4.1.1 Factor loadings

To recap from Chapter 3, I calculated factor arrays (i.e., model Q sorts) for each of the factors in the current conditions Q sort and the preferred alternatives Q sort. Each factor array is a model of how the idealized point of view represented by the factor would sort the statements in the Q sample. Factor arrays are displayed in statement templates in Appendix C, showing idealized statement rankings (+4 to -4) for each factor. Factor loadings are simply correlations between individual Q sorts and associated model factor arrays, and they demonstrate how similar or dissimilar the individual Q sorts are from the model Q sort. Factor loadings are listed in Tables 4.1 and 4.2 for the current conditions Q sort, and the preferred alternatives Q sort, respectively.

All participants who are affiliated with a particular factor ranked statements in a similar way. However, some participants ranked statements in such a way that they are affiliated with more than one factor or no factor at all. This simply means that some participants identify with more than one of the dominant views or that their particular perspective about Gibsons' water is not represented by the dominant views described in this study.

Q methodology is not designed to determine the proportion of people in the general population in support of a particular view; therefore, the number of participants

affiliated with each factor is inconsequential. The purpose of using Q methodology is to describe the nature of each factor, which I will do in subsequent sections of this chapter.

Table 4.1 Factor loadings for current conditions factors

Participants significantly associated with a factor ($p < 0.01$) are identified in boldface. Pure factor representations (participants significantly associated with only one factor and not highly loaded on another factor) are highlighted in grey.

Participant Group	ID	Factor I Inadequate planning & management	Factor II Limited infrastructure	Factor III Unnecessary water waste
Policy Makers	2	**0.77**	0.22	0.23
	4	**0.66**	0.25	-0.11
	10	**0.77**	0.08	-0.05
	14	**0.69**	0.17	0.27
	9	**0.51**	**0.58**	0.22
Water Managers	11	**0.53**	**0.43**	0.09
	15	-0.01	**0.77**	0.21
	19	0.35	**0.43**	0.14
	13	**0.71**	0.07	**0.44**
	12	0.03	0.36	0.00
Water Users	1	**0.66**	0.02	-0.15
	16	**0.53**	0.02	0.33
	20	**0.42**	**0.60**	-0.16
	3	0.28	**0.61**	0.06
	18	-0.02	**0.50**	0.01
	8	-0.05	**0.52**	0.36
	5	-0.05	0.23	**0.71**
	6	0.08	0.34	**0.75**
	7	0.23	-0.09	**0.73**
	17	**0.55**	-0.05	**0.59**
	21	**0.72**	-0.05	**0.43**

Table 4.2 Factor loadings for preferred alternatives factors

Participants significantly associated with a factor (p < 0.01) are identified in boldface. Pure factor representations (participants significantly associated with only one factor and not highly loaded on another factor) are highlighted in grey.

Participant Group	ID	Factor A Demand management planners	Factor B Informed caretakers	Factor C Supply management planners
Policy Makers	2	**0.58**	0.22	0.16
	10	**0.51**	-0.20	0.02
	4	**0.43**	-0.19	0.29
	14	0.07	**0.43**	0.11
	9	**0.62**	-0.10	**0.49**
Water Managers	13	0.12	**0.47**	0.36
	11	-0.06	**0.50**	**0.46**
	15	0.25	0.19	**0.68**
	12	0.35	0.02	**0.62**
	19	**0.43**	**0.42**	**0.45**
Water Users	8	**0.63**	0.15	0.08
	17	**0.74**	-0.03	0.17
	1	**0.77**	**0.39**	-0.11
	16	**0.40**	**0.55**	-0.17
	21	**0.62**	**0.54**	0.07
	18	-0.05	**0.58**	-0.01
	6	0.03	**0.62**	**0.55**
	3	0.15	-0.59	**0.47**
	5	-0.22	0.10	**0.52**
	20	0.16	-0.06	**0.76**
	7	**0.42**	0.10	**0.46**

4.1.2 Factor interpretation

Factor interpretation involves two components: examination of composite factor arrays, and discussion of important statements. Factor arrays (Appendix C) are examined to determine which statements are essential to understanding any given factor, and then these important statements are discussed to produce a narrative that describes the major differences and similarities among factors.

Key statements for describing factor narratives are identified in two ways. First, key statements are identified by looking at the statements that participants ranked most

highly in either a positive or negative direction. Statements ranked as +4 and +3 are those with which participants strongly agree, while statements ranked as -4 and -3 are those with which participants strongly disagree. Statements ranked as either +2 or -2 are those with which participants moderately agree and disagree, respectively, and statements ranked as +1, 0, or -1 are those with which participants either do not feel strongly about or feel neutral about. Second, key statements are identified through statistical means. Statements that significantly differentiate factor narratives ($p < 0.01$) are identified in Appendix D. I use the first method (statements ranked as +4, +3, -4, and -3) to describe each factor in this chapter. Although many statements identified in this way overlap with statements identified statistically, I do not discuss additional statements identified by statistical means alone. Some key statements only identified through statistical means are discussed in Chapter 5, based on their relevance to water policy and decision-making. However, they are not used to explain factor narratives, because they do not add any additional information not already obtained using the first method.

When referring to specific statements in this chapter, the rankings for all three views are listed, and the ranking of the view under discussion is shown in boldface (e.g., '**4** 4 3' corresponds with the rankings for Views I, II, and then III, when View I is being described). Statement numbers are shown in brackets, followed by the statement itself.

4.2 Current conditions factors

4.2.1 Factor summaries and participant affiliation

Brief descriptions highlighting the overarching differences between the current conditions factors, as well as the major points of agreement among factors, are summarized in Table 4.3.

Table 4.3 Current conditions factor summaries and areas of agreement

Factor I: Inadequate planning & management	There are problems with water planning and management in Gibsons and improvements are needed, especially to protect water quality and human health. Conservation should be a priority.
Factor II: Limited infrastructure	There are adequate water supplies available for Gibsons, but the existing infrastructure (storage and delivery) is not sufficient for the future. Water quality is a priority, but current water planning and management efforts are not a major concern.
Factor III: Unnecessary water waste	People are wasting water, even though Gibsons is doing a better job of implementing conservation measures than in the past. Water quality is a priority, but current water planning and management efforts are not a major concern.
Areas of Agreement	Despite Gibsons' improvements in implementing water conservation measures, people continue to waste and devalue water. Gibsons needs to make water quality and quantity issues priorities by protecting water sources, developing storage solutions and conserving water.

Five participants are pure factor representations of Factor I (four policy makers and one water user). One additional policy maker, two water managers, and four additional water users are significantly associated with Factor I but are also associated with either Factor II or III.

Participants who are purely loaded on Factor II include: one water manager and two water users, for a total of three pure loadings on this factor. In addition, one policy

maker, two other water managers, and two other water users are affiliated with more than one factor, including a significant affiliation with Factor II.

Three water users make up the group of participants who purely load onto Factor III. In addition, one water manager and two other Gibsons residents significantly load onto both Factor III and an additional factor. No policy makers are significantly affiliated with Factor III. Factor III is the only factor (of the six factors identified in this study) without significant association from at least one member from each participant group.

4.2.2 Factor I (inadequate planning and management)

All factors consider water quality to be the most important issue relative to all other water issues (statement 30), and as a result, all factors are concerned that Gibsons protect its water sources (31). However, Factor I particularly fears specific water quality threats, such as defective well-drilling (8):

I	II	III	#	Statement
4	4	3	(30)	Water quality is my number one priority, and all other water issues take second seat – protecting the health of the public is number one.
4	3	3	(31)	I'm concerned that Gibsons protects its water sources so that the aquifer doesn't get contaminated, because once the aquifer is contaminated Gibsons is in trouble.
4	0	-2	(8)	Gibsons does live a somewhat dangerous life relative to its water and potential contamination of it and that scares me – that somehow, somewhere, someone unbeknownst to the Town might tap into the aquifer and contaminate it inadvertently by not sealing the well properly.

Factor I is not only concerned about known threats to water quality, but also about the lack of knowledge regarding Gibsons water and the possible threats that may exist (43). Furthermore, this group believes that there are problems with current water planning and management (44). Specific concerns include inadequate long-term plans for climate change (5); required infrastructure improvements (13); and the development of a Sunshine Coast-wide master water plan (39). Unlike factors II and III, factor I places greater emphasis on statements that focus on large-scale and long-term planning and management issues:

3	0	0	(43)	I'm very concerned about the quantity of water, its availability, our lack of knowledge about the extent of the supply, and our lack of knowledge of the sources. We don't know where our water comes from, how big the supply is, or what the threats to it really are.
-3	0	1	(44)	There are no problems related to water quantity in Gibsons, because water managers are on top of it – they monitor the water and impose any necessary restrictions during the summer.
3	-3	-2	(5)	Climate change is a long-range issue, whereas water managers are concerned with short-term planning 5-10-20 years down the road.
3	0	-3	(13)	I suspect there is a lot of breakage and leakage in the water delivery system.
3	-3	-3	(39)	We do not have a master water plan on this coast which is a critical failure.

Like Factor II and Factor III, Factor I believes that water conservation should be a priority in Gibsons (26), and that the need to conserve is not simply due to social and political pressures (14). Unused freshwater that reaches the ocean is not considered a waste (12):

-4	-4	-4	(26)	Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?
-4	-2	-1	(14)	Even though we have plenty of supply, there are social pressures to bring water consumption down – the economics say it's not going to make a huge difference whether we consume 300L/day/person or 670L/day/person, but the politicians say we're water pigs and that they want to bring consumption down to European averages, and this is totally social.
-4	-2	-4	(12)	Water is plentiful and if you don't use it, it goes into the ocean, so what's the big deal?

Factor I, however, does not believe that the costs associated with water conservation are unreasonable (42) or that it is a basic right to have water supplied at a low cost (19). As a result, Factor I believes that the Town should incur the costs associated with implementing an effective water conservation program (36):

-3	-1	0	(42)	Many people are in agreement that we should conserve water, but it is too expensive to take action.
-3	-2	0	(19)	It is a basic right to have water supplied at a low cost.
-3	0	0	(36)	There is a difference between not wasting water and conserving it – I don't think we should waste water, but I don't want to see us incur the costs associated with a water conservation program if it isn't necessary.

4.2.3 Factor II (limited infrastructure)

Like Factor I, Factor II also believes that water quality, human health and water source protection are top priorities (30, 31):

4	**4**	3	(30)	Water quality is my number one priority, and all other water issues take second seat – protecting the health of the public is number one.
4	**3**	3	(31)	I'm concerned that Gibsons protects its water sources so that the aquifer doesn't get contaminated, because once the aquifer is contaminated Gibsons is in trouble.

However, Factor II does not share Factor I's beliefs that there is a lack of knowledge about water supply and that water supply planning and management in Gibsons are inadequate. Instead, Factor II believes that adequate water supply planning is currently taking place on the Sunshine Coast (10, 20, 39). Factor II disagrees that water managers are only concerned with short-term planning (5) and that engineers advocate for status quo management (1):

0	**-4**	-1	(10)	There is tremendous population expansion taking place on the Sunshine Coast, so where is the water going to come from? – there is just not enough, but this hasn't been officially recognized.
0	**-3**	2	(20)	I question whether water supply has been taken into account when planning for new residential development.
3	**-3**	-3	(39)	We do not have a master water plan on this coast which is a critical failure.
3	**-3**	-2	(5)	Climate change is a long-range issue, whereas water managers are concerned with short-term planning 5-10-20 years down the road.
0	**-3**	0	(1)	A lot of these professions (like engineers) get very embedded into their ways of doing things and they get established into a certain way of managing water and so consequently they become their own worst enemies (and our worst enemies) because they advocate for the status quo – why would they want to change things?

Even though this group recognizes that Gibsons' award-winning aquifer water is of limited supply (22), they are not concerned about water shortages or the overall amount of water supply available (32). However, they are particularly concerned about infrastructure limitations related to water storage and delivery (21, 38, 29):

2	**3**	2	(22)	Gibsons has the best water in the world, but a limited quantity of the best water in the world.
-1	**4**	-4	(32)	There is no shortage of water really, and there never will be, it's just a question of how much you want to pay for it in order that you can drink it – we can desalinate, but that costs money – we've got scads of water that we could pipe here, but that costs money – there's no shortage of water.
-1	**3**	0	(21)	Gibsons' problem is water flow for fire fighting, so they're going to have to spend the money on the infrastructure –the size of the infrastructure is not based on consumption, it's based on fire flow.
2	**4**	2	(38)	Climate change poses long-term issues. It's not the quantity of water, it's the time – the summers are getting longer and drier, and the winters are wetter – so it's going to be a storage issue.
-1	**3**	1	(29)	We live in a land where there is perceivably a lot of water, but what concerns me is that we don't seem to store it – we should store it because it's a precious commodity.

