Collaborative water governance in Burgeo, Newfoundland and Labrador

Challenges, successes, and opportunities

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Abstract

Water—a finite natural resource—is complex, thus greater stakeholder representation is encouraged in decision-making. Collaborative governance processes, through which diverse actors pool resources and share responsibilities to effectively solve problems that they could not solve independently, have gained popularity as tools for effective water governance.

In 2015, Burgeo lifted a long-term boil water advisory, and this was a shared effort between the Town of Burgeo and its staff, the residents of Burgeo, the Government of Newfoundland and Labrador, the Government of Canada, and other actors. Despite achieving this milestone, Burgeo continues to face other water-related concerns, including water overuse and high concentrations of certain contaminants. These newer concerns indicate a need for further collaboration to achieve positive water-related outcomes for Burgeo's water security.

This study sought to explore collaborative water governance in Burgeo by examining the interactions, particularly communication and coordination, between the various actors who have been involved in attempting to provide clean, safe drinking water to the residents. An exploratory case study was developed, and data were collected from a range of sources including existing literature, secondary documents, and semi-structured interviews. A collaborative governance framework was developed to aid data collection and analysis.

Drivers of collaborative governance in Burgeo included knowledge-power-resource asymmetries, prehistory of cooperation, and new water concerns. Knowledge-power-resource imbalances were also identified as challenges to successful collaboration, while facilitative leadership and conflict resolution strategies required improvement. The more resources and knowledge an actor/group possessed, the more power they had to influence decision-making in

their favour. These power imbalances, in turn, impacted trust and the extent to which certain actors/groups felt that their contributions were valid and valued.

Acknowledgments

I acknowledge that Ktaqmkuk, the island of Newfoundland, on which this study was conducted is the ancestral territory of the Mi'kmaw people and I acknowledge, with respect, the diverse cultures of the Beothuk, Mi'kmaq, Innu, and Inuit whose lands span across the province of Newfoundland and Labrador.

The end always seemed so distant but several years later, I have finally made it to the finish line, and I could not be happier with the overall journey and the result. I am thankful for all the lessons I have learned, the clarity I have gained on this topic that is so near and dear to my heart, and all the amazing people who have supported me along the way.

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And finally, all I am and ever hope to be, I owe it to God Almighty.

"Still, I rise." ~ Maya Angelou

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[1] All images are credited to Kanyangarara, R.R. (2018).

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List of abbreviations and acronyms

BBS	Burgeo Broadcasting Station
BEE Inc.	Big East Engineering Inc.
BWA	Boil water advisory
CCBF	Canada Community-Building Fund
CCME	Canadian Council of Ministers of the Environment
CDC	Centres for Disease Control and Prevention
CG	Collaborative governance
CWG	Collaborative water governance
CWWOCC and ABC	Canadian Water and Wastewater Operator Certification Committee and Association of Boards of Certification
DBP	Disinfection by-product
DECC[2]	Department of Environment and Climate Change (NL)
DGS NL	Digital Government Service Newfoundland and Labrador
DHCS	Department of Health and Community Services (NL)
DMPA[2]	Department of Municipal and Provincial Affairs
DNCA	Do not consume advisory
DTI	Department of Transportation and Infrastructure
DWA	Drinking water advisory
EHO	Environmental health officers
ENGO	Environmental non-governmental organisation
EPI	Environmental Performance Index
FG	Federal government (Government of Canada)
F-P-T CDW	Federal-provincial-territorial Committee on Drinking Water

[2] Up until 2015/16, the Department of Environment and Climate Change and the Department of Municipal and Provincial Affairs existed as the Department of Environment and Conservation and the Department of Municipal Affairs respectively. Between 2016/17 to 2018/19, the two departments co-existed as the Department of Municipal Affairs and Environment, and as the Department of Environment, Climate Change, and Municipalities in 2019/20. Reference is made to most/all of these departments throughout this paper.

FWP	Federal Water Policy
GCDWQ	Guidelines for Canadian Drinking Water Quality
ICIP	Investing in Canada Infrastructure Program
ICWE	International Conference on Water and the Environment
LSD	Local service district
MAC	Maximum allowable concentration
MBSAP	Multi-barrier strategic action plan
MCW	Municipal Capital Works
MHA	Member of the House of Assembly
MNL	Municipalities Newfoundland and Labrador
MOG	Municipal Operating Grant
MTU	Mobile training unit
NCCEH	National Collaborating Centre for Environmental Health
NCCHPP	National Collaborating Centre for Healthy Public Policy
NGO	Non-governmental organisation
NL	Newfoundland and Labrador
NRTEE	National Round Table on the Environment and the Economy
OETC	Operator Education, Training, and Certification
OHCHR	Office of the United Nations High Commissioner for Human Rights
PDWS	Public drinking water system
PE	Principled engagement
PG	Provincial Government (NL)
PWSS	Public water supply system
RMOH	Regional medical officer of health
SDG	Sustainable development goal
SDWS	Small drinking water system
SOP	Standard operating procedure
TC	Town Council (Burgeo)
TCI and BAE	Tract Consulting Inc. and BAE-Newplan Group

THM	Trihalomethane
U-V	Ultra-violet
UN	United Nations
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WRMD	Water Resources Management Division (NL)
WRP	Water Resources Portal (NL)
WTP	Water treatment plant

Appendices

Chapter one

Introduction

Water is life. It is essential for ecosystems, biodiversity, community development, and overall human well-being (National Round Table on the Environment and Economy (NRTEE), 2010; World Water Council, 2000). Studies show that a healthy adult can go up to three weeks without food, but only three to five days without water (Mitchell, 2017). In addition to consumption and household purposes, water is used in a range of other activities that include recreation (e.g., fishing, and green parks), industry and commerce (e.g., agriculture, fabrication, cooling towers, and businesses), public buildings, thermoelectricity and energy, and medical purposes (e.g., dialysis machines, medical and dental equipment) (Hutson et al., 2004). Various tangible benefits to human health and ecosystems can be achieved by improving access to adequate, safe drinking water, thus, every effort should be made to ensure this goal (World Health Organisation (WHO), 2017). Over the last couple of decades, there has been a growth in the number of national and international declarations and policies that recognise the human right to water and sanitation, such as the 1996 Habitat Agenda which was developed at the UN Conference on Human Settlements and recognised water (and sanitation) as an essential component of the human right to an adequate standard of living (United Nations (UN) Office of the High Commissioner for Human Rights (OHCHR), n.d.). In July 2010, the UN General Assembly formally recognised this right through Resolution 64/292 (UN, n.d.; UN, 2010). Furthermore, clean water (and sanitation) as well as conservation and sustainable use of seas, oceans, and marine resources are highlighted in the Sustainable Development Goals (SDGs) as goals six and 14 respectively (UN Department of Economic and Social Affairs, n.d.).

Although various policies, statutes, and efforts have been made to ensure that this basic human right is afforded to all people, water insecurity is labelled one of the top five global threats of the century (Adeel, 2017). According to the WHO and the United Nations Children's Fund (UNICEF), two billion people globally lack access to clean, reliable, and safely managed drinking water at home (Centres for Disease Control (CDC), 2022). Despite its high levels of industrialisation and perceptions of water abundance and sovereignty, relative to neighbours in the Global South, Canada has also seen a rise in concern over its water security over the last decade (Norman et al., 2010). Water insecurity is especially evident in Indigenous communities where ongoing challenges regarding access to safe drinking water abound (Allan et al., 2013; Hanrahan, 2017; Latchmore et al., 2018). In October 2022, there were 31 long-term boil water advisories (BWAs) affecting 27 First Nations communities across Canada (Indigenous Services Canada, 2022). Canadians who reside in urban areas are at less risk of ill-health from unclean/contaminated water than their counterparts in smaller, more remote/rural communities (Hanrahan, 2017; Hrudey, 2011; Statistics Canada, 2009; Vodden and Minnes, 2014). The example of the province of Newfoundland and Labrador (NL) is discussed further below.

1.1 Problem context

The human right to water (and sanitation) is recognised as non-negotiable by the United Nations Human Rights Council and other organisations (UN, n.d.). Unlike other international jurisdictions, such as England, where drinking water—even in small communities—is provided by large corporations, the provision of clean drinking water in Canada is a shared responsibility between the federal, provincial and territorial, and municipal levels of government as well as Indigenous governments in some contexts (Environment and Climate Change Canada, 2020; Hrudey, 2011; Indigenous Services Canada, 2022). The federal government (FG) is responsible for developing national water quality guidelines, providing funding for municipal water infrastructure, and governing water resources on Indigenous lands in collaboration with Indigenous governments (Indigenous Services Canada, 2021; Indigenous Services Canada, 2022; Office of the Auditor General of Canada, 2021). Provincial and territorial governments oversee daily safe water provision, while municipalities are responsible for managing the day-to-day water treatment and distribution facility operations (Environment and Climate Change Canada, 2020; Health Canada, 2015). The municipal level of government, which has the largest and most direct responsibility for water safety and provision, also has the least financial capacity and technical expertise (Hrudey, 2011).

As mentioned above, small, rural/remote communities experience various ongoing water-related challenges. This is evident in NL where a large number of small towns and rural communities experience water insecurity mostly related to quality and safety (Vodden and Minnes, 2014). Many of these communities have reported concentrations of contaminants, such as disinfection by-products (DBPs), and, in particular, trihalomethanes (THMs) and haloacetic acids (HAAs), in their public drinking water that exceed Health Canada's maximum allowable concentrations (MACs) (Chowdhury et al., 2011; Environment and Conservation NL, 2009).

In NL, approximately 200 drinking water advisories (DWAs) are enforced annually, and long-term boil water advisories (BWAs)—which last for five years or longer[3]—are very common (Jones-Bitton et al., 2016). Many of these are a result of insufficient chlorination in water treatment and distribution systems (Municipal Affairs and Environment NL, 2022). In 2014, reports indicated that the community of Burgeo, NL had been under a BWA for over ten years due to

[3] Indigenous Services Canada defines a long-term DWA as one that has been in effect for more than 12 months (2021).

insufficient chlorination in the water system (Connors, 2014). BWAs were designed to be used in emergency situations, thus, when they are in effect for prolonged periods of time, they may cause long-term effects such as consumer distrust of public drinking water, or they may push consumers to turn to potentially unsafe water sources, such as springs (Hrudey, 2011; Jones-Bitton, et al., 2016; Vodden and Minnes, 2014).

In addition to poor water quality and operating procedures that result in high levels of DBPs and long-term or frequent BWAs, water infrastructure throughout NL has deteriorated significantly since its installation in the 1950s and is, therefore, due for upgrades and/or replacements (Ochoo et al., 2017; Vodden and Minnes, 2014). Reports also show that NL utilises a disproportionately large amount of water in comparison to other Canadian provinces and territories (Allan et al., 2013; Dore, 2015; International Conference on Water and the Environment (ICWE), 1992; Statistics Canada, 2021a). In 2022, the national average residential per capita water usage was 215 litres per person per day; NL's average was 448 litres per person per day, while New Brunswick and Nova Scotia, which have similar population sizes, had averages of 264 litres per person per day and 170 litres per person per day respectively (Statistics Canada, 2021a).

1.2 Problem statement

After the highly publicised outbreak of gastroenteritis in Walkerton, Ontario in 2000, investigations identified the need for "… improved provincial oversight, including regulatory obligations under comprehensive legislation to manage water quality from source to tap," as well as improved coordination in source water protection (Hrudey, 2011, p.9). This can be achieved by employing collaborative governance (CG) approaches whereby at least one public agency engages directly with non-state actors in the decision-making process, and lower levels of government are given direct management responsibilities (Ansell and Gash, 2008). Within the context of this study, Vodden and Minnes (2014) have identified the need to explore the potential for collaboration while examining the various challenges associated with the current approaches to communication and coordination in water governance.

1.3 Purpose statement

The purpose of this study was to respond to the knowledge gap identified in Section 1.2 by gaining a better understanding of the factors that influence communication and coordination (successes and challenges), and, thus, the current and future potential for collaborative approaches in water governance, particularly within NL. This was done by developing a case study identifying the nature of problems or breakdowns that may have occurred while attempting to provide clean, safe drinking water to the Town of Burgeo, as well as the resolutions that were employed or considered and the relationships involved in pursuing these resolutions. The timeline of interest in this study was from the beginning of the long-term BWA in 2001 until the end of data collection within the community in 2019. Suggestions for ways to enhance communication, coordination, and collaboration in water governance, and how to, ultimately, ensure that the human right to water is upheld were also explored.

1.4 Research questions

I. What were some of the major challenges and events that occurred while attempting to provide clean, safe drinking water in the Town of Burgeo?

II. Who were the different actors involved in attempting to address these challenges and provide clean, safe, and adequate drinking water to the community of Burgeo?

III. What were some of the ways in which these actors communicated and interacted relating to water governance?

A. How did the various actors support or hinder the solutions that were presented to address Burgeo's water problems?
B. If the various levels collaborated with one another, how was this done?
C. Did they work well together or were they in conflict? What was the nature of the conflicts that occurred, and how were these resolved?

IV. How might communication and coordination—and the potential for collaboration—have been improved in addressing water-related problems in Burgeo?

1.5 Methodology

The interpretivist approach was used to gain a better understanding of the perspectives, behaviours, and interactions of the various actors who were involved in the water governance processes in Burgeo during the specified period of interest (2001 to 2019). The ontology of interpretivism is one of subjectivism in which different people construct knowledge and understand meanings differently, resulting in as many realities as there are individuals (Kawulich, 2012; Scotland, 2012; Kivunja and Kuyini, 2017). The axiology of interpretivism, which relates to what individuals value, recognises that knowledge is value-laden because of the many realities that exist (Biedenbach and Jacobsson, 2016; Kawulich, 2012; Kivunja and Kuyini, 2017). A mixed methods exploratory case study was designed using the following research methods: review of existing literature, analysis of government documents (including quantitative data), and semi-structured interviews. Interviews were conducted with various actors who were involved in attempting to resolve Burgeo's water issues. Additionally, a collaborative governance framework was developed to guide the interview and data analysis processes.

1.6 Outline of thesis

Chapter two: Literature review

The next chapter provides an extensive traditional review of the existing literature on the core concepts of this study, such as collaborative governance, and qualitative and quantitative water security globally. The focus then shifts to the Canadian context and explores water security, water treatment, BWAs, collaborative water governance (CWG) in Canada, and the importance of effective communication and coordination in governing and managing water resources. The CG framework is also introduced in this chapter.

Chapter three: Water governance in NL

In Chapter three, the specifics of water governance in NL are explored, including the various actors involved. Both qualitative and quantitative aspects of water security are highlighted. The Town of Burgeo is also introduced in this chapter, and an overview of water management, and water-related challenges and successes in the community is provided. This chapter provides the foundation for the results that are discussed in Chapter five.

Chapter four: Research Methods and Methodology

Chapter four provides details of the various methods and overall methodology that guided data collection and analysis for this study. The collaborative governance framework and its main concepts are discussed in greater detail in this chapter.

Chapter five: Results

The results obtained from data collection and applying the collaborative governance framework to the Town of Burgeo are presented in this chapter.

Chapter six: Summary, conclusions, and recommendations

The research questions posed earlier are revisited and answered. This is followed by a discussion regarding the overall findings of the study as they relate to communication and coordination and the potential for collaborative water governance in Burgeo. The chapter is concluded with recommendations for improved water governance in the community.

Chapter two

Literature review

This chapter provides an extensive review of the existing literature on qualitative and quantitative water security globally and in the Canadian context. Collaborative water governance is also introduced in this chapter.

2.1 Defining water security in a global context

Despite 70 percent of the Earth's surface being covered with water, only 2.5 percent (35 million km^3) is freshwater, and of this volume, less than one percent (~200,000 km^3) can be used by humans and ecosystems (Oki and Kanae, 2006; UN Water, 2013). Freshwater is, therefore, considered a finite and vulnerable resource that must be sustainably used and managed (ICWE, 1992).

There are many ways to define water security with especial focus on quality and quantity. The following UN definition of water security has been used to guide this study as it highlights the qualitative and quantitative nature of water security as well as the importance of water security for healthy communities:

> *"… the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development…"* (UN Water, 2013, p. 1).

Water security is an important environmental determinant of health and is critical for consumption/drinking water, food security, wastewater and sanitation, infrastructure, healthy ecosystems and economies, energy, and the environment (Canadian Public Health Association, 2015; Schuster-Wallace and Dickson, 2016; Young et al., 2021). Over the years, various international constitutions and agreements have been developed to ensure that people have access to adequate, safe water (Table 1).

Table 1: International recognitions of the human right to water

Organisation/conference	**Description of recognition**
2030 Sustainable Development Goals (SDGs)	Global commitment to ensuring safe, sufficient drinking water to all people by 2030 (Latchmore et al., 2018).
United Nations General Assembly (2010)	Official recognition of water security as a basic human right, necessary for "… the full enjoyment of life and all human rights" (UN General Assembly, 2010, p.2).
Asia-Pacific leaders (2007)	Access to safe drinking water (and sanitation) is a fundamental part of human security, and, therefore, a basic human right (OHCHR, n.d.).
Abuja Declaration (2006)	"We recognise the importance of water as a natural resource of State that is an essential element for life with a socio-economic and environmental function. We shall promote the right of our citizens to have access to clean and safe water and sanitation within our respective jurisdictions" (Africa-South America Summit, 2006).
The Council of Europe Committee of Ministers (2001) - Recommendation Rec (2001)14 of the Committee of Ministers to member States on the European Charter on Water Resources.	All people have the right to adequate supplies of water to meet their basic needs (OHCHR, n.d.).
The Habitat Agenda, developed at the UN Conference on Human Settlements (1996)	Water (and sanitation) is an essential component of the human right to an adequate standard of living (OHCHR, n.d.).

Agenda 21, established at the UN Conference on Environment and Development (1992)	Regardless of developmental stages and socio-economic conditions, all people have the right "… to have access to drinking water in quantities and of a quality equal to their basic needs" (OHCHR, n.d., p. 3).
The UN Water Conference in Mar del Plata, Argentina (1977)	Basic water requirements regarded as essential for human health and well-being (United Nations - Office of the High Commissioner for Human Rights (OHCHR), n.d.).

The UN OHCHR (n.d.) has provided a globally applicable checklist for the core characteristics that define water security, namely freedoms, entitlements, quantity, quality, accessibility, and affordability. The characteristics for freedoms and entitlements are described in Table 2.

Table 2: Characteristics of the human right to water (and sanitation)

Component	**Explanation/examples**
Freedoms	"Protection against arbitrary and illegal disconnections" (p.7).
	"Prohibition of unlawful pollution of water resources" (p.7).
	"Non-discrimination in access to safe drinking water [and sanitation], notably on the basis of land or housing status" (p.7).
	"Non-interference with access to existing water supplies, especially to traditional water sources" (p.7).
	"Ensuring that personal security is not threatened when accessing water or sanitation outside the home" (p.7).

Entitlements	"… access to a minimum amount of safe drinking water to sustain life and health" (p.7). The water supply for each person must be sufficient and continuous to cover personal and domestic uses, such as consumption, food preparation, laundry, and household hygiene. According to the World Health Organisation (WHO), each person requires at least 50 to 100 litres of water each day, and the absolute minimum acceptable is 20 to 25 litres.
	"…free from microbes and parasites, chemical substances and radiological hazards that constitute a threat to a person's health," and "Of an acceptable colour, odour and taste to ensure that individuals will not resort to polluted alternatives that may look more attractive" (p.9). Various national and local standards/guidelines define drinking water safety. The Guidelines for Drinking Water Quality, developed by the WHO, act as a foundation upon which national water quality standards can be built to ensure water safety.
	"… within safe reach for all sections of the population, including persons with disabilities, women, children, the elderly" (p.9). Water (and sanitation) facilities must be physically accessible
	"No individual or group should be denied access to safe drinking water because they cannot afford to pay" (p.10). Water services must be affordable to all.
	"Access to safe drinking water [and sanitation] in detention" (p.7).

Note. Adapted from UN OHCHR (n.d., p. 7-10).

Despite the diverse range of declarations and policies that recognise the human right to water (and sanitation), global water security is threatened by global population and economic growth which cause increased demand for freshwater resources (Boretti and Rosa, 2019). Studies indicate that if global water consumption patterns remain business-as-usual, by 2050 water demand will exceed the available supply by 55 percent (Adeel, 2017). This threat is further exacerbated by climate change which has caused water to move through its hydrological cycle at an accelerated rate, thereby causing changes in weather and precipitation patterns (Pomeroy et al., 2019). Rising global temperatures mean increased retreating and melting of glaciers, rapid thawing of permafost, and toxic algae contamination of lakes (Pomeroy et al, 2019; United Nations, 2019; Vincent, 2009). Furthermore, many already dry regions are likely to experience more frequent and severe droughts due to less rainfall and the resulting loss of soil moisture (UN Water, 2019; Vincent, 2009), while floods are also expected to increase in some regions mostly due to increased exposure and vulnerability (UN Water, 2019; Vincent, 2009). Small islands and other such low-lying coastal areas are at risk of saltwater intrusion into their freshwater systems due to rising sea levels (UN Water, 2019). Although the global south is expected to bear the brunt of the impacts of climate change on water resources (Dervis, 2007), developed nations, such as Canada, are not immune to qualitative and quantitative water-related challenges (Lam et al., 2017; Global Water Futures et al., 2019).

2.2 Water security in Canada

Water is essential to Canada’s economy and future. The perception of an abundance of water has often been used as an identifier of the nation’s sovereignty (Nanos, 2009). It is, therefore, critical that access to sufficient, good quality water is carefully managed to ensure that Canada’s present water needs are met, while safeguarding sufficient, safe water resources for future generations (Government of Newfoundland and Labrador, 2002). Additionally, ensuring safe drinking water for all supports the 2030 SDGs, namely good health and well-being, and clean water and sanitation (Statistics Canada, 2021a).

2.2.1 Quantitative water security

As mentioned earlier in this chapter, only about 2.5 percent of global water, i.e., freshwater, can be used. Studies estimate that Canada has six to nine percent of global freshwater with only 0.5 percent of the global population (Allan et al., 2013; Environment and Climate Change Canada, 2018; Mitchell, 2017; Natural Resources Canada, 2017). Canada's freshwater is contained in various rivers, aquifers, lakes, groundwater sources, wetlands, snowpacks, glaciers, and soils (Bonsal et al., 2020). However, 50 to 60 percent of this water drains northward into the Arctic Ocean and Hudson Bay and is, therefore unavailable to the majority of Canadians who reside southward (Environment and Climate Change Canada, 2018; Federal-Provincial-Territorial Committee on Drinking Water (F-P-T CDW), 2001; Renzetti and Dupont, 2017).

A lack of distinction between water in Canada's lakes (~ 20 percent of global lakes) versus freshwater sources (six to nine percent of global freshwaters) has resulted in erroneous perceptions of an infiniteness of water in Canada and accompanying wasteful water usage/practices (Sprague, 2007). Numerous studies have listed Canada among the top global water consumers, with the Conference Board of Canada having once ranked Canada number 15 out of 16 countries for water consumption that was more than double its peer average (Allan et al., 2013). Despite these rankings, Canada has seen a steady decline in water consumption over the last decade with the national average per capita water usage decreasing from 222-litres per person per day in 2013 to 215-litres per person per day in 2019. Households in Newfoundland and Labrador (NL), New Brunswick, Yukon, and Quebec, however, use significantly more water than households in other provinces and territories (Statistics Canada 2021). (See Table 3 for average residential water use by province/territory).

Table 3: Average residential daily water usage by province and territory (2019)

Province/Territory	**Per capita water use (litres per person per day)**	**Population (in 2019)**
National	215	31,506,037
Alberta	176	3,662,847
British Columbia	274	4,578,073
Manitoba	158	1,117,129
New Brunswick	264	412,647
Newfoundland and Labrador	448	435,951
Northwest Territories	247	39,654
Nova Scotia	170	594,855
Nunavut	136	35,560
Ontario	172	11,993,599
Prince Edward Island	181	82,191
Quebec	262	7,651,514
Saskatchewan	191	870,667
Yukon	385	31,350

Note. Extracted from Statistics Canada, 2021a.

The World Conservation Union (2006) conducted a study that indicated that more heavily populated Canadian provinces make greater water conservation efforts than their more sparsely populated counterparts (Dore, 2015). For example, Statistics Canada (2019) reported that NL had an average residential per capita water use of 448-litres per person per day, while Ontario, with a responding population 27-times the size of NL, had an average water use of 172-litres per person per day (Table 3). The variations in average per capita water use in Canadian provinces and territories can be attributed to several factors that include: the cost of water, climate, economies, infrastructure, and conservation policies (Statistics Canada, 2019).

Although high water usage is often attributed to intentional overuse, it is also important to acknowledge the role that aging infrastructure plays on the volume of water used. Most Canadian water (and wastewater) systems were installed between the 1950s and 1970s and have, therefore, met their service lives (Allan et al., 2013; Ochoo et al., 2017; Vodden and Minnes, 2014). Aging pipes often contain leaks through which significant volumes of water are lost, thus, upgrading or replacing these structures is paramount (Allan et al., 2013; Ganguly and Cahill, 2020; Health Canada, 2012; Ochoo et al., 2017; Renzetti, and Dupont, 2017).

In addition to overuse/waste, Canada's water supply has also been drastically impacted by environmental factors, namely climate change. All regions across Canada, especially in the Northern Territories as well as some eastern provinces, are experiencing increased precipitation, including more rain than snow in spring and fall seasons (Pomeroy et al., 2019; UN Water, 2019). As global temperatures continue to increase, greater evaporation and transpiration are experienced in summer months (Adams and Peck, 2008; Bonsal et al., 2019) and this may cause soils to dry rapidly if humidity decreases or wind speed increases (Sheffield et al., 2012). Since the 1970s, Western Canada has experienced a steady decline of one to two months in the duration of snowcover in winter and spring months (Pomeroy et al., 2019). The resulting decrease in the depth of snowpack and the amount of precipitation translates to a significant depletion of runoff from melting snow—an important surface water source in western Canada—thus increasing the risk and possibility of droughts (Adams and Peck, 2008; Anis et al., 2021; Bonsal et al., 2019; Pomeroy et al., 2019). Additionally, over the past century, glaciers and icefields, particularly in BC and the Prairie Provinces, have melted, thinned, and receded drastically, by as much as several kilometres in some cases, thus further increasing the risk for drought and other challenges with the drinking and irrigation waters that serve these regions (Bonsal et al., 2019; Natural Resources Canada, 2022; Pomeroy et al., 2019; UN Water, 2019).

2.2.2 Qualitative water security

Good quality, safe water is described as aesthetically pleasing with minimal taste, colour, and odour, and "… free of both disease-causing organisms and chemicals in concentrations that have been shown to cause health problems" (Canadian Council of Ministers of the Environment (CCME), 2004, p.14). Although having been ranked second for best quality water among similar industrialised countries based on the criteria set forth by the Environmental Performance Index (EPI) in 2010, Canada ranked 24th for global drinking water and sanitation in 2022 (Environment and Climate Change Canada, 2017(i); Wolf et al., 2022). According to Wolf et al. (2022), the EPI global drinking water and sanitation rankings are based on "… the number of age-standardized disability-adjusted life-years lost per 100,000 persons due to exposure to unsafe drinking water [and inadequate sanitation facilities respectively]" (p. 78). Challenges with drinking water quality in Canadian communities began to emerge in the 1980s and the start of the 21st century saw an increase in reports of waterborne disease outbreaks (Table 4). Furthermore, Indigenous communities in Canada are more likely than their non-Indigenous counterparts to experience severe water-related challenges (Castleden et al., 2017), including lack of access to potable water (Sarkar et al., 2015) and long-term and chronic DWAs (Hanrahan, 2017). This has been attributed by authors such as Hanrahan (2017) and Canadian Union of Public Employees (CUPE) (2022) to the colonial power dynamics between the Government of Canada and Indigenous communities.

Table 4: Significant water contamination events in Canada

	Drumheller, AB	**Walkerton, ON**	**North Battleford, SK**
Year	1983	2000	2001
Population	6,500	4,800	15,000
Number of people affected	3,000	2,300	5,800-7,000
Number of deaths reported	2	7	*
Illnesses caused	Gastroenteritis	Gastroenteritis	*
Cause of contamination	Spill of raw sewage upstream of the town's drinking water source	Cattle manure contamination of shallow well with heavy spring rainfall and widespread flooding	Inefficient maintenance and sewage contamination.

Note. Extracted from Hrudey (2011); Norman et al. (2010).

*Information not available.

The quality of Canadian water systems may also be compromised by some effects of climate change, such as heavy rainfall which causes increased sediment, nutrients, and pollutants in water and periods of drought that may result in reduced dilution of these contaminants (UN Water, 2019). Additionally, as noted above, increased temperatures may cause toxic algae contamination of lakes (Pomeroy et al, 2019).

Although greater awareness and dialogue have been sparked regarding safe drinking water and the various threats to (drinking) water security nationwide, recent studies indicate that many communities continue to lack access to sufficient, safe drinking water. This has been attributed mostly to their lack of various capacities and resources to install and/or maintain appropriate water systems/infrastructure (Latchmore, 2018).

2.2.2.1 Guidelines for Canadian Drinking Water Quality (GCDWQ)

Since 1968, Health Canada—on the advice of the F-P-T CDW—develops drinking water quality guidelines, known as Guidelines for Canadian Drinking Water Quality (GCDWQs), that outline the MACs for contaminants commonly found in drinking water that may have deleterious impacts on consumer health, especially vulnerable members of society, such as young children and the elderly (Health Canada, 2012; Health Canada, 2018; National Collaborating Centre for Environmental Health (NCCEH), 2020). According to Health Canada (2018), there are three broad water quality guideline categories: microbiological parameters; chemical and radiological parameters; and aesthetic and operational parameters.

The GCDWQs are considered voluntary and non-enforceable, thus, territories and provinces are able to decide whether to adopt them and/or make them legally enforceable (Dunn, et al., 2017). According to Dunn et al. (2017), eight of Canada's jurisdictions (i.e., provinces and territories) have drinking water quality guidelines that are legally binding, with the Northwest Territories adopting all GCDWQs, Nova Scotia and Manitoba adopting most of the guidelines, and Alberta, Saskatchewan, Quebec, Ontario, and Yukon adopting some of the GCDWQs. Municipalities, private sectors, and Indigenous governments, in turn, ensure that these regional guidelines are met within their communities (NCCEH, 2020).

2.2.2.2 Water treatment

Regulated drinking water systems, such as municipal water systems, must maintain a minimum level of water treatment (Liss, 2018). Water treatment is a multi-step process that ensures the safety, palatability, and acceptability of drinking water to consumers. It involves conditioning water by removing contaminants and modifying the aesthetic properties of water by either adding chemicals, filtering the water, and/or employing other techniques that enable the water to meet drinking water quality guidelines (CDC, n.d.; Ochoo et al., 2017).

2.2.2.2.1 Disinfection

Disinfection is considered the most critical stage of water treatment as it ensures that death- or illness-causing waterborne microorganisms, such as bacteria, viruses, and protozoa, are inactivated (Environment and Climate Change NL, 2010; Health Canada, 2006). Many small drinking water systems (SDWSs) in Canada treat their drinking water solely by the addition of a disinfectant to raw source water (Bereskie et al., 2017b; Big East Engineering Inc. (BEE Inc.), 2016). Although chlorine and ozone are the most commonly used disinfectants, ultra-violet (U-V), mixed oxidants, and chloramines are also used (BEE Inc., 2016; Health Canada, 2006).

2.2.2.2.1a Ozonation

Many communities utilise ozone-based water treatment processes whereby pure oxygen is injected into an ozone reactor vessel, and the two react with electricity to oxidise and purify water. Ozonation inactivates microbial bacteria such as *Giardia* and removes aesthetic parameters, such as colour, odour, and taste (Health Canada, 2012; Hussain and Tripathi, 2021; Nakada et al., 2020). However, ozone dissipates rapidly in water, thus, contaminants that enter the water after treatment will remain in the distribution system. To combat this and ensure continuous disinfection of water as it travels through the distribution system, chlorine is used as the primary disinfectant in most communities (Environment and Conservation NL, 2005; Godo-Pla et al., 2021; Health Canada, 2009; Indian and Northern Affairs Canada, 2010).

2.2.2.2.1b Chlorination

Chlorination is the main disinfection method used in most Canadian communities as it is cost effective, practical, and efficient (BEE Inc., 2016; Dore, 2015; Health Canada, 2006; Indigenous Services Canada, 2019; Vodden and Minnes, 2014). Chlorine is a strong oxidising agent that works by inactivating pathogens, thereby inhibiting their growth in the water and throughout the distribution system (American Water Works Association (AWWA), 2006; BEE Inc., 2016; Carrico and Singer, 2009; Dore, 2015).

Chlorine is used in its three forms: gas, liquid, and powder (AWWA, 2006; BEE Inc., 2016; Environment and Conservation NL, 2005). Although gas chlorination is the most effective form—providing 100 percent free chlorine for disinfection—gaseous chlorine tanks are costly and must be stored in separate, airtight rooms (Dore, 2015; Environment and Climate Change NL, 2019; Health Canada, 2009; Municipal Affairs and Environment NL, 2020). Hypo-chlorination systems (i.e., liquid or powder/solid) are less effective as they provide fewer free chloride ions for disinfection: about 12 percent for liquid chlorine and 65 percent for solid/powder chlorine (Dore, 2015). Small and remote communities generally opt for chlorine in its powder form because deliveries, especially during winter months, are few or sometimes not possible, and solid chlorine remains potent until it is mixed, unlike liquid systems which only have a shelf life of three months (Dore, 2015; Health Canada, 2009; Municipal Affairs and Environment NL, 2020).

To ensure the safety of drinking water, a detectable level of chlorine—known as a chlorine residual or free chlorine residual—must be maintained throughout the distribution system (BEE Inc., 2016; CCME, 2004; Environment and Climate Change NL, n.d.(vi); Health Canada, 2009). Requirements for maintaining satisfactory disinfectant residuals vary from province to province but must fall within the federally mandated 0.04-2.0 mg/L range (Health Canada, 2009; Mohseni et al., 2016). It is common for residual chlorine levels to decrease further down the distribution system due to factors such as pH, presence of organic matter, water temperature, and seasonal variability (Mohseni et al., 2016). This is often remedied by introducing chlorine booster stations for secondary disinfection whereby a second dose of chlorine is added to the water after treatment. This improves the consistency of chlorine residuals throughout the distribution system and prevents the re-growth and introduction of opportunistic pathogens/microbes in the water (Bereskie et al., 2017b; Carrico and Singer, 2009; Mohseni et al., 2016).

Disinfection by-products (DBPs)

Chlorine has the potential to form DBPs by reacting with naturally occurring organic matter (e.g., bacteria, soil, algae, decomposed plant material, and animal feces) in surface waters, and biofilm in water distribution systems (BEE Inc., 2016; Dyck et al., 2014; Health Canada, 2006; Health Canada, 2009; Indigenous Services Canada, 2019; Liss, 2018; Vodden and Minnes, 2014). The most common chlorinated DBPs are trihalomethanes (THMs) and halo-acetic acids (HAAs) (Carrico and Singer, 2009). THMs (namely chloroform, bromoform, bromodichloromethane, and dibromochloromethane) are typically sampled at the farthest point of the water distribution system, and the MAC is 0.100 mg/L (Environment and Climate Change NL, n.d.; Health Canada, 2020). There are five main HAAs that are often found in disinfected water, and their total concentration is known as Total HAA5. HAA5 samples are taken in the middle and at the farthest end of the water distribution system, and the MAC is 0.08 mg/L (Environment and Climate Change NL, n.d.; Health Canada, 2020).

Some studies suggest that DBPs may be carcinogenic—especially with chronic exposure—with bladder cancer being more common than colon and rectal cancer (AWWA, 2006; Carrico and Singer, 2009; Dore, 2015; Liss, 2018; Vodden and Minnes 2014). Some communities attribute their higher-than-average rates of cancer occurrences to chlorination of their drinking water and the resulting DBPs, thereby perpetuating negative public perceptions of chlorine as a disinfectant (Chowdhury et al., 2011; Health and Community Services NL, 2016). Although prolonged exposure to DBPs may have adverse effects on health and should, ideally, be minimised, the risks associated with bacteriological contamination or drinking non-chlorinated/untreated water far outweigh any potential risks associated with chronic exposure to DBPs (BEE Inc., 2016; Environment and Conservation NL, 2009; Vodden and Minnes, 2014). Additionally, high DBP concentrations in drinking water can be controlled by reducing the amount of organic matter in water prior to disinfection through processes such as coagulation, flocculation, and filtration in the water treatment process (Environment and Climate Change NL, n.d.; Vodden and Minnes, 2014).

Drinking water quality can be compromised by various contaminants, such as the formation of DBPs as discussed in this section. The groups/agencies that are responsible for managing water resources within communities must protect the public against the deleterious impacts of water quality breaches by providing notifications, additional instructions, and safe alternatives where needed in a timely manner.

2.2.2.3 Drinking water advisories (DWAs)

DWAs are public health statements that inform communities of actual or potential health risks to their drinking water. In Canada, there are three types of DWAs: (i) do not consume advisories (DNCAs); (ii) do not use; and (iii) BWAs (Indigenous Services Canada, 2021). In 2015, 1,838 DWAs were reported across Canada (Eggertson, 2015). Recent years have seen a significant decrease in the number of active DWAs within Canadian communities, with approximately 980 DWAs being reported in 2021 (Water Today, 2021) and 1,030 in August 2022 (Water Today, 2022) (Table 5). British Columbia, Saskatchewan, Newfoundland and Labrador, and Manitoba have the highest numbers of active BWAs in Canada (Water Today, 2022).

Indigenous communities in Canada, however, are more likely than their non-Indigenous counterparts to experience long-term and chronic DWAs (Hanrahan, 2017). Some current long-term DWAs on reserve across Canada include: Neskantaga First Nation, ON (1995); Eabametoong First Nation, ON (2001); Sandy Lake First Nation, ON (2002); Muskrat Dam Lake First Nation, ON (2003); Marten Falls First Nation, ON (2005); Star Blanket Cree First Nation, ON (2007); Bearskin Lake First Nation, ON (2007 and 2020); Gull Bay First Nation/Kiashke Zaaging Anishinaabek (2009); Northwestern Angle No. 33 First Nation (3 DWAs: 2011); Nibinimak First Nation, ON (2013); and Peepeekisis Cree Nation No. 81, SK (2013 and 2015) (Indigenous Services Canada, 2022). Recent years have seen more concerted efforts from the federal government (FG), in collaboration with Indigenous communities and their governments, to lift all long-term DWAs nationwide. This is discussed further in Section 2.4.1a.

Table 5: Drinking water advisories (DWAs) in Canada (2022)

Province/Territory	**BWAs**	**DNCAs**	**Total DWAs**[4]
Alberta	17	N/A	17
British Columbia	319	13	332
Manitoba	132	2	134
New Brunswick	12	2	14
Newfoundland and Labrador	163	1	164
Northwest Territories	1	N/A	1
Nova Scotia	63	N/A	63
Nunavut	5	N/A	5
Ontario	91	1	92
Prince Edward Island	N/A	N/A	N/A
Quebec	95	24	119
Saskatchewan	182	6	188
Yukon	1	N/A	1

[4] Total DWAs include BWAs and DNCs and exclude records of communities issuing advisories due to a lack of disinfection systems or disinfection systems being turned off by operators due to a lack of funds to operate.

Total	1,081	49	1,130

Note. Extracted from Water Today (2022).

BWAs account for over 95 percent of all DWAs in Canada. The next section will, therefore, discuss BWAs in greater detail (Stefanovic and Atleo, 2021; Water Today, 2021).

2.2.2.3.1 Boil Water Advisories (BWAs)/Boil Orders

Health Canada (2015) defines BWAs[5] as "… public announcements advising the public that they should boil their drinking water prior to consumption in order to eliminate any disease-causing microorganisms that are suspected or confirmed to be in the water" (p.2). A "rolling boil" for a minimum of one minute prior to consumption is advised (Stefanovic and Atleo, 2021). BWAs generally result from water sampling and testing activities that detect concentrations of pathogens that exceed the MACs as defined by the GCDWQs or insufficient chlorine residuals (Dore, 2015; Environment and Climate Change NL, n.d.(i).; Health Canada, 2015). BWA notices must be clear, easy to understand, and include all pertinent information, such as the issue date and reason. They can be disseminated through a range of outlets such as social media platforms, radios, televisions, newspapers, mailboxes, public notice boards, and door-to-door canvassing (CCME, 2004; Dawe, 2013; Health Canada, 2015; Jones-Bitton et al., 2016).

The Walkerton crisis of 2000 resulted in many BWAs being issued nationwide as precautionary measures without any confirmed water system failures or contaminations (Dawe,

[5] BWA and DWA may be used inter-changeably throughout the study.

2013; Dore, 2015). In 2021, 90 percent of water advisories issued nationwide were due to equipment and process-related reasons, while only two percent and eight percent were issued due to confirmed *E. Coli* and other microbiological contaminations respectively (Environment and Climate Change Canada, 2022). Smaller communities, unlike their more densely populated counterparts, have declining and aging populations and significantly lower tax bases. This often translates to less capacity to procure, maintain, or upgrade aging water treatment and distribution infrastructure, as well as challenges attracting and/or retaining full-time certified water systems operators to operate and maintain their water systems. In such cases, BWAs may be issued to absolve the responsible authorities of any potential liabilities (BEE Inc., 2016; Dore, 2015; Environment and Climate Change Canada, 2022; Indigenous Services Canada, 2021; Pelley, 2019).

Although BWAs are intended to be emergency or short-term, incident-specific public health precautionary measures that protect consumers and prevent or minimise potential health risks, many BWAs are considered long-term as they have been in effect for five[6] years or longer (BEE Inc., 2016; Dawe, 2013; Dore, 2015; Environment and Climate Change Canada, 2022; Health Canada, 2015; Hrudey, 2011; Vodden and Minnes, 2014). Some effects of long-term or prolonged BWAs include message fatigue, public panic, loss of confidence in public drinking water systems (PDWSs), and risks of future BWAs not being taken seriously (Dawe, 2013; Dore, 2015; Haider and Rasid, 2002; Health Canada, 2015; Jones-Bitton et al., 2007; Jones-Bitton et al., 2016; Ochoo et al., 2017). The agencies responsible for drinking water are, therefore, encouraged to work efficiently to resolve the problems affecting the water system (Dawe, 2013).

[6] Indigenous Services Canada (2021) defines a long-term BWA as one that has been in effect for 12 months or longer.

For BWAs that are issued due to contamination events, repeated sampling and bacteriological analyses until negative results are yielded are required before the advisory can be lifted. In the case of operational failures, the water system must be satisfactorily repaired (Dore, 2015; Health Canada, 2015).

2.2.2.3.2 Drinking water alternatives during BWAs

Since the Walkerton incident of 2000, many Canadians have continued to doubt or question the quality of their drinking water and have, therefore, taken independent precautions to ensure their own drinking water safety by purchasing water filtration devices, or seeking alternative water sources, such as bottled water (CCME, 2004; Dupont, 2005; Health Canada, 2015; Ochoo et al., 2017; Vodden and Minnes, 2014). Collecting drinking water from springs is a common practice in many parts of Canada. Spring water is aesthetically pleasing to consumers as it is generally clear, colourless, odourless, and tasteless. Many local governments do not discourage consumption of spring water. However, "… just because water looks "crystal clear" does not mean that it is safe to drink" (Health and Community Services NL, 2009). Springs are not monitored routinely for chemical or microbiological parameters, and their quality changes rapidly due to their vulnerability to anthropogenic pollutants and environmental contamination, such as animal fecal matter, debris, rainfall, and runoff (Health and Community Services NL, 2009; Pelley, 2019; Vodden and Minnes, 2014).

2.2.3 Operator training and certification

As discussed above, many smaller, rural/remote communities have aging and declining populations and lower tax revenue bases and, thus, often face challenges with recruiting and retaining qualified/certified water operators to manage their water systems efficiently (BEE, Inc., 216; Pelley, 2019). According to Association of Boards of Certification (ABC) (2019), the Walkerton Inquiry proved that those responsible for operating (drinking) water systems must possess the required knowledge, training, and experience to be able to make the best decisions to protect public health. Certification is considered a demonstration of professionalism and competency in water facility operation and maintenance (Environment and Climate Change NL, n.d.(ii)). There is a general consensus nationwide that all staff involved in the water systems processes must possess the necessary knowledge, training, and experience to make the best decisions for public protection (BEE Inc., 2016; Canadian Water and Wastewater Operator Certification Committee (CWWOCC) and ABC, 2014; CCME, 2004; Dunn, et al., 2017; Environment and Climate Change NL, n.d.(ii); Pons et al., 2014). The CWWOCC and ABC (2014) recommend that all water treatment and distribution systems have a minimum of one appropriately certified operator. Larger, more urban communities typically employ full-time certified operators to maintain their water systems, while smaller, more remote communities may either employ part-time operators or depend upon volunteers to manage their water systems (BEE Inc., 2016; Murphy et al., 2017; Vodden and Minnes, 2014). However, there may be some reluctance from volunteers because of the associated demands and potential liabilities due to inadequate training and equipment provisions (BEE Inc., 2016).

2.2.4 The cost of providing clean water

There are many expenses associated with providing clean, good quality drinking water, such as administration, and water service and delivery costs. Consumers are, therefore, generally required to pay a fee for water services to cover these expenses. Water costs can either be determined using flat rate pricing whereby consumers pay a fixed monthly fee with no cap on how much water they use, or by using meters and charging consumers based on the actual volume of water used (Canada West Foundation, 2011; Dore, 2015; Renzetti, 2007).

Operation and maintenance of water systems is costly and Rossow (2013) states that water and wastewater treatment facilities often account for 25 to 40 percent of monthly municipal electricity expenses. As mentioned earlier, most water lines in Canada were installed in the 1950s/1970s, and are, therefore, in need of major upgrades and/or replacements. Ochoo et al. (2017) and Allan et al (2013) have estimated that water treatment and delivery system upgrades nationwide may require a total of $31-$90 billion. However, the high cost of water service operations, maintenance, and delivery, coupled with the relatively low pricing of water in many Canadian communities, and constraints to how revenues can be raised and spent, means that municipalities have limited financial capacities to facilitate these necessary upgrades and/or repairs (Allan et al., 2013; Ochoo et al., 2017). According to data analysed by Renzetti (2009) from 2001 to 2008, Canadians, on average, paid only about 70 percent of the true cost of water service and delivery through local water taxes- an amount that does not represent the full cost of water services and delivery. It is for this reason that water in Canada is significantly subsidized, especially at the municipal level, with higher levels of government (the federal, provincial, and territorial) providing funding to communities to assist with various water systems costs (Canada West Foundation, 2011; Infrastructure Canada, 2020).

Due to the various multi-faceted threats to water security in Canada, such as water overuse, declining freshwater reserves, compromised water quality, lack of trained system operators, and inadequate financial capacities, Canada has sought to manage its water resources through governance approaches (Norman et al., 2010; Simms and de Löe, 2010).

2.3 Water governance

In the past, governments had monopoly over water resources. If the public and other non-state stakeholders[7] were engaged in discussions regarding water resources, this was typically done through informing or consultations through which stakeholders were provided with timely, accurate information to help them understand the issues being addressed and the solutions being considered or decisions that were already made/policies that were implemented (Loux, 2011). Through these processes, the government would maintain control of decision-making, often with little/no accountability except for democratic processes in the case of democracies. However, these methods of addressing complex water problems proved to be ineffective and unpopular, particularly at the local level (Fish et al., 2010; Roth and de Loë, 2017). Arnstein's (1969) popularised ladder of citizen participation demonstrates how citizenship engagement is categorized into non-participation (i.e., manipulation and therapy); tokenism (i.e., informing, consultation, and placation); and partnership (i.e., partnership, delegated power, and citizen control). Public engagement in natural resources management is considered a democratic right and communities are increasingly seeking more authority and involvement for partnerships in decision-making processes for their water resources, thus, there has been a significant shift from government to governance (Douglas et al., 2020; Reed, 2008; Rosenbloom and Gong, 2013). According to Loux (2011), stakeholders are most meaningfully engaged through the following ways (i) consulting/involving where they are engaged in active two-way dialogue in an effort to gain a better understanding of the problem at hand, proposed solutions, and questions that may

[7] Stakeholders are those to whom organisations/agencies have legal obligations, and those who are interested in the issue at hand or are affected by it or who could actively or passively influence decision-making and policy implementation, especially if they are excluded from decision-making processes (ISO 26000, 2010; Varvasovszky and Brugha, 2000).

arise; and (ii) collaborating in which they are empowered to play an active role in decision-making.

Water governance relates to beliefs of how societies should be organised, and how and by whom decisions should be made and implemented to govern water resources[8] (Armitage et al., 2012; Graham et al., 2003). Governance is a more inclusive and participatory, multi-level process involving multiple actors and a diverse range of state and non-state resources and instruments (Bressers and Kuks, 2004; de Boer et al., 2016). Kooiman (1993) posits that governance is based on the premise that no single private or public actor possesses all the necessary knowledge/information, power, or resources to effectively solve complex environmental, economic, and societal problems independently. Through governance approaches, higher levels of governments share various responsibilities for effectively and sustainably governing, managing, and maintaining resources and facilties with local governments, organisations, and citizens (Brandes, and Curran, 2017; Fish et al., 2010; Rosenbloom and Gong, 2013).

2.3.1 Collaborative governance (CG)

CG is a form of shared governance, with especial focus on equity and meaningful inclusion, that began to gain global popularity in the 1990s as a highly effective public administration tool for addressing various environmental and societal issues that could not be resolved by any one actor on their own (Ananda and Proctor, 2013; Brisbois et de Loë, 2016; Emerson et al., 2012; Duan et al., 2020; Robertson and Choi, 2012; Rosenbloom and Gong, 2013; Roth and de Loë, 2017; Ryan and Bidwell, 2007). Through CG, a diverse group of actors from public agencies,

[8] Water governance precedes water resources management and the latter relates to the management, treatment, protection, and provision of water resources by the responsible parties.

different levels of government, and private and civil sectors engage meaningfully in an interactive, deliberative, inclusive decision-making process. CG can be defined as a formal, long-term "… process of negotiation that depends on highly context-specific stakeholder interests and perspectives" (Douglas et al., 2020, p. 497; Lahat and Sher-Hadar, 2020;). CG is an inter-personal approach and, therefore, focuses on the attitudes, behaviours, and relationships between actors (Douglas et al., 2020). As described by Ansell and Gash (2008), Brisbois et de Loë (2016), and Brown et al. (2016), it can be identified by the following:

- Forum initiation generally conducted by institutions or public agencies to manage public policies.
- Broad inclusion and equitable participation of state and non-state actors and delegations from other interest groups in decision-making.
- Formal deliberations with face-to-face interactions being encouraged where possible.
- Knowledge and resource pooling.
- Consensus-based decision-making.

The most fundamental premise of CG is collectively achieving actions that participants would be unable to attain independently (Emerson et al., 2012; Fish et al., 2010; Huxham, 2003; Agranoff and McGuire, 2003). Collaborative actions are tools used to ensure and measure the success of collaboration and often occur gradually. Based on works by Ananda and Proctor (2013), Ansell and Gash (2008), Brown et al. (2016), CCME (2004), Connick and Innes (2003), Cook (2014), de Boer et al. (2016), Emerson et al. (2012), Fish et al. (2010), Fliervoet et al. (2016), Gibson (2014), Gray (1985), and Rosenbloom and Gong (2013), these include: decreased pressure on governments through sharing/assigning responsibilities to other actors; improved civic engagement and democracy through diverse stakeholder representation; increased legitimacy; greater government accountability for designated roles; production of more effective, long-term solutions for complex problems; increased capitals (financial, political, knowledge, resources) through pooling; and shared learning and generation of new ideas and technological advancements. Some common factors that challenge or hinder the success of collaboration, include pre-history of conflict; ineffective/non-facilitative leadership; stakeholder exclusion; knowledge, power, and resource imbalances; low levels of commitment; lack of mutual understanding; overlap of responsibilities due to poor assignment of duties across the group of actors; lack of consensus; lack of progress/stagnancy or slow progress; availability of other avenues to address issues; and/or lack of legitimacy, transparency, and accountability (Ananda and Proctor, 2013; Ansell and Gash, 2008; Brown et al., 2016; CCME, 2004; Connick and Innes, 2003; Cook, 2014; de Boer et al., 2016; Emerson et al., 2012; Fish et al., 2010; Fliervoet et al., 2016; Gibson, 2014; Gray, 1985; Rosenbloom and Gong, 2013).

When considering the inter-personal nature of CG, the varying values, goals, and interests of the actors involved, coupled with the diversity of tools and resources, such as knowledge forms, experience, power, and other resources, CG approaches require effective and efficient communication which, in turn, is required for effective and efficient coordination to achieve collaborative goals (Ansell and Gash, 2008; Emerson et al., 2012; Kapucu, 2005; Kleinbaum et al., 2008; Vodden and Minnes, 2014). “Communication is at the heart of collaboration” (Ansell and Gash, 2008, p. 558) and is defined as the process through which information is shared within and across organisations, while coordination relates to the deliberate aligning or adjusting of actions in an orderly manner through organized communication that ensures that shared goals are achieved (Gulati et al., 2012; Kapucu, 2005; van de Ven et al., 1976).

2.3.1.1 Collaborative governance framework

For this research, CG frameworks popularised by Ansell and Gash (2008) and Emerson et al. (2012) were merged to produce the framework depicted in Figure 1 which highlights the interconnectedness of the CG stages and the essence of actor dynamics and engagements. This framework will be briefly revisited in Chapter Four: Methodology.

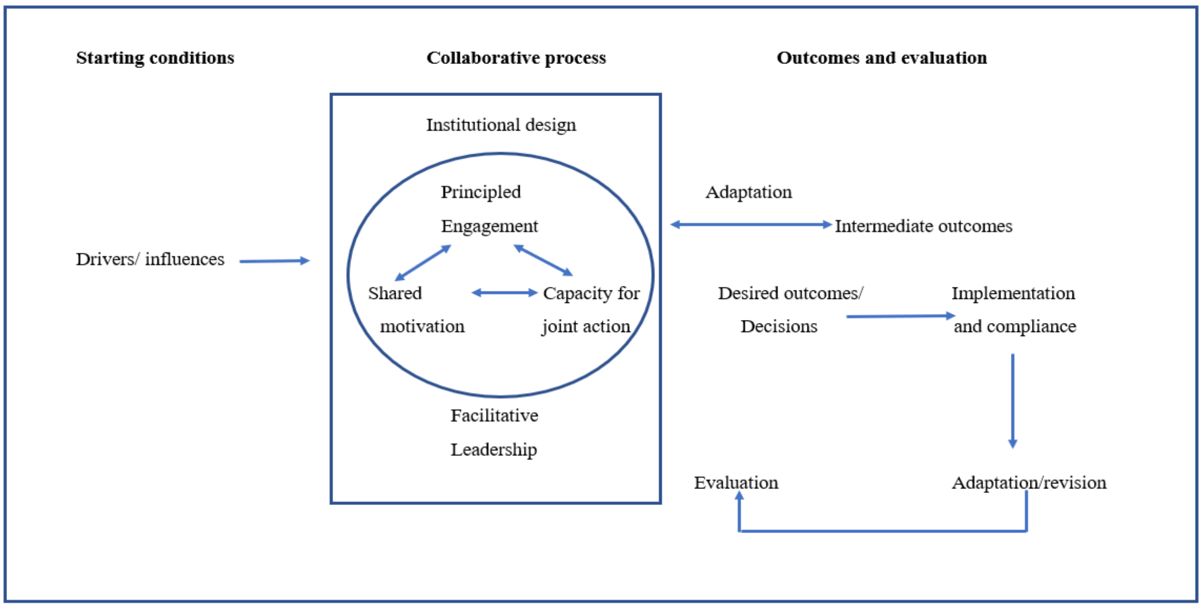

Figure 1: Collaborative governance framework

Note. Adapted from Ansell and Gash (2008) and Emerson et al. (2012)

2.3.1.1.1 Starting conditions: drivers/influences

Drivers are typically present at the outset of a collaborative process and can either facilitate or hinder collaboration. Emerson et al. (2012) propose that a minimum of one driver is required to initiate collaboration, although the more drivers present the greater the likelihood of collaboration. Some of the most common drivers include power-knowledge-resource asymmetries, emerging environmental threats or crises, financial and other incentives, changing legal mandates, prehistory of conflict/cooperation, leadership, and uncertainties (Ansell and

Gash, 2008; Bingham, 2009; Bryson et al., 2006; Emerson et al., 2012; Fish et al., 2010; Gray, 1985; Selin and Chavez, 1995; Thomson and Perry, 2006).

Power-knowledge-resource asymmetries/imbalances

Many governments have realised that improved public administration can be achieved at a lower cost by utilising the expertise, financial and human capacities, flexibilities, and creativities of non-governmental organisations (NGOs) and other stakeholders, instead of attempting to duplicate these qualities themselves (Brisbois and de Loë, 2016; Rosenbloom and Gong, 2013). This reiterates the premise that no single actor or group possesses all the required knowledge, power, or resources to successfully address a multi-faceted problem independently (and, indeed, all actors/groups hold more or less of each than others). Financial resource imbalances are most common in CG (Molenveld et al., 2021). Emerson (1962) and van Slyke (2007) describe a relationship between resource imbalances, such as financial resources and preferred knowledge, and power imbalances, i.e., the more resources an actor/group has, the more power they possess to influence decision-making in their favour. To ensure equitable participation and contributions from all groups, while preventing monopolies, actors, thus, engage with each other to complement their deficiencies or to build capacity (Brisbois and de Loë, 2016; Emerson et al., 2012; Fish et al., 2010; Gibson, 2014; Gray, 1985; Huxham, 2003; Agranoff and McGuire, 2003; Roth and de Loë, 2017; van Tol Smit et al., 2015).

Prehistory of cooperation or conflict

If actors have a history of working well and successfully together, they may have a greater sense of inter-connectedness and mutual trust, thereby facilitating collaboration (de Boer et al., 2016; Kim, 2016;). However, if there is a history of tension or conflict and mistrust, actors may be reluctant to engage in collaboration again (Reilly, 1998). Conversely, Weber (2003) argues that prolonged conflict can also act as an incentive as mounting frustrations may push actors/groups to regard collaboration as the only way to tackle the issue at hand.

Incentives for and constraints on participation

Incentives can be described as policy tools that facilitate collaboration (Ansell and Gash, 2008; de Vries and Hanley, 2016). There are various types of incentives that can be used to drive collaboration. Consequential incentives can be either internal, e.g., the existence of problems, interests, opportunities, resource needs, or they can be external, such as threats, crises, and opportunities for collaboration to resolve complex problems that were unsuccessfully addressed through traditional avenues (Emerson et al., 2012). Government incentives include regulations and enforcement actions, and these facilitate collaboration by pushing private and civil sectors to make meaningful changes (Holley et al., 2012). However, not all consequential incentives are negative, e.g., funding opportunities that may lead to collaboration. Regardless of whether incentives have negative or positive impacts, they are necessary as they facilitate leadership and collaboration (Emerson et al., 2012).

As previously mentioned, power-knowledge-resource asymmetries often propel collaboration. Some groups who lack the necessary resources may find the transaction costs of collaboration (e.g., time spent and other resources) significant and may be deterred from meaningful participation, thereby hindering collaboration (Ansell and Gash, 2008; Gibson, 2014; Lukasiewicz and Baldwin, 2014). There are also instances where certain groups are not invited to the table because their views are regarded as weak or illegitimate (Johnston et al., 2011).

Uncertainties

When uncertainties, or "the perceived lack of knowledge" (Abbott, 2005), are unable to be resolved internally, actors turn to collaboration to reduce, share, or diffuse the associated risks (Emerson et al., 2012; Roth and de Loë, 2017). Individuals/groups often experience uncertainty regarding the extent to which traditional problem-solving processes can produce the desired result, and when uncertainty about how to address a problem is mutual amongst actors, interdependence—a critical component of successful collaboration—is fostered (Emerson et al., 2012).

2.3.1.1.2 Collaborative process

The collaborative process describes the stages that occur as actors make efforts to work together to address a common issue and find a mutually agreeable/suitable solution. It is characterized by the collaborative dynamics—principled engagement, shared motivation, and capacity for joint action—which are facilitated by the institutional design and facilitative leadership (Ansell and Gash, 2008; Emerson et al., 2012).

Institutional design

Ansell and Gash (2008) define institutional design as "… the basic protocols and ground rules…" (p.13) that are necessary for legitimising collaboration and managing recurring interactions over extended periods of time to ensure that they remain positive (Emerson et al., 2012; Siddiki et al., 2017). Clear ground rules and process transparency help build the actors' confidence in the genuineness and legitimacy of collaborative negotiations by preventing "backroom deals" that typically benefit a select group, while ensuring that all actors have access to all relevant/pertinent information, including rationales for decisions made (Ansell and Gash, 2008; Lukasiewicz and Baldwin, 2014; Subatin and Pramusinto, 2019). To ensure that ground rules are established and adhered to and to increase transparency throughout collaboration, the framework highlights the need for facilitative leadership, participatory inclusiveness, and forum exclusiveness.

In CG, actors are often referred to as partners, collaborators, or parties and may include clients, constituencies/local governments, decision-makers, public agencies, NGOs, businesses/corporations, communities, and the public (Emerson et al., 2012; Gibson, 2014). Gray (1985) posits that stakeholders who are typically entitled to participate (and, thus, become "actors") are those who are affected by the other actors'[9] actions. The success of collaboration is, therefore, dependent on actors accepting each other's rights to participate. CG encourages the representation and participation of a diverse range of actors in the policy process by engaging relevant groups and individuals early on, particularly in defining the problem and exploring potential solutions (Ansell and Gash, 2008; Brown et al., 2016; Carboni et al., 2017; Emerson and Nabatchi, 2015; Roth and de Loë, 2017). This results in greater public satisfaction, more effective implementation, increased compliance and trust, and building capacity for the future (Carboni et al., 2017; CCME, 2004; Lahat and Sher-Hadar, 2020; Plummer et al., 2017; Ryan and Bidwell, 2007). A diverse group of actors means a greater, more comprehensive understanding of the issue at hand; resources, costs, risks, and benefits are more equitably allocated; all actors gain access to a more diverse pool of knowledge, resources, and expertise;

[9] For the purposes of this study, the term "actor" is used to refer to both actors who are directly involved in decision-making and stakeholders who may not be directly involved in decision-making but are impacted by the resulting policies/decisions and should, therefore be represented in the group of actors.

and legitimacy increases (Armitage et al., 2012; Beierle and Crayford, 2002; Emerson et al., 2012; Gray, 1985; Roth and de Loë, 2017).

For collaboration to be successful, it must also be the only forum/avenue that exists to address the issue at hand. Forum exclusiveness motivates and convinces actors of the need to collaborate (Ansell and Gash, 2008). If certain groups are excluded, they may establish their own forum to address the same issue, and if multiple forums exist, actors may decide to join the forums that are better aligned with their views and goals, thus threatening the effectiveness of collaboration (Ansell and Gash, 2008; Subatin and Pramusinto, 2019).

Facilitative leadership

Actors/groups typically identify leaders who are responsible for "… spearhead[ing] the initiative and build[ing] necessary linkages to other relevant actors" (Gibson, 2014, p. 57). Facilitative leadership—which focuses on uniting and engaging actors throughout collaboration—is essential for the establishment and implementation of clear ground rules, trust building, dialogue facilitation, conflict resolution, consensus building, public advocacy, and exploring mutual benefits (Ansell and Gash, 2008; Emerson et al., 2012; Siddiki et al., 2017). To ensure successful collaboration, leaders must be committed to solving the problem and exercising impartiality for preferred strategies, while bearing the high transaction costs of collaboration by securing staff, technologies, and other necessary resources (Bryson et al., 2006; Emerson et al., 2012; Schneider et al., 2003).

2.3.1.1.2a Collaborative dynamics

Collaborative dynamics—principled engagement, shared motivation, and capacity for joint action—relate to how actors interact and work together. These elements work interactively and iteratively to produce collaborative actions (Emerson et al., 2012).

Principled engagement

Principled engagement (PE) is characterised by open, inclusive, fair, and civil dialogue, balanced representation of all relevant actors, and a welcoming environment for sharing knowledge (Ansell and Gash, 2008; Carlson, 2007; Henton et al., 2005; Innes and Booher, 1999; Leach, 2006; O'Leary et al., 2006; Susskind et al., 1999). Actors are, therefore, encouraged to meet regularly, and face-to-face meetings are generally preferred as they enable knowledge to be shared more easily to increase the actors' understanding of the problem, while ensuring that they develop and foster positive relationships (Ansell and Gash, 2008; Emerson et al., 2012). However, face-to-face interactions are not always possible, and COVID-19 has provided additional barriers to actors meeting in person. PE occurs gradually and iteratively with the involvement of different participants at various stages of collaboration. The four main components of PE are: discovery, definition, deliberation, and determination (Emerson et al., 2012; Kossman et al., 2016).