Like the other factors, Factor II agrees that water conservation should be a priority in Gibsons (26):

-4	**-4**	-4	(26)	Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?

Finally, Factor II does not believe that people in Gibsons want to be independent from the Sunshine Coast Regional District with respect to water supply (35):

0	**-4**	2	(35)	People in Gibsons want to be independent from the Sunshine Coast Regional District – they want to have enough water quantity to provide the entire town with their own groundwater so they can break ties with the Regional District.

4.2.4 Factor III (unnecessary water waste)

Like Factors I and II, Factor III also places high priority on water quality, human health and water source protection (30, 31):

4	4	**3**	(30)	Water quality is my number one priority, and all other water issues take second seat – protecting the health of the public is number one.
4	3	**3**	(31)	I'm concerned that Gibsons protects its water sources so that the aquifer doesn't get contaminated, because once the aquifer is contaminated Gibsons is in trouble.

Even though Factor III is concerned about water quality, this group is even more concerned about water waste in Gibsons. Factor III expresses concern that people devalue and waste water (18, 34). This group strongly disagrees that freshwater that reaches the ocean is wasted (12) and that there is no shortage of water (32):

1	1	**4**	(18)	People don't see a value in water – they think it is of unlimited supply – they take it for granted.
1	2	**4**	(34)	People do waste a lot of water, watering their lawns or washing their cars.
-4	-2	**-4**	(12)	Water is plentiful and if you don't use it, it goes into the ocean, so what's the big deal?
-1	4	**-4**	(32)	There is no shortage of water really, and there never will be, it's just a question of how much you want to pay for it in order that you can drink it – we can desalinate, but that costs money – we've got scads of water that we could pipe here, but that costs money – there's no shortage of water.

Despite this concern about people's limited appreciation of water, Factor III believes that awareness and appreciation about water quality have increased recently since Gibsons won the Berkeley Springs International Water Tasting competition (9, 33):

-1	1	**4**	(9)	People in Gibsons do appreciate the water, particularly since winning that 'best water in the world' award. That award has helped raise consciousness because the value of water has increased in people's awareness.
1	2	**3**	(33)	People who receive the Sunshine Coast Regional District water supply will travel quite some distance to pick up water from the Town of Gibsons – they know it's good water, and they know it's not chlorinated.

Factor III disagrees with statements that are critical of current water management and planning efforts (13, 39, 41):

3	0	**-3**	(13)	I suspect there is a lot of breakage and leakage in the water delivery system.
3	-3	**-3**	(39)	We do not have a master water plan on this coast which is a critical failure.
-2	1	**-3**	(41)	There is a lot of development planned and upper Gibsons is already supplied by the Sunshine Coast Regional District, so it won't be long before the aquifer cannot supply any more.

Not only does Factor III think that current planning and management are adequate, but Factor III believes that there have been recent improvements in water conservation efforts in Gibsons because the Town has made conservation a priority (26, 25, 4):

-4	-4	**-4**	(26)	Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?
1	2	**3**	(25)	Gibsons is doing a better job at adopting and implementing water conservation measures than in the past – there have been improvements in planning, awareness and having the staff to get out there and do it.
0	-1	**-3**	(4)	The Sunshine Coast Regional District is doing way more innovative water conservation programming than the Town of Gibsons – water conservation is not a priority in the Town of Gibsons.

4.2.5 Areas of agreement

General Attitudes about Water and Conservation

In general, all factors agree that people in Gibsons take water for granted (18) and that some people waste a lot of water (34):

1	1	4	(18)	People don't see a value in water – they think it is of unlimited supply – they take it for granted.
1	2	4	(34)	People do waste a lot of water, watering their lawns or washing their cars.

However, when responding to statements about their own attitudes toward water use and value, all factors disagree that they want unlimited amounts of reasonably priced water (6) and that water is simply wasted if it reaches the ocean without being used (12). Disagreement with these statements suggests that there is a discrepancy between what people believe "others" views are, and what they report their own views to be:

-2	-1	-2	(6)	As long as I can turn the water on and use it for whatever I want, whenever I want and pay for it at a reasonable rate then I'll be happy.

-4	-2	-4	(12)	Water is plentiful and if you don't use it, it goes into the ocean, so what's the big deal?

All three factors *strongly* disagree that water conservation is unnecessary in Gibsons (26), and that an effort to reduce water consumption is a social movement fueled by local politicians (14), indicating that all factors believe there are alternate reasons for conserving water, other than water supply shortage threats and social pressures:

-4	-4	-4	(26)	Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?
-4	-2	-1	(14)	Even though we have plenty of supply, there are social pressures to bring water consumption down – the economics say it's not going to make a huge difference whether we consume 300L/day/person or 670L/day/person, but the politicians say we're water pigs and that they want to bring consumption down to European averages, and this is totally social.

The ranking of statement 26 as '-4' by all factors emphasizes the high level of support for conservation among these participants.

Water Quality and Source Protection

There is a consensus among factors that Gibsons has a limited quantity of excellent water (22), and that people will travel from all over the Sunshine Coast to pick up Gibsons' great-tasting water (33):

2	3	2	(22)	Gibsons has the best water in the world, but a limited quantity of the best water in the world.

1	2	3	(33)	People who receive the Sunshine Coast Regional District water supply will travel quite some distance to pick up water from the Town of Gibsons – they know it's good water, and they know it's not chlorinated.

Due to the agreement that Gibsons has the best municipal water in the world (22), it is not surprising that all factors *strongly agree* that water quality should be a number one priority in Gibsons (30) and that Gibsons should protect its water sources (31):

4	4	3	(30)	Water quality is my number one priority, and all other water issues take second seat – protecting the health of the public is number one.
4	3	3	(31)	I'm concerned that Gibsons protects its water sources so that the aquifer doesn't get contaminated, because once the aquifer is contaminated Gibsons is in trouble.

Once again, rankings of '+4' and '+3' across all factors, emphasizes the importance of water quality to the participants in this study.

Water Management

All factors agree that Gibsons is doing a better job at implementing water conservation measures than in the past (25); however, despite these improvements, the Town must continue to respond to long-term issues, such as climate change, which will pose challenges for water storage (38):

1	2	3	(25)	Gibsons is doing a better job at adopting and implementing water conservation measures than in the past – there have been improvements in planning, awareness and having the staff to get out there and do it.
2	4	2	(38)	Climate change poses long-term issues. It's not the quantity of water, it's the time – the summers are getting longer and drier, and the winters are wetter – so it's going to be a storage issue.

4.3 Preferred alternatives factors

4.3.1 Factor summaries and participant affiliation

Brief factor summaries and an overview of the areas of agreement about how the Town of Gibsons could improve its water management are described in Table 4.4.

Table 4.4 Preferred alternatives factor summaries and areas of agreement

Factor A: Demand management planners	Improve water planning; meter and charge for water use; and limit population growth and ecosystem pressures.
Factor B: Informed caretakers	Protect water sources to maintain water quality; use appropriate education and discussion to increase people's understanding and concern about water conservation and the role of water in the environment.
Factor C: Supply management planners	Continue with water planning; meter and charge for water use; and enhance water supplies to accommodate future population growth.
Areas of Agreement	Water quantity and quality conservation are priorities. Low-effort conservation measures (on Gibsons' behalf) are ineffective at influencing voluntary behaviour change. Metering is the fairest way to charge for water.

Of the participants affiliated with Factor A, four are pure factor loadings (two policy makers and two water users). A further two policy makers, four water users, and one water manager are significantly affiliated with Factor A and associated with at least one additional factor.

Only two participants purely load onto Factor B: one policy maker and one water user. However, three water managers and four additional water users significantly load onto Factor B and at least one other factor, or have a loading on another factor that is close in value to the significant loading on Factor B.

Four participants are pure representations of Factor C (one water manager and three water users). One policy maker, three water managers, and two water users are affiliated with more than one factor, but are significantly associated with Factor C.

4.3.2 Factor A (demand management planners)

Factor A believes that water management planning improvements are necessary on the Sunshine Coast (7, 38):

4	0	0	(7)	We need a master water plan on the Sunshine Coast to try and come up with a strategy for all water systems so that everybody is working together instead of each of these water systems having their own little empire.
3	0	4	(38)	The most important factor in making decisions about water is to have a strategic plan that you follow and revisit every five years or so, and that has buy-in from all stakeholders.

Factor A would also like to see broader ecosystem and watershed concerns included in water planning and management decisions (19, 15):

4	-1	-3	(19)	I would love to see our growth here on the coast be limited by our ecosystem's natural ability to supply water.
3	4	-2	(15)	If we know that we are going to be facing increasingly stressful situations due to climate change then we want the forests to be ready as much as possible so there should be no logging in community watersheds.

The people affiliated with Factor A are also in support of water conservation (28) and they disagree that the monetary costs of conservation are too onerous (25, 33, 43, 34):

-4	-1	-4	(28)	If Gibsons and the Sunshine Coast Regional District negotiate a deal where the Regional District continues to supply Gibsons with water, then there will be no need for Gibsons to conserve water, because the Town will have enough.
-3	-2	2	(25)	If you do a cost-benefit analysis on implementing water conservation measures (i.e., efficient fixtures, meters, etc.) implementation won't be favourable in Gibsons, because we don't have huge capital deferrals – we don't have a billion dollar program to defer by conserving water.
-3	1	-3	(33)	If a proposed policy suggested that all of a sudden people had to start paying for their water usage, I don't know if it would pass. How do you put a value on water that has always been free?
-4	-1	0	(43)	The unfortunate thing about raising water rates is that everybody is punished and I don't think that's fair.
-4	2	-1	(34)	Before deciding to spend money on water conservation the Town of Gibsons should ask taxpayers what they want done with their money.

Factor A strongly supports water meter implementation, and "price per unit" charges for consumption (20, 1), rather than education and explanation, which it sees as ineffective at influencing water use (3, 40). Ultimately, Factor A believes the Town should tax residents for water and educate them so they understand why they are paying more (21):

4	3	4	(20)	Metering is the most fair and equitable way to charge for water.
3	-4	3	(1)	Water is a resource like gasoline, where you should pay by what you consume.
-3	-3	-3	(3)	For most people, if you explain to them why we need to conserve water, then they will support it.

-3	4	3	(40)	The more education there is around understanding water and what water does for the environment and what water does for life in general, the more people will respect it and if people respect it, they will treat it accordingly.
3	-1	0	(21)	The solution to implementing water conservation measures is to tax people and educate people so that they understand why they are paying more.

4.3.3 Factor B (informed caretakers)

Factor B believes the most important water management objective is maintaining water quality via watershed and source protection (15, 31):

3	**4**	-2	(15)	If we know that we are going to be facing increasingly stressful situations due to climate change then we want the forests to be ready as much as possible so there should be no logging in community watersheds.
1	**3**	4	(31)	We need to be careful about our water supply, not necessarily about quantity, but about quality – we should care about our water and protect it before a crisis occurs.

The people affiliated with Factor B believe that an ongoing dialogue and a deeper understanding about water and its role in the environment will lead to shifts in attitudes toward water and eventually better water use behaviour (8, 40, 41):

0	**4**	2	(8)	The more we talk about water conservation and water use, the more we change people's point of view – people absorb information and gradually change their behaviour.
-3	**4**	3	(40)	The more education there is around understanding water and what water does for the environment and what water does for life in general, the more people will respect it and if people respect it, they will treat it accordingly.
1	**-4**	-2	(41)	The soft-sell approach to water conservation is not having any effect whatsoever – we're wasting our money on advertising.

Although Factor B strongly promotes education and understanding as a means to attitude and behaviour changes, Factor B disagrees that explanation alone is adequate to effect water use behaviour change (3, 9, 27):

-3	**-3**	-3	(3)	For most people, if you explain to them why we need to conserve water, then they will support it.
-1	**-3**	1	(9)	The average household is the prime culprit in wasting water and Gibsons does promote common sense things to reduce water use (brochures, reminders, etc.) that do add up when multiplied by thousands of households in BC.
2	**-3**	2	(27)	By actually showing people how much they are getting charged for water by month they will have the opportunity to decide whether or not they want to use less or not.

Factor B's overall attitude toward water conservation is favourable – conservation is considered the cheapest and easiest way to pursue an increased water supply (26). Furthermore, Factor B agrees with Factor A and Factor C that metering is the most equitable way to charge for water (20, 35); however, Factor B highly objects to comparing water (an essential element for life) to gasoline (1). Finally, in keeping with its emphasis on education and understanding, Factor B is not in a rush to find solutions (39):

1	**3**	3	(26)	Conservation is the best means to pursue an increased water supply because it is cheaper and easier than other methods.
4	**3**	4	(20)	Metering is the most fair and equitable way to charge for water.
0	**-3**	-1	(35)	Water metering is a good idea, but unfortunately it's going to be the people on a limited income that suffer – the people with lots of money don't give a hoot how much water they use, because they can afford it.