Discovery occurs when actors reveal their individual and shared interests, concerns, and values/beliefs, and they identify and analyse relevant, significant information about the problem at hand (Emerson et al., 2012). All views, beliefs, and solutions expressed must be welcomed, even if they would, otherwise, be disregarded as irrelevant (Fish et al., 2010).

Dialogue continues through the definition stage whereby actors make continuous efforts to build a shared understanding of the problem and establish common goals and objectives, agreeing on collaborative language to be used when describing or discussing the problem or opportunities, clarifying and refining respective duties and expectations, and determining shared criteria for assessing information (Bentrup, 2001; Emerson et al., 2012; Fish et al., 2010).

Deliberation, also referred to as “candid/reasoned communication,” is when actors carefully examine the issue at hand, advocate for their individual/respective organisations’ interests, listen sincerely to each other’s views, explore effective conflict resolution strategies, and collectively agree on a common goal (Emerson et al., 2012). Actors must be willing to engage in uncomfortable dialogues in which they ask and answer “hard” questions, thus, leaders must facilitate a safe space for dialogue and be prepared to resolve conflict effectively (Emerson et al., 2012). By deliberating, participants can better understand what other actors consider important and why (Robertson and Choi, 2012). Through effective deliberation, actors widen the pool of relevant information and engage in meaningful discussions to achieve consensus-based decisions that are generally reflective of the full range of actor concerns and interests (Choi and Robertson, 2014).

Finally, determinations are tangible, measurable improvements that occur as collaboration progresses. Dukes (2004) notes that more substantial and better-quality determinations can be the outcomes of CG. According to Agranoff and McGuire (2003), Bryson et al. (2006), Emerson et al. (2009), Emerson et al. (2012), Fung, (2015), Leach and Sabatier (2005), determinations may include: greater clarity on important issues; agreement on action items or final recommendations; assigning duties/work groups; effective conflict resolution; improved mutual trust and respect; increased capacities (social, operational/resources, and problem solving) and incorporation of all relevant knowledge forms; and/or improved legitimacy within and outside the realm of collaboration.

Capacity for joint action

"Capacity for joint action" relates to the pooling and redistribution of resources, thereby enabling collaboration amongst actors and the creation of potential for collective actions that did not previously exist (Emerson et al., 2012; Kossman et al., 2016). For collaboration to be successful, this capacity must be nurtured for as long as the shared goal/purpose of collaboration exists (Emerson et al., 2012). The four core elements of capacity for joint action are: procedural and institutional arrangements, leadership (discussed earlier), and shared resources, including knowledge and power (Emerson et al., 2012; Kossman et al., 2016).

Procedural and institutional arrangements—established both individually and collectively within the group of co-collaborators—often include ground rules and operating protocols, decision rules, charters, by-laws, and regulations (Emerson et al., 2012). Procedural fairness relates to the transparency, fairness, and democracy of decision-making. Fair processes are consistent, neutral/unbiased, ethical, and founded on accurate information, representative of all actors, and offer opportunities for feedback and reviews (Leventhal, 1980; Siddiki et al., 2017). Procedural justice can influence actors' attitudes and experiences throughout the process because, if actors perceive potential procedural injustices, they may be reluctant to engage further in collaboration, thereby affecting coordination and the achievement of positive collaborative outcomes (Lubell and Lippert, 2011; Rubin, 2007).

One of the main tenets of CG is that participants can pool, leverage, and redistribute their resources as needed to ensure that the shared goals of collaboration are realised (Emerson et al., 2012; Gray, 1985). Critical resources that increase the capacity for joint action amongst actors include funding, time, technical and logistical support, administrative and organisational assistance, labour, knowledge (including requisite skills for analysis or implementation and essential expertise), and power (Emerson et al., 2012; Gray, 1985; Lubell et al., 2009).

Knowledge, sometimes referred to as "the currency of collaboration", is a resource that can be shared or generated collectively (Emerson et al., 2012). Yang (2018) notes that there are 3 main types of knowledge that are widely considered in CG literature: (i) natural science; (ii) social science; and (iii) local knowledge, e.g., Indigenous, traditional, community, experiential. Scientific knowledge (from natural science) is more formal, explicit, and structured and is typically acquired through academic instruction or professional experience (van Tol Smith et al., 2015). Social science relates to observations and understandings of human behaviour in the environments and social systems through which it is expressed (PRIA International Academy, 2013). Local knowledge—unlike scientific/technical knowledge—is more informal, relates to personal knowledge of a phenomenon, and is context-specific, experiential, and implicit in nature (van Tol Smith et al., 2015).

According to Armitage et al. (2012), throughout the 20th century, technical and scientific knowledge (natural science) was regarded as the authority in environmental decision-making. However, on its own, it is insufficient, and recent years have seen a shift in this paradigm (Roth and de Loë, 2017; van Tol Smit et el., 2015). Public education levels have increased, and knowledge is becoming increasingly democratized (Armitage et al., 2012). Citizens have been rejecting or challenging scientific knowledge-based decisions produced through top-down approaches which fail to consider local level actors (van Tol Smit et al., 2015). This has resulted in more concerted efforts to incorporate local knowledge in decision-making processes and natural resources management. The incorporation of diverse knowledge forms enables actors to co-generate more context-specific information and produce a wider range of possible solutions (van Tol Smit et al., 2015).

Power relates to the ability of an individual/group to control or influence others' behaviours, attitudes, or decisions (Brisbois et de Loë, 2016; Ran and Qi, 2019). Dispersing power amongst multiple actors, as opposed to maintaining a concentration of power amongst a select group of actors, greatly facilitates collaboration by ensuring that all actors are able to influence setting the direction of the decision-making process (Gray, 1985; Robertson and Choi, 2012). Gray (1985) notes that power does not need to be distributed evenly as this may lead to stalemate and inaction, but when power is dispersed, each actor gains some functional control over decision-making. However, power dispersal is often unpopular, especially amongst those actors who lose or share it, but without it, power imbalances result and often lead to conflict and diminished levels of trust, thereby hindering collaboration (Gray, 1985; Ran and Qi, 2019;).

Shared motivation

As stated earlier, actors come from a diverse range of backgrounds and affiliations, thus, they have different motives and goals for collaborative processes (Brisbois et de Loë, 2016). Governments, for example, may initiate collaboration to address their own needs or to divert attention from their lack of capacity to resolve complex issues or problems that have significant uncertainties; private sector firms may seek involvement to ensure that their social licenses of operation are maintained; environmental non-governmental organisations (ENGOs) may participate to push their sustainability agendas; and citizens may seek to address local problems that affect them directly (Brisbois and de Loë, 2016; Roth and de Loë, 2017).

"Shared motivation" is a cyclical concept that relates to the interpersonal and relational aspects of collaboration. It enables consensus to be reached which, although not always possible or required, increases the likelihood of successful implementation of the resulting policies (Kossman et al., 2016). Shared motivation can be initiated by PE, thus making it an intermediate outcome of collaboration, and once it has been initiated, it can, in turn, accelerate the process of PE (Huxham and Vangen (2005). Four core elements of shared motivation are: mutual trust, mutual understanding, shared commitment, and internal legitimacy (Colman, 1988; Emerson et al., 2012; Kossman et al., 2016; Putnam, 2000;).

Fisher and Brown (1989) state that shared motivation begins with the development of trust, which is built gradually as actors learn to understand each other and prove their credibility and dependability to their collaborative partners. Hosmer (1995) and Luhman (2000) define trust as an individual/group's willingness to surrender control over the outcomes and to embrace vulnerability to risks from others' actions, such as breaches of confidentiality, opportunistic acts, and failure to fulfill obligations. Participants in CG can build mutual trust by engaging in frequent interactions and open, honest dialogues, and actively seeking to gain a better understanding and appreciation of each other's views, beliefs, and interests (van Oortmerssen et al., 2014). Additionally, by establishing serious commitments to the process and exhibiting enough flexibility to compromise on their individual and/or groups' needs and interests when needed, actors can demonstrate their trustworthiness (Waardenburg et al., 2020). Huxham (2003) notes that, because actors do not have the privilege of selecting whom they work with, suspicions can sometimes be high at the outset. The level of trust amongst actors can significantly impact how committed they are to collaboration, their confidence in each other's competencies, and their belief in the potential for positive outcomes to be achieved (Ansell and Gash, 2007; Siddiki et al., 2017; Waardenburg et al., 2020). Increased trust can stimulate learning, knowledge development and sharing and innovation, and facilitate, safe spaces for open, honest dialogues which, in turn, foster trust (Emerson et al., 2012; Ran and Qi, 2019; Siddiki et al., 2017; van Oortmerssen et al., 2014). When the actors involved trust each other, they do not feel the need to control one another's behaviours, and they can share relevant information freely to aid decision-making without fear of negative consequences (van Oortmerssen et al., 2014).

People interpret the world, their surroundings, and new information differently based on their existing beliefs (Ajzen, 1991; Siddiki et al., 2017). According to Emerson et al. (2012), mutual understanding is the ability of actors to understand and respect one another's beliefs and interests even when they disagree. Roberts (2002) states that this is achieved when all actors are treated equally, listen to each other's concerns or opinions emphatically, and analyse their own assumptions and views. Inter-dependence, a necessary pre-condition for collaboration and a core component of mutual understanding, develops as actors come to realise that they cannot achieve a goal independently and that collaborative goals are impacted by their individual (and collective) actions (Emerson et al., 2012; Gray, 1989; Robertson and Choi, 2012). Actors then begin to define their needs and interests based on their inter-dependencies, as opposed to their individual organisations' interests. This makes it easier for them to make compromises or to forego their individual or organisations' interests for the benefit of the collaborative goal(s) (Gray, 1985; Fish et al., 2010; Medema et al., 2017).

Shared commitment relates to an individual's/group's beliefs regarding the likelihood of achieving mutual long-term goals and their willingness to continue the course despite challenges or weak evidence of progress (Fish et al., 2010; Plummer et al., 2017). By clearly defining roles and responsibilities, all actors gain a better understanding of what is expected of them, thereby increasing their levels of commitment to the process of attaining positive collaborative outcomes (Armitage et al., 2012). Additionally, when actors acknowledge and celebrate small wins/victories/intermediate outcomes along the way, commitment levels are further strengthened (Ran and Qi, 2019).

The final key element of shared motivation is internal legitimacy and accountability. Some studies indicate that achieving accountability is easier to achieve in hierarchical/top-down governance approaches in which non-governmental agencies and local authorities may be given policies to manage and responsibilities to implement but these policies and measures are, ultimately, decided upon by higher levels of government (Armitage et al., 2012; Fliervoet et al., 2016). Watson et al. (2009) state that this reduces accountability because central governments can deflect the blame and responsibility when processes fail. Internal legitimacy occurs when CG participants establish their trustworthiness and credibility by justifying their actions, beliefs and duties to each other, and begin to regard their interdependence and collective actions or decisions as correct, relevant, desirable, and based on social constructs of norms, values, beliefs, and definitions (Emerson et al., 2012; Gibson, 2014). The legitimacy of collaboration is increased by involving a diverse range of actors, especially the public, in decision-making and it is decreased/challenged when/if key actors are absent, whether voluntarily or involuntarily (Cohen, 2006; Fung, 2015; Gibson, 2014). The determination of legitimacy and accountability is often done, particularly in more top-down arrangements, through legislation and regulations such as environmental protection acts, and through formal agency mandates. However, accountability can also arise from "… moral positions of non-formal relationships of trust… between managers and resource users" (Armitage et al., 2012, p. 252). Accountability, whether formal or non-formal can be identified by increased clarity regarding roles and responsibilities, performance-related consequences, sensitivity towards other actors, checks and balances to ensure transparency, and open communication and information sharing (Armitage et al., 2012; Waardenburg et al., 2020). Waardenburg et al. (2020) also note that actors remain accountable to each other through evaluations of their respective organisations, their peers, and the overall collaborative process.

2.3.1.1.3 Implementation and collaborative outcomes

The premise of CG is to achieve goals that actors could not have achieved independently (Emerson et al., 2012). Collaborative outcomes are "… the results and effects of governance and management" (Plummer et al., 2017, p.3). Examples of collaborative outcomes include securing endorsements, educational opportunities, and policy implementation (Emerson et al., 21012). Collaborative outcomes, as they relate to water governance in Burgeo, will be discussed in greater detail in Chapter Five.

2.3.1.1.4 Evaluation and adaptation

Adaptation is often required at various stages of collaboration due to changes, such as modifications to mandates, new knowledge, or the introduction of new actors. Through evaluating CG efforts, actors can produce key information to determine if the problem has been successfully addressed and whether collaboration is more effective than other traditional problem-solving regimes (Robinson et al., 2020). However, evaluating the outcomes of CG may be challenging as outcomes often occur over extended periods of time (Robinson et al., 2020). Additionally, due to the diverse backgrounds of the individuals and groups involved, success is highly subjective (Kim, 2016). Thus, actors are encouraged to participate in surveys, focus groups, and key informant interviews to examine measures such as the levels of satisfaction with the process(es), the state of actor relationships, and whether actors perceive improvements to the conditions being addressed (Robinson et al., 2020).

2.3.2 Collaborative water governance (CWG)

Governance—and particularly CG—approaches are increasingly favoured when addressing water problems due to changes in governmental roles, globalisation, technological advances, and increases in the risks and complexities of water resources (Lahat and Sher-Hadar, 2020). Water resources are spread across both public and private lands, and they benefit private, public, and civic sectors, thus, representation from all relevant actors is encouraged for more effective and equitable resolutions (Robinson et al., 2020). Collaborative water governance (CWG) is built upon the formal principles of CG and has gained popularity as a tool for governing and managing water resources effectively (NRTEE, 2011; Rojas et al., 2020). CWG highlights the importance of communication and coordination by encouraging actors at all levels to share responsibilities and resources, and to make meaningful contributions to decisions regarding how water resources should be governed (Rojas et al., 2020).

2.4 Water governance in Canada

Canada's *Constitution Act* of 1867 established the division of powers between the various levels of government, namely federal, and provincial and territorial. Due to the complex nature of the environment and natural resources, these levels of government are involved—directly or indirectly—in natural resources management, land use planning, environmental protection, and public health (Bereskie et al., 2017a; CCME, 2004; Dawe, 2013; Minnes and Vodden, 2017; Mitchell, 2017; NRTEE, 2010). Further responsibilities are then passed on to governments at the local or community scale, such as municipalities and Indigenous governments. Canada has one of the most decentralised water governance structures globally in which each order of government has its unique set of roles and responsibilities to ensure that water resources are efficiently managed (Hanrahan, 2017). However, this allocation of responsibilities across all levels of government, agencies, and actors (referred to as fragmentation) results in poor coordination and/or gaps in responsibilities and authority in water governance processes across the nation (Bakker and Cook, 2011; Hill et al., 2008; Morris et al., 2007; NRTEE, 2010). (See Appendix A for water resources management responsibilities for these tiers of government).

2.4.1 The federal government's role in water governance

The federal government (FG) is committed to ensuring clean, safe drinking water for all Canadians, and governing waters related to "… fisheries, navigation, federal lands, and international relations… boundary waters shared with the United States" (Environment and Climate Change Canada, 2020). These responsibilities are outlined in several federal laws and Acts, such as *Canada Water Act* (1970); *Federal Water Policy* (1987); *Fisheries Act* (1985); *International Boundary Waters Treaty Act* (1909); *International River Improvements Act* (1985); *Navigable Waters Protection Act* (1985); *Canadian Environmental Protection Act* (1999), and the *Safe Drinking Water for First Nations Act* (2013) (Environment and Climate Change Canada, 2020; Latchmore, 2018; NRTEE, 2010).

The *Federal Water Policy* (FWP) is an important water governance tool. It was created and implemented in 1987 out of recognition that public input should be sought and incorporated in all aspects of water management decisions due to the broader social, economic, and environmental implications associated with water resources (Environment and Climate Change Canada, 1987). Works by Environment and Climate Change Canada (1987), Environment and Climate Change Canada (2020), Health Canada (2012), and Mitchell (2017) indicate that, through the FWP and under the leadership of the Minister of the Environment—the national leader for water management in Canada—the FG is committed to the following:

- Clarifying its responsibilities, goals and actions for efficient facilitation and equitable development and usage of water resources.
- Encouraging collaboration with all relevant actors in the development of water policies.
- Establishing GCDWQs and ensuring that international, federal jurisdiction, and inter-provincial water quality guidelines are met.
- Advocating to ensure that water services and resources are priced suitably and providing financial assistance for water resource projects that meet federal and provincial development priorities.
- Providing research and development, expertise, and technological support to provincial and territorial governments to enhance water quality management.
- Ensuring public access to environmental reporting systems and promoting public awareness and understanding of critical issues regarding drinking water safety; and
- Encouraging sustainable and equitable freshwater usage with consideration of the social, environmental, and economic needs of present and future generations.

Since the 1990s, the FG has successively withdrawn from frontline participation in water governance, including policy development and implementation (Mitchell, 2017; Renzetti and Dupont, 2017). This has been attributed to its lack of capacity to be the sole decision-maker for water resources (Brandes and Curran, 2017). Although the FG remains active within its constitutionally mandated areas, its role in overall water governance has often been described as discreet and/or unclear. This has led provincial and territorial governments to try to govern their water resources with less input from the FG (NRTEE, 2010; Renzetti and Dupont, 2017). However, the FG does remain responsible for water governance on Indigenous lands.

2.4.1a Indigenous water governance in Canada

As discussed earlier, the FG is responsible for water on reserves. However, recent years have seen calls for greater engagement and collaboration with Indigenous communities and their leaders to ensure efficient and effective governance and management of their water resources that reflects their culture, traditions, values, and beliefs (Bradford et al., 2017). The responsibility for drinking water in First Nations communities is based on location: (i) reserves south of the 60th parallel; (ii) reserves in BC; and (iii) reserves in territories. For reserves south of the 60th parallel (i.e., in British Columbia, Alberta, Saskatchewan, and Manitoba), the FG and First Nations communities are responsible. First Nations are considered owner and operator of water infrastructure in their communities thus, chiefs and councils manage daily water systems operations and maintenance, including water quality sampling and testing, issuing DWAs on the advice of environmental health officers (EHOs), and making infrastructural improvements based on community needs (Indigenous Services Canada, 2021; Office of the Auditor General of Canada, 2021). Within the FG sphere, Indigenous Services Canada provides funding for water-related infrastructure, water systems operation and maintenance, operator training and certification, and providing communities with public health advice to address drinking water quality concerns (Indigenous Services Canada, 2021; Office of the Auditor General of Canada, 2021). For First Nations communities in BC, the First Nations Health Authority is responsible for providing independent public health advice and support, including funding and technical support for drinking water quality monitoring, to First Nations (Indigenous Services Canada, 2021). Water quality in Northern Canada—in some of the Northwest Territories as well as in

Nunavut—is also protected by Crown-Indigenous Relations and Northern Affairs Canada in collaboration with Indigenous Services Canada, First Nations, Inuit, Métis, and Northerners (Crown-Indigenous Relations and Northern Affairs Canada, 2022; Indigenous Services Canada, 2021). The Government of the Northwest Territories is responsible for water governance in the rest of the Northwest Territories, while the Government of Yukon is responsible for its water resources (Indigenous Services Canada, 2021). Other FG agencies that are responsible for water governance and safety in Indigenous communities across Canada include the following: Health Canada (development of GCDWQ), Aboriginal Affairs and Northern Development, and Environment Canada (Latchmore, 2018).

Self-governing Indigenous nations in Canada have experienced a disproportionate number of long-term DWAs over the years. In October 2022, 29 Indigenous communities across Canada were affected by 34 long-term DWAs (Indigenous Services Canada, 2022). With increased pressure and demands for environmental justice for these communities, Indigenous governments have been increasingly involved in environmental resources management—including water resources. In 2013, the *Safe Drinking Water for First Nations Act* was established to facilitate meaningful collaboration between the FG and First Nations communities in the development of effective regulations to ensure better access to safer, cleaner drinking water (Brandes, and Curran, 2017; Latchmore, 2018). Furthermore, in 2021, an Agreement in Principle with Tataskweyak Cree Nation, MB (DWA since 2017), Curve Lake First Nation, ON, and Neskantaga First Nation, ON (DWA since 1995) was announced by the federal Indigenous Services minister (Carolino, 2021; Indigenous Services Canada, 2022). According to Michael Rosenburg this agreement "… recognises a basic human right to clean drinking water, compensates those who were wrongly deprived of it, and gives First Nations confidence that the future will not resemble the past" (as cited by Carolino, 2021). Indigenous Services Canada is working to gradually transfer services—including water services—to First Nations-led organisations who will then be responsible for developing, providing, assessing, and improving clean water services within their communities (Indigenous Services Canada, 2022). Improved access to clean, safe drinking water in First Nations communities has already been observed with 136 long-term DWAs that were in effect since 2015 having been lifted as of October 2022- a collaborative effort between the FG and First Nations to end all DWAs (Indigenous Services Canada, 2022). In just one example, Shoal Lake First Nation No.40 (Manitoba and Ontario) lifting a long-term DWA in 2021 that had been in effect since 1997 (24 years) (City of Winnipeg, 2022).

2.4.2 The role of provincial and territorial governments in water governance

Although the federal, provincial, and territorial levels of government collaborate to ensure qualitative and quantitative water security for all Canadians, under the *Constitution Act* (1867), provinces and territories are allocated ownership of natural resources, including surface and groundwater. This means that they bear the responsibility of managing and regulating drinking water systems, including establishing jurisdiction-specific quality standards, overseeing source waters, treatment facilities and distribution systems, and managing routine and daily water operations (CCME, 2004; Environment and Climate Change Canada, 1987; Environment and Climate Change Canada, 2020; F-P-T CDW, 2001; Health Canada, 2009).

Although water governance is a shared responsibility between various government ministries and departments at the provincial or territorial level, one ministry or department is typically identified as the lead, and in most Canadian provinces, this is the Department/Ministry of Environment (Environment and Climate Change Canada, 2017; Health Canada, 2009). Other government agencies that are also responsible for water governance processes include Natural Resources, Health Services, Public Works/Municipal Affairs, and Agriculture (CCME, 2004, Climate Change Canada, 2017).

2.4.3 The role of municipalities in water governance

Municipalities/local governments have been described as the foundation of local democracy and are responsible for matters directly related to their communities (Bulmer, 2017). The municipal level is where citizens can most easily contact elected representatives, thereby allowing them (citizens) to participate in governing their own communities. This is especially important because locals have a better knowledge of their own needs (Municipal and Provincial Affairs NL, 2021). Municipal councillors are elected to ensure a balance in decision-making processes, effective communication, as well as maintaining and nurturing relationships with other levels of government (Municipal and Provincial Affairs NL, 2021). Although municipalities are not considered a separate order of government under the Canadian Constitution (1867), they receive their authority to issue by-laws from the provincial or territorial governments through legislatures, such as the *Municipalities Act*, 1999 in NL (Bereskie et al., 2017a; CCME, 2004; Hrudey, 2011; Mitchell, 2017; Municipal and Provincial Affairs NL, 2021).

Since the Walkerton incident, Canadian municipalities have been scrutinised more sternly to ensure that they remain accountable for the provision of safe drinking water in their communities (Hrudey, 2011). Municipalities are principally responsible for operating and maintaining water treatment and distribution facilities and ensuring that drinking water quality standards are met (CCME, 2004; Health Canada, 2009). Municipalities have a legal and moral duty to provide consumers with "… potable water which does not pose a threat to public health and is satisfactory in its physical, chemical and aesthetic characteristics" (CCME, 2004, p. 29).

This chapter provided an overview of global water security and focused on water security in Canada in greater detail by highlighting the governance structure and the roles of the various levels of government. Qualitative and quantitative aspects of water security in Canada were also addressed, and some attention was given to the importance of operator training in ensuring that water systems are operated and maintained well, as well as financial considerations for providing water in Canada. The next chapter looks at challenges to water security in NL, the roles of the various departments involved in providing water throughout the province, as well as provincial water quality standards.

Chapter three

Water governance in Newfoundland and Labrador

3.1 The role of the Government of Newfoundland and Labrador in water governance.

Chapter two highlighted that, although drinking water safety and provision is a shared responsibility between the federal and provincial/territorial governments, the latter have jurisdiction over their water resources and are, therefore, primarily responsible. In NL, the PG oversees PDWSs, while daily operation and maintenance of these systems is the responsibility of local governments (municipalities and LSDs through the Municipalities Act, 1999 and Indigenous Community Governments in Nunatsiavut communities) (Eger et al., 2021). The Government of NL is committed to prioritising the provision of clean and safe drinking water across the province (Engage NL, n.d.). The province of NL uses the following Acts to govern its water resources:

- *Municipalities Act*, 1999: responsible for granting authority to municipalities to construct, operate, protect, and maintain water systems, and to allocate the required funds (House of Assembly NL, 2022; NCCEH, 2014). (See Appendix B for extracts from this Act).
- *Municipal Affairs Act*, 1995: responsible for administering waterworks management (House of Assembly NL, 2017).
- *Environmental Protection Act*, 2002: administered by the Department of Environment and Climate Change's Water Resources Management Division (WRMD) (Department of Environment NL, 2002a; House of Assembly NL, 2019; NCCEH, 2014).
- *Water Resources Act*, 2002 (also 2003, 2004, 2005): administered by the Department of Environment and Climate Change's WRMD. Responsible for regulating water rights

administration, protecting public water sources, and constructing and developing permits for drinking water infrastructure and supplies (Department of Environment NL, 2002; House of Assembly NL, 2017; NCCEH, 2014). (See Appendix C for extracts from this Act).

In NL, there are five main provincial government (PG) departments responsible for collaborating with municipal/local governments to manage drinking water: (i) Environment and Climate Change; (ii) Municipal and Provincial Affairs; (iii) Transportation and Infrastructure; (iv) Health and Community Services; and (v) Digital Government and Service NL.

3.1.1 Department of Environment and Climate Change

The Department of Environment and Climate Change (DECC) works to support environmental sustainability in municipalities, communities, and regions throughout NL by protecting and enhancing the environment through various regulations and policies that target water resources and pollution prevention. Additionally, the DECC provides environmental impact assessments for proposed development projects and maintains any impacted areas (Environment and Climate Change NL, n.d.(vii)).

The WRMD of the Environment and Labour Branch is responsible for water resources management. The WRMD develops province-specific regulations, policies, and guidelines for drinking water quality using the GCDWQ as the foundation and point of comparison (Environment and Climate Change NL, n.d.(iv)). (See Appendix D for NL's water quality parameters adapted from the GCDWQ). This Division is also responsible for issuing design, construction, operation, and maintenance approvals for water and wastewater systems (Environment and Climate Change NL, n.d.(iv)).

The WRMD collaborates regularly with municipalities to monitor public source and tap water by collecting, analysing, and reporting on physical and chemical water properties (Environment and Climate Change NL, n.d.(iv)). Annual and quarterly water quality reports are open and accessible through the department's Water Resources Portal (WRP) (Dore, 2015; Environment and Climate Change NL, n.d.(iv)).

Additionally, the WRMD oversees the province's preventative risk management tool, known as the Multi-Barrier Strategic Action Plan (MBSAP) (Dore, 2015; Environment and Climate Change NL, 2019; Environment and Climate Change NL, n.d.(v)). The MBSAP provides multiple levels of security against water contamination, thereby allowing identification of all potential and known risks, and enforcement of appropriate barriers to remove or minimise these risks, including factors that affect the aesthetic properties of water (Dore, 2015; F-P-T CDW, 2001; Environment and Climate Change NL, 2019; Environment and Climate Change NL, n.d.(v)). The three levels of the MBSAP are:

> (i) "source water protection; drinking water treatment; drinking water distribution systems; (ii) monitoring; inspection and enforcement; data management and reporting; operator education, training, and certification; [and] (iii) legislative and policy frameworks; public involvement and awareness; guidelines, standards, and objectives; research and development; corrective measures" (Environment and Climate Change NL, n.d.(v)).

Under the monitoring level of the MBSAP, the WRMD provides "… education and training opportunities to municipal water and wastewater system operators…" to ensure clean, safe drinking water and improved public health through its Operator Education, Training, and Certification (OETC) program (Environment and Climate Change NL, n.d.(viii)). The OETC program was launched in 2002 and has been committed to ensuring that all municipalities have access to its services, such as regular cost-free educational seminars for municipal water (and wastewater) operators, on-site training through its three mobile training units (MTUs), and annual drinking water workshops. Water (and wastewater) system operators can obtain certification by successfully completing the examinations that are offered through the OETC (Environment and Climate Change NL, n.d.(viii)).

3.1.2 Department of Municipal and Provincial Affairs

The Department of Municipal and Provincial Affairs (DMPA) "… strives to ensure that residents live in safe and sustainable communities and are served by open, effective and accountable local governments" (Municipal and Provincial Affairs NL, n.d.). The DMPA supports municipalities' financial stabilities and service deliveries by offering various funding tools, such as the Gas Tax Agreement (GTA), Municipal Operating Grants (MOGs), Municipal Capital Works (MCW) and Cost-Shared Funding Programs (Municipal and Provincial Affairs NL, 2021d). Municipalities can use these funds to advance water-related projects, such as repairs, renewals, and new purchases. Additionally, through the Department's Municipal Training program, municipal councillors and their staff can access relevant trainings and continuing educational programs to enhance their skills and overall governance in their municipalities (Municipal and Provincial Affairs NL, 2021b).

3.1.3 Department of Transportation and Infrastructure

Through the Municipal Infrastructure Division, the Department of Transportation and Infrastructure (DTI) supports municipalities with various funding avenues, such as MCW and the Investing in Canada Infrastructure Program (ICIP). Municipalities can use these funds for capital works infrastructure projects, including water and wastewater facilities, to ensure sustainable economic growth and more efficient municipal services and delivery (Transportation and Infrastructure NL, 2021).

3.1.4 Department of Health and Community Services and Digital Government and Service NL (DGS NL)

Bacteriological monitoring of public water supply systems (PWSSs) for coliforms and *E.coli* and/or inadequate disinfection in NL is conducted regularly and is a joint responsibility between environmental health officers (EHOs) from Digital Government and Service NL (DGS NL) and the Department of Health and Community Services (DHCS) (Dore, 2015; Health and Community Services NL, n.d.; Ochoo et al., 2017; Vodden and Minnes, 2014). EHOs relay results from these analyses to the relevant communities who then work on remedying any deficiencies. Where required, EHOs or regional medical officers of health (RMOHs) recommend BWAs (Health and Community Services NL, n.d.).

3.1.5 Indigenous water governance in Newfoundland and Labrador

The traditional Mi’kmaq Nation extends from Quebec through the Atlantic provinces and into NL, particularly the island of Newfoundland (Ktaqmkuk) (Qalipu First Nation, n.d.). The only federally (Indian Act) recognized Mi’kmaq reserve on the island is Miawpukek Mi'kamawey Mawi'omi, located on the. Island’s south coast (Miawpukek First Nation, n.d.). In 2011, however, Qalipu (Mi’kmaq) First Nation was established as an Indigenous Band under the Indian Act. Although Qalipu has no reserve land, its membership spreads across 67 traditional Mi’kmaq communities throughout NL (Burgeo First Nation, n.d.; Qalipu First Nation, n.d., Robinson 2014). A number of these communities have their own local band councils as well.

Flat Bay, for example, is considered a self-governed community led by a registered non-profit band council, No'kmaq Village (Flat Bay Band Inc.). which represents the community with provincial and federal governments (Omosule, 2017). In addition to the Mi'kmaq of the island of Newfoundland, Indigenous peoples in NL also include the Inuit of Nunatsiavut, the Southern Inuit (NunatuKavut), and the Innu of Labrador (Vodden and Minnes, 2014).

Indigenous communities in NL—like other Indigenous communities across Canada—face various water-related challenges, namely long-term and frequent BWAs. For example, in 2018, Miawpukek First Nation lifted a four-year BWA- the fifth and longest one issued in the community since 2007. According to Glen Benoit (Director of Public Works for Miawpukek First Nation), the community had been on BWA 50 percent of the time since 2004 (Barry, 2018). In 2014, Flat Bay—a Mi'kmaq community in southwest NL—experienced a complete lack of potable water for eight weeks and it was reported that the community had experienced annual breakdowns in its water infrastructure since 2006 (Hanrahan and Dosu Jnr., 2017).

The PG is the lead authority for managing drinking water in Indigenous communities in NL and this is done through collaboration with local and Indigenous community governments (Vodden and Minnes, 2014). These include Nunatsiavut Government and Inuit Community Governments within Nunatsiavut, Innu Nation, NunatuKavut Community Council, Miawpukek First Nation Band Council, Qalipu First Nation and community band councils (Vodden and Minnes, 2014a; Omosule, 2017). NL's 1948 Terms of Union with Canada made no reference to Indigenous peoples in the newly formed province and they were, thus, not recognized as status Indians and were treated the same as other Canadian citizens (Burgeo First Nation, n.d.; Hanrahan, 2003; Tanner et al., 1994). The FG thus allocated funds and responsibilities for administering certain programs and services, such as health, municipal services, and education, for Indigenous peoples to the PG (Tanner et al., 1994). This resulted in drinking water—which is typically a federal responsibility—becoming a provincial responsibility in Indigenous communities in NL (Burgeo First Nation, n.d.; Hanranhan, 2003). However, compared to the FG, the PG has limited "… capacity, financial and political, to carry out the fiduciary responsibilities of the state towards aboriginal citizens" (Tanner et al., 1994, p.6). Today, Indigenous peoples throughout the province continue to pursue self-government and Indigenous governance, especially for water resources, is increasingly recognized and expressed throughout the province, thus ensuring that the rights, cultures, values, beliefs, and perspectives of Indigenous peoples in NL are reflected in the policies made and implemented (Eger et al., 2021).

3.2 The role of local governments in water governance in Newfoundland and Labrador

NL has over 270 municipalities that represent almost 90 percent of the province's population (Municipalities Newfoundland and Labrador (MNL), n.d.). The provincial legislature through which municipalities are able to provide PWSSs also enables them to enforce their own regulations and by-laws, thus enabling them to efficiently operate and maintain their water systems, including purchasing and maintaining infrastructure and day-to-day responsibilities, such as testing and operating treatment facilities (Vodden and Minnes, 2014).

It is important to also highlight that NL has over 170 unincorporated communities that are referred to as local service districts (LSDs) (Kennedy, 2022). LSD regulations are also administered under the *Municipalities Act*, 1999 by five to seven elected individuals who form the LSD committee (House of Assembly NL, 2011; MPA, n.d.). LSDs are able to provide limited services, including water, sewer, fire, garbage, street lighting, animal control, and road maintenance including snow clearing and LSD committees can charge residents/users fees for the services they provide (MPA, n.d.). According to an article by Crocker (2021a), LSDs are unable to make or enforce any regulations. They also do not qualify for government grants or services and, as Butch Vardy noted in the article by Crocker (2021a), LSDs are unable to implement mill rates that would otherwise allow them to bank money. When considering all of these factors, it is evident that LSDs have even less resources/revenue and autonomy than (incorporated) municipalities.

3.2.1 Water treatment in Newfoundland and Labrador

Municipalities are responsible for treating drinking water and maintaining and operating water treatment and distribution systems. In NL, water systems are required—by the PG—to utilise disinfectants, and "… all water entering a water distribution system must have a minimum [disinfectant] residual of 0.3 mg/L after a minimum of 20 minutes contact time at a peak hourly flow…" (Environment and Climate Change NL, n.d.(vi)) or a CT of 6 mg·min/L (Bereskie et al., 2017b; Dore, 2015). Approximately 90 percent of PWSSs in NL utilise chlorine as the primary (or sole) disinfectant. Other commonly used disinfectants include U-V, mixed oxidants, ozone, and chloramines (Dore, 2015; Environment and Climate Change NL, 2021; Environment and Climate Change NL, n.d.(vi)). In NL, "… a detectable free chlorine and total chlorine residual must be provided at all points throughout the entire water distribution system," thus, secondary disinfection is used to maintain disinfectant residuals throughout the distribution system to prevent bacterial regrowth (Environment and Climate Change NL, n.d.).

3.3 Boil Water Advisories in Newfoundland and Labrador

NL has a "… zero-risk tolerance approach…" so, if any risk to drinking water is perceived or if coliform is detected in the routine water testing, BWAs are immediately recommended by EHOs or RMOHs, and then enforced by the relevant municipal authorities (Dawe, 2013; Ochoo et al., 2017). As mentioned in Chapter Two and shown in Table 5, NL has one of the highest incidence rates of DWAs in Canada. There are 21 BWA reason codes in NL with specific standard operating procedures (SOPs) for their removal (BEE Inc., 2016). (See Appendix E). NL has, at any given time, an average of 200 active DWAs, with an average of 140 of these being classified as BWAs, most commonly issued due to chlorine residual challenges, repairs/upgrades to the systems, and microbiological contamination, while the remaining advisories are generally issued due to a lack of disinfection systems or chlorination/disinfection systems being turned off by operators due to a lack of operating funds (BEE Inc., 2016; CBC, 2020; Dawe, 2013; Dore, 2015; Jones-Bitton et al., 2016; Municipal Affairs and Environment NL, 2022). See Table 6 for DWAs in NL from 2001-2021.

Table 6: Drinking water advisories in Newfoundland and Labrador (2001-2021)

Year	**Total number of active DWAs[10] in NL**	**Number of communities affected**
2021	220	220
2019	200	N/A
2018	150	150
2017	193	145
2016	216	157
2015	238	173

[10] DWAs here include BWAs, DNCAs, and reports of communities that have no disinfection system or whose disinfection systems have been turned off by the operators due to a lack of operating funds.

2013	256	184
2011	215	N/A
2010	218	157
2009	211	145
2008	228/229	159
2006-2007	215	145
2001	322	223

Note. Extracted from BEE Inc., 2016; Dawe, 2013; Dore, 2015; Dunn, et al., 2017; Environment and Climate Change NL, 2019; Environment and Conservation NL, 2005; Hrudey, 2011; Jones-Bitton et al., 2016; Municipal Affairs and Environment NL, 2022; Pelley, 2019; Vodden and Minnes, 2014.

In NL, DWAs are classified as long-term if they have been in effect for five years or more and approximately 50 percent of DWAs in the province are classified as long-term DWAs, with many of these having been issued 10 or more years ago (BEE Inc., 2016; Dawe, 2013; Vodden and Minnes, 2014). According to data provided by Municipal Affairs and Environment (2022), about three percent of NL's DWAs were issued in the 1980s, 15 percent in the 1990s, 28 percent in the early 2000s, and the remainder between 2010 and 2022.

Studies have shown a correlation between small community sizes and the prevalence of BWAs. Most BWAs in NL—sometimes up to 98 percent—are issued for SDWSs that serve populations of 5,000 or less (Bereskie et al., 2017b; BEE Inc., 2016; Dawe, 2013; Health

Canada, 2015; National Collaborating Centre for Healthy Public Policy (NCCHPP), 2011). As previously stated, smaller, more remote communities, especially LSDs, typically have lower tax bases and financial capacities, thereby hindering them from attaining and/or maintaining their water systems and/or certified water operators. In a survey conducted by Vodden and Minnes (2014), 80-percent of communities in NL reported inadequate financial resources for effective and efficient municipal operations. In 2020, Minister Braggs (DMPA), stated that municipalities requiring provincial funding would be required to make clean, safe drinking water their number one priority, and communities under BWAs would be required to resolve and lift their BWAs prior to applying for funding (CBC, 2020). Although prioritisation of clean, safe drinking water is required, individuals such as Mayor Sheila Fitzgerald (of Roddickton–Bide Arm) have argued that such restrictions leave many vulnerable communities in a quandary and have informed the PG that "We need support, we need money. We need viable, doable solutions that towns can use to fix their water" (Sheila Fitzgerald as cited by Connors, 2020).

3.4 Funding for water-related projects in Newfoundland and Labrador

Most drinking water systems in NL were constructed in the early 1950s thus, 80 percent of LSDs and 65 percent of municipalities are due for water (and wastewater) system upgrades or repairs (Government of Newfoundland and Labrador, 2002; Vodden and Minnes, 2014). Federal Minister Gudie Hutchings states that by repairing and/or upgrading infrastructure, communities will continue to have improved access to clean drinking water (Infrastructure Canada, 2021). Municipalities can apply for financial support/funding for water-related projects from the FG (e.g., ICIP, Canada Community-Building Fund (CCBF), federal budget top-ups, and Clean Water and Wastewater Fund (CWWF)) as well as MCW from various PG departments, such as the DMPA and the DTI, to ensure better municipal governance and more effective and efficient water services and delivery (Crocker, 2021; Jones, 2017; Infrastructure Canada, 2020; Infrastructure Canada, 2022; Infrastructure Canada, 2022(i); Westcott, 2018). Most of these funding opportunities are cost-shared in nature, thus municipalities are required to make financial contributions to their projects (Table 7). Despite these various funding opportunities, an overwhelming number of communities—particularly smaller, more remote communities—continue to cite insufficient funding as a barrier to implementing these necessary upgrades (Vodden and Minnes, 2014).

Table 7: Municipal Capital Works cost-sharing for water (and wastewater)

Population size	< 3,000	3,000-7,000	>7,000
Provincial share (%)	90	80	70
Municipal share (%)	10	20	30

Note. Extracted from House of Assembly, NL (2008).

The community of interest for this study is the Town of Burgeo, located in south-west NL. The next section provides a brief introduction to Burgeo and an overview of its drinking water system.

3.5 Introduction to the Town of Burgeo, NL and its drinking water system

Image 1. Sandbanks Provincial Park, Burgeo, NL (2018)

3.5.1 Background

Burgeo[11] is a small town located on the south-west coast of NL (Tract Consulting Inc. and BAE-Newplan Group Ltd. (TCI and BAE), 2010). It is well-known for the Sandbanks Provincial

[11]Burgeo "… has a long history of Indigenous settlement by groups such as Mi'kmaq" (Gale, 2022). Approximately 17 percent of Burgeo's residents identify as Indigenous (Statistics Canada, 2021). Burgeo is a Qalipu community and the Burgeo Qalipu Cultural Committee was established to support Mi'kmaw heritage and cultural traditions in the community (Burgeo First Nation, n.d.). Burgeo First Nation Inc. (formerly Burgeo Band of Indians) was incorporated in 2018 (DGS NL, n.d.) and was established for people who were excluded from the larger Qalipu First Nation Band due to differences in geography and/or ideology (Grudic, 2018). Although members of the band are currently considered non-status Indians… they have plans to eventually seek status under Canada's Indian Act" (Chief Janes as cited by Grudic, 2018).

Park- home to some of NL's most picturesque sandy beaches (Parks Newfoundland and Labrador, n.d.; TCI and BAE, 2010). Burgeo was officially incorporated as a town in 1950 (Pitt, 2012; TCI and BAE, 2010). Burgeo, like many other communities in NL, once relied heavily on its fishing industry. It was regarded as the central hive of fishing and fish-processing activities on the south-west coast of the island of Newfoundland until the introduction of the cod moratorium in 1992 (Pitt, 2012; TCI and BAE, 2010). After the moratorium, Burgeo explored various other industries and fishing opportunities, such as redfish in Northwest Atlantic Fisheries Organisation (NAFO) area 30, crab, and aquaculture. However, these avenues were unsuccessful for the community (Senate of Canada, 2005). In the early 2000s, Burgeo's fish plant was converted into a fish meal plant that operated seasonally (TCI and BAE, 2010). In 2017, Burgeo Fish Market—a family business—was expected to sell its license to process and sell seafood to Premium Choice Foods in Saint John's, NL (CBC News 2017). Unfortunately, with most of Burgeo's experienced fisherpersons retiring, coupled with a lack of interest in fishing from the community's younger members, Burgeo's fishing industry may experience further challenges (CBC New, 2017).

Burgeo's population steadily declined from ~1,796 in 2001 to 1,307 in 2016, and 1,176 in the most recent 2021 census- a common trend observed in many rural/remote communities in the province (Statistics Canada, 2016; Statistics Canada, 2019; Statistics Canada, 2022; TCD3, 2017; TCI and BAE, 2010; Town of Burgeo P7, 2017). Burgeo's vision statement is to be:

> … a hospitable, healthy and holistic community that will continue to build upon its unique qualities while building a sustainable economy that represents the natural environment, and maintain arts, cultural heritage, recreation and social supports for local residents and visitors alike. (TCI and BAE, 2010, p.19).

(See Appendices F and G for Burgeo's governance goals and projects and environmental goals and projects respectively).

3.5.2 Burgeo's water source

Burgeo's water source is surface water from Long Pond (Dawe, 2013; House of Assembly NL, 2006; 2015; Environment and Climate Change NL, 2021(i)); Environment and Climate Change NL, n.d.(iv) (Image 2). Long Pond is protected under the Water Resources Act, and it is monitored regularly by the DECC's WRMD (House of Assembly NL, 2006; P15).

Image 2. Long Pond, Burgeo, NL (2018)

3.5.3 Burgeo's water infrastructure

Burgeo's original water line, like most water lines in Canada, was installed in the 1960s and it was funded by the Town, the PG, the FG, and the fish plant (Parsons, 2017; P01; P03; P04;

P05, P07; P09; P11; P12; P13). Initially, the water and sewer systems were connected to over 75 percent of the households, excluding those in the Smalls Island, Upper Messieurs, and Upper Short Reach areas which were connected to water and sewer in the 1980s (P01) (Image 3 and Table 8). The portion of the transmission line through which water flows from Long Pond to the water treatment plant (WTP) has a diameter of 350mm (~ 13.8 inches). The inside of the WTP contains a 12-inch pipe (Municipal Affairs and Environment NL, 2005). The remainder of the transmission line—depicted in yellow in Image 3— is made of steel with a diameter of 18-inches and a depth between four to six feet and is responsible for transporting water from the WTP to the water distribution system (Municipal Affairs and Environment NL, 2005; P01; P07; P09; P11). (See Table 8 for map legend). The distribution system is composed of pipes, valves, and pumps that facilitate the movement of water from the transmission line to the community. The core of the town—orange line in Image 3—is serviced by a 12-inch cast iron distribution line, while outer areas, such as the Messieurs area and Smalls Island are serviced by a 6-inch PVC line. The service/lateral lines are the pipes that transport water from the distribution line to the consumers' taps. (Municipal Affairs and Environment NL, 2005). The original lateral lines were copper-based and came within four feet of buildings (P01; P11; P13). However, as the Town Council (TC) began to replace these lateral lines, they were only able to bring them within 10 feet from the building curbs and thus, left it to homeowners to ensure that their properties were properly connected to the main line. In many cases, homeowners did not have access to the appropriate equipment and were forced to use hand shovels, resulting in shallow lateral lines that are one to two feet in depth (P01; P07; P11). The consequences of these shallow lateral lines are discussed later.

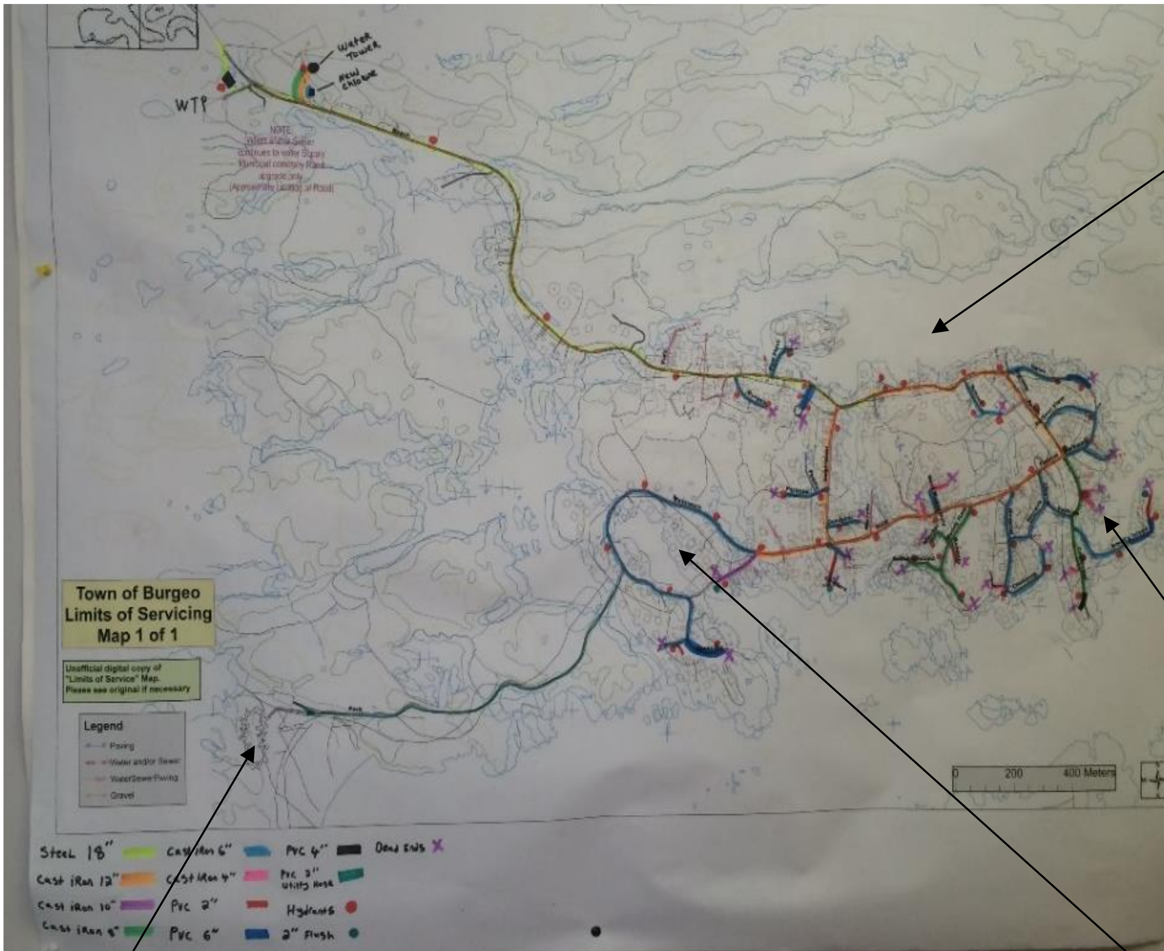

Image 3. Town of Burgeo Limits of Servicing Map 1 (2017)

Table 8: Burgeo Limits of Servicing Map 1 Legend

(yellow)	18-inch steel line		(blue)	6-inch PVC line
(orange)	12-inch cast iron line		(black)	4-inch PVC line
(purple)	10-inch cast iron line		(turquoise)	2-inch PVC utility hose
(green)	8-inch cast iron line		●	Fire hydrants
(light blue)	6-inch cast iron line		●	2-inch flushing station
(pink)	4-inch cast iron line		X	Dead ends
(red)	2-inch PVC line			

3.5.4 Water treatment

Burgeo, like other communities in Canada and NL, is required to maintain a minimum level of treatment to ensure the safety of its water. Over the years, Burgeo's water treatment processes have evolved and become more elaborate.

3.5.4.1 Water treatment before establishment of water treatment plant

Before the water lines were installed in Burgeo, residents collected water from Long Pond in buckets (P01). According to an interview with P04, a gravity flow system was later installed through which the water received minimal treatment, namely chlorination as it left the pond, followed by pH optimisation using soda ash and lime. However, with minimal treatment, Burgeo's water was significantly discoloured, especially during rainy months when runoff increased (P01; P02; P04) (Image 4). Additionally, the water contained elevated concentrations of DBPs, thus, it became imperative for Burgeo to obtain a WTP to combat these qualitative water concerns (P02).

Image 4. Discolouration of raw water from Long Pond (2018)

3.5.4.2 Water treatment plant

Community member Hann recalls that during their time in office as mayor of Burgeo, (late 1990s/early 2000s), TC held a meeting during which they presented the Minister of Municipal Affairs and staff from the Ministry of Fisheries with a sample of the town's tea-coloured water and asked them if they would drink it. Within months of this meeting, the town received approval for funds to build the WTP. Installation of the first WTP began in 2001 (P02; P02; P05). In 2004, a fire—caused by malfunctioning of the ozonation system—resulted in significant damage to the WTP (P01; P02; P11; VLEX, n.d.). Several years lapsed before the new/current WTP was commissioned in 2013 (Environment and Climate Change NL, 2021(i)) (Table 9). See Appendix S for Burgeo's voting results for an operational water plant).

Image 5. Water treatment plant exterior, Burgeo (2018)

Table 9: Burgeo’s water treatment plant summary

Water supply	Long Pond
Serviced area	Burgeo
Population serviced	1,176
Region	Western
Commission date	March 2013
Water treatment type	Ozone-direct filtration
Water treatment class	II
Water distribution class	I
Water treatment process	Sand filtration; ozone; multi-media filtration (anthracite and sand); activated carbon filtration; gas chlorination; caustic soda
Rated capacity (m^3/day)	2,712 m^3/day

Note. Extracted from Environment and Climate Change NL, 2021(i); P09; Statistics Canada, 2021.

To satisfy the requirements outlined in the Drinking Water Treatment Standards for Newfoundland and Labrador, Burgeo utilises a multi-step water treatment process (Bereskie et al., 2017b; Environment and Climate Change NL 2021) (Figure 2). Once the water is treated, it is pumped up to a water tank (1,823m^3) and then flows down to a booster chlorine station before it feeds back into the transmission line and makes its way through the distribution system (Municipal Affairs and Environment NL, 2005; P07; P09).

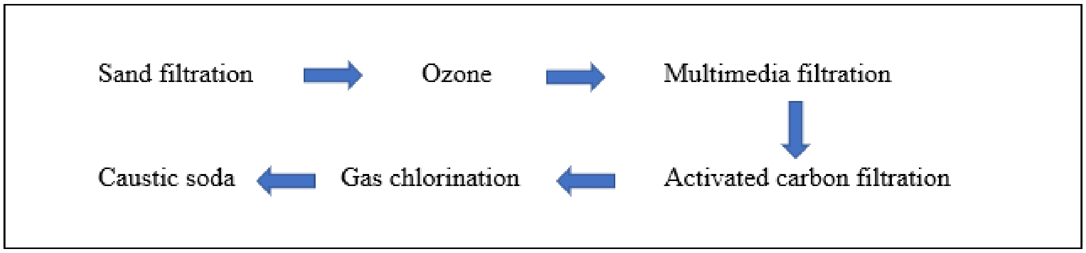

Figure 2: Burgeo water treatment steps

Note. Extracted from Environment and Climate Change NL, 2021(i).

3.5.4.2.1 Filtration

Although filtration is not a mandatory procedure for drinking water treatment systems in NL, many SDWSs employ this step before disinfection (Bereskie et al., 2017b; Vodden and Minnes, 2014). Burgeo's WTP first utilises sand filtration followed by a multi-media filter system, composed of anthracite and sand, to remove large sediments from the water (P09). The final filtration system is made of activated carbon which removes contaminants and impurities through a process known as adsorption (P04; Penn State University, n.d.). The effluent collected from filtration processes is released into the ocean (P09).

Image 6. Activated carbon, Burgeo (2018)

3.5.4.2.2 Disinfection

As previously mentioned, disinfection is a mandatory process for drinking water systems in NL. Many communities across the province utilise various disinfection systems, including chlorine, chlorine dioxide, ozone, U-V radiation, and chloramines (Environment and Climate Change NL, 2021).

Ozonation

Burgeo's WTP is equipped with state-of-the-art ozone technologies (Environment and Climate Change NL, 2021(i); P04; P05; P07; P10; P11) (Image 7). Ozone is a very effective disinfectant, and it removes aesthetic parameters, such as colour, odour, and taste (Municipal Affairs and Environment NL, 2005; P03; P09; P11;). This is especially important in Burgeo where the water is often discoloured (P01; P02; P04; P05; P07; P12).

Image 7. Ozonation system, Burgeo (2018)

Ozonation also removes organic matter in the water, thereby reducing the amount of material that can react with chlorine to produce DBPs (TCD6, 2017). However, ozone levels in Burgeo's water are not tested for, thus, chlorine is utilised to ensure that the PG's requirements for chlorine disinfection are satisfied (P09).

Chlorination

According to Environment and Climate Change NL (2021), the minimum requirement for primary disinfection is a 2.0-log reduction of viruses, while secondary disinfection requires a minimum chlorine residual of 0.3 mg/L before or at the first consumer and a maximum chlorine residual of 4 mg/L at the first consumer or anywhere along the distribution system.

Image 8. Chlorine tanks, Burgeo (2018)

Burgeo has experienced challenges with maintaining satisfactory chlorine residuals over the years. Previously, 100-lb of chlorine were added to the water daily in an attempt to ensure that the minimum chlorine residual requirements were met (P09). However, residents who lived at the beginning of the distribution system complained of their water being over-chlorinated, while residences and other establishments at the end of the line, such as the Sandbanks Provincial Park, yielded little/no chlorine residuals (P02; P04; P10; P11). In an interview, community member Meade summarised this conundrum as follows:

> I kept trying to convince the Council that upstream, we had to make sure people knew not to drink the water regardless, because the chlorine was too high. Our chlorine meter wouldn't even read it. If people wanted to drink, they would put it in a bucket and leave it for 24 hours to let the chlorine dissipate… The water line is fairly long thus, it was challenging trying to keep chlorine residuals up because of high [concentrations] upstream and fear of poisoning that end, versus providing safe drinking water to the other half.

Over the years, some residents have installed filters to eliminate excess chlorine in their drinking water (P04). Today, the amount of chlorine used to treat Burgeo's water has decreased significantly, and the water is now chlorinated twice daily (Liss, 2018; P09). Primary disinfection is done by adding 18-lb of gaseous chlorine to the water in the WTP, where a chlorine residual between 2.5 and 2.6 is maintained (P09). This stage of disinfection eliminates various pathogens found in the raw source water (Liss, 2018). However, as the water is pumped up and stored in the tank, the chlorine begins to dissipate, thus the water is chlorinated a second time at the booster station located south of the tank, where a further 10-12 lb of chlorine are added to maintain the quality of the water throughout the distribution system (Liss, 2018; P02; P04; P07; P12). This secondary disinfection is crucial as, without it, chlorine residuals in Burgeo decrease from between 1.0 and 1.2 near the plant to between 0.10 and 0.20 at the farthest points from the plant (Liss, 2018; P09).

Image 9. Chlorine booster station, Burgeo (2018)

Chlorine residual readings in Burgeo are conducted daily from four different locations within the town (P03; P04; P09). Locations typically include the first building in the distribution system, various sites in different pressure zones, exit points from the water tank, and the far ends of the distribution system (BEE Inc., 2016; CCME, 2004).

3.5.4.2.3 pH adjustment

There have been some concerns regarding the acidity of Burgeo's water, with its pH lying low at 4.3 as opposed to the optimal pH for water which is between 6.5 and 8.5 (P03; P04; P09; P11). Burgeo's original water line is copper-based, and the reaction of the acidic water with the copper causes rapid corrosion of the water line. This results in many leaks throughout the distribution system (P04; P09). Over the years, many residents who have owned copper-based appliances, such as kettles, have had to find replacements within as little as three or four months due to damage/corrosion from the water's acidity (P03; P04; P09).

Previously, soda ash and lime were used to neutralise the water's pH, and now caustic soda with a 50 percent membrane—although highly corrosive and costly—is used to adjust the pH (P03; P04; P09; P11) (Image 10). It is shipped from St. John's and, due to its tendency to freeze at temperatures below 20˚C, it often crystallises before it is delivered to the facility. According to P09, Burgeo is considering switching to caustic soda with a 25 percent membrane, as the temperature will be easier to control and prevent freezing.

Image 10. Caustic soda, Burgeo (2018)

3.5.5 Water quality testing

Over the years, many residents have complained about the aesthetic properties of the town's water, such as colour, taste, odour, and the presence of biofilm, and this has caused some doubts concerning the quality of the town’s water (TCD7, 2017). Previously, Burgeo’s water was tested for pH and chlorine levels only. However, maintaining pH and chlorine did not guarantee the safety of the town’s drinking water thus, Burgeo began to conduct full water sampling and testing several years ago (P04; P12). The DHCS sends representatives to Burgeo monthly to sample and test the town’s water (P04). Staff from the DECC also travel to Burgeo four times a year to conduct drinking water sampling and to touch base with TC and its staff (P03; P04; P15). (See Appendix H for Burgeo water quality testing profile in 2021 and 2018). Once sampling and testing have been completed, PG officials relay the results and any resulting recommendations to the TC (P07).

3.5.5.1 Disinfection by-product (DBP) concerns in Burgeo

Between February 2006 and September 2021, the Water Resources Portal (WRP) indicated, repeatedly, that Burgeo’s water quality was not ranked due to either active BWAs or elevated DBP concentrations. As discussed earlier in this chapter, the presence of elevated DBPs in the water was one of the drivers that led to Burgeo procuring a WTP. However, reports from the WRP indicate that DBPs continue to affect the quality of the town’s water (P02; P01; P03; P06; P15). As Chapter Two briefly explains, DBPs are formed from the reaction of pond water, that already has high levels of naturally occurring organic matter, with chlorine. When the fish plant shut down after the cod moratorium was issued, water delivery to the plant ceased, thus, algae began to build up in the pipes, thus catalysing the formation of DBPs (P06).

Ozonation, as discussed earlier, removes organic matter from water, thus, reducing the amount of DBPs that can form. Prior to the installation of the ozonation system, between 2009-2010, THMs in Burgeo’s water were sometimes recorded at 795 ppm—almost ten times the

MAC of 80 ppm as defined by Health Canada. Between 2012-2014, with a fully functioning WTP, THM levels dropped to 23-58 ppm. However, in 2016, the average annual THM reading in Burgeo had increased again to 194.23 ppm (TCD6, 2017).

DBPs have been linked with cancer, and some residents have attributed Burgeo's higher than average occurrences of cancer to high levels of these contaminants (P05; P12). TC reassures locals that they do not use facts about elevated DBP concentrations in the town's water as a scare tactic but, rather, to be transparent and provide facts to the public about the quality of their water (TCD7, 2017).

3.5.6 Water system capacity

According to an interview with P05, the PG has indicated that a water treatment system, based on the Canadian average flow rate of 250 to 300 gallons per minute, would be sufficient for Burgeo based on its population size. However, Burgeo's water system has a far greater capacity. The WTP can hold a maximum of 700-800 gallons of water at any given time; it can pump water at a rate of 1,200 gallons per minute; and it has a maximum capacity of 2,712m^3/day (~700,000 gallons) (Municipal Affairs and Environment NL, 2020(i); P01; P05; P09). TC and the residents of Burgeo admit that, although the WTP works well, it is overloaded, and even though it was designed to carry three times the amount of water required for their population, it struggles to keep up with the community's demands (P01; P05; P10). Additionally, some residents have expressed concerns regarding whether a new WTP would be required to meet growing needs if Burgeo acquired new industries, residents, or tourists in the future (P02; P06).

Image 11. Water tank, Burgeo (2018)

3.5.7 Water treatment plant operation and maintenance

As previously mentioned, water operators and WTP staff are critical actors in ensuring the production and delivery of clean, safe water to residents by overseeing daily operation and routine maintenance of the water treatment facilities. In the past, Burgeo's WTP had only one member of staff working at any given time (P09). Around the time that the WTP was commissioned, the town hired a part-time worker and a student to assist the lead hand and ensure that the WTP remained fully functional (P07; P11). Now the plant has two or three staff always present (P09; P11). Burgeo's water operator/lead hand successfully completed their water Level I certification examination in 2016 and they have been employed with the Town since 2009 (P09; TC, 2019). The WTP can be remotely operated as shown in Image 12.

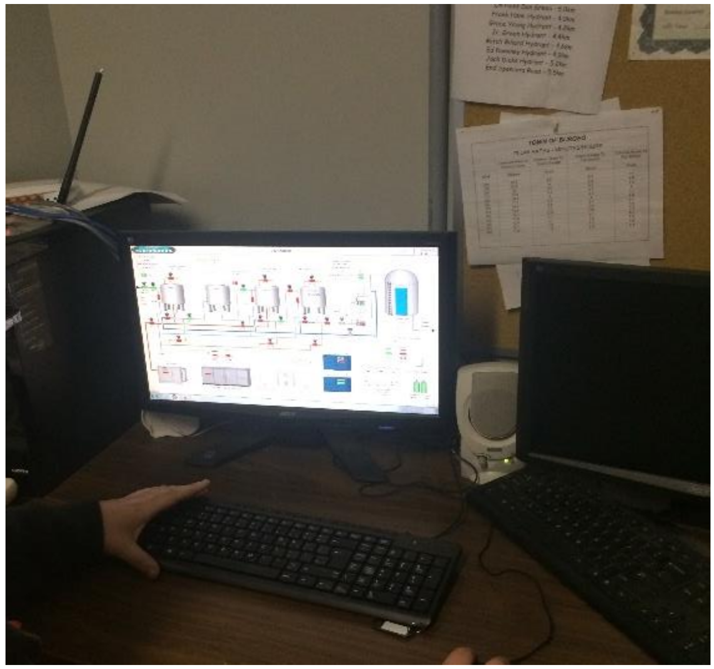

Image 12. Remote operating system, Burgeo (2018)

3.5.8 Water service and delivery expenses

Burgeo is one of many communities in NL to benefit from federal and provincial funding to help with the costs of infrastructure projects, operating and maintaining the WTP, and upgrading the town's chlorination system (Connors, 2014; Tait, 2017). (See Appendix I for a compilation of some of the funding that Burgeo has received from the FG and PG for water-related projects since 2001).