3	**-4**	3	(1)	Water is a resource like gasoline, where you should pay by what you consume.
0	**-4**	0	(39)	No more water studies, let's get on with it – find a solution and stick with it.

4.3.4 Factor C (supply management planners)

Like Factor B, Factor C strongly agrees that water quality is a top priority for water management (31):

1	3	**4**	(31)	We need to be careful about our water supply, not necessarily about quantity, but about quality – we should care about our water and protect it before a crisis occurs.

However, Factor C shares Factor A's beliefs about the importance of planning to water management (38). Unlike Factor A, however, Factor C strongly disagrees that no one is paying attention to water planning on the Sunshine Coast (17):

3	0	**4**	(38)	The most important factor in making decisions about water is to have a strategic plan that you follow and revisit every five years or so, and that has buy-in from all stakeholders.
0	-1	**-4**	(17)	We need to conduct a really fast study with a short term outlook, to determine whether we have enough water for the next 10 years, because I think it's a major crisis and nobody's paying attention.

Factor A and Factor C also differ in opinion about the best way to plan for future water supply security. Although both views recognize that something must be done to match water supply with human demand, Factor C believes that the appropriate solution is to secure an increased water supply by raising the height of the dam on Chapman Creek (a local stream used for water supply) or by tapping into new supply sources (32).

Factor C disagrees with Factor A that human demand should be limited by restricting population growth and development on the Sunshine Coast (19):

1	-2	**3**	(32)	We will definitely run short of water here due to growth and we should be planning for it now, either through raising the height of the dam on Chapman Creek or going somewhere else to look for it, far away.
4	-1	**-3**	(19)	I would love to see our growth here on the coast be limited by our ecosystem's natural ability to supply water.

Despite Factor C's emphasis on obtaining additional water supply, Factor C is still in favour of water conservation (28, 26):

-4	-1	**-4**	(28)	If Gibsons and the Sunshine Coast Regional District negotiate a deal where the Regional District continues to supply Gibsons with water, then there will be no need for Gibsons to conserve water, because the Town will have enough.
1	3	**3**	(26)	Conservation is the best means to pursue an increased water supply because it is cheaper and easier than other methods.

Factor C agrees with Factor A that metering and "price per unit" charges for consumption are necessary (20, 1). Furthermore, Factor C doesn't see these types of pricing changes as infeasible (politically) (33):

4	3	**4**	(20)	Metering is the most fair and equitable way to charge for water.
3	-4	**3**	(1)	Water is a resource like gasoline, where you should pay by what you consume.
-3	1	**-3**	(33)	If a proposed policy suggested that all of a sudden people had to start paying for their water usage, I don't know if it would pass. How do you put a value on water that has always been free?

Factor C also agrees with Factor B that effective education will promote respectful water use behaviour (40), and that mere explanation is not a substitute for effective education (3):

-3	4	**3**	(40)	The more education there is around understanding water and what water does for the environment and what water does for life in general, the more people will respect it and if people respect it, they will treat it accordingly.
-3	-3	**-3**	(3)	For most people, if you explain to them why we need to conserve water, then they will support it.

Factor C is not in favour of smaller-scale, alternative water supply options, possibly because it feels that this will not solve large-scale supply needs to accommodate growth or that these options are currently impractical (37, 14):

0	2	**-4**	(37)	There should be more encouragement to use rainwater in gardens – the Town of Gibsons should have a rain water barrel program.
0	1	**-3**	(14)	Double piping of water (i.e., potable and non-potable water) would be great so that we don't use aquifer water to wash our cars – we can start with new developments and use tax incentives to promote retrofitting.

4.3.5 Areas of agreement

General Attitudes about Water Conservation

All factors disagreed with the statement that Gibsons would not need to conserve water if the Regional District continued to supply the Town with as much water as the Town could use (28). Once again, disagreement with this statement highlights that participants may think that there are other reasons for conserving water. One possible

reason that all factors agree is their shared belief that conservation is the cheapest and easiest method for obtaining increased water supply (26):

-4	-1	-4	(28)	If Gibsons and the Sunshine Coast Regional District negotiate a deal where the Regional District continues to supply Gibsons with water, then there will be no need for Gibsons to conserve water, because the Town will have enough.
1	3	3	(26)	Conservation is the best means to pursue an increased water supply because it is cheaper and easier than other methods.

Specific Water Conservation Measures

Each factor *strongly disagrees* that people will support water conservation efforts if you simply explain to them why it is necessary to conserve water (3). Along with this disapproval for using explanation as a means to convince people to change their behaviour, all factors disagree that a self-policing system amongst neighbours is an appropriate way to encourage water conservation (42):

-3	-3	-3	(3)	For most people, if you explain to them why we need to conserve water, then they will support it.
-2	-1	-2	(42)	People turning in other people who are in breach of the sprinkling regulations –that is a much more effective public education program than pamphlets being passed out at the desk at the municipal hall. Then people start policing themselves, because they don't want to get out of sorts with their neighbours.

Although there is no widespread agreement on what conservation measures are most ***effective***, all factors *strongly agree* that water metering is the most ***equitable*** way to charge for water (20):

4	3	4	(20)	Metering is the most fair and equitable way to charge for water.

Water Quality Objectives

All factors are in agreement that water supply protection, especially for water quality, is important (31):

1	3	4	(31)	We need to be careful about our water supply, not necessarily about quantity, but about quality – we should care about our water and protect it before a crisis occurs.

CHAPTER 5: DISCUSSION

5.1 Chapter overview

In this chapter, I discuss the significance for water decision-making of the views about water and water management described in Chapter 4. I also consider the implications of this study for broader understanding of perceptions about water in Canada. Although I summarized and described factors in detail in Chapter 4, Table 5.1 provides additional factor summaries for easy reference throughout the following discussion.

Table 5.1 Current conditions and preferred alternatives factor summaries

CURRENT CONDITIONS FACTORS	
Factor I: ***Inadequate planning & management***	· Management and planning need improvement · Conserve water quality and quantity
Factor II: ***Limited infrastructure***	· Management and planning are adequate · Improve existing infrastructure
Factor III: ***Unnecessary water waste***	· Management and planning are adequate · People waste and devalue water
PREFERRED ALTERNATIVES FACTORS	
Factor A: ***Demand management planners***	· Improve planning and limit growth · Meter and charge for water
Factor B: ***Informed caretakers***	· Protect water sources and quality · Promote understanding about water
Factor C: ***Supply management planners***	· Plan and seek additional water supply · Meter and educate about water

The discussion proceeds as follows. I use participant affiliation with factors, key statements and ideas, and the general perspectives toward water management implied by specific factors to structure a discussion about the water decision-making arena in Gibsons. In Section 5.2, I discuss how the theoretical groups of interest in the study (policy makers, water manager, and water users) think about current conditions and preferred alternatives. I also reflect on how decision-making might be influenced, given the differences and similarities between the groups' perspectives. In Section 5.3, I explore reasons why participants who share perspectives about current water management conditions in Gibsons do not necessarily share perspectives about how water management might be improved. In Section 5.4, I explore participants' perceptions about water conservation outcomes, and the potential use of these perceptions in the decision-making process. In Section 5.5, I compare assumptions about peoples' attitudes that are prevalent in the water management literature with those attitudes empirically determined in Gibsons, in order to explore general ideas about local government water management and people's attitudes toward water in Canada. Finally, I offer suggestions about future research in Section 5.6, and I provide concluding remarks in Section 5.7.

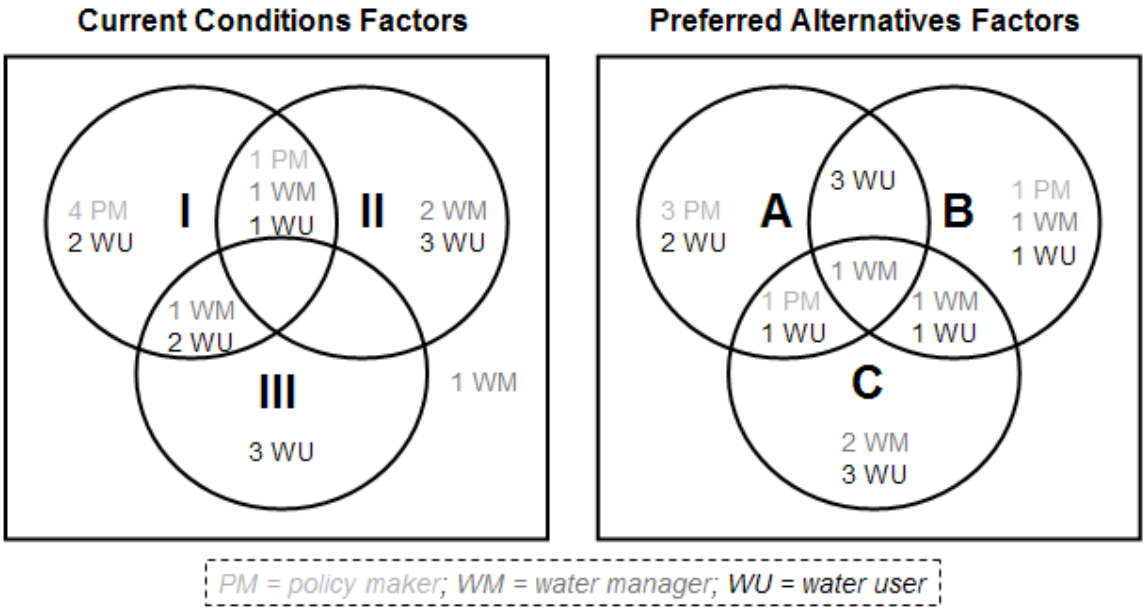
5.2 Participant group views

As demonstrated in Chapter 4, the roles that participants play with respect to the water supply system (policy makers, water managers, and water users) do not determine the sets of participants that share similar views about current water management conditions and possible preferred alternatives in Gibsons. That is, not all policy makers, or all water managers, or all water users share the same view about water and water management simply because of their similar role in the water decision-making process.

For all factors (except Factor III), at least one member from each group is significantly associated with each factor (Figure 5.1). Even Factor III has representation from two of the three groups. Groupings of participants into factors in this study are created based on participants' attitudes and perspectives as revealed by their Q sorts, rather than on their affiliation with a particular segment of the community. However, given that each of the theoretical groups of interest plays a specific role in the community with respect to water, it is important to look at how each group thinks about water and water management in order to understand the dynamics between actors in the water policy arena in Gibsons.

Figure 5.1 Participant affiliation with current conditions and preferred alternatives factors

Circles represent Factors I, II, III, A, B, and C. The numbers of participants (from each theoretical group of interest) that are affiliated with each factor are written inside each circle.



All possible policy makers and key water managers influencing water decisions in Gibsons participated in this study. Therefore, I am able to discuss the proportion of

participants in those groups who are associated with certain factors (i.e., the entire population from each group is represented in this study, rather than just a sample from each group). Because only a sample of participants from the water user group is represented in this study, rather than the entire population of water users, and the sample is not statistically representative of the larger population, I am unable to generalize as to how the views of water users are distributed across the community. The number of participants affiliated with each factor in the water user group is irrelevant and is not discussed. However, given that participants were sampled from the community to represent the diversity of views that exist, this study likely captures the main views in Gibsons.

As I discuss the views of policy makers, water managers, and water users in the subsequent sections of 5.2, portions of Tables 4.1 and 4.2 are repeated from Chapter 4 so that the factor loadings for each Q sort can be easily referenced. As a reminder, for Tables 5.2 to 5.7, participants significantly associated with a factor ($p < 0.01$) are identified in boldface. Pure factor representations (participants significantly associated with only one factor and not highly loaded on another factor) are highlighted in grey.

5.2.1 Policy makers

Table 5.2 Policy makers' factor loadings for current conditions factors

Participant Group	ID	Factor I	Factor II	Factor III
		Inadequate planning & management	Limited infrastructure	Unnecessary water waste
Policy Makers	2	**0.77**	0.22	0.23
	4	**0.66**	0.25	-0.11
	10	**0.77**	0.08	-0.05
	14	**0.69**	0.17	0.27
	9	**0.51**	**0.58**	0.22

Elected officials in Gibsons have similar perspectives about current water supply and management in the Town. Four out of five elected officials only identify with Factor I (inadequate planning and management), and the fifth policy maker for the Town identifies with both Factor I and Factor II (limited infrastructure). These shared perspectives represent the most distinct grouping (based on the theoretical groups of interest) in this study. In general, policy makers tend to see current water management conditions in the same way, whereas a variety of perspectives are held by participants in the 'water manager' and 'water user' groups. These shared perspectives may be a reflection of council discussions, "group think", shared policy goals, or a reflection of public priorities.