The CCBF (formerly the Gas Tax Fund) is a permanent source of funding provided twice annually to Canadian provinces and territories to support their municipalities' infrastructure projects. Municipalities are able to "… pool, bank and borrow against this funding, providing significant financial flexibility" (Infrastructure Canada, 2022). There are currently 19 project categories to which municipalities can direct the funds they receive through the CCBF, including drinking water and wastewater infrastructure and capacity building (Infrastructure Canada, 2022). Appendix J provides a breakdown of Burgeo's CCBF allocations for 2019 to 2024.

Burgeo's initial budget for a WTP to ensure efficient water service and delivery within the community was $4 million. However, the actual amount spent on this facility, has far exceeded this budget, and is reported to be in the range of $7-$10 million (Hann, 2017; P01; P02; P07; TCD7, 2017). Data from the TC between 2014 and 2016 show that the town spent $150,000 to $220,000 to provide water to Burgeo's residents annually (P01; P02; TCD4, 2017; TCD7, 2017) (See Table 10). This amounts to $229 to $343 per household, based on 655 households (Statistics Canada, 2021). During this same time period, the town spent $5,500-$7,000 in monthly hydro bills alone to keep the plant running (P03; P07; P09; TCD4, 2017). (See Appendices K to N for Burgeo's monthly WTP expenses between 2014-2017). Burgeo's water tax is $192-$200 per annum, i.e., $16 per month per household, which is considered relatively low in comparison to the town's water expenditures (P02; Town of Burgeo, 2018). According to P02, other areas of town operations, such as road maintenance, are suffering because most of the town's funding is allocated to operation and maintenance of the water system.

The rate of water use in the community has been deemed too high for the size of the population. Regardless of how this water is used, it still undergoes processing, treatment, and distribution. As more water is used, the town's water-related expenses also increase as greater amounts of chemicals and power are required to treat and distribute the water (TCD4, 2014). Although Burgeo sets aside an annual amortisation of $200,000, TC admits that, if things continue business-as-usual, they will not be able to sustain the costs of operating and maintaining the WTP (P02; TCD4, 2014).

Table 10: Summary of Town of Burgeo's water treatment plant expenses (2014-2016)

Treatment	**Expenses 2014**	**Expenses 2015***	**Expenses 2016**
Hydro	$66,768.92	$84,595.46	$72,790.10
BBS	$1,296.00	$1,080.00	$1,293.00
Maintenance	$28,780.95	$41,516.99	$8,378.35
Salaries	$19,557.70	$26,867.35	$29,351.56
Chlorine	$7,868.26	$24,340.30	$11,024.39
Caustic soda	$20,662.55	$28,667.50	$35,331.52
Freight	$6,900.95	$15,448.70	$10,898.77
Total cost	$151,835.33	$222,516.30	$169,067.69

Note. Extracted from TCD4, 2017.

*The operational and maintenance costs of the WTP were considerably higher in 2015 because the ozonation equipment required repairs and replacement of a part (TCD4, 2017).

TC is committed to replacing the aging water infrastructure and they estimate that $4 million will be required to fully replace the 5,000 feet of 18-inch steel pipe from the WTP to the end of the distribution line (P02; P08). In 2018, TC noted that an additional $80,000 was required to repair the three most significant leaks that had been identified throughout the water distribution system (P08). TC also applied for $150,000 to install seven flushing stations across town.

Unfortunately, due to fiscal constraints, communities in NL—including Burgeo—are unable to receive funding every year (P02).

3.5.9 Public views on Burgeo's water

According to Doug Griffiths, "Don't have quality water" is the number one way to kill a community (2016). There is consensus within Burgeo that everyone has the right to clean, safe drinking water, and some residents believe that administering this right is the TC's responsibility (TCD3, 2017). In March 2017, the Town of Burgeo affirmed its commitment to providing "… good quality, cost-effective drinking water" to the residents (TCD2, 2017). Realising this goal is especially important as sufficient quantities of good quality water are important to support and meet the personal and medical needs of chronically ill residents and long-term care and acute care patients at the Calder Health Centre (O'Brien, 2015; P07). Poor water quality means that many residents no longer trust the water provided by the Town, and refuse to drink it, even though TC reassures them that the water is safe to drink once it leaves the WTP (P04; P05). Community member Barter describes Burgeo's water as falling short of "first world"[12] standards:

> I told someone the other day that Newfoundland is a third world province. You might say that we're pristine, but we haven't got water fit to drink. It affects getting new residents and a more positive perspective on the community and getting industry and tourists.

This chapter provided an overview of water governance and management structures in NL, including the various actors and/governmental departments involved. DWAs—common water challenges experienced across the province—were discussed briefly. The Town of Burgeo and

[12] "First world" refers to the industrialisation or strong economic and social development of a nation.

its drinking water system were also introduced and described in this chapter, including highlights of some of the community's water-related concerns. The next chapter will delve into the methodologies and methods utilised to explore water governance in Burgeo, NL.

Chapter Four

Research Methods and Methodology

Kothari (2004) defines research methodology as a step-by-step guide, outlining how a research question is tackled, and it highlights the logic behind each step. Research methodology encompasses the philosophies behind the research design and the methods used to collect and analyse research data (Goundar, 2012; Kothari, 2004). Both philosophies and the methods employed in this research are described below.

4.1 Research philosophy

Researchers use different philosophies based on what they believe is true and real, and what they believe can be known about a particular subject/phenomenon (Ryan, 2018). An interpretivist lens—through which reality, truth, and knowledge of a phenomenon are subjective, influenced by culture and history, and based on individual interpretations—was employed in this study (Baxter and Jack, 2008; Crowe et al., 2011; Edwards and Holland, 2013; Ryan, 2018).

The phenomenon of interest in this study—the potential for collaborative water governance in Burgeo, NL, including successes and challenges of communication and coordination—was identified through a preliminary review of the existing literature on relevant related topics. A phenomenological approach was then used to explore this phenomenon whereby rich, detailed, untainted descriptions of individuals' lived experiences as they related to the phenomenon in its natural context were collected (Grossoehme, 2014; Lester, 1999). With these descriptions, a better understanding of individuals' accounts of reality and their shared social meanings relating to the phenomenon was gained. A mixed methods approach—which combined both qualitative and quantitative dimensions in data collection, analysis, and interpretation—was utilised to increase the knowledge pool and strengthen the validity of the claims made throughout the study by corroboration (Johnson et al., 2007; Schoonenboom and Johnson, 2017; Tashakkori and Creswell, 2007).

4.2 Conceptual framework

Frameworks are critical features of qualitative research, and they are derived from lessons learned from previous studies and are used to explain how phenomena progress (Camp, 2001). They summarise how the key concepts and theories of a process/phenomenon work by highlighting the relationships between the variables (Grant and Osanloo, 2014). Due to the policy-oriented nature of this study, i.e., the development, implementation, and evaluation of drinking water-related policies in Burgeo, NL, the five-stage policy cycle popularised by Howlett and Ramesh (1995), i.e., (I) agenda setting; (II) exploration of potential solutions; (III) decision-making; (IV) implementation; and (V) evaluation, informed the understanding of the CG framework that was developed.

4.2.1 Collaborative governance framework

The CG framework (see Table 11 and Figure 1) was developed to ensure a well-rounded understanding of the research phenomenon described above by emphasizing the inter-connectedness and iterative nature of the core components of CG. The framework was used in developing the research and interview questions, and in the deductive reasoning stage of data analysis. (The core components of this framework were discussed in Chapter Three).

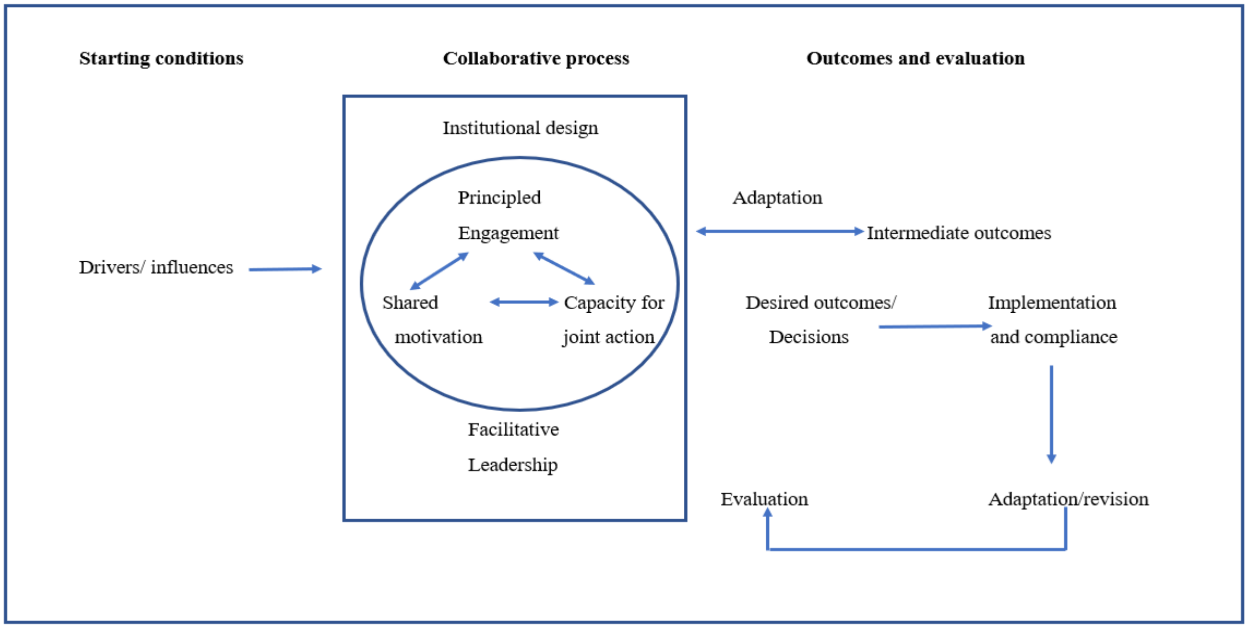

Figure 1: Collaborative governance framework

Note. Adapted from Ansell and Gash (2008) and Emerson et al. (2012).

Table 11: Breakdown of collaborative governance framework components

Collaborative governance stage	**Components**
Starting conditions	
	Power-knowledge-resource asymmetries
	Incentives for and constraints on participation
	Prehistory of cooperation or conflict
	Timeline of organisation's development
Collaborative process	
Institutional design	Participatory inclusiveness diverse actor representation

	Forum exclusiveness
	Clear ground rules
	Process transparency
Facilitative leadership	Process for conflict
	Leadership structure
	Facilitation participation
Collaborative dynamics	Principled engagement: Discovery, Definition, Deliberation, Determination
	Capacity for joint action: Procedural and institutional arrangements, Leadership, Power, Knowledge, Resources
	Shared motivation: Mutual understanding. Shared commitment, Trust, Internal legitimacy and accountability
Implementation and Outcomes	
Evaluation and Adaptation	

Note. Adapted from Ansell and Gash (2008) and Emerson et al. (2012).

4.3 Research design: Case study

Yin (1994) defines research design as "… the logical sequence that connects the empirical data to the study's initial research questions and, ultimately, to its conclusions" (p. 19). The purpose of this study was to respond to and fill a gap in the literature regarding communication and coordination and the current and future potential for collaboration in addressing water-related concerns in NL. Thus, by using the CG framework, a case study was designed to facilitate the generation of a well-rounded narrative by relevant actors, thereby ensuring a broader understanding of the processes used by the research community to address their particular drinking water issues. The case study was, therefore, used as "... an empirical inquiry that investigate[d] a contemporary phenomenon in-depth and within its real-life context…" in which the investigator/researcher had very little or no control over the event/phenomenon (Yin, 1994, p.3).

4.3.1 Case study type and selection

The Town of Burgeo was selected due to the community's long-standing battle with various water-related concerns and the documented efforts of the community to combat these. Although designed specifically for Burgeo's context, this case study can be used to gain a better understanding of water governance, the importance of communication and coordination, and the potential for collaboration in similar small and/or remote communities in NL and beyond (Crowe et al., 2011).

4.3.2 Data sources and triangulation

Data triangulation minimises the potential for biases that may occur from using a single data source (Cox and Hassard, 2012; Evers and van Staa, 2012; Gibson, 2014; Yin, 1994;). To ensure a more comprehensive and accurate report of water-related concerns and water governance in Burgeo, multiple data sources and types—both qualitative and quantitative—were collected and analysed. Qualitative data will be discussed in-depth next as these were the primary data sources collected and analysed for this study.

4.3.2.1 Qualitative data

Cameron (1963) states that “not everything that can be counted counts, and not everything that counts can be counted” (p. 13). Qualitative research involves collecting, analysing, and interpreting textual data from conversations and observations to gain a better understanding of how individuals experience a phenomenon in its natural context (Malterud, 2001). In accordance with Stake’s (2000) recommendations for data collection for case study research, the following data were collected and analysed:

- Literature review and secondary document analysis:
  - Physical geography of Burgeo and how it affects the people and the economy
  - Burgeo’s water system
  - Historical context of water-related problems and solutions in Burgeo to build a foundation
  - Social, political, and legal components of water governance in Burgeo
- Accounts of lived experiences relating to water governance in Burgeo through interviews

Literature review and document analysis:

A review of the existing literature on Burgeo’s physical geography, demographics, economy, and water-related problems was conducted, using keywords such as Burgeo, water security, water governance, collaborative governance, and BWAs. Sources such as scholarly/peer-reviewed journals, newspaper articles, and government websites provided significant textual data. Some key documents (e.g., meeting minutes, letters to Council, Town plans) were also provided by the Town of Burgeo for review prior to data collection within the community.

Qualitative interviews

Qualitative interviews were designed and used to co-generate knowledge with the interview participants by giving them opportunities to share their perceptions, interpretations, and lived experiences of the factors that influence communication and coordination and the potential for collaboration as they relate to water governance in Burgeo (Barlow, 2012; Edwards and Holland, 2013; Johnson and Rowlands, 2012; Platt, 2012).

By considering Johnson and Rowland's (2012) observation that the most ideal candidates for interviews are those who participate in, deal with, or have a genuine interest in the phenomenon, initial contact was made with one of Burgeo's water resolution pioneers and members of council at the time, Barbara Barter. An in-person introductory meeting was conducted in which a suggestion was made to request a list of former and current members of council from the Town Manager. Additionally, the snowballing method was used to identify other members of the community and local business operators and owners who had engaged in or were interested in discussions regarding the town's water and would potentially be interested in the study. Snowball sampling occurs when research participants who are selected at the start of a study are asked to identify additional participants who may have similar or any kind of experiences or interests relating to the research phenomenon (Naderifar et al., 2017). These newly identified participants may, in turn, refer further potentially interested parties to the researcher and so the cycle continues (Noy, 2008). Invitations to participate were sent to prospective participants via e-mail. Additionally, an interview was conducted on Burgeo Broadcasting Station (BBS) Channel 10 to inform locals of the study and to invite any interested individuals to make contact to set up an interview. To ensure diverse actor representation in the interview process and to minimise biases associated with potentially recruiting participants with similar experiences and viewpoints through snowball sampling (Kirchherr, 2018), electronic invitations to participate in the study were also sent to various representatives of the Government of NL, particularly from the DECC, DMPA, DTI, as well as the Member of the House of Assembly (MHA) for Burgeo-La Poile. A total of 17 interviews were conducted for this study and they were classified as follows:

- Town of Burgeo:
  - 4 current councillors (at the time of the interviews, i.e., 2018/2019).
  - 7 former councillors (at the time of the interviews, i.e., 2018/2019).
  - 3 business operators/owners/residents.
- Government of Newfoundland and Labrador:
  - MHA Burgeo-La Poile.
  - Representative from the WRMD.
  - Representative from DTI.

Individual interviews were selected as opposed to group interviews to reduce the likelihood of participants holding back or altering information/knowledge due to the presence of their peers and perceptions of how the information may negatively impact their relationships (Beitin, 2012). Some participants—who were considered key informants—were interviewed multiple times through various media, such as e-mail, in-person, telephone, and virtual conversations, to ensure that any new knowledge that emerged after the interviews were concluded was reported and recorded (Johnson and Rowlands, 2012).

The interviews conducted were in-depth and semi-structured whereby an interview guide, outlining the main themes and topics of interest, was developed based on the background knowledge obtained from reviewing the existing literature and secondary data (Edwards and

Holland, 2013). The interview guide was flexible enough to give participants opportunities to describe their experiences in their own words, and to discuss what they thought was most relevant to the study (Barlow, 2012; Cohen and Crabtree, 2006). (Interview guides for each participant group are attached after the Appendices). Due to the limited amount of information that was known about water governance and communication and coordination in Burgeo, initial interviews were used to explore and to begin to unpack and understand this phenomenon. As the interviews progressed, a reserve of knowledge was built for use in subsequent interviews for corroboration of the information, and the interview guide was adapted as needed (Johnson and Rowlands, 2012; Platt 2012).

Participants selected the locations for the interviews based on what was most convenient and comfortable for them (Edwards and Holland, 2013; Herzog, 2012). Residents of Burgeo opted to meet in the Town Chambers, their residences, and workplaces. Unfortunately, representatives from the PG were unable to meet in-person thus, given the geographic separation, email interviews (e-interviews) were used. This offered the respondents time to reflect on the research questions and their responses. The textual nature of e-interviews also saved time by eliminating the need for transcription. However, these e-interviews produced accounts that were significantly more formal and, presumably, less candid than the local in-person interviews (Edwards and Holland, 2013).

Audio tape recorders were used for the in-person interviews to minimise distractions from extensive notetaking, to allow for verbatim recordings of the respondents' expressiveness, emotions, and tone of voice during the interviews and to ensure that these records would be preserved after the interviews (Luker, 2008). Although notetaking during interviews is often considered distracting and inferior to verbatim recordings (Edwards and Holland, 2013; Johnson and Rowlands, 2012), brief field notes were taken of non-verbal language cues which are typically not picked up on by audio tape recorders, such as hand gestures, and facial expressions.

Qualitative data are not always replicable due to their subjectivity, and this may raise questions about the reliability and validity of the data (Grossoehme, 2014). Mack et al. (2005), therefore, encourage the use of quantitative data to corroborate the findings and claims made through qualitive methods. (Limitations of the qualitative data collection methods utilised are addressed in Chapter Six: Discussion and conclusion).

4.3.2.2 Quantitative data:

Quantitative research is an empirical process that involves the collection and analysis of structured data that can be measured accurately and represented numerically (Ahmad et al., 2019; Goertzen, 2017). Quantitative research methods are considered ideal for answering "what" and "how" questions (Goertzen, 2017). According to Muijs (2004), quantitative research methods also offer better guarantees of maintaining the anonymity of the respondents involved as individuals cannot be identified from numerical data. Quantitative research is considered to be more objective and conclusive, thus, enabling generalizations, which Polit and Beck (2010) define as "…an act of reasoning that involves drawing broad inferences from particular observations" (p.1451; Ahmad et al., 2019). A prime example in this study is observing water usage patterns and generalizing that water usage every year is higher in the winter and lower during the summer months. By enabling researchers to detach from the data, quantitative research eliminates the potential for researcher bias and enables objectivity in interpreting and explaining data and drawing conclusions (Daniel, 2016; Denscombe, 1998).

For the purposes of this study, quantitative data regarding how much water was used on average validated the claims made by residents and other studies about the high volume of water used in Burgeo (Ahmad et al., 2019). Additionally, financial records were collected and analysed to determine average monthly water-related expenses in Burgeo. Data collected from the interview process were also analysed and quantified to determine the most common themes, as well as to distinguish any areas of significant disagreements and/or agreements amongst the participants.

4.3.3 Data analysis

The qualitative data yielded in this study were rich and descriptive. To make sense of this data and the themes that were presented, the data were organised and interpreted by identifying, coding, and sorting themes or patterns that highlighted water governance and communication and coordination in Burgeo (Chowdhury, 2015; Evers and van Staa, 2012). The relatively low number of interviews conducted did not warrant the use of computer-assisted qualitative data analysis software (CAQDAS), thus, data were analysed manually using both deductive and inductive processes. The CG framework facilitated deductive analysis whereby pre-established themes, namely the core components of collaboration, were used to make sense of the data (Evers and van Staa, 2012). As the research and data analysis progressed, a few new themes, which had not previously been covered in the literature review and CG framework, emerged, thereby resulting in inductive data analysis (Evers and van Staa, 2012).

By obtaining multiple views on the same phenomenon, the challenge of whose standards or criteria of truth to use in the final report arose (Johnson and Rowlands, 2012). However, this was combated by conducting a validity process known as “member checking” (Evers and van Staa, 2012; Johnson and Rowlands, 2012). Research findings and interpretations of the data collected during the study were verified with three key informants during a meeting with the Town Council in Burgeo in May 2019, and a summary of the final results was presented to a small group of residents (including members of council) virtually in October 2021. Although consensus was not the goal of these processes, these events facilitated further dialogue about the study and presented participants with opportunities to provide feedback about how they and their community were portrayed, the levels of confidentiality and diplomacy, and their overall thoughts about the study (Johnson and Rowlands, 2012; Kaiser, 2012).

4.3.4 Ethical considerations

Prior to the start of data collection, a proposal for this study was submitted to the Grenfell Campus Research Ethics Board for clearance for ethical qualitative research involving human subjects. Commitments were made to ensure the privacy of all participants by using pseudonyms in publications (unless otherwise requested), and by storing audio recordings, interview transcripts and confidential data safely. Additionally, details of data disposal upon completion of the study and third parties, such as supervisors, who may have had access to research data, were outlined.

Community assent was sought through informal approval from the Town of Burgeo by submitting a brief proposal that outlined how collecting data from key informants would benefit the study (Kaiser, 2012). Harm/risk was minimised by ensuring that all standards of ethical conduct were met, such as taking necessary precautions to protect participant identities- unless otherwise requested (deRoche and deRoche, 2012; Johnson and Rowlands, 2012; Wallace, 2012).

Informed consent was sought from participants through a detailed, written document that provided information about the purpose of the study, its duration, research methods, and possible benefits or risks of participation (deRoche and deRoche, 2012; Johnson and Rowlands, 2012; Marzano, 2012). (Consent forms for each group of participants are attached after the Appendices). Participants were assured that participation was entirely voluntary, confidentiality would be respected (except in cases where participants agreed to have their identities revealed), and withdrawal of consent or participation at any point during the study would be honored without negative consequences (deRoche and deRoche, 2012; Marzano, 2012). Prior to the start of all interviews, participants were granted ample time to review informed consent forms and to ask any questions that they had regarding confidentiality or any other part of the study (Kaiser, 2012). All participants were provided with a copy of the primary investigator's contact information.

4.3.5 Results dissemination

Upon completion and finalisation of this study, a copy of this report will be presented to the Town of Burgeo for access to members of council and residents alike. Electronic copies will be uploaded to the Memorial University of Newfoundland Research Repository, and to LinkedIn (personal profile).

This chapter summarised the methodologies and methods (qualitative and quantitative) used to explore the research phenomenon. Limitations and challenges of the research methods are addressed in Chapter Six: Discussion and conclusion. The next chapter delves deeper into the most commonly identified water-related concerns in Burgeo, and the results and themes that emerged from the qualitative interviews are presented and discussed.

Chapter Five

Results

One of the core goals of this study was to provide a detailed summary of some of the most notable water-related events/challenges that occurred in Burgeo and resolutions that were attempted to address these. The beginning of this chapter is, therefore, dedicated to providing details of these events as recounted by research participants.

5.1 Boil water advisories in Burgeo

Over the years, Burgeo has experienced numerous short- and long-term BWAs. Many of these were issued due to low chlorine residual readings in the water distribution system (P03; P04; P11). The initial event of interest for this study was the previous long-term BWA that lasted for more than ten years and was lifted in 2015, thus, this will be discussed in greater detail next.

Burgeo's long-term boil water advisory

As highlighted earlier in Chapter Three, prior to installation of the first WTP, Burgeo's water underwent a simple treatment process: primary disinfection using chlorine, followed by pH adjustment using soda ash and lime. Without secondary disinfection, the chlorine added to the water during primary disinfection dissipated rapidly before the water travelled through the distribution system. This resulted in little/no chlorine residual readings at the farthest points along the distribution system, namely the Sandbanks Provincial Park (Connors, 2014; P03; P04; P08; P09; P11; P15; TCD4, 2014). In 2001, the DHCS issued a code E1 BWA for the Town of Burgeo, which was defined as, "… water entering the distribution system or facility, after a minimum 20-minute contact time, [did] not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value" (Municipal Affairs and Environment NL, 2022) and there was no reported

E. Coli (Dawe, 2013). In 2014, reports suggested that Burgeo had been on a long-term BWA (longer than five years) for about 10 years (Connors, 2014; TCD4, 2014). However, conversations with members of the community between March and July 2018 indicated that there is a lack of consensus on the length of this long-term BWA, as residents recalled various time frames, ranging from a couple of years to 20 years (P01; P03; P07; P08; P10). One member of the community remarked that it seemed as though the town was "… on boil order as much as we were off boil order" (P04). According to an interview with a representative from the WRMD (P15, 2018), this long-term BWA only affected the Sandbanks Provincial Park as it yielded the lowest chlorine residual readings. Despite the actual length of the BWA, it appears that there was some "on and off" during that period with a series of short-term BWAs that lasted from three months to one year (P03; P04). This long-term BWA was finally lifted in November 2015 (Environment and Climate Change NL, 2019a; P03; P07; P12).

Since this BWA was lifted, the community has experienced numerous, short-term BWAs that have been issued due mostly to insufficient chlorine residual readings or system maintenance/repairs (Environment and Climate Change NL, 2019a; Municipal Affairs and Environment, 2019; P11; Water Resources Portal NL, 2020; Water Today Canada, 2020). (See Table 12 for a list of BWAs issued in Burgeo from 2001 to 2020).

Table 12: Burgeo BWAs (2001 – 2020)

BWA reason code	**Reason code explanation**	**Date issued**	**Date lifted**	**Source**
E2	Partial. Sandbanks Park. No free chlorine residual detected in the water distribution system	14/08/2001	25/11/2015	Environment and Climate Change NL, 2019a
E2	Partial. No free chlorine residual detected in the water distribution system	14/08/2001	02/04/2012	Dawe, 2013
E1	Water entering distribution system or facility, after a minimum contact time does not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value	07/5/2010	02/04/2012	Dawe, 2013; Environment and Climate Change NL, 2019a
D1	Water distribution system is undergoing maintenance or repairs	30/05/2017	08/06/2017	Environment and Climate Change NL, 2019a
D1	Water distribution system is undergoing maintenance or repairs	23/05/2018	12/06/2018	Environment and Climate Change NL, 2019a
E2	No free chlorine residual detected in the water distribution system	21/08/2018	09/11/2018	Environment and Climate Change NL, 2019a
D1	Water distribution system is undergoing maintenance or repairs	29/11/2018	14/01/2019	Environment and Climate Change NL, 2019a

D1	Partial. Garage to Reach Road Auto. Water distribution system is undergoing maintenance or repairs	22/10/2019	17/12/2019	Municipal Affairs and Environment NL, 2019
E2	Partial. Long Pond to Reach Auto Road. No free chlorine residual detected in the water distribution system	18/02/2020		Water Resources Portal NL, 2020; Water Today Canada, 2020
D1	Water distribution system is undergoing maintenance or repairs	02/08/2020		Water Resources Portal NL (2020)

Coping with boil water advisories in Burgeo

The residents of Burgeo have learned to adapt to changes to their water system, especially when BWAs are issued (P05; P10; P11). Although a few residents admit that they continue to drink water directly from the tap, others find alternatives (P05; P07; P11; P12).

Many residents turn to the local spring located 15 minutes outside of Burgeo (P03; P05; P10; P11; P12; P13; TCD7, 2017). Some individuals who collect water from the spring believe that its quality is on par or even exceeds the town's water. In an interview, one resident stated that "They [TC] had the spring tested years ago, and I think they said that it was "the [] purest water" they'd ever seen in this area" (P12). However, as mentioned in Chapter Two, spring water is not regularly monitored for impurities, and it is prone to contamination from various chemical, natural, and anthropogenic sources and activities. Additionally, many residents agree that the DHCS would never approve of its safety for consumption (P07; P11).

Many residents purchase bottled water, including filling up containers at reverse osmosis stations in stores, such as Foodland (P02; P07). Numerous residents have purchased and installed personal reverse osmosis systems in their homes (P01; P02; P03; P05; P07; P08; P11; P12; TCD7, 2017).

The residents of Burgeo are resilient and have found ways to deal with various water-related issues in their community over the years. Many residents do not feel inconvenienced by having to seek water alternatives. According to P10, they make their drive to the local spring a monthly outing with family. However, some residents agree that "…there's a difference between choice and being expected/required to. [We] shouldn't be forced to buy a reverse osmosis system or a filtering system" (P02). Additionally, concerns have been raised for single mothers and senior citizens who may have mobility, financial, or time constraints that make it exceptionally difficult for them to seek these alternatives (P10).

Many residents note that they are not impacted by BWAs as they generally do not consume the town's water, even when it is reported to be safe for consumption (P05; P07; P11; P12). Some businesses use water only for their washroom facilities thus, they are not affected significantly by BWAs (P05). However, other business owners have had to incur double costs for installing reverse osmosis systems in both their homes and businesses (P17).

Despite TC's tireless efforts and the vast amounts of money that have been poured into ensuring victories over long- and short-term BWAs, Burgeo's journey to achieving sustainable water security continues to be laced with various other challenges. These concerns are addressed in the next section.

5.2 Burgeo's other water-related concerns

Burgeo has faced numerous isolated water-related incidents that were resolved relatively quickly. For example, in 2018, the WTP experienced a minor explosion which required the expertise of a technician from Germany to ensure that the ozone generator was properly repaired. Fortunately, the expenses associated with this repair were shared with the Town of Gander which has a similar water treatment system. Burgeo's share of the expense was approximately $25,723 and the town was reported to have applied for capital works funding to cover 90 percent of this cost (Blue, 2018).

In March 2018, a chlorine leak was reported in the WTP (P09). Also, during this same period, reports show that the town's water was undergoing only three stages of treatment because of the challenges with the ozonation system noted above (P05; P08). As previously mentioned, ozonation is the process that removes aesthetic properties, such as colour and taste in water, thus, without this step in the treatment process, Burgeo's water reverted to its former discoloration (P05; P08; P09) (Image 13).

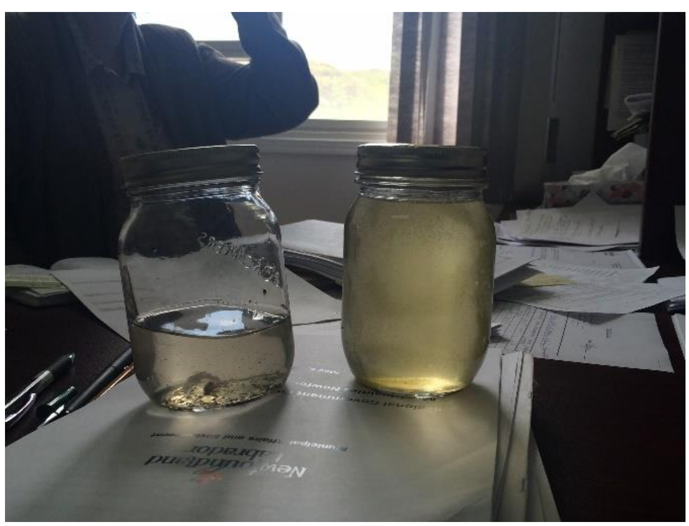

Image 13. Water discolouration from resident's tap, Burgeo (2017)

Power outages were also reported in late December 2017 and in March 2018, causing hundreds of carbon filters to blow out of some of the tanks in the WTP (P08; P09). A power outage in July 2015 affected the water supply to the Calder Health Centre, and this resulted in a cancellation of all outpatient procedures until the issue was resolved (O'Brien, 2015).

The next section will briefly discuss some common, more long-term water-related problems that were identified during this study. These include aging infrastructure, water usage, lack of operator training, and financial constraints.