During interviews and Q sorts, Gibsons' elected officials indicated that water governance reform is necessary, and that water conservation policy should be a bigger priority than it has been for previous Town councils, particularly given high water consumption in Gibsons. Elected officials are concerned about issues that are not completely under their control, such as water quality, potential contamination, infrastructure leaks, and climate change. Rather than being concerned about their own governance, policy makers in Gibsons tend to be concerned about issues that have largely been the responsibility of other people (e.g., previous Town councils, or the Provincial government).

Table 5.3 Policy makers' factor loadings for preferred alternatives factors

Participant Group	ID	Factor A Demand management planners	Factor B Informed caretakers	Factor C Supply management planners
Policy Makers	2	**0.58**	0.22	0.16
	10	**0.51**	-0.20	0.02
	4	**0.43**	-0.19	0.29
	14	0.07	**0.43**	0.11
	9	**0.62**	-0.10	**0.49**

Despite having very similar perspectives about current conditions, policy makers in Gibsons differ to some extent in their ideas about improving water management. One policy maker only identifies with Factor B (informed caretakers); however, three other policy makers are slightly negatively correlated with Factor B. These negative correlations are likely due to the opinions of some elected officials that Factor B was the predominant approach to water conservation taken by previous Town councils, which some current council members consider ineffective. Four of the five elected officials are significantly associated with Factor A (demand management planners), and one of those four is also significantly associated with another factor (Factor C: supply management planners). To summarize, elected officials in Gibsons represent all views identified about improving water management, but in general, elected officials most cohesively identify with Factor A. A wide representation of views held by council members is an asset for balancing multiple community perspectives in decision-making, but reaching agreement on strategies and policies may be challenging if council members believe that different approaches to improving water management are necessary. Given that elected officials generally identify with Factor A, it is interesting to compare policy maker perspectives with those held by water managers, who play a role in advising on water decision-making and implementing decisions.

5.2.2 Water managers

Table 5.4 Water managers' factor loadings for current conditions factors

Participant Group	ID	Factor I	Factor II	Factor III
		Inadequate planning & management	Limited infrastructure	Unnecessary water waste
Water Managers	11	**0.53**	**0.43**	0.09
	15	-0.01	**0.77**	0.21
	19	0.35	**0.43**	0.14
	13	**0.71**	0.07	**0.44**
	12	0.03	0.36	0.00

Water managers differ in their perspectives about current water management conditions in Gibsons. This result is not surprising, given that different water management roles exist, requiring managers to focus on different aspects of water, such as water quality, water supply and distribution, or demand-side management. Two managers significantly load only onto Factor II (limited infrastructure), one manager loads onto both Factor I (inadequate planning and management) and Factor II, one manager loads onto both Factor I and Factor III (unnecessary water waste), and the final manager does not significantly load onto any factor. Although three perspectives about current conditions are present among the group of water managers in this study, certain managers are more closely tied to decision-making in Gibsons. For example, the two water managers that significantly identify with Factor II only are both staff with the Town of Gibsons, and of the water managers who participated in this study, they are the only two that work for the Town. This suggests a particular emphasis on infrastructure issues in current decision-making in Gibsons.

Table 5.5 Water managers' factor loadings for preferred alternatives factors

Participant Group	ID	Factor A Demand management planners	Factor B Informed caretakers	Factor C Supply management planners
Water Managers	13	0.12	**0.47**	0.36
	11	-0.06	**0.50**	**0.46**
	15	0.25	0.19	**0.68**
	12	0.35	0.02	**0.62**
	19	**0.43**	**0.42**	**0.45**

In the second Q sort, the majority of elected officials in Gibsons identify with Factor A (demand management planners), but the majority of water managers identify with Factor C (supply management planners). Four out of five water managers are significantly affiliated with Factor C, suggesting that as a group, water managers in this region tend to agree that supplying water to accommodate future demand is necessary for future water management. This is not to say that water managers do not at all identify with Factors A (demand management planners) or B (informed caretakers). One manager only identifies with Factor B, another identifies with both Factors B and C, and another identifies with all three factors – the only participant to identify with all three factors in either Q sort in this study. Although Gibsons' water management staff identify with a single current condition factor, Factor II, this is not the case with the preferred alternatives factors. One Gibsons staff identifies with Factor C only, and the other identifies with all three factors, perhaps suggesting a greater openness to alternative types of water management strategies in Gibsons in the future.

Due to elected officials' heavy affiliation with Factor A (demand management planners) and water managers' heavy affiliation with Factor C (supply management planners), reaching agreement on water management decisions in Gibsons might be

difficult. Supply management and demand management are sometimes considered opposing strategies. In broad terms, participants on Factor A want to limit human demand for water by restricting population growth, whereas participants affiliated with Factor C want to accommodate population growth and an increased demand for water by supplying additional water. This discrepancy between policy makers' and water managers' views about appropriate preferred alternatives may explain why those strategies supported by Factor B (informed caretaker), such as education and social marketing, have been used in Gibsons in the past. Promoting a deeper understanding about water in order to protect water quality and quantity may have offered a middle-ground solution that appealed to both those interested in limiting demand and those interested in augmenting supply. However, current support for education and soft-sell initiatives (i.e., moral suasion) is limited among elected officials, perhaps because these approaches were used by the previous Town council, but also because some officials consider them ineffective. Therefore, considering new types of compromises (e.g., bridging demand and supply management) might appeal to both policy makers and water managers.

5.2.3 Water users

Table 5.6 Water users' factor loadings for current conditions factors

Participant Group	ID	Factor I Inadequate planning & management	Factor II Limited infrastructure	Factor III Unnecessary water waste
Water Users	1	**0.66**	0.02	-0.15
	16	**0.53**	0.02	0.33
	20	**0.42**	**0.60**	-0.16
	3	0.28	**0.61**	0.06
	18	-0.02	**0.50**	0.01
	8	-0.05	**0.52**	0.36
	5	-0.05	0.23	**0.71**
	6	0.08	0.34	**0.75**
	7	0.23	-0.09	**0.73**
	17	**0.55**	-0.05	**0.59**
	21	**0.72**	-0.05	**0.43**

An interesting finding about the water user group is that individuals in the community identify with the full range of perspectives identified in this study. Water users as a collective do not simply have a single perspective about current water conditions or preferred alternatives. At least one water user purely identifies with each of the six factors. Other water users significantly identify with all possible dual combinations of factors (i.e., I-II, I-III, A-B, B-C, and A-C) except for the combination of Factor II (limited infrastructure) and III (unnecessary water waste). In fact, no participant in any of the theoretical groups of interest (policy makers, water managers, and water users) is significantly associated with both Factor II and III. Although Factors II and III believe that current water planning and management efforts are adequate, each factor differs in its beliefs about human control over water. For example, statement 32, which significantly differentiates all three factors, demonstrates that Factor II believes that there is no shortage of water, because humans can manipulate the environment with technology

to gain additional water supplies. However, Factor III is very concerned about wasteful human behaviour, and believes that water shortages are possible in the future – Factor III does not see water availability in terms of what can be accessed in the environment, but in terms of how people should behave.

Table 5.7 Water users' factor loadings for preferred alternatives factors

Participant Group	ID	Factor A Demand management planners	Factor B Informed caretakers	Factor C Supply management planners
Water Users	8	**0.63**	0.15	0.08
	17	**0.74**	-0.03	0.17
	1	**0.77**	**0.39**	-0.11
	16	**0.40**	**0.55**	-0.17
	21	**0.62**	**0.54**	0.07
	18	-0.05	**0.58**	-0.01
	6	0.03	**0.62**	**0.55**
	3	0.15	-0.59	**0.47**
	5	-0.22	0.10	**0.52**
	20	0.16	-0.06	**0.76**
	7	**0.42**	0.10	**0.46**

With the preferred alternatives factors, some of the water users in Gibsons may have more inclusive perspectives than policy makers and water managers about possible options that would accommodate a variety of interests in water planning and policy making in the future. No policy maker or water manager is significantly affiliated with both Factors A and B, although one water manager is affiliated with Factors A, B, and C. That is, most policy makers and water managers do not identify with both the demand management planner and informed caretaker perspective – these perspectives are considered mutually exclusive. Some water users do identify with both of these approaches, possibly indicating water users' greater flexibility in incorporating new demand management strategies, along with former education and soft-sell approaches,

such as including notices with tax bills and providing fridge magnets that remind residents about summer lawn watering restrictions.

5.3 Relationship between views about current conditions and preferred alternatives

In other Q methodology studies, researchers have demonstrated a link between participants' views about grizzly bear management problems and solutions (Chamberlain, 2006), views about large carnivore management problems and solutions (Mattson, Byrd, Rutherford, Brown, & Clark, 2006), and beliefs about water and anticipated management challenges (Colorado Institute of Public Policy, 2006). These studies illustrate that the ways in which participants' think about management problems or current conditions influence the types of solutions they prefer or the types of challenges they think are most pertinent. In general, groups of participants who identify with a specific view about current conditions tend to also share a view about solutions or challenges.

Based on such previous research, I expected to find relationships between how participants in Gibsons think about current conditions and how they think about preferred alternatives. The only relationship that resembles this type of link between beliefs about current conditions and preferred alternatives occurs among policy makers. Of the five policy makers affiliated with Factor I, four are also affiliated with Factor A (i.e., policy makers have similar views about current water management conditions, and they also have similar views about how water management might be improved). However, no other general relationships are apparent between factors. Participants who are significantly associated with Factor I (inadequate planning and management) are not simply associated with one particular preferred alternative. Different participants

associated with Factor I actually identify with either Factor A, B, or C. This pattern is the same for the other two current conditions factors: Factor II (limited infrastructure) and Factor III (unnecessary water waste). At least three people who are significantly affiliated with each of the current conditions factors are also significantly affiliated with each of the three preferred alternatives factors.

There are several possible reasons why no discernible relationships exist between the current conditions factors and preferred alternatives factors in the present study. First, unlike in the studies by Chamberlain (2006) and Mattson et al. (2006), the current conditions Q sort in this study was not focused on defining a predetermined management problem followed by a Q sort focused on solutions to that problem. Instead, the current conditions Q sort was designed to explore participants' broad views about water supply and management. Participants affiliated with Factor I believe that current water management is inadequate, whereas participants associated with Factors II and III believe that current water planning and management efforts are not major concerns. Because not all participants think current water management is a problem in the first place, the association between problem definition and preferred solutions is less likely to take place.

Second, grizzly bear management in the Banff Bow Valley (Chamberlain, 2006), large carnivore management in the northern U. S. Rocky Mountains (Mattson et al., 2006), and water management in the Rocky Mountain West (Colorado Institute of Public Policy, 2006) are highly controversial issues, whereas water management in Gibsons is not currently as controversial. Stakeholders involved in controversial resource management might have firmly entrenched and polarized positions leading them to see problems and solutions from narrower and more oppositionally defined perspectives.

Many participants in Gibsons actually identify with more than one view about current conditions and possible preferred alternatives. Participants in Gibsons may indeed be aware of the multiple perspectives that exist about water management and wish to include them in planning and management or they may simply perceive water management as a multi-faceted endeavour.

Regardless of the reason for the lack of a distinct relationship between current conditions factors and preferred alternatives factors, the lack of a relationship may have implications for water management in Gibsons. The absence of a relationship suggests that current views about water and water management are not firmly entrenched in segments of the community. Because some participants identify with more than one perspective, it might be easier to develop win-win management solutions in the current decision-making environment. Even though some participants believe that current water management efforts are sufficient, community members' views may change over time. Eventually, residents might see water management as a problem, potentially causing them to view water management more narrowly in the future. Therefore, this may be an ideal time for the Town to engage community members in water planning and decision-making, while residents identify with multiple perspectives toward water management.

5.4 Further policy implications

5.4.1 Water conservation

Participants generally agree that water conservation is a good objective. However, participants disagree about what priority should be given to conservation relative to other water issues (and even other municipal issues), how well water

conservation objectives are currently being met, and what conservation measures should be pursued in the future.