5.2.1 Inadequate water system flushing

Due to the aging nature of the town's water infrastructure, impurities build up and become trapped in the distribution pipelines, thereby causing aesthetic issues such as discolouration, turbidity, and odour (CCME, 2004; P04). Additionally, Burgeo's water distribution system has many "dead ends" where any dirt that is transported through the water system accumulates (P02) (See Image 3 for locations of dead ends in the community). Pipes can be cleaned by removing trapped impurities or sediment in a process known as "flushing" (CCME, 2004). According to community member Meade, in the past, Town Staff employed a simple flushing technique in which they "… turn[ed] on the fire hydrants and let out a little bit of water" between 12am and 6am, and they would rush to turn off the hydrants at 6am even if the process was not completed because residents at higher elevations would experience a significant decrease in water pressure. However, during this time of the day, only the topmost layer of dirt would be removed. Calculations done by TC indicate that effective flushing requires water to flow at a minimum rate of 1.7 feet per second. This translates to a flow rate of 1,500 gallons per minute from the fire hydrants. A flow rate less than this is insufficient to agitate the dirt and sediment that is deposited at the bottom of the pipes and flush it out through the hydrants (P04). The WRMD states that flushing should be conducted annually at minimum (Municipal Affairs and Environment NL, 2020(i)). However, over the years, Burgeo's water system has not been adequately flushed (P02; P04). Additionally, the naturally occurring organic matter present in pond water results in the accumulation of biofilm in pipes. Flushing alone is insufficient to remove biofilm. However, this slimy material can be removed through chemically assisted flushing through a process known as bio-purging (Moulton, n.d.). By first removing biofilm, flushing processes become more efficient, resulting in significantly cleaner pipes, thus TC hopes to be able to conduct at least one bio-purge annually (P02).

5.2.2 Water usage

The national average per capita water usage for the residential sector is about 215 litres or 60 gallons per person per day (Statistics Canada, 2021a). Chapter Two mentions that the province of NL is among the highest for per capita water usage in Canada. With its population of ~1,100 residents and only 655 households (with several of these unoccupied), Burgeo requires an average of 66,000 gallons of water per day to be consistent with the national average for residential water usage. However, many reports indicate that Burgeo's average is generally 15-20 times more than the national average (P10; TCD3, 2017; TCD4, 2014). Community member Vatcher believes that Burgeo runs water "… as if there were 18 people in each household." For example, in 2010 and 2013, TC reported that Burgeo used an average of over 800,000 and 648,000 gallons of water per day respectively[13] (P07; TCD4, 2014). Additionally, TC provided a report of an incident where the tank of water—that has a capacity of 500,000-700,000 gallons and should have lasted at least two to three days—lasted only four to six hours (P03; TCD4,

[13] It is unclear if the data provided by the TC for water usage/flow rates included both residential and commercial usage.

2014; TCD7, 2017). During the peak/coldest winter months (namely January/February), it is common for the town to go through double the tank's capacity, and flow rates during these periods are typically between 600-850 gallons per minute (P04; P11; TCD3, 2017). This is due to residents—whose lateral lines are shallow—running their water to prevent their pipes from freezing. Town statistics show that water use drops to 100-200 gallons per minute during the warmer summer months (i.e., April/May to October/November) (P04; TCD3, 2017). (See Appendices O to Q for Burgeo's water flow rates from 2015 to 2017).

Residents and business owners/operators often feel that they are blamed for overusing water (P11). This may be attributed, in part, to the common yet erroneous belief that Burgeo has "… thousands of water…" (P05). Despite the seemingly vast supply of water that is available to the community, government agencies require the water to be upheld to various quality standards thus, the water must undergo treatment processes which are costly (P01; P02; P05; P07; TCD7, 2017). It is for this reason that many residents and community leaders cannot justify flushing down thousands of gallons of good, treated water (P01; P02; P05). However, it is also important to note that there are other reasons for the alarming amount of water used in Burgeo. TC believes that differentiating between water that is used and water that is wasted is key in addressing water usage in the community (TCD2, 2017).

As discussed above, several community members strongly believe that Burgeo's water usage is high because many residents must run their water to prevent their pipes from freezing during the winter months. Estimates from members of the TC suggest that a third of residents run their water wastefully by running it during summer months, taking the ball out of their toilets, taking apart their water pipes, or running water into their sewer systems (P02; P07; P13; TCD3, 2017); one-third of residents run their water conservatively, using methods such as straw flow or saddle valves (P02; TCD3, 2017); and another third of residents may run their water unknowingly e.g., through leaky valves (P02; P10; TCD7, 2017).

Although TC acknowledges that many people do not run their water simply because they want to run it, but, rather, out of necessity, they also note that water can be run conservatively and still have the same effect (P02; P03; P07; P10; P11; TCD7, 2017). TC has conducted experiments to determine the absolute minimum volume of water required to prevent pipes from freezing. These studies have shown that residents only need to run one-third gallon per minute to prevent their water from freezing. Based on this figure, the town would only need to run 266 gallons per minute to cater to the residents' needs, including preventing pipes from freezing (TCD3, 2017).

5.2.2.1 Town Council's response to water usage in Burgeo

TC is committed to working with residents to gain a better understanding of how much water the community is running and where losses of water can be minimised (TCD7, 2017). In May 2017, TC spent several hours, brainstorming on how to address the community's various water problems. This resulted in the development of a tentative Town Plan to reduce the flow rate and maintain good quality water (P02; TCD3, 2017). This plan included eight different steps that could be taken to realise this goal (TCD3, 2017). These steps are summarised below. (See Appendix R for detailed eight step plan).

1. Pilot project to buy and install four water meters in volunteer residences to estimate water usage in homes.
2. Manage curb stops to ensure they are visible, accessible, and clearly marked for Town operations.

3. Leak management through identification and repairs.
4. Turning off water in vacant homes.
5. Homes unoccupied for four weeks or longer to register with TC and have water turned off. If not, TC to turn off water, and homeowner required to pay reconnection fee upon return.
6. Availability and accessibility of educational materials for water conservation.
7. Metering*:
    a. Part-time monitor to work with residents to determine water use and to identify opportunities for conservation.
    b. Installation of water meters for residents who are not comfortable with monitor in their home.
8. Review of policies to ensure explicit mention of Town Staff inspecting and signing off on new and replacement lines before covering lines, and for water and sewer lines to be approved by TC before new residences are occupied (TCD3, 2017).

*Due to public resistance/backlash, these two were removed from the water plan (P02; P05; P12).

Steps 1, 3 and 7 evoked the greatest responses and controversy during conversations with various members of the community, TC, and PG, between March 2018 and May 2019 and will, therefore, be discussed briefly in the next section.

Leak management through detection and repairs/upgrading of aging infrastructure

TC acknowledges that leaks, especially within the aging water infrastructure, are inevitable (P02; P10). However, for TC to repair the leaks around town, they must first distinguish between water that is used by residents for basic purposes, including preventing lines from freezing, and water that is lost to leaks (TCD7, 2017). Some members of the community believe that leaks are used as an excuse for water overuse when, in fact, residential water use is the primary culprit (Hann, 2017; P01; P07). When comparing the significantly greater volume of water used in the winter months to summer usage, P01 posed the following question: "Who fixes all the "leaks" in June and puts them back in December?" However, most of the community agrees that a tremendous volume of water is lost to leaks (P01; P02; P06; P08; P10; P11; P12). In an interview, community member Cossar summarised this as follows:

> Coming on at the end of March, when people start turning their water off… even at 12 o'clock in the night, you could have a flow rate of about 150 gallons per minute coming from the plant… Everybody is gone to bed. Nobody is running their water. There's no fish plant operating. So, there's got to be water running away that [the] people [are] not running.

For this reason, some residents have argued that TC should begin by addressing the leaks in their water infrastructure before requiring residents to employ water conservation practices (P02; P06; P12). Additionally, the presence of multiple leaks in the system has caused concerns for some residents regarding the safety of the water. Leaks may also cause water quality breaches, a concern mentioned by P07 who asked how the town is getting "good" drinking water if contaminants are able to enter the distribution system through the leaks, and if most of the chemicals added to treat the water are lost through these same leaks (see Colombo and Karney, 2002).

Identifying the number and location of leaks in the system has been a challenge for the town (P02; P11). TC has managed to identify four main leaks through which 250 gallons per minute of water are lost (P08). According to an interview with P01, leak detection should not be challenging as it can be conducted effectively by using basic mathematics. In addition to minimising water quality breaches, if the town is able to identify and repair leaks within the distribution system, this will result in significant savings as less energy and chemicals will be used to treat and pump excess water that ends up lost to the leaks (Colombo and Karney, 2002).

Some members of the community believe that, when it comes to leaks, they are "… fighting a losing battle," because as they fix one leak, a new one develops due to the aged and degraded condition of the infrastructure (P08). If water pressure increases significantly, portions of the line begin to rupture, resulting in more leaks (P11; P12). Additionally, the town does not have some of the necessary equipment to repair leaks in certain parts of the system (P10). Despite these challenges, Burgeo is committed to combatting leaks in the system by investing funds to replace the infrastructure. TC states that replacing the waterline "… has been listed as our number one priority…" (Tait, 2017). TC is devoted to developing a long-term plan, which will be implemented in stages, to ensure that the 18-inch steel pipes are replaced with 12-inch PVC pipes by 2022-23 (P01; P02; P07; P08; P12; Tait, 2017). TC has continued to seek funding to realise this goal and, in fact, in 2022, Burgeo had received funding to complete the sixth phase of its watermain replacement (Infrastructure Canada, 2022; P02; TCD5, 2014) (Refer to Appendix I).

TC does, however, emphasise that, replacing the pipe and, thereby eliminating the leaks is only one piece of the puzzle to addressing the community's multi-faceted water issues (P02). TC is also hoping that over the next couple of years, the Town, and residents alike, will ensure that their water lines are at the proper depth and are adequately insulated to prevent leaks and freezing (TCD5, 2014). This will be tackled by redoing lateral lines throughout the community, which P01 believes should be funded by the CCBF.

Image 14. Watermain Replacement Phase II sign, Burgeo (2018)

Water monitor

To address the issue of water overuse, TC also discussed the idea of hiring a part-time water monitor who would work with residents in their homes and help TC gain a better understanding of water that is used by residents versus the water that is lost to leaks in the infrastructure (P02; P10; TCD2, 2017). According to TC, a monitor would be beneficial to residents, especially senior citizens and widows, who typically live alone and are unable to afford upgrades to their lines or obtain acceptable flow rates in their homes, by educating them about the importance of water conservation and helping them to identify such opportunities in their homes (P02; TCD2, 2017; TCD7, 2017).

The cost of hiring a water monitor would be far less than the costs associated with installing, reading, and maintaining water meters in a larger number of households, and the monitor would be guaranteed employment for 6 months. Upon determining flow rates, residents would be given options for regulating their flow, such as using saddle valves, 1/8-inch flow, or circulating pumps. If this project succeeded by helping TC understand acceptable flow rates for the community, the water monitor program would be eliminated (TCD2, 2017). However, TC raised concerns regarding the number of households that would require monitoring to produce results that would be representative of the entire community. Additionally, TC struggled to determine the selection criteria for households that would be chosen to participate in the water monitoring pilot project. The dilemma was that they could not "…discriminate against one resident over another and place meters on those [they] suspect[ed] of abusing" (TCD2, 2017). Another significant challenge to implementing the water monitor program identified by TC was the potential resistance from the public due to the program being regarded as an act of policing (P10; TCD, 2017). One member of council stated that the hired monitor would need to have "… the heart of a lion, the skin of a rhino, and the will and determination of Donald Trump" to overcome any potential push back from residents (TCD2, 2017). There was also the issue of who would be held responsible for pipes that froze despite compliance during the program (P12). Furthermore, TC acknowledged that a water monitor entering a home would have to be by invitation, not force (TCD7, 2017). However, households that did not comply with water monitoring would be subjected to water meter installation in their homes (and businesses) (TCD2, 2017).

Water meters

The idea of installing water meters in homes is not a new one, and it has been brought up by previous councils, albeit with no follow through. TC has stated that they would rather invest in new, insulated pipes than to introduce water meters (TCD2, 2017; TCD7, 2017).

Water meters work similarly to hydro/electricity bills that "… remind people to turn off lights and use efficient light bulbs" (TCD7, 2017). Meters act as financial incentives for water conservation and financial disincentives for excessive usage, because as residents are charged for the volume of water they use—as opposed to paying a flat rate—they become more aware of the cost of their water use patterns and volumes, thereby encouraging conservation. Water metering would ease the pressure on the water system and enable the town to save on infrastructure repair and replacement costs (P07; TCD2, 2017; TCD7, 2017). The data produced by water meters could also provide a platform for PG officials to step in and assist the town with conserving water by providing financial assistance for insulating or replacing water lines (P07). Additionally, meters would enable TC to measure the flow of water in households and detect leaks more accurately (P02; P05; P07; TCD2, 2017).

However, there are several disadvantages to introducing meters within the community. Firstly, TC notes that proper installation of meters in older residences and buildings would be challenging (TCD2, 2017). Secondly, the costs of installing (e.g., digging) and maintaining water meters (e.g., plumbing, electrical processes, and meter reading) are high (TCD2, 2017). In 2017, it was estimated that installation of the meters would cost residents $500-$600, and the drive-by meter would cost the town $25,000 (P12; TCD2, 2017). However, the installation cost is not the only cost that residents would incur. TC estimates that installation of a water meter in an average household of four with a daily water use of ~ 3,000 litres would generate a monthly bill of $90.00 (TCD2, 2017). This monthly amount is over five times more than the rate that Burgeo's residents are accustomed to paying with the current flat rate pricing system. Additionally, Burgeo's population continues to decline, and 70-75 percent of residents who are over 60 years old are sustained by low incomes, thus, they would be unable to afford this change (P12; TCD7, 2017). Finally, many residents feel that water meters would make them "… frightened to death to use their water… It will force people to stop showering and flushing their toilets" (TCD7, 2017).

Despite this myriad of challenges to introducing water meters in Burgeo, TC suggested implementation of water meters in two different capacities. Firstly, TC approved a pilot project to have four water meters installed in four volunteer residences in different parts of the community to gain a better understanding of how the meters work, their benefits, negative impacts, and water usage patterns in various parts of the town (Step 1 of 8-step plan) (P02; P05; P07; TCD7, 2017). The information produced would be provided to the public but approval for this pilot project would not guarantee implementation of the project (TCD7, 2017). Secondly, under Step 7b of TC's 8-step plan, TC also discussed installation of water meters in homes and businesses if residents/owners refused to comply with the water monitor in Step 7a (TCD2, 2017; TCD7, 2017). Unfortunately, before details of the water meter components of the 8-step water plan had been fully ironed out, incomplete information was leaked to the public and this led to mistrust of TC's plans and intentions for the community (P02; P05). Firstly, some residents thought that TC was planning to install water meters in a few households for billing purposes as opposed to using the data collected for information purposes only (P05). Secondly, many members of the community believed that TC had made the decision to move forward with installing water meters in all residences, businesses, and buildings (P01; P05; P10; P12). This resulted in significant public backlash, and a protest was held in August 2017 to inform TC that water meters had no place in Burgeo (P01; P02; P05; P12; P13). Despite the public's resistance to water meters, some members of the community believe that water meters may become a reality for Burgeo in the future if all other water conservation initiatives fail (P01; P02; P07). Additionally, some PG consultants have urged TC to revisit installing water meters to help them gain a better understanding of the leaks within the water system and the community's flow rates (P02).

Seasonal bypass for water conservation

Seasonal bypass, whereby water is diverted away from the WTP and receives the minimum acceptable treatment (namely disinfection and pH adjustment as was the case before the community had a WTP) has been discussed as another method to address Burgeo's excessive water usage (P04). TC states that many towns in NL chlorinate pond water without any additional treatment, thus, bypass is very common, and the PG generally only intervenes if something critical occurs because of the bypass (TCD2, 2017). Several members of the community (and some members of TC) strongly support seasonal bypass during winter months, i.e., from October to April or for four to six months of the year (Hann, 2017; P02; P12; P07; P15; TCD2, 2017; TCD3, 2017; TCD7, 2017). The primary argument in favour of seasonal bypass relates to financial savings, such as the $5,000-$7,500 that the town spends on monthly electricity bills from running water through the WTP (TCD2, 2017). Additionally, the WTP has been overworked, trying to pump water over its intended capacity thus, this option would give the system a much-needed opportunity to recover (P12; P15; TCD2, 2017). TC states that, while on bypass, residents can use as much water as they please because of the significant reduction in chemical and treatment costs, and that during winter months, water quality is generally at its best thus residents would not notice a significant change in the quality of their water (TCD2, 2017).

Although bypass may seem like a simple solution, there is no way to guarantee good quality water if the water does not receive all the necessary treatment and processing (TCD2, 2017). TC anticipates that, while on bypass, DBP levels will increase significantly, thereby putting public health at greater risk (P02; TCD2, 2017; TCD6, 2017). TC reminds the community that, before the WTP was installed, Burgeo's THM levels were ten times the MAC of 80 ppm (0.08 mg/L) thus, the WTP was installed, in part, to "… get away from chlorinated pond water- a process that creates THMs" (TCD7, 2017). Additionally, without treatment processes, such as ozonation, Burgeo's tap water would revert to its original brown/tea colour (P02; P04; P08; P11). Bypass would leave the Town liable for any resulting illnesses or fatalities (TCD2, 2017). Additionally, the town would continue to incur chlorine costs—including the associated operation and maintenance of the WTP—as disinfection remains mandatory for PWSSs in NL (TCD2, 2017). The bypass would need to be initiated in the WTP which would be another expense, and additional funds would be required to ensure that the water tank remains clean (TCD2, 2017). Once winter is over, the costs associated with rebooting the system would also be significant (TCD2, 2017). TC and some residents argue that it does not make sense to have an $8-million-dollar WTP and not use it for almost half of the year (TCD7, 2017). Community member Hann urged the community to consider using less water throughout the year so that the system does not have to be put on bypass because "…Shutting down the plant because we are using too much water is like [] getting rid of the fire truck because we are having too many fires." In 2017, TC stated that they do not intend to put the system on bypass and that they are working hard to find a more suitable and sustainable way to address the issue of water overuse (Savoury, 2017).

Residential water conservation practices

Tom McMillan, former federal Minister of Environment, stated that Canadians should seek to use water "…in our own time in a way that leaves it unimpaired for our children and their children after them" (Environment Canada, 1987). TC has been educating the public about water overuse through a conservation communication program (P01; P03; P05; P10). By conserving water, the strain on the water system will be eased (P02; P10). TC also acknowledges that many residents have undertaken various measures to conserve water. These include insulating pipes; decreasing shallow bury by adding more soil to ensure that lines are deep enough to keep from freezing; installing heat tracers on pipes; shutting off water at curb stops when leaving residences for extended periods of time; replacing leaky valves/installing water valves on lines; and/or using circulating pumps (P02; P05; P07; P09; P10; P11; TCD3, 2014; TCD4, 2017).

Additionally, one member of the community has proposed installing two water lines: one line with water that is not as rigorously treated that can be used for domestic purposes such as bathing and flushing, and a second line with potable water that is upheld to more rigorous water quality standards for consumption (P05). However, Burgeo has already spent many years trying to operate, maintain and repair/replace the existing distribution system, and installing a second distribution system would require significant additional funding and more operating staff which the town may not be able to afford.

5.2.5 Inadequate operator training

As discussed in Chapter Two, it is crucial for all PWSSs to be operated by fully trained/certified water operators. Additionally, water system operators must strive to continuously learn about breakthroughs in disinfection and optimisations of treatment processes within and outside their jurisdictions to determine whether these processes may be beneficial and adaptable to their practices (CCME, 2004). P11 recalls that, previously, Town Staff "… didn't know any more about the ozonating system than […] flying an aeroplane." However, there were always opportunities to learn on the job (P04; P11). The DECC's OETC program travels to Burgeo for on-site training when requested by TC and offers opportunities for operator training and certification (P04; P15; TC, 2019). Previously, the DECC (Municipal Affairs and Environment at the time) provided operator training for new WTPs with the possibility for follow-up training after three months (Municipal Affairs and Environment NL, 2005). However, TC states that this type of training with the follow-ups is no longer offered as communities are now required to enroll their water operators in relevant training sessions that are offered by the OETC (TC, 2019).

At the time of data collection (2018/19) Burgeo had three WTP personnel. However, only the lead hand/water operator possessed Level I certification (P09; P11; TC, 2019). Although the lead hand was commended for showing a good understanding of the water system, its maintenance, pH, chlorine, and ozone dynamics, Level I certification provides training on water basics only and not on operation and maintenance of the water system (P04; TC, 2019).

In a follow-up meeting in Burgeo in 2019, some members of TC admitted that inadequate operator training and certification may be the cause of some of the town's more recent water-related problems and that former councils may have had less regard for adequate, appropriate operator training and certification as a critical component of drinking water management (TC, 2019). They also expressed that PG engineers should demand that all staff receive adequate training before operating a plant, and that as the PG invests money into its communities, it must also provide training for each community to ensure that each employee across the province is adequately and appropriately trained. However, TC notes that the PG does not enforce strict regulations regarding training and certification requirements for water operators and they leave it for individual communities to ensure that their operating staff are satisfactorily trained (TC, 2019).

The Town of Burgeo has sought (paid) assistance from Gander's water specialist who has provided three or four training sessions with Burgeo staff on maintenance and operation of the ozone based WTP (TC, 2019). TC argues that there is a lack of ozone-based water treatment systems training throughout the province due to its limited demand as only three other communities in NL were utilising ozone technologies at the time of data collection (TC, 2019).

5.2.6 Financial challenges

Municipalities across the province rely heavily on funding from the PG and the FG. Burgeo has invested significantly in various water-related projects with funding from both the federal and provincial levels of government (Appendix I). However, the community still requires funding to complete projects, such as replacing the mainline and installing flushing stations. Unfortunately, due to fiscal constraints and the large number of municipalities in NL, the PG cannot guarantee that every single community will receive funding every year or every time they submit an application (P02). Communities typically wait several years after making applications for funding before approval is received. This makes it especially challenging for communities—such as Burgeo—to make consistent improvements to their water services and infrastructure (Barber as cited by Tait, 2017).

The next section utilises the CG framework and core concepts from the literature to assess CWG in Burgeo, with especial focus on dynamics between the actors involved, namely communication and coordination. This section will also seek to better understand the experiences and stories shared by research participants as they relate to the CG framework and its key elements.

5.3 Assessing collaborative water governance in Burgeo, NL

As discussed in Chapter Two, collaborative governance (CG) is a process in which diverse actors from public agencies, governments, and private or civil sectors come together to deliberate, pool resources, and make decisions to address complex problems that they could not otherwise achieve independently. This sections presents the results obtained and analysed from the various research methods utilised throughout this study and it identifies if and how the core components of CG (as defined in the framework below in Figure 1; also see Table 11) have influenced water governance—particularly communication and coordination—in Burgeo. These results also provide the foundation for the responses to the research questions posed in Chapter One.

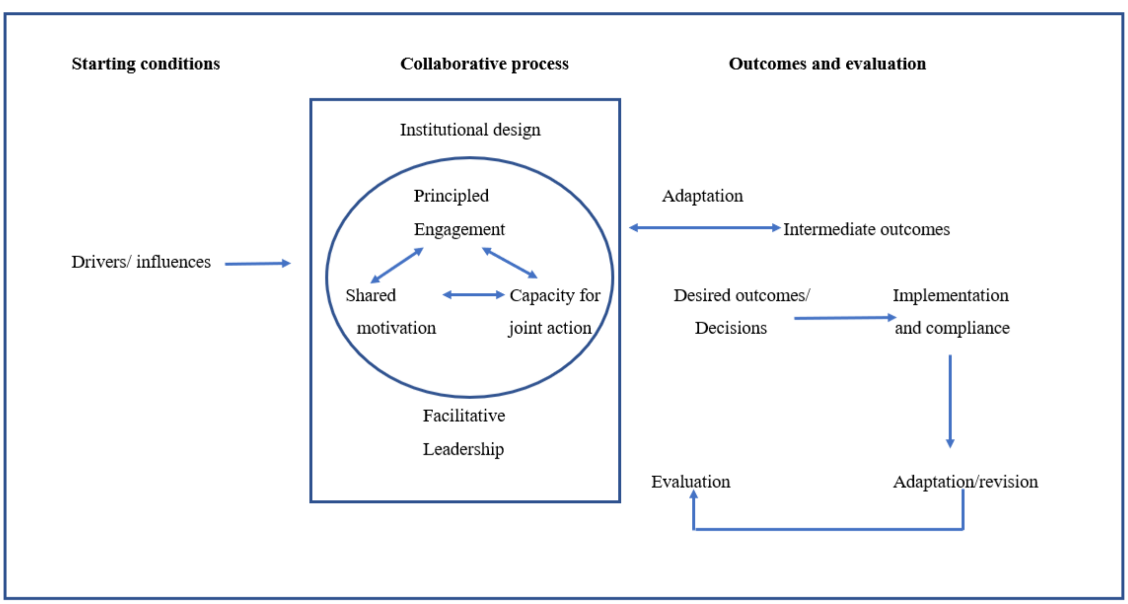

Figure 1. Collaborative governance framework

5.3.1 Starting conditions: drivers/influences

Chapter Two highlighted that drivers are present at the start of collaborative processes. At least one driver is required to initiate collaboration, although the more drivers present, the greater the likelihood of collaboration (Emerson et al., 2012). Drivers can either facilitate or hinder collaboration (Ansell and Gash, 2008). Three key types of drivers/influences are presented in the CG framework and considered in this research. Of these, two are most commonly noted as influencing CG in drinking water provision: power asymmetries (along with related knowledge and resource asymmetries) that often cause challenges to collaboration on one hand, and the emergence of newer, more complex water issues (along with legal obligations/regulations) that serve as an incentive on the other. In the case of Burgeo, both power asymmetries and the emergence of newer, more complex water issues were identified and discussed by 14 out of 17 research participants.

Knowledge-power-resource asymmetries

As illustrated in Table 13, with respect to knowledge-power-resource asymmetries, power imbalances were observed by the majority of interview participants (14 out of 17) although there was a lack of consensus on which actor/group possessed the most power to influence water-related decision-making and the overall collaborative process. As discussed in Chapter Two and Chapter Three, provincial (and territorial) governments provide significant funding to municipalities for water-related projects and infrastructure through programs such as MCW in NL. This was echoed by eight of 17 participants who noted that the PG—as the primary financial/economic actor—possessed most of the decision-making power as, without funding, water-related projects would come to a complete halt. Additionally, five participants agreed that the PG's technical/scientific experts had greater weight in decision-making than actors who possessed more traditional/local or non-technical/scientific forms of knowledge. According to an interview with P05, "… it was frustrating to get the government to move on a different path, and once they decided that an ozone system was there, this is what they were going to do." A smaller number of participants (two of 17) believed that the Town—as the owner and operator of its drinking water system—held the most power to influence decisions. One respondent argued that the residents of Burgeo—the group of actors most directly impacted by the resulting water-related policies—possessed enough power to steer decisions in their favour.

Table 13: Results for knowledge-power-resource asymmetries

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Power imbalances	14	82.4
Resource imbalances	11	64.7
Knowledge imbalances	11	64.7

Knowledge imbalances were described by 11 out of 17 participants. This included five participants who believed that actors who possessed more technical and scientific knowledge tended to dominate discussions and decision-making processes, thereby rendering those actors with less technical/scientific knowledge or more experiential and local knowledge believing that their contributions were less valid or unwelcome. This was echoed in the sentiments expressed by P04 who said, "You can't tell engineers nothing, you know. They have that degree." As mentioned in Chapter Two, scientific and traditional knowledge were previously regarded as the authority in environmental decision-making, However, this is no longer the case and calls have been made for greater inclusion of more diverse knowledge forms, thus, this concentration of technical and scientific knowledge within one actor/group may be a significant hindrance to collaboration.

While not the most commonly noted asymmetry, participants who did speak of resources (11 of 17) all felt that financial imbalances were most important. Exploring these differences further, four respondents agreed that certain actors/groups often faced staff/labour shortages. For example, P02 stated that they were not convinced that the DECC (Department of Municipal Affairs and Environment at the time) had "… enough people involved in solving the water issues across the island." Human resource limitations were also identified at the community level with a lack of adequate operator training being highlighted. While other asymmetries were described as a challenge to collaboration, these resource shortages encouraged collaboration. In the case of Burgeo, the Town, for example, engaged in collaboration, because it lacked the resources, namely funding and technical/scientific expertise to address its water problems independently. The PG, acknowledging its limitations in addressing all the water concerns within its jurisdiction, appears to have joined the collaborative table to enlist the Town's expertise and other capacities to ensure that the community's water resources were effectively and efficiently operated and maintained, while providing financial and technical support.

Incentives for participation

Incentives are considered an important driver as their presence facilitates collaboration. There are many different types of incentives that may be present at the outset of collaboration and some of these were highlighted in Chapter Two. Table 14 shows that the emergence of newer, more complex water-related issues was observed by most interview participants (14 out of 17) as an incentive for participation. More specifically, ten participants identified that leaks throughout the water distribution system required immediate attention and, thus, facilitated collaboration. As previously noted, while the average residential per capita water usage in Canada in 2019 was 215 litres per person per day, Burgeo's average water usage was often reported to be double this amount. This was echoed by nine participants who agreed that the community's excessive water usage needed to be addressed promptly. Another nine respondents noted the need for sustainable solutions for residents who had to run their water during colder months to prevent their pipes from freezing. Both leaks and running water during the winters are linked to excessive water use. Nearly half of the respondents (eight out of 17) also felt that replacement of the town's aging water infrastructure required prioritisation and consistent, adequate funding from the PG. Finally, one respondent thought that DBP exceedances in Burgeo's water were concerning as the town's water was often reported to contain THM and haloacetic acid HAA concentrations that exceeded the MACs as defined by Health Canada.

Legal obligations and/or regulations were mentioned by 13 of 17 participants. For example, community member Meade stated that "… the people who drink [the water] drink it with the assumption that somebody down the line is providing nice, clean, safe drinking water." Upon further consideration, 11 participants agreed that various PG departments, such as the DECC and the DMPA (collectively the Department of Municipal Affairs and Environment at the time), were responsible for the regulatory and financial aspects of water service and delivery in Burgeo. Additionally, five out of 17 respondents identified the Town as the owner and operator of the drinking water system and, therefore, considered them responsible for the daily operation and maintenance, while a further five respondents—some of whom agreed that the TC was responsible for safe water provision—felt that the lead hand/water operator was the individual who was most directly responsible for operating the water system and ensuring drinking water safety in Burgeo. Indeed, as discussed in Chapter Two and Chapter Three, each of these individuals/groups—relevant PG departments, TC, and water operators—held some legal responsibility for drinking water in Burgeo which, in turn, encouraged them to work together.

Table 14: Results for incentives for collaboration

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Emergence of newer, more complex water issues	14	82.4
Legal obligations/regulations	13	76.5
Prehistory of cooperation or successful collaboration	5	29.4
Personal gain/benefits	4	23.5
Funding opportunities	2	11.8
Opportunities for communities to share costs, knowledge, experiences, and best practices	2	11.8
Research opportunities	2	11.8

With respect to having a prehistory of cooperation or successful collaboration, many participants agreed that actors, over the years, collaborated successfully to ensure achievements of various water-related milestones. For example, nine participants mentioned that procurement of the current WTP was achieved through successful collaboration by actors such as the TC, various PG departments (DHCS, DECC, DMPA), and engineers (TC- and PG-contracted) who came together and pooled their resources to ensure that Burgeo's goal of securing a WTP was realised, while seven respondents agreed that the same was true for procurement of the first WTP. Additionally, six of 17 respondents noted that establishment of the original water line to enable running water through households and buildings in Burgeo was also the result of successful collaboration where the majority of the funds for the infrastructure was provided by the PG and the fish plant. A further five participants agreed that lifting the previous long-term BWA in 2015 was the result of a collaborative effort that was spearheaded by the mayor of Burgeo at the time and involved the TC and its staff who oversaw the water treatment and distribution facility, various PG departments (such as the WRMD of the DECC which conducted regular analyses to determine the safety of the town's water), and the residents of Burgeo who complied with the BWA, thereby minimising any associated health-related risks. Another four participants attributed more frequent and specialised water operator training opportunities to collaborative efforts between the TC and its staff, and the WRMD who administers the OETC program across NL. Although not exhaustive, these successes have served as incentives for further/continued collaboration.

Personal benefits from improved access to clean, good quality drinking water were identified by a smaller number of research participants (four out of 17). According to community member Ingram, "… as a councillor and as well as a resident, you want to be living in a town where you've got clean, quality water." Additionally, the emergence of new funding opportunities, such as grants for Capital Works applications, as an incentive for collaboration was discussed by two participants.

Opportunities to collaborate with other communities within the region or those with similar water treatment systems was also highlighted by two respondents. For example, certain members of the TC regularly attended the South-West Joint Council meetings to share and exchange knowledge and best practices. Finally, two respondents indicated that Burgeo welcomed various scholars and other researchers who conducted research/studies on the community's various water-related concerns and provided recommendations for improved water quality, conservation, and service and delivery.

Constraints on collaboration

There are numerous factors/constraints that may deter actors from collaborating with other actors to address complex problems. Table 15 below shows that, in the case of Burgeo, various constraints existed at the outset, thereby hindering collaboration as the community sought to address their various drinking water issues. According to the results of this study, limited financial capacity—which is linked to the financial asymmetries noted above—was the most frequently identified constraint to collaborating to address drinking water challenges. Approximately half of the participants (nine out of 17) felt that certain actors who lacked or had limited financial capacities were often vulnerable and/or dependent upon stronger economic actors, such as the PG. For example, P03 stated that, when applying for funding for water projects, "It's not a smooth process. Lots of obstacles, lots of paperwork… Nobody will loan or give you money for something you won't be able to operate or maintain…"

A further eight out of 17 participants explained that actors were sometimes deterred from engaging in collaboration because their contributions were not well-received by other actors in the past. Further, as noted above, experiential, and local/traditional knowledge was sometimes seen as less valid or welcome than scientific and/or technical knowledge.

Table 15: Results for constraints on participation

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Limited financial capacity	9	52.9
Lack of openness to and genuine consideration of other actors' views	8	47.1
Prehistory of conflict or unresolved conflict	8	47.1
Lack of engagement of relevant actors/groups	6	35.3
Slow pace at which collaborative outcomes are achieved	4	23.5
Lack of human capital	3	17.6
Lack of tangible benefits from previous collaborative efforts	2	11.8
Unresolvable water issues	2	11.8

When asked about conflict, eight of 17 participants identified various conflicts between certain actors, often within the community. For example, seven respondents agreed that there were conflicts between the TC and the residents. One resident recalled that, during the summer of 2017, "… the Town was moving ahead with a water treatment plan, and there was a demonstration… and once the councillors got inside the building, some of the protestors decided to bang on the building…" (P05). This incident was reported by CBC News in August 2017. A smaller number of respondents (three of 17) mentioned conflict amongst councillors who did not always see eye-to-eye. One member of council admitted that, despite attempts to remain civil toward one another, conflict between councillors led to certain councillors being barred from outreach within the community as their water-related views were often seen as unpopular. A further 4 respondents acknowledged conflicts between the TC and the PG regarding issues such as the size/capacity and type of WTP that would have best served Burgeo and its needs.

Exclusion from collaboration or lack of meaningful engagement was noted by six of 17 respondents who felt that residents were either excluded from important discussions regarding the community's water or, if they were engaged, it was done as a formality and that their contributions did not hold much weight in decision-making. P13 stated that "There is a platform for residents to participate in discussions regarding the town's water, but sometimes their opinions don't count." Another four participants acknowledged that the slow pace at which collaboration occurred may have discouraged some groups from engaging in discussions about the town's water. As highlighted earlier, due to the PG's limited financial capacities, municipalities across the province are not guaranteed to receive funding for water-related projects every year or each time they submit an application, and this often hinders their progress to achieving positive water-related outcomes. A further three respondents also noted that due to the PG's limited specialised staff capacities, such as having one designated regional water operator, communities often have to wait extended periods of time before they can engage with these specialists to address their water concerns. Finally, two participants admitted that previous collaborative efforts yielded little/no results, while another two participants felt that the complex, multi-faceted nature of Burgeo's water problems was daunting and/or unresolvable and that the community was stuck in a vicious cycle whereby as one water issue was resolved, another one would emerge.

Summary of starting conditions: drivers/influences observed in Burgeo

This section described some of the constraints that participants identified in Burgeo. These included the imbalances that existed while attempting to address water problems in Burgeo. Although all three imbalances (power, resources, and knowledge) were identified, participants suggested that both knowledge and resource imbalances influenced power, i.e., the more resources and knowledge an actor/group possessed, the more power they had to influence decision-making; a phenomenon noted by Emerson (1962). Lack of financial resources was the most discussed constraint after these imbalances. This was followed by disregard for other actors' knowledge, views, or concerns. Various other constraints existed, oftentimes concurrently. Actors, such as the TC, who experienced multiple constraints—namely, limited financial capacities, power, knowledge (scientific and technical) imbalances, and inadequately trained staff—felt that they experienced disproportionately more barriers to collaboration.

In terms of incentives, the emergence of newer, more complex, multi-faceted water-related problems in Burgeo was identified as the primary incentive for collaboration. However, as considered above, the constant emergence of newer water-related concerns was described as discouraging to some actors. The second most discussed incentive was legal obligations/regulations for actors who were legally required to ensure clean, safe, sufficient drinking water in Burgeo, such as the TC (and its staff) and the PG. Other incentives discussed in this section included a prehistory of cooperation or successful collaboration which facilitated further collaboration as actors sought to replicate previous successes. This was followed by personal benefits from accessing clean, safe, sufficient drinking water, especially for residents and businesses, as well as tourists. Actors who had multiple incentives, such as the TC and residents, were more likely to engage in collaboration with other actors to achieve positive drinking water outcomes for Burgeo.

5.3.2 Collaborative process

In addition to the preconditions in place, the outcomes of CG are shaped by the collaborative process itself, including the dimensions of institutional design and facilitative leadership. The CG framework further identifies principled engagement, shared motivation, and capacity for joint action as three additional key components for effective collaborative processes. Findings related to each of these collaborative process elements are reviewed next.

5.3.2.1 Institutional design

Institutional design—as presented in Chapter Two—relates to the rules and regulations that structure and guide actors as they plan and manage their goals/objectives. This is important as it ensures effective and efficient fulfillment of shared mandates, and it increases credibility and legitimacy. The CG framework suggests that there are four key elements to an effective institutional design (see Table 16), each of which are discussed below in relation to collaborative drinking water governance in Burgeo.

Table 16: Summary of results for institutional design

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Process transparency	16	94.1
Forum exclusiveness	10	58.8
Clear ground rules	5	29.4
Representation of all relevant actors/groups	2	11.8

Process transparency

Process transparency is the ability of actors to view and understand how the various stages of collaboration operate through open communication and accountability. Table 16 illustrates that the vast majority of participants (16 out of 17) agreed that some stages of collaboration were transparent. Delving deeper into this theme, nearly half of the respondents (eight of 17) mentioned that pertinent water-related information, including dates and reasons for issuing and/or rescinding BWAs was readily available through media such as BBS Channel 10 (eight respondents); TC monthly (open) meetings (three respondents); the WRP, mail, and public notice board (two respondents each); telephone inquiries to the TC, the Town's social media pages, and email correspondence (one respondent each).

When asked if the processes for designing and approving water systems and infrastructure were generally clear, only two of 17 respondents shared their views in agreement. Finally, one respondent felt that communications and processes between members of the TC, as well as those between the TC and the various PG departments, were open and transparent.[14]

Despite the responses provided in support of transparency related to drinking water governance in Burgeo, five out of 17 participants noted a lack of transparency throughout one or more stages or processes of collaboration. For example, three respondents felt that the actions of certain actors/groups were not transparent to the broader group of actors. One community member stated that "… there were a couple of interviews and what I would call "reports" of what council said they were doing and what they were actually doing and there seemed to be a discrepancy and that was angering the people." Additionally, two respondents mentioned that some actors—namely residents—did not have access to the same information as other actors. Finally, four out of 17 respondents stated that questions arose regarding how the PG decided on the town's current WTP's size and treatment system despite having been in strong agreement with the TC that Burgeo would have benefited the most from a different treatment system with a greater capacity.

Forum exclusiveness

Collaboration is more likely to occur if it is the only avenue that exists for actors to address complex water-related problems (referred to as forum exclusiveness by Ansell and Gash, 2008). More than half of the respondents (ten out of 17) agreed that collaboration with all other relevant actors was the only way to ensure access to sufficient, clean, safe drinking water in Burgeo, thus

[14] It is important to note that the low response rates described here do not imply that the majority of respondents thought or felt otherwise. Many participants either chose not to provide additional comments or felt that they did not have adequate knowledge or experience with these themes to be able to provide detailed comments.

supporting the need for CG. Participants noted that, through collaboration, actors/groups were able to complement each other's limited capacities, such as funding (seven respondents) and expertise (1 respondent). Town Staff explained that one of the main drivers that led to establishment of the first WTP was that the fish plant "… required pressure and a main line for operation," and thus, engaged other actors, such as the TC and the PG, in collaboration to ensure that this need was met.

Clear ground rules

Establishing and implementing clear ground rules, and encouraging compliance ensures that interactions between actors are transparent and respectful. The existence of clear, concise ground rules was mentioned by six of 17 participants. This included two participants who felt that ground rules relating to the approval process for water system designs were clear, and two respondents who believed that the protocols for locals who wished to engage in open TC meetings were accessible. Furthermore, one respondent noted that the PG's requirements for staff who were permitted to work on the projects that they funded were clear, albeit oftentimes inconvenient.[15]

Diverse actor representation

Chapter Two highlighted the need for all actors/groups to be well-represented throughout collaboration. This ensures a greater understanding of the problem at hand and increases the resource and knowledge pools.

[15] Many respondents felt that they did not possess sufficient knowledge or experience to provide additional comments regarding ground rules as they related to water governance in Burgeo.

All 17 participants identified one or more actors/groups who were represented in the group of actors, and these are summarised in Figure 3 below. The most dominant actors identified by participants were the TC, residents, local businesses, the PG (including DECC and its engineers), and Burgeo's lead hand. Roles and responsibilities of these actors are discussed later in this chapter.

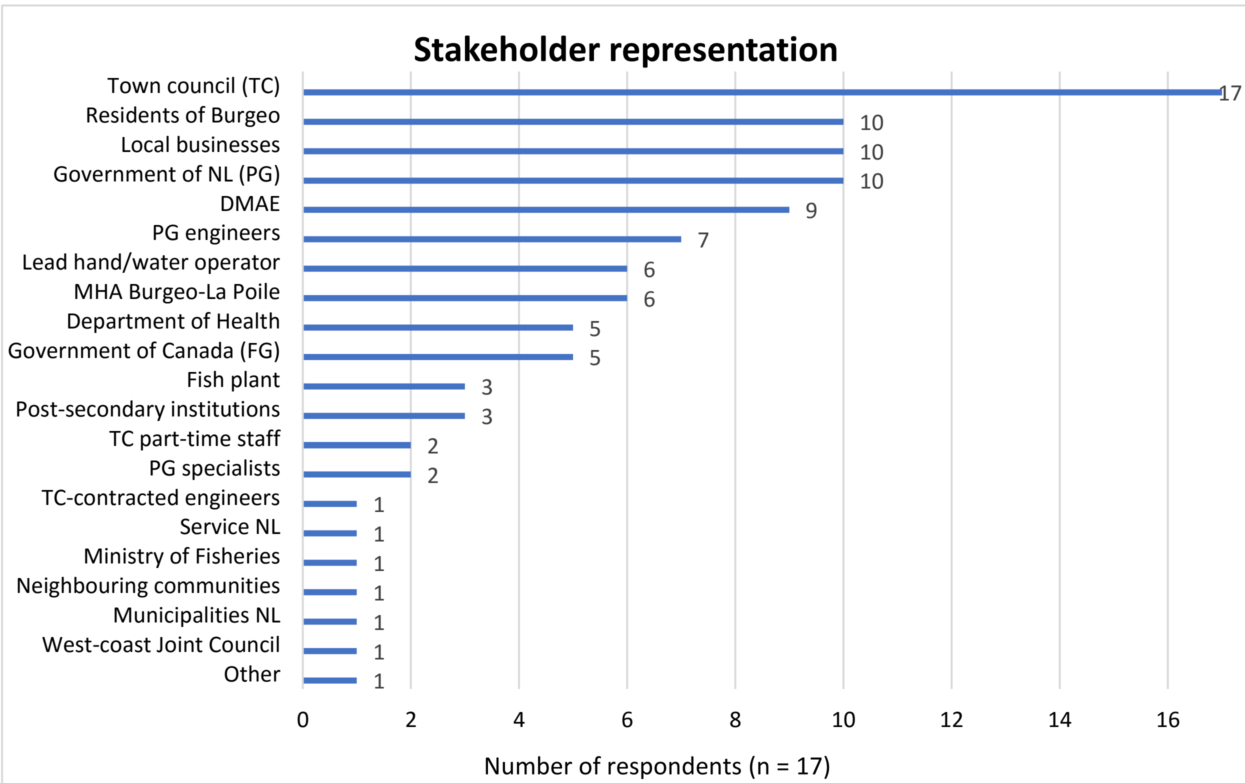

Figure 3: Stakeholder/actors represented in Burgeo[16]

Summary of results for the institutional design for water governance in Burgeo

In this section, process transparency was the most commonly discussed component of the institutional design. Additionally, collaboration was identified as the only means by which

[16] Burgeo First Nation and its role in water governance in Burgeo did not come up in the study.

Burgeo could achieve positive drinking water-related outcomes, thereby confirming the notion that no single actor/group possesses sufficient resources, knowledge, or power to resolve complex environmental concerns as discussed in Chapter Two. Although clear ground rules were less commonly discussed, they were established, and they guided the various stages/processes of collaboration. Finally, although participants identified a diverse range of actors/groups who were involved throughout the various stages of collaboration, there were few responses indicating that this pool of actors was truly representative of all relevant stakeholders.

5.3.2.2 Facilitative leadership

To prevent stagnancy in collaboration, leaders must guide the process. Additionally, as stated in Chapter Two, being invited to the collaborative table does not guarantee meaningful engagement thus, leaders of collaboration are expected to play a facilitative role in which they encourage participation from all actors. Leaders must also ensure that effective conflict resolution strategies are established and implemented.

Based on Table 17, nine out of 17 respondents discussed leadership structures, noting that leaders were often representatives or individuals with significant authority from the various actor groups. These leaders had varying roles and responsibilities that emerged as collaboration progressed. For example, seven participants identified the mayor as the local leader of/in Burgeo. A further five out of 17 respondents acknowledged that the MHA of Burgeo-La Poile played a significant leadership role in advocating for the community. Finally, two respondents identified the Minister of Municipal Affairs and Environment (now divided into DECC and DMPA) as the leader of their department, while one respondent identified the Program Lead for the WRMD's Hydrometric, Climate Change and Water Quality Agreements section as the leader of their team.

Table 17: Summary of results for facilitative leadership for water governance in Burgeo

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Leadership style	15	88.2
Leadership structures	9	52.9
Procedures for conflict resolution	3	17.6

When asked about the leadership styles that emerged and whether they were mostly facilitative, 15 of 17 participants expressed their views. The first group (8 participants) felt that certain leaders, such as the mayor of Burgeo, facilitated meaningful engagement of all (or most) actors. However, seven respondents disagreed and felt that some of the leadership exhibited throughout collaboration was not facilitative and that certain leaders did not encourage or facilitate meaningful participation or engagement with other actors. For example, P01 stated, "Wouldn't you say the Minister of Municipal Affairs should be interested in what the people of Burgeo are drinking? He didn't even have the decency to respond to the letter."

Although ten out of 17 participants agreed that various conflict resolution strategies/processes were established, such as the various means through which stakeholders and actors communicated openly with each other, these same respondents admitted that conflict resolution was ineffective and resulted in many disgruntled stakeholders and/or actors throughout collaboration. Some participants (three of 17) suggested that leaders implemented a few effective conflict resolution procedures/strategies. However, these mostly related to conflicts or concerns emanating within the community or those requiring TC-intervention. For example, P01 noted that "… we did offer a round table. I said, "Anyone who has genuine concerns, we have no problem with a group of you getting together…. We'll sit around the table with you.""

5.3.2.3 Principled engagement (PE)

PE is characterised by honesty, mutual respect, and openness to other views, beliefs, and interests. This is important as it enables actors to better understand each other's interests, to arrive at a common definition of the problem at hand, and to work together towards a common goal as discussed in Chapter Two. In this section, findings relating to the four Ds of PE (discovery, definition, deliberation, and determination) are reviewed. (Table 18 reflects the number of respondents who discussed each theme).

Table 18: Summary of results for principled engagement (PE) for water governance in Burgeo

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Definition	17	100
Determination	17	100
Discovery	16	94.1
Deliberation	13	76.5

Although face-to-face interactions are preferred, they are not always necessary for collaboration. By meeting in person, the risk of miscommunication is reduced, and it encourages actors to build and nurture stronger bonds with each other. For this study, two participants agreed that face-to-face interactions were encouraged during collaboration. A further four respondents noted that the TC was required to hold one meeting every month, and 11 mentioned that in-person special meetings were held as needed. Some special meetings that were mentioned included check-in meetings with specialists from the WRMD, regular TC meetings with the MHA to discuss water-related concerns and future projects for the community, and annual TC meetings with an environmental scientist with the WRMD's Community Water and Wastewater Program. The TC also engaged in discussions/meetings with several researchers from post-secondary institutions who were interested in exploring water-related phenomena in Burgeo.

Discovery of individual and shared water-related values and goals

Discovery is the stage where actors come together and reveal their individual and shared interests, concerns, beliefs, and values. The majority of participants (13 out of 17) agreed that most actors were generally welcoming of each other's interests, beliefs, and concerns. Table 19 provides a list of some interests/problems/concerns that were identified by participants and many of these were discussed earlier in this chapter and in Chapter Three.

Based on Table 19, aging infrastructure was the most commonly identified water-related concern in Burgeo. This is very common throughout the province as water (and sewer) infrastructure dates to the 60s and is, therefore, due for upgrades or renewals as discussed in Chapter Three and earlier in this chapter. Additional commonly discussed concerns were water overuse, more recent shorter-term BWAs, and the previous long-term BWA. It is, however, important to note that, oftentimes, the most widely identified concerns are not necessarily the first ones to be addressed, as was the case in Burgeo. For example, P02 stated that, despite pressing needs, such as encouraging water conservation in the community and ensuring timely replacement of the main line, in early 2018, the TC instead focused its attention to developing shelters for feral cats. Participants also identified a host of other water-related concerns that were important to them based on their beliefs and/or experiences. These ranged from issues with the water itself (quality and quantity) to the dynamics between the various actors and relevant stakeholders.

Table 19: Summary of identified water-related problems/concerns in Burgeo

Identified problem/concern	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Aging infrastructure	12	70.6
Water overuse (including running water to prevent freezing of pipes)	11	64.7
Frequent and/or long-term BWAs	11	64.7
Funding constraints	8	47.1
Unsatisfactory chlorine residual readings	8	47.1
Discoloration of water	8	47.1
Leaks in distribution system	8	47.1
Elevated DBP concentrations and potential links to cancer	7	41.2
The controversy of seasonal bypass to conserve water	7	41.2

Shallow or poorly insulated (lateral) lines	6	35.3
Multi-faceted and seemingly never-ending nature of Burgeo's water problems	5	29.4
The need for more water conservation in the home	5	29.4
Poor water quality	4	23.5
Slow/lack of progress	4	23.5
Message fatigue caused by excessively long/frequent BWAs	3	17.6
Undersized water system	3	17.6
Staffing/labour constraints	3	17.6
Other areas of concern in the community suffered due to primary focus on water issues	2	11.8
Inadequate bio-purges and/or flushing of the water system	2	11.8
Certain actors failed to pull their weight/fulfill their duties/obligations	2	11.8
Authoritarian leadership styles	2	11.8
Unfair scrutiny of some actors/groups	2	11.8

Definition of goals and responsibilities

Definition is the process through which actors/groups articulate their common purposes and goals and confirm or identify their respective roles and responsibilities to minimise any potential overlaps. Table 20 indicates that, through the definition stage of collaboration, actors were able to clarify their respective roles/responsibilities and it lists some common actor roles/responsibilities that were identified by the participants.

Table 20: Definition of roles/responsibilities of stakeholders/groups

Actor/group	**Roles/responsibilities**	**Number of respondents (n=17)**	**Percentage of respondents (%)**
TC	Operated and maintained the WTP and distribution system	12	70.6
	Engaged locals through various meetings/town halls and educated them about various water-related issues.	9	52.9
	Submitted applications for funding for water-related projects.	7	41.2
	Allocated and utilised financial resources appropriately	6	35.3
	Proposed solutions to various water-related concerns	5	29.4
	Established and enforcing various local by-laws and regulations	1	5.9

Mayor	Led and represented the TC and the community.	4	23.5
Municipal Affairs and Environment	Provided funding/financial support.	9	52.9
	Monitored and tested drinking water and source waters.	6	35.3
	Issued (and/or rescinded) BWAs	6	35.3
	Selected/approved water systems/designs	5	29.4
	Liaised with the TC to ensure clean, safe water in Burgeo	3	17.6
	Maintained and updated the WRP	2	11.8
	Operator training and certification.	2	11.8
	Enforced the Water Resources Act	1	5.9
	Provided technical expertise and support.	1	5.9
Local businesses	Provided safe drinking water alternatives during periods of water quality crises/	6	35.3
	Constructed and/or maintained WTP and distribution system	2	11.8
BBS	Provided TC with a platform to disseminate water-related messages and information e.g., BWAs to residents	9	52.9

Fish plant	Provided funding for installation of the main line	1	5.9
Residents	Selected their preferred drinking water source (e.g., town water, purchased, spring water)	11	64.7
	Practised various water conservation strategies within their homes	6	35.3
	Engaged in water-related conversations with other stakeholders and/or actors, e.g., the TC	5	29.4
	Elected officials to represent them and address matters that concern them	1	5.9

Despite the differing loads/duties, it can be seen from Table 20 that each identified actor/group was required to play a role that was critical to the success of collaboration. For example, the TC's roles were related to service delivery, and operation and maintenance of the water system, while actors like the PG had more regulatory roles. Residents had roles that were more directly linked to the water itself, such as reporting concerns or perceived water quality breaches to the TC, as well as ensuring the sustainability of the town's water for the future through conservative use.

Deliberation to determine course of action/inaction

Deliberation is characterised by a "safe space" in which actors can ask and answer challenging questions about their co-collaborators' values, interests, concerns, and beliefs, and express any honest disagreements. (See Chapter Two). Approximately half of the participants (nine out of 17) agreed that actors generally facilitated a civil/safe environment to challenge each other's values/interests while defending their own positions. However, nine of the research participants also noted that, despite these opportunities for candid reasoning, certain actors/groups were dismissive of other actors' responses with little or no justification. According to P05:

> [The PG] acknowledged that the sand filtration system would probably have been a better fit for the community for the long-term basis. It was very frustrating to sit on the other side of the table and hear them concede and admit that and still insist on the ozone system that we have.

Additionally, six of 17 respondents felt that certain actors/groups were generally hostile when challenged by or when challenging other actors, and this significantly affected the deliberation stages of collaboration. Relating back to the concerns noted above regarding conflict resolution, P02 recounted that "… some people were automatically angry, and I wouldn't set up a meeting that would put councillors at risk of being yelled at and bullied."

Most participants (12 of 17) agreed that, through deliberation, actors were able to agree on the primary desired outcome of collaboration—qualitative water security. Secondary to this, as mentioned by nine participants, was quantitative water security through sustainable usage. To better understand how actors came to agree on these goals, some participants discussed consensus, which, as presented in Chapter Two, is highly desired/sought in collaboration but is oftentimes not possible. This was articulated by 12 of 17 participants who felt that there was a lack of consensus regarding priorities and measures for realising the identified common goals. P02 noted that certain actors, such as the TC, were required to reach consensus independently prior to engaging with the broader group of actors: “A council is supposed to operate on majority vote or consensus. Then the mayor speaks. He/she is the voice of that group of people—not the voice of one or two.”

Determinations observed in water governance in Burgeo

Actors can measure the efficacy of collaboration as it progresses by reflecting on/measuring increases in various determinations- which are defined as improvements that are observed in interactions amongst stakeholders and actors, as well as improved clarity on shared interests and goals, and establishing capacity for further collaboration. All 17 participants discussed one or more determinations that developed or improved throughout collaboration, with all 17 participants observing improved clarity on key water-related issues and increases in social and resource capacities. Furthermore, 13 participants acknowledged greater incorporation of some relevant knowledge forms, and 12 stated that legitimacy improved. Additionally, six participants mentioned that mutual trust and respect between certain stakeholders and/or actors increased as collaboration progressed.

5.3.2.4 Capacity for joint action

Capacity for joint action was described in Chapter Two as a process that enables actors to pool and distribute resources, thereby creating greater potential for new or more collective actions or outcomes. This capacity is created through procedural and institutional arrangements, resources, power, knowledge, and leadership.

Resources

All 17 respondents noted that, through collaboration, actors were able to pool various critical resources. For example, 15 participants mentioned that certain actors/groups pooled and/or redistributed staff expertise/labour resources to ensure that collaborative goals were achieved thus, human resources were most commonly shared. A further ten respondents agreed that the TC and the PG pooled their financial resources to support the provision of water services and delivery in Burgeo, and this was summarised by P07 who said, "… there's no 100 percent financing in our grants or funding. So, the PG is saying, "We can do something for you, but the Town has to be responsible too."" However, seven of 17 respondents also acknowledged that the economic actors did not always have readily available funds. One respondent stated that residents also contributed to the financial pool by paying for their monthly water usage through a flat rate water tax. Finally, ten respondents noted that certain technologies were shared by actors. For example, BBS—Burgeo's local television network—was used to disseminate knowledge/information that was generated by the PG and/or the TC regarding water quality to the residents of Burgeo.

Procedural and institutional arrangements

Actors establish and follow individual and collective procedural and institutional arrangements. These arrangements guide actors throughout collaboration and increase legitimacy and transparency. The vast majority of respondents (16 out of 17) noted that various procedural and institutional arrangements were established both individually and collectively by actors/groups, and some of these are summarised in Table 21.

Table 21: Individual and collective procedural and institutional arrangements

Actor/group	**Standard operating procedures (SOPs), ground rules, protocols**	**Number of respondents (n=17)**	**Percentage of respondents (%)**
TC (and staff)	Ensure timely public announcements of BWAs issued and/or rescinded (e.g., on BBS channel 10)	7	41.2
	Hold one monthly (open) meeting	4	23.5
	Conduct daily water testing (for chlorine residuals)	4	23.5
	Encourage physical presence for TC meetings	2	11.8
	Attend regular water-related training sessions and maintain or update certifications (lead hand/water operator)	2	11.8
	Establish and enforce protocols for public engagement during (open) TC meetings	2	11.8
	Foster an “open door” policy for residents to discuss water-related concerns	2	11.8
	Base decision-making on majority vote or consensus	1	5.9
	Subsidise water fees/rates	1	5.9

	Submit water facility designs to PG engineers for review and/or approval	1	5.9
PG	Issue BWAs based on relevant BWA code(s)	6	35.3
	Conduct regular analysis of water samples	5	29.4
	Update and maintain the Water Resources Portal (Environment and Climate Change)	2	11.8
	Facilitate litigation procedures (where applicable)	2	11.8
	Ensure compliance with standard operating procedures for treatment system design and approval (Environment and Climate Change)	1	5.9
	Hold meetings with other stakeholders and/or actors (e.g., the TC) upon request or as needed	1	5.9
	Enforce the Water Resources Act (Environment and Climate Change)	1	5.9
	Provide operator training and certification	1	5.9

Power

Power—as a precondition/driver of collaboration—relates to the ability of an actor/group to influence decision-making. Power as a form of capacity for joint action, should, ideally, be dispersed amongst a number of actors to prevent monopoly in decision-making. Dispersed/shared power was mentioned by 15 out of 17 participants. For example, eight respondents noted that residents exercised their power by rejecting some of the resulting policies if they disapproved. One form of rejection is non-compliance which can cause implementation of these policies to fail. Another five respondents agreed that the TC—as the elected body for Burgeo—was able to make decisions on behalf of and in the best interests of the community. A further three respondents noted that, through advocating, the MHA of Burgeo-La Poile was able to influence other "stronger" actors—especially within the PG realm—to consider the community's requests or concerns. However, three participants felt that power remained concentrated amongst the actors who possessed the most financial resources and knowledge—namely the PG—thereby resulting in them monopolizing decision-making.

Knowledge

Chapter Two highlights knowledge as a driver for collaboration. Despite attempts to incorporate a variety of knowledge forms in collaboration, participants admitted that scientific and technical knowledge were more commonly drawn upon in drinking water governance and were treated as superior to other knowledge forms. The majority of participants (12 of 17) identified the incorporation of scientific knowledge (generated by engineers, architects, scholars/researchers, scientists, analysts, etc.) in collaborative decision-making, while seven participants observed the inclusion of technical knowledge (generated by contractors, technicians, operators, etc.). However, only five of 17 participants recognised the inclusion of local and/or experiential knowledge through meetings with the TC, informal discussions, letters, and emails.

Leadership

Leadership ensures that ground rules are established and adhered to, and that mediation occurs to achieve consensus and positive outcomes (again as a capacity for joint action). Through further investigation, eight participants agreed that most of the leaders who emerged throughout collaboration fostered environments in which rules were followed, and three felt that leaders mediated to ensure effective conflict resolution and achievement of consensus and positive outcomes. These leaders were responsible for establishing networks with other relevant actors on behalf of their communities/organisations, securing necessary resources, such as funding and expertise, and bearing some of the high transactional costs of collaboration by devoting significant amounts of their time.

Table 22: Summary of results for capacity for joint action in water governance in Burgeo

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Resources	17	100
Procedural and institutional arrangements	16	94.1
Power	15	88.2
Knowledge	13	76.5

Leadership	10	58.8

5.3.2.5 Shared motivation

Actors often approach the collaborative table with various concerns, interests, and goals. As collaboration proceeds and mutual respect and trust are fostered, actors become increasingly motivated and committed to ensuring that their collective goals are realised. This shared motivation is generated through mutual understanding, shared commitment, mutual trust, and internal legitimacy and accountability (see Table 23).

Table 23: Summary of results for shared motivation in water governance in Burgeo

Theme	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Mutual understanding	17	100
Shared commitment	16	94.1
Internal legitimacy and accountability	12	70.6
Mutual trust	10	58.8

Mutual understanding

All 17 participants shared their opinions and/or experiences relating to mutual understanding in collaboration. Through further discussion, all participants recalled instances in which actors understood each other's needs, interests, concerns, and beliefs. Eleven respondents noted that actors mutually understood the importance of their co-collaborators' involvement in collaboration, as well as their overall interconnectedness. Another six respondents believed that actors were mutually understanding of the goals and/or objectives of collaboration. This was summarised by P03 who said, "Everybody is concerned about the water… And we are all working towards that goal." Finally, four out of 17 respondents felt that actors were generally understanding of each other's limitations/constraints. However, as presented in Table 23, 12 of 17 respondents spoke more about actors who disregarded other actors' concerns, beliefs, needs, and interests. P06 stated that "…Government went ahead and approved a system that was far too small for the town's needs. Was this their way of getting us to conserve water? Even if it was, that's not what we asked for." Referring to roles and responsibilities (listed in Table 20) 12 participants mentioned that there is a mutual understanding of each other's roles/responsibilities throughout collaboration.

Shared commitment

It is important for actors to remain committed to the process and to their common goals, although levels of commitment are often affected by conflict, a lack of progress/outcomes, or various other challenges. Meeting expectations is one of many ways through which actors can prove to their co-collaborators that they are committed to the process. As demonstrated in Table 23, 16 of 17 participants discussed commitment in collaboration. As discussed above, 11 respondents noted that actors generally understood the importance of other actors' involvement in collaboration, as well as their overall interconnectedness, thereby fostering a greater sense of commitment to the collaborative process.

Approximately half of the respondents (nine out of 17) indicated that, despite the various challenges that occurred throughout the collaborative process, actors, such as the TC, generally remained committed to ensuring positive water-related outcomes in Burgeo. A further six participants agreed that most actors fulfilled their designated roles/responsibilities, thereby increasing their own levels of commitment. However, nine respondents also identified at least one actor/group who, despite being committed to collaboration, fell short of other actors' expectations, or failed to pull their weight, with negative impacts for collaboration. In an interview, P05 expressed that "Unless the provincial government really steps up to the plate, the general public are going to find their own solutions like they have done in the past." Additionally, although BWAs are typically not issued for DBP exceedances, P02 felt that in March 2018, the PG failed to take any relevant action to address elevated DBP concentrations in the town's water: "… although we're not on a boil order, the last report we had, we were double government standards. Government standard is 100 ppm, and we were over 200 ppm. So, we weren't on a boil order…"

A further three out of 17 participants admitted that, for various reasons, some actors—primarily residents—had no interest in engaging in collaboration to address the community's water problems. P04 admitted that "Now that I'm retired, I just feel comfortable to go to the tap and get water. That's the only involvement that I want to have with the water." However, P03 felt that certain stakeholders/groups who had little/no interest in committing to addressing water-related concerns in Burgeo did not view their involvement as critical to the success of collaboration and said, "When it comes to water, everyone should be involved, but for some reason, they (residents) don't want to be. They leave it to and for the council."