As demonstrated in the analysis of the current conditions Q sort, all factors agree that water quality is a top priority (statement 30), but factors differ in opinion about how water quantity conservation should be prioritized relative to water quality issues. For example, Factor I does not believe that wastewater concerns and potential water contamination from wastewater (16) or other municipal issues, such as sewer management, which could potentially impact the quality of water supply in Gibsons (23) are more important than water conservation. In the preferred alternatives Q sort, Factor A only mildly agrees with a statement that suggests that water quality is more important than quantity (31), whereas Factors B and C place a higher priority on water quality. Based on the Q sorts and interviews, some community members are extremely concerned about water quality, and even though they think water conservation is important, they would likely prefer to see resources directed toward issues that address quality concerns, if Town resources are limited. Other members in the community are more equally concerned about quantity and quality, both of which they consider necessary for long-term water supply protection.

Based on identified perspectives about current conditions, participants generally agree that Gibsons is doing a better job at implementing water conservation measures than in the past (25). However, participants disagree about the efficacy of certain conservation measures. Factor I believes that Gibsons' soft-sell approach to conservation has been ineffective (24), whereas Factor III believes that fridge magnets and notices included with tax bills are effective. This discrepancy between views might be explained

by participants' conceptualization of effectiveness. I suspect that participants affiliated with Factor I view effectiveness in terms of reductions in water consumption, whereas participants affiliated with Factor III likely view effectiveness in terms of changes in awareness and appreciation about water issues. These differences in opinion about current conditions affect participants' views about the type of water conservation measures that they think would be effective in Gibsons.

During interviews and Q sorts, participants discussed and distinguished conservation measures based on whether they thought a measure was equitable, effective at achieving desired goals, feasible to implement, or cost effective for the Town. These distinctions are also apparent in the Q sort results. For example, Factor A believes that water metering and pricing mechanisms are an effective way to change water use behaviour, whereas Factor B agrees that water metering is an equitable solution, but that promoting understanding is the more effective solution to changing water use behaviour. Factor C agrees that both water metering and education are equitable and effective but that non-potable water capture and storage is politically infeasible.

As described in initial and post-sort interviews, some participants affiliated with Factor C have more nuanced views about water metering. Regardless of whether meters help to change water use behaviour, they feel that meters might be effective policy tools because they inform managers about where and how water is being used, which for example, could potentially lead to improved leak detection and repair. However, they believe that actually implementing a metering program would be economically inefficient, because the Town does not have any planned large capital investments that could be potentially deferred by conserving water through a metering program.

The above findings illustrate that various criteria influence community members' support for conservation strategies and that no single strategy may satisfy all possible criteria. Maas (2003) recommends that communities use a variety of policies to achieve water conservation goals, but this is practically difficult for a smaller community, like Gibsons, that has limited resources to implement comprehensive strategies. In an attempt to work within the Town's limited resources and balance different views about the suitability of various conservation measures, Gibsons may want to develop a phased plan to implement different conservation measures over time. Alternatively, Gibsons may want to consider an approach that focuses on adopting an appropriate process for developing an acceptable conservation strategy, not simply the outcome of selecting specific conservation measures to implement.

5.4.2 Process versus outcome

During the post-Q sort workshop, further analysis of some Q sample statement rankings stimulated interesting discussion about community members' perceptions of "process". During the workshop, I inquired about the different rankings assigned to statements regarding a "master water plan" on the Sunshine Coast. In the current conditions Q sort, Factor I strongly agrees that there is no master water plan on the Sunshine Coast, whereas both Factors II and III strongly disagree with this statement:

3	-3	-3	(39)	We do not have a master water plan on this coast which is a critical failure.

This discrepancy in views is echoed in the preferred alternatives Q sort. Factor A strongly believes that a master water plan is necessary on the Sunshine Coast, whereas Factors B and C rank this statement as neutral:

4	0	0	(7)	We need a master water plan on the Sunshine Coast to try and come up with a strategy for all water systems so that everybody is working together instead of each of these water systems having their own little empire.

Unlike many statements in the Q samples, these two statements seem to be based on perceptions of fact, rather than opinion. I was surprised that participants held opposing views about something that appeared to be a fact. Participants in the workshop identified three possible reasons why these statements received such different rankings by some factors. First, participants clarified that the Sunshine Coast Regional District does indeed have an award-winning master water plan, but that Gibsons is not included in the SCRD plan. Instead, Gibsons has its own water plan, so some participants may see the exclusion of Gibsons in a coast-wide plan as a failure. Second, some members of the public may simply be unaware that these plans exist at all, perhaps demonstrating a lack of communication between the Town and its residents regarding water planning. Third, not all community members were involved in the creation of the SCRD and Gibsons water plans; therefore, some people may not recognize current plans as valid because they were excluded from the initial development process. Comments made in the workshop highlight that participants are concerned not just about water management and planning outcomes, but also their role in the process. This theme was not evident from analysis of individual Q sort statements.

For example, statement rankings in the preferred alternatives Q sort suggest that no factors strongly support public involvement in water conservation policy decision-making. Factor A strongly disagrees that Gibsons should consult tax payers before spending money on conservation. Factor C agrees with Factor A, but does not feel quite

as strongly about this statement, whereas Factor B moderately agrees that tax payers should be consulted about water conservation spending.

-4	2	-1	(34)	Before deciding to spend money on water conservation the Town of Gibsons should ask taxpayers what they want done with their money.

Similarly, no factors feel strongly about engaging the public in dialogue for implementation purposes. Factor A mildly disagrees with engaging the public, Factor B is neutral, and Factor C mildly agrees.

-1	0	1	(12)	In moving forward with water planning the public needs to be engaged in dialogue, and this dialogue actually needs to be used in the implementation phase.

Furthermore, all factors strongly disagree that people will support water conservation policies and spending, if you explain to them why it is necessary.

-3	-3	-3	(3)	For most people, if you explain to them why we need to conserve water, then they will support it.

Based on the different views expressed about public engagement in the workshop and Q sorts, I speculate that participants may be expressing a preference for the use of their own views in decision-making, but not the views of others in the general public. For example, Factor A (demand management planners) is the only factor that very strongly disagrees that tax payers should be asked how they would like their money spent. Interestingly, Factor A supports preferred alternatives, such as universal metering, that have been considered (by some) contentious policies and that have been excluded from previous water management approaches in Gibsons. Participants affiliated with

Factor A may feel that their views have been excluded from past water planning and management, and thus they may wish to be involved in current planning. During an interview, one policy maker even implied that the exclusion of certain water management ideas and practices was a motivating factor in their decision to run for a council position. Factor A may be concerned about others' potential involvement in water planning, fearing that others will favour status quo management, ultimately opposing the alternatives that Factor A supports, or perhaps the policy makers who are affiliated with Factor A believe they know what should be done and are responsible for acting in the community's best interest. If Gibsons is interested in including multiple perspectives in water planning and decision-making, it will be important for the Town to establish a process that is inclusive, and perceived as fair by community members. The Town may also wish to specifically address those interests that have been excluded in past decision-making. Finally, the Town may want to facilitate a process that allows participants to gain a better understanding of the views of others, in order to demonstrate common goals that community members share (even though they may support different solutions). Collaborative planning is promoted in North America as a suitable alternative to other planning and decision-making models, particularly for dealing with conflicts in natural resource decision-making (Gunton & Day, 2003; Gunton & Flynn, 1992; Wondolleck & Yaffee, 2000). Some benefits of collaborative planning include: the creation of potentially better decisions due to stakeholder involvement in the decision-making process; improved implementation because stakeholders support end decisions; and the development of social capital amongst stakeholders as a result of engaging in the decision-making process (Gunton & Day, 2003).

5.5 A comparison of empirical attitudes and assumed attitudes

Based on descriptions in Chapter 4, views about current and possible water management in Gibsons are more complex than the presumed attitudes described in Chapter 2. Although the policy makers in this study largely share the same views, other participants who share views in this study are not divided based on their membership with a particular group in the community (water user, water manager, or policy maker). Despite differences between empirically documented attitudes and presumed attitude structures, elements of the attitudes described by the POLIS Project on Ecological Governance (Brandes & Ferguson, 2004; Brandes et al., 2005; Maas, 2003) may be present in participants' views in this study. The following discussion is a reflection on how attitudes determined in this study are similar and different from attitudes described in Canadian water literature, and, where a discrepancy between the two exists, why this may be the case.

5.5.1 Myth of abundance

Individual statement rankings in the current conditions Q sort suggest that participants in Gibsons do not subscribe to the myth of water abundance. During initial interviews, some participants described attitudes that they expected other people in the community to hold that are consistent with the myth of abundance. Examples of these kinds of statements include:

-2	-1	-2	(6)	As long as I can turn the water on and use it for whatever I want, whenever I want and pay for it at a reasonable rate then I'll be happy.
-4	-2	-4	(12)	Water is plentiful and if you don't use it, it goes into the ocean, so what's the big deal?
-3	-2	0	(19)	It is a basic right to have water supplied at a low cost.
-4	-4	-4	(26)	Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?

Although some participants thought that these attitudes would be prevalent in the community, none of the views expressed in the Q sorts agree with these ideas. Furthermore, some views very strongly disagree (-4, -3) with statements that allude to a belief in water abundance.

Researchers and participants alike share the belief that other people think water is abundant, and that this perception influences their water use. The very essence of View III (unnecessary water waste), illustrates that some participants in Gibsons are concerned that other people devalue and waste water. A few possible reasons why this "water abundance" view is not present in this study include:

- no one in Gibsons actually thinks this way,
- participants are incorrectly stating or misrepresenting their attitudes,
- statements used in the Q sorts were too extreme to capture views about water abundance, or
- people who hold this view were not included as participants in this study.

Other research has certainly documented people's tendencies to answer in socially desirable ways, and that self-reported attitudes about conservation rarely match

conservation behaviour (de Oliver, 1999). Participants in this study have possibly misrepresented their attitudes, but I think this is very unlikely, because participants were not commenting on their intentions to behave. Instead, participants were merely trying to explain their perceptions and beliefs about water and water management. Further, although the entire population of Gibsons was not included in this study, people who participated held a diverse set of views about water, and represented both community members who are actively engaged in the water debate in Gibsons, and people who are not actively engaged. Therefore, it seems unlikely that a particular view is not present in this study due to inadequate sampling.

Rather than focusing on why the "water abundance" view is not present, perhaps the more relevant issue is why a mismatch exists between what some people think other individuals in the community believe, and what individuals actually indicate as their own beliefs. I have two possible explanations for this discrepancy. First, participants may be reporting their attitudes truthfully, but researchers (as well as members of the public) incorrectly believe that attitudes are directly linked to behaviour. This belief certainly prevailed in social psychology up until the 1970s, at which point researchers discovered that expressed attitudes rarely predicted behaviour, leading to the conclusion that many other external social processes also influence both attitudes and behaviour (Myers & Spencer, 2006). Perhaps people can indeed believe that water is a valuable, finite resource, and still use what some might consider excessive amounts of water. Second, people's definitions of, and perceptions about, "water abundance" and "water waste", for example, may be inherently different, resulting in different subjective interpretations of

language that is thought to portray a single meaning. I will use two examples to illustrate what I mean by this.

From the current conditions factors, Factor III (unnecessary water waste) is concerned that people waste water in Gibsons, but is not overly concerned about current planning and management efforts. Water users and one water manager (but no policy makers) identify with Factor III. Therefore, due to a lack of concern about overall water management in Gibsons (and predominantly water user affiliation with this factor) I speculate that some people might categorize these participants as subscribing to the water abundance myth. Alternatively, these participants may actually see the nature of water problems, if they are considered problems at all, differently, based on local conditions. Participants affiliated with Factor III do not believe that they are in a water crisis, and therefore do not express dire urgency to change water management practices or implement conservation measures. The absence of this urgency does not mean that these participants necessarily believe that water is abundant; and in fact they express concern about others who undervalue and waste water (18, 34). However, Factor III simply has a different perspective about the current situation in Gibsons than people who believe it is necessary to implement water conservation measures immediately.

From the preferred alternatives factors, Factor B (informed caretakers) supports education to influence behaviour toward water, but not pricing incentives and punishments. This view is contrary to what many water experts recommend as a necessary step to water conservation in Canada – full cost pricing and the use of economic incentives (Marbek Resource Consultants & Renzetti, 2005). Simply because Factor B does not believe that economic incentives are appropriate conservation

measures does not mean that Factor B opposes demand-side management or policies that result in paying more for water. Factor B simply places a higher priority on water quality than quantity, and believes that education will be more effective at influencing behaviour in Gibsons than water meters, for example. This view about influencing behaviour parallels those research findings that have determined that household water demand is price inelastic (Renzetti, 2002), but represents a different view from the dominant perspective in the literature that economic incentives are essential.

In summary, some people may assume that water abundance views exist based on a limited understanding of others' perspectives and based on peoples' behaviour. Moreover, views about water abundance and conservation may be very dependent on the immediate socio-political and biophysical context. A deeper exploration of the views of participants in Gibsons suggests that no one actually believes that water is abundant. Perhaps people in Gibsons simply have different views than people elsewhere in Canada, but ultimately policy makers and academics should strive to fully understand other peoples' perspectives in context, and avoid making broad assumptions about their attitudes.

5.5.2 Supply-driven, technical solutions

Unlike the absence of water abundance perceptions in this study, elements of supply-focused perceptions are present. However, water managers and engineers are not the only people who identify with supply management approaches, and people who support supply management approaches do not do so to the exclusion of demand management approaches.

Both Factor II (limited infrastructure) and Factor C (supply management planners) appear to be representative of the supply management perspective that the POLIS Project describes. Participants associated with Factor II are not dissatisfied with current water planning and management in Gibsons, nor are they concerned about water shortages or water supply availability. Factor II strongly agrees with the statement that there is no shortage of water – it is just a question of how much you want to pay (current conditions statement 32). Factor II tends to perceive water management in terms of economic and technical challenges. Consequently, people affiliated with Factor II are most concerned about water infrastructure, storage, and delivery issues. Despite this technical focus, Factor II strongly disagrees that water conservation should not be a priority in Gibsons (statement 26). Factor II places a higher priority on storage, distribution, and water quality issues, but does not believe that water conservation is unnecessary. In reference to the notion of water abundance, although participants affiliated with Factor II are not concerned about water shortages or water supply availability, this does not mean that they believe water is abundant. Instead, Factor II believes that for an economic cost, and with the help of technology, scarce or difficult-to-access resources can be acquired.

Factor C's approach to improving water management in Gibsons includes expanding water storage capacity or obtaining additional water supply sources to accommodate growth (preferred alternatives statement 32), but also includes elements of demand-side management. In general, Factor C believes that conservation is the best means to obtain increased water supply, because it is cheaper and easier than other methods (statement 26). Factor C believes that education can promote respectful water

use behaviour (40). Factor C also supports implementation of universal metering, although not necessarily for reasons of water conservation. Some participants affiliated with Factor C think that metering would be useful simply because it would provide data about where water is going, and it is an equitable way to charge consumers for the amount of water they use.

To sum up, participants in this study generally do not see supply management and demand management as mutually exclusive, but rather as complementary approaches. Even participants affiliated with Factor A (demand management planners), who would prefer to limit population growth, mildly agree (+1) that additional water supplies will need to be augmented to accommodate inevitable future growth (statement 32). Although participants may not support implementation of water management initiatives for the sake of conserving water, they may support implementation of demand management measures (such as universal metering) for other reasons, such as establishing an equitable way to charge for water and pay for infrastructure. Implementation of such measures may then have the additional benefit of managing demand, and people will not oppose those measures because they support at least one reason for implementing them.

5.5.3 Contentious policy

The POLIS Project suggests that politicians prefer status quo water management options that avoid "contentious" policies such as the use of economic incentives and water pricing reform (Maas, 2003). All policy makers in Gibsons are associated with Factor I (inadequate planning and management), which believes that there are problems with current water management and planning practices and that water conservation is

necessary. Contrary to the POLIS Project assertion, four of five policy makers in Gibsons are significantly affiliated with Factor A (demand management planners), which strongly supports the implementation of universal water metering, a DSM measure that is considered controversial by some. Obviously, results in this study are participants' stated attitudes, and will not necessarily lead to action, but interestingly, no factors identified in this study actually believe that political action is blocking successful implementation of universal water metering:

-1	0	-2	(2)	My sense is that there is widespread opposition to water metering despite the fact that the communities that have gone to metered water all seem to be communicating that it's working – we just don't have the political will to push it through and I think it's the politicians that are the ones that have to be convinced.

Policy makers in Gibsons are not entirely opposed to DSM measures that might be considered controversial. For example, the Town intends to conduct a universal water metering feasibility study in 2008 (B. Shoji, personal communication, October 30, 2007). This is not surprising, given that both Town of Gibsons staff and Gibsons' elected officials have identified the importance of water conservation to the current council. Based on interviews and personal interactions, there appears to be some hesitation to immediately launch a universal water metering campaign, but not simply because politicians fear how this decision would affect the outcomes in the next municipal election. Although one elected official stated "metering is a place that you don't want to drive the car" during an interview, other concerns about metering include:

- pricing equity,
- its ability to reduce consumption,

- limited financial resources and staff to implement a metering program, and
- priority relative to other water issues.

Political feasibility is not the only factor that influences whether to adopt and implement a given policy. For example, in 2006 the Town completed a water audit and leak detection study, which identified that an estimated 21 percent (± 73 percent) of water use was unaccounted for (B. Shoji, personal communication, October 30, 2007). The study also identified that the majority of water loss is from private service connections and not municipal mains (B. Shoji, personal communication, October 30, 2007). Based on this study, the Town identified and fixed a few leaky fire hydrants and it plans to conduct an annual leak detection survey (B. Shoji, personal communication, October 30, 2007). This program is costly for the Town, and thus implementation of other DSM measures may have to wait, because the Town cannot afford at this time to conduct multiple DSM programs at once. However, leak detection and repair is a valuable DSM strategy that is expected to result in water savings of approximately 152 litres per person per day in Gibsons.

5.6 Suggestions for future research

5.6.1 Alternate methodologies

By using Q methodology to explore participants' perspectives about water and water management in Gibsons, I identified distinct shared viewpoints about current conditions and possible preferred alternatives. Although I was able to describe what views exist and why people hold them, I was unable to determine how these views are distributed in the community, which can only be completed using a large, representative sample of people (R methodology).

In an official presentation of the results to the Town of Gibsons, some meeting attendees expressed interest in identifying how these views are distributed in the community. In particular, interest lies in determining the proportion of community members who support specific conservation measures that the Town is considering implementing, such as universal water metering.

Triangulation (i.e., using multiple methods to study the same phenomenon) is a recognized approach for determining the accuracy of research results. However, after using both Q and R methodology to explore perspectives about forest management, Martin and Steelman (2004) concluded that the different methodologies reveal different patterns about how human views are expressed. Whereas " R-analysis detects trends in the aggregated data set…Q-analysis reveals how these important, but more generalized, variables play out within individual perspectives" (Martin & Steelman, 2004, p.49). That is, R method determines a broad, shared view about a topic, while Q method reveals differences in how people think about that topic by considering their individual perspectives. Therefore, if the Town of Gibsons wants to complete an R study to assist water conservation decision-making, it should think carefully about how it might use information about general trends established in an R study, in conjunction with the specific details about various perspectives from this Q study.

For example, if a survey of Gibsons' community members identifies that only 15 percent of residents support implementation of a universal water-metering program in the Town, how should this influence policy decisions? Should this type of result be interpreted as general lack of support amongst community members, so that metering is equated with political suicide, and therefore abandoned as a policy option? Or, should

policy makers, who as a group generally favour water metering, try to determine the circumstances under which community members might support water metering (e.g., by implementing other policies at the same time that are thought to be effective by the remaining 85 percent)? Alternatively, if 85 percent of residents support universal metering, should the Town immediately launch implementation, or is it necessary to consider how the views of the remaining 15 percent might be accommodated in decision-making?

In general, people are more familiar with the results of R studies and are possibly more willing to rely on data from such studies when making policy decisions. Although R study results about support for water management alternatives in Gibsons would be theoretically interesting and possibly very useful for decision-making, they may not be necessary for sound water decision-making in Gibsons.

5.6.2 Comparison to other communities

Views about water and water management described in this study differ from attitudes that experts describe in the DSM literature. The attitudes documented in the DSM literature may simply be assumptions that are incorrect, or they may accurately reflect general attitudes in Canada, in which case people in Gibsons simply hold unique perspectives.

During interviews with participants, many people referred to an environmental ethic that is shared by residents on the Sunshine Coast. Participants explained that people move to the Sunshine Coast to escape larger urban centres and to enjoy living in closer proximity to natural environments. Recently, in the summer of 2007, residents on the

Sunshine Coast pressured the SCRD to take action regarding logging in the Chapman Creek Watershed. In a precedent-setting application of the Provincial Health Act, the SCRD ordered Western Forest Products Incorporated to halt logging on steeper slopes in the watershed. Although the SCRD decision was subsequently overturned by the Supreme Court of British Columbia, the SCRD order was the first of its kind in British Columbia, and suggests that perhaps people on the Sunshine Coast and in Gibsons hold progressive views toward water and water management.

Additional research on attitudes in communities in British Columbia and in Canada will help to determine whether perspectives in Gibsons are simply unique or whether they are more representative of general attitudes about water and water management in Canada. It may be that some communities currently feel the pressure of water-related challenges more than others, resulting in locale-specific attitudes, rather than a general attitude prevalent among Canadians. Currently, in British Columbia, regions such as the Capital Regional District (CRD) are implementing comprehensive DSM strategies. The CRD is likely pursuing DSM because it relies on a single supply source and encounters summer droughts. However, for other regions such as the Greater Vancouver Regional District (GVRD), DSM is not a priority. This is likely because the GVRD has three supply sources, and arguably has ample water supply to provide to residents in the short term. Rather than trying to determine the average Canadian's view about water and water management, further insight into implementing DSM policies in Canada might be obtained by comparing the views of people in communities where the pressures on current water systems are high (such as in the CRD) with those in

communities where the pressures on current water systems are low (such as in the GVRD).

5.7 Concluding remarks

Using Q methodology, I identified three perspectives about current water supply and management conditions in Gibsons, and three perspectives about how water management might be improved in Gibsons. Some viewpoints identified in this study share similarities with attitudes described in the Canadian water literature, and some do not. In general, viewpoints described in this study are considerably more complex than attitudes typically discussed in water literature. People in Gibsons who share perspectives about current conditions and preferred alternatives are not divided based on their roles in the water policy-making arena (policy maker, water manager, or water user). Members from each of these groups identify with the full range of perspectives observed in this research.

Although people who identify with different viewpoints support different water management alternatives, participants are not fixated on specific positions. Many people in Gibsons identify with more than one perspective, and groups of people who share similar views about current conditions often support different preferred alternatives. Balancing multiple perspectives can be difficult, but the current mentality in Gibsons appears to be interest-focused rather than position-based, and it might be ideal for constructive water policy design that would appeal to a range of viewpoints. As part of the decision-making process, people in Gibsons emphasize the importance of equitable water policy. Peoples' conceptualization of equitable water policy includes both the

specific outcomes that are achieved, and their involvement as stakeholders in the policy process.

Had I used an alternate methodology to explore participants' perspectives in Gibsons, I might have arrived at different conclusions regarding water conservation policy in the Town. Using a larger representative sample, I could have determined the proportions of the community that support specific conservation measures. However, by using Q method, a deeper discourse emerges about policy measures, highlighting nuances that might otherwise go unnoticed. These nuances paint a comprehensive, albeit complex, picture of the policy environment, providing policy makers with better information with which to make decisions. As an effective tool for exploring human perceptions, Q method has the potential for widespread use in policy, especially if the goals are to understand rather than simply assess preferences and perspectives, and to overcome barriers that might otherwise block implementation of effective policy.

APPENDICES

Appendix A: Interview questionnaire

Table A1 Interview questions used to develop statements for Q sorts

Interview Question	Thematic Category	Perspective Component
What do you think about Gibsons' current water supply?	Water supply	Expectation
What do you think about Gibsons' water supply in the future?	Water supply	Expectation
Do you have any concerns that there will be changes in climate that will affect water supply?	Water supply	Expectation
What do you think are the most important factors that should be taken into account in making decisions about managing Gibsons' water supply?	Water management	Expectation
What do others think are the most important factors that should be taken into account in making decisions about managing Gibsons' water supply?	Water management	Expectation
Have there been any problems related to water quantity in Gibsons and the surrounding area?	Water supply	Expectation
Should reducing water use, or using water more efficiently, be priorities in Gibsons?	Water use/ conservation	Demand
Are there sectors/groups that should be targeted to reduce water use or improve efficiency?	Water use/ conservation	Demand
How successful has Gibsons been at adopting and implementing measures to reduce water use?	Water management	Expectation
What specific measures have been adopted and implemented in Gibsons?	Water use/ conservation	Expectation
What types of measures do you think would work best, or be most effective, in Gibsons?	Water use/ conservation	Demand
Who do you think would support or oppose such measures?	Water use/ conservation	Expectation
Have there been any challenges with, or barriers to, implementing water conservation measures in Gibsons?	Water management	Expectation
What would it take to overcome these barriers?	Water management	Expectation
What suggestions can you offer in moving forward with a water conservation strategy?	Water management	Demand
If there was one message that you could give to others about water supply and use, what would it be?	Water supply/ water use	Demand

Appendix B: Analytic methods

B1. Unrotated factor matrices

Table B1 Unrotated factor matrix for the current conditions Q sort

Factors that are significant according to the Kaiser Criterion (Kaiser, 1960) are identified with an *.

Q Sort #	Unrotated Factors							
	I	II	III	IV	V	VI	VII	VIII
1	0.4716	-0.3926	-0.2854	0.3824	0.2119	0.0014	-0.2647	-0.1567
2	0.8125	-0.2004	-0.0656	-0.2408	-0.1229	0.0567	-0.0944	0.0496
3	0.5068	0.3391	-0.2782	0.2400	-0.1379	-0.4764	-0.0670	0.2319
4	0.5860	-0.1966	-0.3549	-0.2401	0.0404	-0.1925	0.3383	0.0707
5	0.3572	0.3911	0.5306	0.2032	0.1151	0.2144	-0.0276	-0.3657
6	0.5280	0.4126	0.4813	0.0912	-0.0995	-0.2787	-0.1407	-0.2141
7	0.4551	-0.0169	0.6173	-0.1425	0.1697	0.0896	-0.1456	0.3949
8	0.3393	0.5296	0.0973	-0.0130	-0.4464	0.1912	-0.1997	0.1925
9	0.7523	0.2309	-0.1766	-0.2154	-0.1581	0.0922	-0.1821	0.0499
10	0.6218	-0.3807	-0.2531	0.0122	0.0491	0.2811	-0.1348	-0.0719
11	0.6460	0.0604	-0.2289	0.3477	0.2093	-0.2473	-0.0782	0.1789
12	0.1800	0.2702	-0.1682	-0.3934	0.7080	0.2648	-0.1732	0.1448
13	0.7814	-0.2393	0.1917	-0.1032	0.0448	-0.1446	0.2165	-0.0870
14	0.7397	-0.1880	0.0032	-0.2148	-0.0078	-0.2124	-0.3342	-0.1760
15	0.4195	0.6655	-0.1485	-0.2568	0.3022	-0.1056	0.1453	-0.0645
16	0.5731	-0.2000	0.1541	0.1171	-0.3921	0.2613	0.1231	0.3106
17	0.6671	-0.1998	0.4135	0.1788	0.1698	-0.0541	0.2899	-0.0919
18	0.2057	0.4129	-0.2054	0.6095	0.2323	0.2353	0.2993	0.1496
19	0.5214	0.1760	-0.1424	-0.3670	-0.2161	0.0985	0.4534	-0.1505
20	0.5313	0.1968	-0.4910	0.1705	-0.2365	0.2945	-0.0945	-0.2714
21	0.7352	-0.3392	0.2325	0.1629	0.1408	0.1154	0.0861	0.0534
Eigenvalues	**6.8578***	**2.1975***	**1.9799***	**1.4420***	**1.3567***	**0.9679**	**0.9574**	**0.7882**
Variance (%)	**33**	**10**	**9**	**7**	**6**	**5**	**5**	**4**

Table B2 Unrotated factor matrix for the preferred alternatives Q sort

Factors that are significant according to the Kaiser Criterion (Kaiser, 1960) are identified with an *.

	Unrotated Factors							
Q Sort #	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
1	0.6374	-0.3625	-0.4734	-0.0077	-0.0385	0.0837	0.0825	-0.2691
2	0.5927	-0.0818	-0.2337	-0.3633	0.1859	-0.0198	-0.2964	0.0111
3	0.1465	0.7524	-0.0289	-0.0662	-0.3267	-0.0393	-0.0147	-0.0944
4	0.3941	0.3361	-0.1930	0.2698	0.4643	0.2053	-0.0511	0.4660
5	0.1812	0.1865	0.5092	0.4979	0.4302	0.1349	-0.0203	-0.3120
6	0.5901	-0.2242	0.5405	-0.1211	0.1056	-0.2322	-0.0616	-0.0038
7	0.6050	0.1817	0.0162	0.1668	-0.3445	0.0069	-0.3203	-0.0653
8	0.5549	-0.0578	-0.3422	0.3820	0.3740	-0.2178	-0.0581	-0.0584
9	0.6819	0.3662	-0.1728	-0.1447	-0.1739	0.0486	0.0266	-0.1725
10	0.2934	0.1923	-0.4207	0.0018	-0.0259	-0.3733	0.6111	-0.2278
11	0.4288	-0.1740	0.5052	-0.5397	0.2334	0.1828	0.1650	-0.1000
12	0.6134	0.3277	0.1367	0.0687	0.0337	0.0134	-0.1804	-0.1884
13	0.4827	-0.2006	0.3002	0.1837	-0.2447	-0.1468	0.3539	0.5017
14	0.2864	-0.2990	0.1791	0.1872	-0.2299	0.6953	0.3142	-0.1469
15	0.6497	0.2125	0.3028	0.0263	-0.1373	-0.0870	0.1057	0.1886
16	0.4035	-0.5461	-0.1875	0.4118	0.1243	-0.1172	0.0826	-0.0551
17	0.6073	0.1422	-0.4348	-0.0465	-0.1350	0.2844	-0.0340	0.2616
18	0.1937	-0.4970	0.2447	0.2671	-0.4399	-0.2861	-0.2751	-0.0344
19	0.7337	-0.0917	0.1242	-0.4883	0.2175	-0.1780	0.0612	0.0404
20	0.5275	0.4583	0.3306	0.2529	-0.0711	-0.0459	0.0729	-0.0487
21	0.6960	-0.3949	-0.1952	-0.0642	-0.1245	0.1658	-0.1701	0.0174
Eigenvalues	**5.7081***	**2.3621***	**2.1270***	**1.5815***	**1.3263***	**1.0964***	**0.9983**	**0.9166**
Variance (%)	**27**	**11**	**10**	**8**	**6**	**5**	**5**	**4**

B2. Cattell's scree test

Figure B1 Cattell's scree test for unrotated current conditions factors

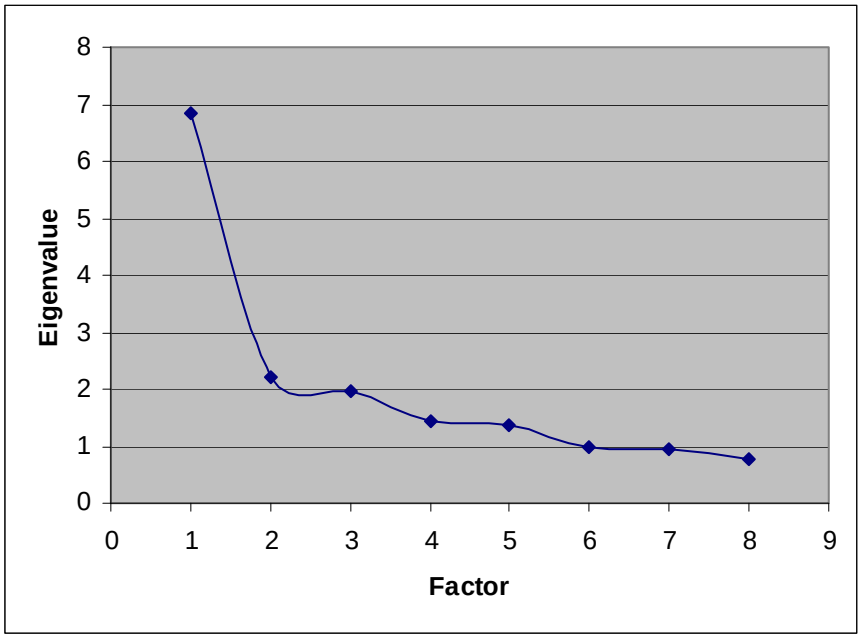
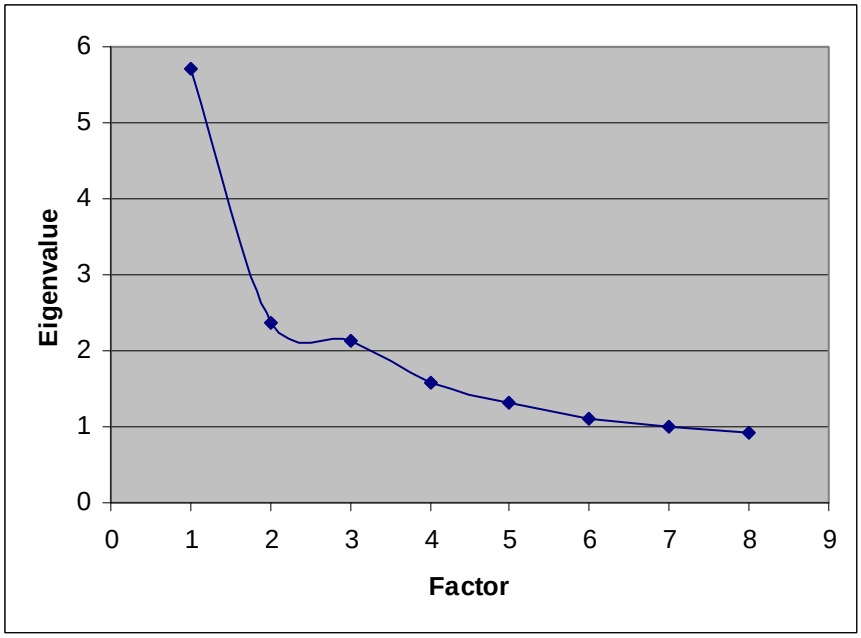


Figure B2 Cattell's scree test for unrotated preferred alternatives factors



Appendix C: Factor arrays (model Q sorts)

Figure C1 Current conditions factor arrays

Numbers in templates refer to statement numbers.

Factor I

-4	-3	-2	-1	0	+1	+2	+3	+4
12	19	6	3	1	18	2	5	8
14	36	11	9	4	25	22	13	30
26	42	16	21	7	33	24	39	31
	44	28	23	10	34	27	43	
		41	29	15	37	38		
			32	17	40			
				20				
				35				

Factor II

-4	-3	-2	-1	0	+1	+2	+3	+4
10	1	2	4	8	7	17	21	30
26	5	3	6	13	9	25	22	32
35	20	12	11	16	15	33	29	38
	39	14	27	24	18	34	31	
		19	28	36	23	37		
			42	40	41			
				43				
				44				

Factor III

-4	-3	-2	-1	0	+1	+2	+3	+4
12	4	5	7	1	2	20	25	9
26	13	6	10	16	3	22	30	18
32	39	8	14	19	11	23	31	34
	41	15	17	21	28	35	33	
		24	37	27	29	38		
			40	36	44			
				42				
				43				

Figure C2 Preferred alternatives factor arrays

Numbers in templates refer to statement numbers.

Factor A

-4	-3	-2	-1	0	+1	+2	+3	+4
28	3	4	2	6	16	22	1	7
34	25	5	9	8	24	27	15	19
43	33	13	11	10	26	29	21	20
	40	42	12	14	31	30	38	
		44	18	17	32	36		
			23	35	41			
				37				
				39				

Factor B

-4	-3	-2	-1	0	+1	+2	+3	+4
1	3	11	17	2	4	16	20	8
39	9	24	19	6	5	22	26	15
41	27	25	21	7	14	30	31	40
	35	29	28	10	23	34		
		32	42	12	33	37		
			43	13	44			
				18				
				36				
				38				

Factor C

-4	-3	-2	-1	0	+1	+2	+3	+4
17	3	2	4	7	5	8	1	20
28	14	15	6	13	9	25	26	31
37	19	18	10	16	11	27	32	38
	33	41	34	21	12	29	40	
		42	35	22	23	36		
			44	30	24			
				39				
				43				

Appendix D: Q samples and factor scores

Table D1 Current conditions Q sample statements and factor scores

Factor scores in boldface indicate statements that significantly differentiate factor narratives (p < 0.01).

Statement	Factor Score		
	I	II	III
1. A lot of these professions (like engineers) get very embedded into their ways of doing things and they get established into a certain way of managing water and so consequently they become their own worst enemies (and our worst enemies) because they advocate for the status quo – why would they want to change things?	0	**-3**	0
2. Water shortages have already occurred and shortages will be our future on the Sunshine Coast – climate change is taking us to longer drier summers, it's just a matter of time before shortages really hit people where it hurts.	2	**-2**	1
3. Water conservation should be a priority in every community because monetary and natural resources are wasted in building excess water supply capacity.	-1	-2	1
4. The Sunshine Coast Regional District is doing way more innovative water conservation programming than the Town of Gibsons – water conservation is not a priority in the Town of Gibsons.	0	-1	-3
5. Climate change is a long-range issue, whereas water managers are concerned with short-term planning 5-10-20 years down the road.	**3**	-3	-2
6. As long as I can turn the water on and use it for whatever I want, whenever I want and pay for it at a reasonable rate then I'll be happy.	-2	-1	-2
7. Gibsons' water is at risk because the supply is outside the jurisdiction of the Town – the water comes from somewhere else.	0	**1**	-1
8. Gibsons does live a somewhat dangerous life relative to its water and potential contamination of it and that scares me – that somehow, somewhere, someone unbeknownst to the Town might tap into the aquifer and contaminate it inadvertently by not sealing the well properly.	**4**	0	-2
9. People in Gibsons do appreciate the water, particularly since winning that 'best water in the world' award. That award has helped raise consciousness because the value of water has increased in people's awareness.	-1	1	**4**
10. There is tremendous population expansion taking place on the Sunshine Coast, so where is the water going to come from? – there is just not enough, but this hasn't been officially recognized.	0	**-4**	-1

Statement	Factor Score		
	I	II	III
11. Using water is not a crime – there is a lot of social value in using water, from beautification to the luxury of having it.	-2	-1	1
12. Water is plentiful and if you don't use it, it goes into the ocean, so what's the big deal?	-4	**-2**	-4
13. I suspect there is a lot of breakage and leakage in the water delivery system.	**3**	**0**	**-3**
14. Even though we have plenty of supply, there are social pressures to bring water consumption down – the economics say it's not going to make a huge difference whether we consume 300L/day/person or 670L/day/person, but the politicians say we're water pigs and that they want to bring consumption down to European averages, and this is totally social.	-4	-2	-1
15. Using water for gardening is not a waste because that water feeds into a system that generates other kinds of aesthetic pleasure and purposes.	0	1	-2
16. Rather than quantity, I'm more concerned about what we do with our wastewater and the possibility of poisoning our water.	-2	0	0
17. I would pay a lot for water because I value it so much.	0	2	-1
18. People don't see a value in water – they think it is of unlimited supply – they take it for granted.	1	1	**4**
19. It is a basic right to have water supplied at a low cost.	-3	-2	0
20. I question whether water supply has been taken into account when planning for new residential development.	0	**-3**	2
21. Gibsons' problem is water flow for fire fighting, so they're going to have to spend the money on the infrastructure –the size of the infrastructure is not based on consumption, it's based on fire flow.	-1	**3**	0
22. Gibsons has the best water in the world, but a limited quantity of the best water in the world.	2	3	2
23. Conserving water and using water more efficiently should be a priority in Gibsons, but not a top priority given all of the other issues that local government must consider, such as sewers, roads and traffic flow.	-1	1	2
24. The Town's attempts at conservation are pretty hokey – sending out the little pleas (fridge magnets and notices with the tax bill) – by the time the drought hits at the end of July, everyone has totally forgotten those efforts.	**2**	0	-2
25. Gibsons is doing a better job at adopting and implementing water conservation measures than in the past – there have been improvements in planning, awareness and having the staff to get out there and do it.	1	2	3

Statement	Factor Score		
	I	II	III
26. Water conservation should not be a priority in Gibsons – why should money be put into conservation when we live in a rainforest?	-4	-4	-4
27. The small amount I pay for water is unreasonable – it is practically free and it's incredibly good quality water, most of which gets flushed.	**2**	-1	0
28. From a human standpoint we haven't had any problems with water quantity, but I'm sure that the amount of water we are consuming has implications for fisheries and all sorts of wetland and aquatic life.	-2	-1	1
29. We live in a land where there is perceivably a lot of water, but what concerns me is that we don't seem to store it – we should store it because it's a precious commodity.	-1	3	1
30. Water quality is my number one priority, and all other water issues take second seat – protecting the health of the public is number one.	4	4	3
31. I'm concerned that Gibsons protects its water sources so that the aquifer doesn't get contaminated, because once the aquifer is contaminated Gibsons is in trouble.	4	3	3
32. There is no shortage of water really, and there never will be, it's just a question of how much you want to pay for it in order that you can drink it – we can desalinate, but that costs money – we've got scads of water that we could pipe here, but that costs money – there's no shortage of water.	**-1**	**4**	**-4**
33. People who receive the Sunshine Coast Regional District water supply will travel quite some distance to pick up water from the Town of Gibsons – they know it's good water, and they know it's not chlorinated.	1	2	3
34. People do waste a lot of water, watering their lawns or washing their cars.	1	2	4
35. People in Gibsons want to be independent from the Sunshine Coast Regional District – they want to have enough water quantity to provide the entire town with their own groundwater so they can break ties with the Regional District.	0	**-4**	2
36. There is a difference between not wasting water and conserving it – I don't think we should waste water, but I don't want to see us incur the costs associated with a water conservation program if it isn't necessary.	**-3**	0	0
37. There is tremendous conflict between human use and fisheries requirements in the Chapman and Gray creek system.	1	2	-1
38. Climate change poses long-term issues. It's not the quantity of water, it's the time – the summers are getting longer and drier, and	2	4	2

Statement	Factor Score		
	I	II	III
the winters are wetter – so it's going to be a storage issue.			
39. We do not have a master water plan on this coast which is a critical failure.	**3**	-3	-3
40. We are giving water away – it seems like a renewable resource that has no true monetary value placed on it – it's almost free.	1	0	-1
41. There is a lot of development planned and upper Gibsons is already supplied by the Sunshine Coast Regional District, so it won't be long before the aquifer cannot supply any more.	-2	1	-3
42. Many people are in agreement that we should conserve water, but it is too expensive to take action.	-3	-1	0
43. I'm very concerned about the quantity of water, its availability, our lack of knowledge about the extent of the supply, and our lack of knowledge of the sources. We don't know where our water comes from, how big the supply is, or what the threats to it really are.	**3**	0	0
44. There are no problems related to water quantity in Gibsons, because water managers are on top of it – they monitor the water and impose any necessary restrictions during the summer.	**-3**	0	1

Table D2 Preferred alternatives Q sample statements and factor scores

Factor scores in boldface indicate statements that significantly differentiate factor narratives (p < 0.01).

Statement	Factor Score		
	A	**B**	**C**
1. Water is a resource like gasoline, where you should pay by what you consume.	3	**-4**	3
2. My sense is that there is widespread opposition to water metering despite the fact that the communities that have gone to metered water all seem to be communicating that it's working – we just don't have the political will to push it through and I think it's the politicians that are the ones that have to be convinced.	-1	0	-2
3. For most people, if you explain to them why we need to conserve water, then they will support it.	-3	-3	-3
4. The law breakers should be punished, but I would use this as a last resort because if someone charged me for over-using water I would just blow it off, it wouldn't make me more conservation minded.	-2	1	-1
5. The Sunshine Coast Regional District has a program where they spend lots of money replacing people's toilets – somehow I think that money could be better spent looking for more water or upgrading water systems.	-2	1	1
6. I see the population growth of the town being such that the only way we're going to resolve providing for the increase in population is by using more Regional District water – which is of lower quality.	0	0	-1
7. We need a master water plan on the Sunshine Coast to try and come up with a strategy for all water systems so that everybody is working together instead of each of these water systems having their own little empire.	**4**	0	0
8. The more we talk about water conservation and water use, the more we change people's point of view – people absorb information and gradually change their behaviour.	**0**	4	2
9. The average household is the prime culprit in wasting water and Gibsons does promote common sense things to reduce water use (brochures, reminders, etc.) that do add up when multiplied by thousands of households in BC.	-1	-3	**1**
10. I firmly believe that there is a lot of groundwater on the mountainside in different places, and I think that has potential for being a good source of supply both for the Sunshine Coast Regional District and the Town of Gibsons – there is the potential for a lot of small wells.	0	0	-1
11. Rain barrels are a useless tool here on the Sunshine Coast, because when we need water we don't have any, so who cares if you have a rain barrel.	-1	-2	**1**

Statement	Factor Score		
	A	B	C
12. In moving forward with water planning the public needs to be engaged in dialogue, and this dialogue actually needs to be used in the implementation phase.	-1	0	1
13. It doesn't make sense for Gibsons to provide an incentive for retrofitting toilets because they can't afford it, so any incentive they try to roll out will look skimpy – people will view the offer as an insult.	-2	0	0
14. Double piping of water (i.e., potable and non-potable water) would be great so that we don't use aquifer water to wash our cars – we can start with new developments and use tax incentives to promote retrofitting.	0	1	**-3**
15. If we know that we are going to be facing increasingly stressful situations due to climate change then we want the forests to be ready as much as possible so there should be no logging in community watersheds.	3	4	**-2**
16. Conservation is an important factor because we don't want people wasting water – rather than buying water from the regional district, just don't waste it.	1	2	0
17. We need to conduct a really fast study with a short term outlook, to determine whether we have enough water for the next 10 years, because I think it's a major crisis and nobody's paying attention.	0	-1	**-4**
18. If managers were smart, if they were visionary, if they were intelligent, they would say maybe there's an alternative way of dealing with human waste rather than using beautiful water to flush it.	-1	0	-2
19. I would love to see our growth here on the coast be limited by our ecosystem's natural ability to supply water.	**4**	-1	-3
20. Metering is the most fair and equitable way to charge for water.	4	3	4
21. The solution to implementing water conservation measures is to tax people and educate people so that they understand why they are paying more.	**3**	-1	0
22. Gibsons doesn't have any type of incentives to use low-flush toilets whereas the Sunshine Coast Regional District does – incentives should be offered across the board to reduce water consumption whether it be Regional District water or the Town of Gibsons water.	2	2	0
23. Gibsons needs to keep up the good work with its water management – they're doing a good job, and they just need to keep moving forward.	-1	1	1
24. Water conservation education isn't going to reduce water consumption, it's water meters that will reduce consumption because raising the rate makes people more conscious.	1	**-2**	1

Statement	Factor Score		
	A	B	C
25. If you do a cost-benefit analysis on implementing water conservation measures (i.e., efficient fixtures, meters, etc.) implementation won't be favourable in Gibsons, because we don't have huge capital deferrals – we don't have a billion dollar program to defer by conserving water.	-3	-2	**2**
26. Conservation is the best means to pursue an increased water supply because it is cheaper and easier than other methods.	1	3	3
27. By actually showing people how much they are getting charged for water by month they will have the opportunity to decide whether or not they want to use less or not.	2	**-3**	2
28. If Gibsons and the Sunshine Coast Regional District negotiate a deal where the Regional District continues to supply Gibsons with water, then there will be no need for Gibsons to conserve water, because the Town will have enough.	-4	**-1**	-4
29. In moving forward with water conservation we need to focus on the problem –outdoor water use.	2	**-2**	2
30. Our water supply is limited and the current consumption rates have us using more per capita than most other places in this country. Limited resources and high consumption, those aren't good converging trends and clearly local government has to enact water conservation as soon as possible.	2	2	0
31. We need to be careful about our water supply, not necessarily about quantity, but about quality – we should care about our water and protect it before a crisis occurs.	1	3	4
32. We will definitely run short of water here due to growth and we should be planning for it now, either through raising the height of the dam on Chapman Creek or going somewhere else to look for it, far away.	1	**-2**	3
33. If a proposed policy suggested that all of a sudden people had to start paying for their water usage, I don't know if it would pass. How do you put a value on water that has always been free?	-3	**1**	-3
34. Before deciding to spend money on water conservation the Town of Gibsons should ask taxpayers what they want done with their money.	**-4**	**2**	**-1**
35. Water metering is a good idea, but unfortunately it's going to be the people on a limited income that suffer – the people with lots of money don't give a hoot how much water they use, because they can afford it.	0	-3	-1
36. Finding new sources of supply is going to be expensive, so we've got to start developing cost charges today to pay for that linkage.	2	0	2

Statement	Factor Score		
	A	B	C
37. There should be more encouragement to use rainwater in gardens – the Town of Gibsons should have a rain water barrel program.	**0**	**2**	**-4**
38. The most important factor in making decisions about water is to have a strategic plan that you follow and revisit every five years or so, and that has buy-in from all stakeholders.	3	**0**	4
39. No more water studies, let's get on with it – find a solution and stick with it.	0	**-4**	0
40. The more education there is around understanding water and what water does for the environment and what water does for life in general, the more people will respect it and if people respect it, they will treat it accordingly.	**-3**	4	3
41. The soft-sell approach to water conservation is not having any effect whatsoever – we're wasting our money on advertising.	**1**	-4	-2
42. People turning in other people who are in breach of the sprinkling regulations –that is a much more effective public education program than pamphlets being passed out at the desk at the municipal hall. Then people start policing themselves, because they don't want to get out of sorts with their neighbours.	-2	-1	-2
43. The unfortunate thing about raising water rates is that everybody is punished and I don't think that's fair.	**-4**	-1	0
44. If I was the mayor of Gibsons I would launch a big public education campaign about water.	-2	1	-1

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