Internal legitimacy and accountability

Actors must establish a set of tools to ensure their internal legitimacy and accountability. Both components are characterised by transparency, open and honest dialogue, and feedback mechanisms. Internal legitimacy is often increased through consensus-based decision-making as discussed in Chapter Two. As illustrated in Table 23, 12 participants addressed internal legitimacy and accountability in collaboration. More than half of the research participants (ten out of 17) agreed that certain actors/groups ensured that they notified other actors and/or end users of any water quality-related data or decisions using the various platforms that were previously discussed to prevent any liabilities from non-disclosure and to ensure accountability. A smaller number of respondents (two of 17) mentioned that actors, such as the TC, were required to prove their fiscal responsibility, such as their ability to repay any loans, to financial actors before they were able to access funds. P15 discussed various tools that governed the actions of the PG, thereby ensuring its legitimacy, such as, "The DMAE [Department of Municipal Affairs and Environment] governs water resources through the Water Resources Act… [and] employs the [multi-barrier strategic action plan] MBSAP to ensure that water resources are efficiently and sustainably managed…"

Mutual trust

As collaboration progresses and as actors communicate respectfully and fulfill their respective obligations, trust increases. Mutual trust is important because as it increases, so does the level of commitment amongst actors, which in turn incentivizes collaboration as outlined in Chapter Two. Table 23 shows that ten participants mentioned mutual trust. In addition, six respondents noted that actors developed and maintained trust gradually as collaboration proceeded and as they proved themselves—their abilities, reliability/commitment, and intentions—to their peers. P11 recounted their experience operating the town's water system and expressed that, "… I always kept them [TC] informed regarding the happenings which would help them make informed decisions. They put good faith in me." However, nearly one-third of respondents (five of 17) felt that there was a lack of trust between certain members of the TC and various PG representatives as the former often felt that the latter did not meet expectations, were often unable to fulfill their obligations, or did not prioritize Burgeo's water goals. P06, highlighted a lack of trust in the competencies of the various engineers who were involved when Burgeo's WTP was established by stating that:

> … [councillors] trust that their engineers will consult with government engineers and provide them with the best options…neither group (of engineers) had specialised in water systems… Their recommendation to put the chlorine house before the water tower showed how incompetent they were.

Summary of findings for the collaborative process for water governance in Burgeo

In this section, participants identified the leaders from the various groups involved. The successes of facilitative leadership in establishing and implementing effective conflict resolution strategies, as well as some of its challenges were described. Many participants felt that some leaders—such as certain PG departmental heads and some individuals who served as mayor of Burgeo during the timeframe of this study—needed to play more facilitative roles to encourage mutual respect and more meaningful engagement of all stakeholders and actors.

The ways in which the capacity for joint action in collaboration was increased through pooling and/or redistributing various resources, knowledge, power, and leadership were also highlighted. Participants identified missed opportunities or gaps in this capacity due to imbalances in resources and knowledge, power concentration, and unfavourable leadership styles. Participants also acknowledged the operational and institutional policies/protocols that the various actors/groups established both independently and collectively. Although these protocols were designed to guide actors in their interactions with each other, they did not always result in improved transparency and/or accountability.

The four Ds of PE (discovery, definition, deliberation, and determination) were discussed as they related to water governance in Burgeo. This led to the identification of a range of water-related concerns in the community—many of which are yet to be addressed. Through PE, actors engaged in discussions regarding which of these water-related concerns to tackle and how. The majority of participants agreed that ensuring qualitative (and quantitative) water security was the goal of collaboration. However, despite this consensus, actors were unable to agree on how best to achieve this goal.

Finally, shared motivation, a crucial component of collaboration—which is formed by mutual understanding, trust, and commitment, as well as internal legitimacy and accountability—was explored. All research participants were able to describe one or more ways in which actors fostered mutual understanding throughout the process of seeking to address drinking water challenges and provide clean, safe drinking water to the citizens of Burgeo. Despite the myriad of challenges that actors encountered, the majority of them remained committed to achieving various positive outcomes for Burgeo's water, although several imbalances and/or conflicts that affected the levels of trust amongst participants were also discussed. Participants identified the ways in which actors ensured (or failed to ensure) their legitimacy and accountability.

5.3.3 Implementation and outcomes

Outcomes or results of collaboration, such as policies, procedures, regulations, and legislature, are implemented. Outcomes produce tangible benefits to the stakeholders/end users and can be used to determine the effectiveness of collaboration. Although Burgeo's water challenges may be far from over, 15 out of 17 research participants acknowledged that, through collaboration, the community managed to achieve some commendable milestones in its quest to achieving and maintaining water security. Some of these outcomes are outlined in Table 24 below.

Table 24: Summary of positive water-related outcomes of collaboration in Burgeo

Outcome	**Number of respondents (n=17)**	**Percentage of respondents (%)**
Lifting of long- and short-term BWAs	12	70.6
Procurement of 2nd WTP	9	52.9
Installation of the main water (and sewer) lines in the 60s	8	47.1
Procurement of 1st WTP	8	47.1
Establishment of routine water testing by various actors/groups	8	47.1
Replacement of original water line (in progress)	6	35.3
Increased opportunities for operator training and certification	4	23.5

Installation of water tank	3	17.6

5.3.4 Evaluation and adaptation

Chapter Two described the importance of actors offering feedback on or evaluating collaborative processes and the resulting policies to determine their efficacy. Actors must also be prepared to adjust or improve the policies and/or processes as needed. This reduces the number of potentially disgruntled stakeholders as well as actors and increases rates of compliance with the policies. Three quarters of participants (13 out of 17) agreed that there were various avenues through which stakeholders and actors were able to provide feedback on the resulting policies of collaboration or to evaluate each other's performances, such as the seven respondents who stated that residents were given opportunities to provide feedback to the TC through open council meetings, private meetings with TC members, phone calls, and letters. For example, eight of 17 respondents noted that residents who were displeased with the TC's proposal to possibly introduce water meters in the community provided their feedback opposing this proposition to TC, and this resulted in water meters being removed from the discussion table. A further five respondents agreed that the TC and the PG were able to provide mutual feedback through open communications such as e-mail, phone calls, letters, as well as during in-person meetings. However, two of 17 respondents mentioned that, despite having provided feedback regarding the small size of the water system that was designed and approved by the PG, the PG was either unwilling or unable to make changes and increase the capacity of the water system. P05 stated that, "It was very frustrating for them… to know that we have that 700 gallon per minute community and weren't willing to put in a system to handle the existing capacity…" Finally, four participants noted that members of the TC were able to provide feedback and/or review their internal policies during "privileged" TC meetings.

This chapter presented the results obtained from qualitative interviews conducted with members of the community, the TC, as well as representatives from the PG with guidance from the CG framework highlighted earlier in the study. The comments and themes discussed in this section form the basis of the responses to the research questions posed in Chapter One and the next chapter will address these research questions more specifically.

Chapter Six:

Discussion and conclusion

The purpose of this study was to respond to the set of research questions that were posed in Chapter One. This final chapter will, therefore, summarise the overall findings from the study and answer these research questions.

6.1 Overview of study

Water is essential for life. Water security is defined as having enough (quantity) clean, safe (quality), affordable water for life within a community. Freshwater makes up less than 2.5 percent of global waters, and is threatened by overuse, population growth, and the impacts of climate change, such as global warming (ICWE, 1992; Oki and Kanae, 2006; UN Water, 2013). The large number of BWAs that are in effect in Canada at any given time speaks to the compromised water quality in many Indigenous and other rural/remote/less densely populated communities.

To effectively and sustainably govern and manage water resources, thereby ensuring water security, traditional top-down government approaches have been increasingly forsaken in favour of governance approaches where communities and other non-state stakeholders have more authority in decision-making related to their water resources. The framework used to guide this study, drawn from works by Ansell and Gash, 2008, and Emerson et al., 2012 (see Chapter Two and Chapter Four), outlined the variables in CG—namely drivers, the collaborative process, implementation, and evaluation and adaptation—and it highlighted the interactions between the actors, as well as the reasons why collaboration is often sought and ways in which it may be hindered.

Water governance in Canada is a shared responsibility between all levels of government: the FG, PGs or territorial governments, and local governments. The roles of these orders of government were discussed in greater detail in Chapter Two and Chapter Three. In NL, municipalities are supported by various PG departments—namely DECC, DMPA, DTI, DHCS, and DGS NL— to ensure water security within their communities.

One of the purposes of this study was to respond to the knowledge gap identified by Vodden and Minnes (2014): to explore the successes and potential for CG approaches while examining the challenges that have been encountered in current approaches to communication and coordination while addressing water-related problems in NL. The Town of Burgeo (discussed in greater detail in Chapter Three) was selected as the case to explore this gap based on the town's history of numerous water-related challenges, particularly the previous long-term BWA that was lifted in 2015.

The literature review conducted at the beginning of the study encompassed various broad terms, such as CG, water governance, water governance in NL, and BWAs. However, for data specific to Burgeo, findings were limited in scholarly/peer-reviewed articles/journals, thus, the majority of Burgeo-specific secondary data reviewed in this study was retrieved from news article, TC documents and correspondence, and various PG databases, such as the WRP.

The recruitment process for interview participants was described in detail in Chapter Four. There were some challenges and limitations with the interview processes and design. Firstly, some residents stated that water in the community was a sensitive topic, thus, they chose not to participate in the study out of fear of potential confidentiality breaches and the resulting implications. After data collection had been completed in Burgeo, a few residents stated that they were unaware that this study was being conducted, thus, revealing a potential flaw with the interview recruitment process. About one percent of Burgeo's population took part in this study. Due to the various policies in place, participation from PG invitees defaulted to a senior representative of the PG agency most involved in drinking water management- the WRMD. The MHA for Burgeo-La Poile agreed to participate in the study to represent their constituents. When reflecting on the broader group of actors who were identified as having been involved in attempting to address the town's water issues, it is important to note that the views expressed by the relatively small pool of respondents (17 individuals) may not be representative of all actors involved. Additionally, as identified by Kirchherr (2018), the use of the snowballing technique for participant recruitment may have resulted in a biased participant pool as individuals may have chosen to refer parties with whom they shared similar views regarding the research phenomenon. This was, however, partially overcome/minimised by broadcasting the study on BBS Channel 10 and inviting other interested individuals to engage in the research.

The question guide for the in-person semi-structured interviews conducted for this study was developed using the CG framework outlined in Chapter Two. Due to the inter-personal nature of CG, the questions posed focused significantly on how actors have interacted and communicated with each other and the dynamics between them, while providing participants with ample opportunities to recount their experiences and share their views relating to drinking water in Burgeo. At the beginning of this study, the event of interest was the previous long-term BWA that was lifted in 2015. However, as the interviews progressed, it became evident that, although participants had some comments to share regarding the period of this BWA, they wished to focus more on other pressing issues, such as water conservation, overuse, shallow lines, operator training, and the power dynamics between the various actors involved, thus, the interview guide was adapted accordingly. It is important to further highlight the subjectivity of qualitative interviews through an interpretivist lens. Despite being asked similar questions regarding the same research phenomenon, research participants related to the phenomenon and recalled their experiences with it differently, thus, causing some discrepancies with details, such as dates and quantitative data. Although interviews conducted in-person in Burgeo generally elicited more candid responses, PG representatives (including the MHA) opted to respond via email, and, unfortunately, these responses seemed more formal and less detailed.

Due to the small pool of respondents, manual data analysis was utilised and the CG framework, as well as the themes identified in the existing literature, provided a framework for analysis and interpretation during this process. Some newer key themes also emerged during data analysis. One main challenge that was experienced through manual analysis was ensuring accurate interpretation of the vast amount of textual data that was collected to ensure that relevant themes were identified.

As stated at the beginning of this chapter, one of the preliminary stages of this study was to develop a set of research questions to guide exploration of the phenomenon at hand. This next section addresses these research questions.

6.2 Revisiting the research questions

The answers to the research questions posed at the beginning of this study were obtained through a combination of reviewing the existing literature and other secondary documents as well as through the semi-structured interviews that were conducted with various actors who have been involved in attempting to address Burgeo's water problems. Responses to each of the research questions are provided in this section.

What were some of the major challenges and events that occurred while attempting to provide clean, safe drinking water in the Town of Burgeo?

A myriad of challenges was encountered while attempting to provide clean, safe drinking water in the Town of Burgeo. These were addressed in greater detail in Chapter Five. Some of these challenges were linked directly to the town's water (i.e., quality and quantity), while others affected communication and coordination amongst the actors/groups who were involved in addressing water-related problems in the community.

Quantitative challenges—namely water overuse—were identified by reviewing water usage reports in the community and also identified by interview participants. Intentional overuse encompassed practices, such as removing the ball from toilets, and reflected a need for more conservation practices within residences and local establishments. Overuse that was considered necessary included running water during colder months to prevent pipes from freezing. This need was attributed to shallow or poorly insulated lateral lines. Unintentional overuse occurred through leaky valves in residences—which residents were generally unaware of—and leaks within the water distribution system which were due to the aging nature of the water infrastructure.

Many of the qualitative water-related challenges that were encountered in Burgeo were linked to the aesthetic properties of the water, such as discoloration. The pH of the water in Burgeo was reported to be on the acidic side, and this caused corrosion of copper-based elements in residential appliances. The quality of Burgeo's water was also compromised by contaminant concentrations that exceeded the MACs outlined by the GCDWQs, including DBPs, such as THMs and HAAs which have both been linked to cancer. As discussed in Chapter Three, disinfection is a mandatory stage in water treatment processes throughout NL. In Burgeo, chlorine is the primary disinfectant used. However, the community experienced numerous challenges with chlorine residual readings whereby the farthest point along the distribution system yielded little to no residual readings. With insufficient or unsatisfactory chlorine residuals, the town was forced to go on a BWA which lasted for over 10 years and was lifted in 2015. To combat the challenge of unsatisfactory chlorine residual readings, the town attempted to increase the amount of chlorine used but this resulted in residents living at the beginning of the distribution system reporting that the chlorine concentration (and the resulting smell and taste) in the water was so strong that many of them opted out of drinking the water.

Another set of challenges encountered while attempting to provide clean, safe drinking water in Burgeo related to the interactions (communication and coordination) between the various actors involved. Many of these were attributed to various imbalances (knowledge, power, resources), issues with some of the demonstrated leadership styles, as well as differences in values and priorities for Burgeo's water. Water-related processes in Burgeo were described as time-consuming and slow to produce desired results due to the challenges associated with engaging and coordinating with a diversity of actors from different levels of government, organisations, and community members. Funding constraints meant that the town was not guaranteed funding each time they applied, and this caused delays for the community's water projects. Additionally, these constraints prevented multiple problems from being addressed concurrently.

As highlighted throughout this study, Burgeo's water challenges are multi-faceted, thus, the actors involved experienced challenges with agreeing on priorities from this multitude of issues. Some interview participants noted that the water-related concerns that were prioritised/the first to be addressed were often decided upon by the “stronger” actors even though other actors—especially local ones—had identified a different problem that needed to be prioritised, based on their lived experiences. It was interesting to note that in Burgeo, imbalances of knowledge, power, and resources facilitated and also hindered collaboration. For example, the TC receives its authority to govern the community from the PG, and with this power, the TC is only able to enforce by-laws. Thus, with a lack of power to independently govern Burgeo’s water resources, the TC sought to collaborate with the PG. However, the majority of power appears to have remain concentrated within the PG.

A sense of urgency is ideal when collaborating with a broad group of actors as it fosters momentum. However, this was identified as lacking in Burgeo and was generally not due to intentional delays but, rather, due to the various limited capacities that the actors/groups faced. Levels of motivation and commitment as they related to ensuring positive water-related outcomes in Burgeo varied amongst the different groups of actors. Members of the community (residents and the TC) had the most direct stake relating to the water, thus, they seemed more motivated to ensure that Burgeo’s water problems were addressed efficiently and effectively. Additionally, the TC had a legal and moral responsibility to provide clean, safe water to the community, thereby increasing their motivation. The various PG departments also had legal obligations which served as their motivation, but without a personal stake in the matter, it appeared that they were not as motivated or committed as local actors. This may have been misinterpreted as a lack of concern by some actors. Unfortunately, due to staffing constraints, actors from the PG were unable to provide on-demand support and solutions to the town. Finally, due to the town’s longstanding battle with various water issues and the delays that were encountered while attempting to address these concerns, many residents had lost confidence in the town's water and some refused to consume it even when the TC assured them of its safety.

Who were the different actors involved in attempting to address these challenges and provide clean, safe, adequate drinking water to the community of Burgeo?

Although a diversity of actors were involved in attempting to provide clean, safe drinking water in Burgeo, three core groups were significantly involved: TC (and its staff- lead hand/water operator), residents, and the PG (DECC, DMPA, DHCS, DGS NL, and PG engineers, consultants, and specialists). Other actors included the Ministry of Fisheries, the FG, local businesses (e.g., Foodland, BBS), the fish plant (when it was in operation), MHA Burgeo-La Poile, post-secondary institutions/students/researchers, neighbouring communities, Municipalities Newfoundland and Labrador (MNL), and the West-coast Joint Council. Their various roles were described briefly in chapters two, three and five.

What were some of the ways in which these actors communicated and interacted relating to water governance in Burgeo?

Actors who were involved in attempting to provide clean, safe drinking water in Burgeo communicated and interacted in person, where possible and when required. In situations where in-person meetings were not possible, actors communicated through email, telephone calls, mail, social media, virtual platforms, and through BBS Channel 10.

Members of the TC held special meetings as needed to discuss various issues—including the town's water—and to agree on a standpoint to present to the community through majority-based deliberations. Although councillors were generally encouraged to be physically present for these meetings, virtual accommodations (e.g., Skype) were made if they were unable to do so. The TC also held one regular monthly meeting—as outlined in the *Municipalities Act* 1999—and these meetings were open to the public. If residents wished to participate during these meetings, they were required to contact the Town Manager and submit a request to be included in the agenda. The TC also had an open-door policy for residents whereby they could set up a meeting with a preferred councillor to discuss any concerns that they may have had regarding water in the community (or any other issue). Additionally, residents were also able to contact the TC via telephone, email, or letter at any time. The TC also encouraged residents to form committees to present their concerns collectively to the TC.

In addition to meeting in person when needed or where possible, the TC and representatives from the various PG departments utilised a range of other communication methods including email, telephone, and mail. Staff from the WRMD travelled to Burgeo quarterly to discuss the water and to provide training to the Town Staff when required or requested. The MHA for Burgeo-La Poile played an integral advocacy role for the communities within their district and, therefore, met regularly with the TC to listen to their water-related concerns and needs and provide them with advice. Interview participants generally agreed that although the various avenues of communication available to the actors and other stakeholders were effective, in-person meetings, especially between different levels of government, seemed more effective and efficient.

How did the various actors support or hinder the solutions that were presented to address Burgeo's water problems?

Due to the diverse realities, backgrounds, experiences, and views of the actors who were involved in attempting to provide clean, safe drinking water in Burgeo, differences of opinion regarding priorities (i.e., which of the water issues to address) and how to address these concerns arose. The actors generally tried to create an open space in which they could challenge each other's views and motives, especially when they felt that that a different course of action would be more beneficial for the town and its water. Although there were instances whereby actors disagreed with some of the decisions that were made, they, ultimately, supported these solutions that resulted in positive water-related outcomes for the community. An example of this was the disagreements that occurred between some members of the TC and the PG regarding the size of the town's water system. Although the TC attempted to explain to the PG that a water system with a larger capacity would be required to meet the needs of the community, the PG suggested and decided on a smaller sized system. Nonetheless, the TC worked hard to operate and maintain this smaller system and even engaged residents in water conservation education campaigns to minimise strain on the system due to overuse.

Although actors generally supported the solutions that were presented—even when they disagreed—there were instances whereby actors challenged solutions, in some cases resulting in these resolutions being dismissed completely from the discussion. An example is the protest that occurred in 2017 which was discussed in Chapter Five. By challenging what residents thought was the TC's decision to introduce water meters in their homes, the idea of water meters—even for informational and educational purposes—was removed from the Town's Water Plan.

If the various levels collaborated with one another, how was this done?

CG is based on the premise that no single actor/group possesses enough knowledge, power, or resources to effectively manage resources independently. This was the case in Burgeo. Due to the vast number of communities across the province and the PG's limited human capacity, the PG depended on the TC and its staff to operate and maintain the water treatment and distribution system, while providing the Town with funding and technical support. As discussed in chapters two and three, municipalities represent the lowest level of government with limited financial capacities thus, the TC, in turn, depended upon the PG for financial support to fund water-related projects in the community. This inter-dependence was an important driver for collaboration as it encouraged actors to pool and redistribute their resources where required to ensure positive water-related outcomes for Burgeo. There were various policies and procedures that governed the ways in which certain actors collaborated with each other. For example, to access funds from the PG, the TC was required to submit an application, outlining how the funds were to be allocated and utilised.

In the past, Town-contracted engineers met with PG engineers to discuss Burgeo's water infrastructure and to determine which system would be most beneficial for the community. This is an example of how knowledge was pooled in Burgeo to gain a deeper understanding of the town's needs and to explore the options that were available. Certain councillors attended regional meetings (e.g., MNL and the West-coast Joint Council in Figure 3) whereby communities collaborated by sharing best practices and discussing regional approaches to managing resources such as water. Over the years, Burgeo also welcomed various researchers and scholars from post-secondary institutions who were interested in the town's water. The TC and the residents collaborated with these researchers to co-generate knowledge by sharing their lived experiences as they related to the water in Burgeo. Residents were also able to collaborate with the TC by forming committees with other residents with similar interests or concerns. Regular, open communication was an important tool for collaboration between the various actors involved. Through this process, actors were able to voice their views and concerns, thereby providing additional context to Burgeo's multi-faceted water problems.

It is important to distinguish between meaningful engagement and decision-making as the two foster different expectations from actors. In Burgeo's case, a diversity of actors was engaged and/or consulted in discussions about the town's water. However, despite expectations of playing a more direct role in decision-making, some groups were not represented in the group of actors who were directly involved in this process. This raised questions about how truly collaborative water governance in Burgeo was if these groups felt that they were merely consulted but not actively engaged as actors in decision-making, thus drawing further attention to Arnstein's ladder of citizen participation.

One of the core tenets of CG is consensus-based decision-making where possible and in Burgeo, with a diversity of stakeholders, decision-making occurred in stages. Firstly, the TC was required to decide and agree on a stance to present to the residents, then the TC and the residents would come to an agreement on priorities for the town's water. The TC would then communicate this community-based decision to the PG and other actors, and from this, final decisions would be made. Thus, essentially, the PG and the TC were the primary actors although they were influenced by other actors and/or stakeholders.

Did they work well together or were they in conflict? What was the nature of the conflicts that occurred, and how were these resolved?

The actors who were involved in attempting to address Burgeo's water problems generally worked well together by focusing on the goal of water security by ensuring positive water-related outcomes for the community. Many of these outcomes were highlighted in Chapter Five. However, as mentioned above, engaging diverse actors often results in differing and sometimes opposing views. Conflict in Burgeo's case was not necessarily due to differences of opinion but, rather, from challenges with communication, such as misunderstandings and dismissals of other actors' views.

Although TC presented as a united front before other actors (e.g., the PG and local residents), and despite attempts to maintain cordiality, behind closed doors, there were some conflicts between some councillors with strongly opposing views, resulting in certain councillors feeling like they were being excluded or barred from engaging with other actors. Differences of opinions within the TC were resolved—albeit oftentimes to the discontent of one or more councillors—by employing majority-based decision making.

The TC and residents generally worked well together as these two groups were most directly impacted by the water and, therefore, shared similar goals and values. When BWAs were issued, residents generally complied and trusted that the TC would work to rectify the issue causing the BWA, thus complaints during these periods were generally minimal. Some conflicts between the TC and residents were caused by a mutual failure to meet each other's expectations whereby the TC felt that residents did not make significant efforts to employ water conservation practices in their homes, while residents felt that the TC should have first fixed the leaks in the water distribution system- which they believed caused the high flow rates observed in the community. Through its open-door policy and being welcoming of feedback to improve services within the community, the TC took the lead by ensuring that leaks within the distribution system were identified and repaired. As discussed above and in Chapter Five, one of the most notable conflicts that occurred within the community was the anti-meter protest in 2017 during which residents conveyed to the TC very clearly that water meters, or any similar policing of water, had no place in Burgeo. In this case, by recognising that local support is essential for policies to be implemented successfully, TC made the decision to remove the option of introducing water meters from the Town's Water Plan. Regarding conflicts between the TC and residents, it seems that the desires of the citizens prevailed ultimately, thus they were able to influence decision-making as participating actors.

The TC and the PG worked well together overall by pooling their resources and distributing tasks and responsibilities to ensure that Burgeo had access to sufficient, good quality, safe water. However, the various imbalances that existed caused numerous conflicts between these two groups. For example, some members of the TC (and its staff) felt that the PG prioritised scientific and technical knowledge—which PG staff and specialists generally possess—over the local and traditional knowledge of the TC, the water operator, and residents. This resulted in disagreements regarding the most suitable WTP capacity and treatment system for Burgeo's needs whereby members of the community felt that the PG showed a lack of concern for their needs. As discussed in Chapter Five, there appeared to be a relationship between scientific and/or technical knowledge and resources (namely money and technical expertise), and power. Considering the PG possessed more financial resources and technical and scientific knowledge—which the PG treated as the authority over traditional and local knowledge—it seemed that the PG had more decision-making power than the TC. Although TC disagreed with some of the solutions that were provided by the PG, TC oftentimes felt like they had no say as they required financial, and technical and scientific support from the PG to tackle Burgeo's water issues.

How might communication and coordination—and the potential for collaboration—be improved in addressing water-related problems in Burgeo?

Recommendations for improving communication and coordination and the potential for collaboration in Burgeo are addressed in the final section below.

6.3 Discussion and conclusion

One important message from this study was that the residents of Burgeo and other actors who have been involved agree that water is a basic human right worth fighting for as echoed by the various recognitions and policies summarised in Chapter Two. The case of Burgeo also highlights the threats to quantitative and qualitative water security, namely water overuse and aging infrastructure, and contaminants exceeding MACs and long-term or frequent BWAs respectively, which are observed across Canada and have been discussed by authors such as Allan et al. (2013), Eggertson, 2015, and NCCEH (2020). The same misconception highlighted by Sprague (2007) that Canadians generally have about an abundance or infiniteness of water in Canada is similarly evident within Burgeo when considering the town's water usage. As discussed in the literature, this is often attributed to a lack of differentiation between Canada's overall water supplies/bodies (~ 20 percent of global water) versus Canada's freshwaters (six to nine percent) which are available for use. Additionally, the high volume of water used in Burgeo is reflective of studies, such as Dore (2015), that indicate that smaller/rural/remote communities have fewer water conservation practices in place. Aging water infrastructure, another significant concern in Burgeo, is also common across Canada as most systems have reached their service lives and are due for upgrades and/or replacements and this has been highlighted in works by authors such as Ochoo et al. (2017), Renzetti and Dupont (2017), and Vodden and Minnes (2014a). Fortunately, replacing the water mains in Burgeo is a priority for the community and is currently underway. Some qualitative water concerns noted in Burgeo have also been identified in numerous communities in NL and across Canada. Before delving into these concerns, it is important to highlight that the Town of Burgeo complies with the PG's requirement for mandatory disinfection of drinking water by utilising chlorine (in addition to other treatment steps/processes). As highlighted by research participants who have had direct experience with Burgeo's water system, chlorine dissipates rapidly in water thus, to ensure satisfactory chlorination of the town's water, secondary chlorination using a booster station is practised. However, like many small/rural/remote communities in NL, Burgeo has encountered challenges with chlorine in drinking water, especially with regards to the aesthetic properties of the water, namely taste and smell. Some water studies in NL, including works by Vodden and Minnes (2014), have indicated that some residents do not like the taste or smell of chlorine in their water and, therefore, choose not to consume it. This is true for some residents in Burgeo, especially with previous over-chlorination at the beginning of the distribution line in an attempt to obtain satisfactory chlorine residual readings at the farthest points along the distribution system. Disinfection by-products have raised significant concerns in Burgeo, with some members of the community attributing high cancer occurrences to exposure to these contaminants. Although this fear has been noted in previous studies (such as AWWA, 2006; Carrico and Singer, 2009), numerous researchers and health authorities, including Health and Community Services NL (2009), have indicated that the risks associated with consuming untreated water (i.e., water that has not undergone disinfection) far outweigh the risks of chronic and/or acute exposure to these contaminants. Spring water is an example of a common water source of preference for many people living in NL, including some residents of Burgeo, and it is appealing as it is generally clear, colourless, and odourless. However, as the Government of Newfoundland and Labrador, as well as other researchers, have indicated, spring water is not regularly monitored or tested and may, therefore, pose a threat to consumer health. However, based on the numerous issues and challenges that Burgeo has faced with its water system, many residents have lost confidence in their PDWS and indicate that they would rather consume spring water or purchase water than to drink the town's water even when it has undergone all necessary treatment and sampling and testing.

As noted throughout this study and in works by Kooiman (1993), CG is based on the premise that no single actor possesses enough resources and/or power to govern and manage water resources effectively and efficiently. This is true in Burgeo's case, especially when considering both the Town and the PG's limited capacities. CG requires the engagement of a diversity of actors to ensure that all views and concerns are represented/expressed. Burgeo has done well in engaging diverse actors and other interested parties in discussions regarding the town's water. The TC is also aware of the importance of engaging local level actors, especially when it comes to their democratic rights, and policy implementation and compliance.

As indicated by scholars of CG, such as Ansell and Gash (2008) and Emerson et al. (2012), the more drivers present at the outset, the greater the likelihood of collaboration. However, some drivers may hinder collaboration. In the case of Burgeo, multiple drivers existed, including prehistory of cooperation and/or conflict, knowledge-resource-power imbalances, incentives for collaboration as well as constraints, and newer/emerging water-related concerns. In Burgeo, certain groups of actors have a history of working well or successfully together, to achieve some of the positive water-related outcomes outlined in Chapter Five. These groups include the residents and the TC, members within the TC, the TC and the PG, and the TC and other communities and scholars. These previous successes have incentivised most of these groups to continue to work together to address the community's newer water issues. Other incentives that have facilitated collaboration in Burgeo include regulations that hold certain actors, such as the TC as well as relevant PG departments, responsible for the provision of clean, safe water to the residents. Despite having lifted a long-term BWA that was in effect for over 10 years, Burgeo continues to face newer water issues, such as overuse, aging infrastructure (including leaks), and contaminants that exceed Health Canada's MACs. Actors may have to turn to collaboration to ensure that these concerns are effectively and efficiently resolved.

Knowledge-power-resource imbalances are commonly noted in collaboration as actors/groups often have more or less of each of these "resources" and this was true amongst actors in Burgeo, with financial imbalances being most significant- a trend observed by Molenveld (2021). There is a general understanding amongst actors and within the community that without money, there is no progress. The Town of Burgeo, like many communities in NL, has a small, declining and/or aging population, which means a lower tax base from which the Town can afford municipal services to its residents. As highlighted in earlier chapters, water in Burgeo is subsidized significantly (as shown by the relatively low water tax paid by residents annually) and the Town relies on funding from higher levels of government (PG and FG) to be able to provide clean, safe water to the residents. Financial imbalances in Burgeo are further confirmed by the contribution ratios of funding streams, such as MCW through which the Town pays 10 percent of the costs, while the PG pays 90 percent. As stated by one community member, the PG does not provide 100 percent funding to the Town, thus, the two groups must work together and pool funds, amongst other resources, to provide efficient water services in the community.

Studies by Roth and de Loë (2017) and van Tol Smit et el. (2015) highlight that no actor/group possesses enough knowledge to successfully address water concerns independently. In Burgeo's case, higher levels of government (PG and FG) possess most of the technical and scientific knowledge. However, they lack traditional/local/experiential knowledge which is often brought to the table by local actors through their lived experiences with the town's water system. Considering calls in recent years for greater incorporation of other forms of non-scientific/technical knowledge, higher levels of government are being urged to seek local/traditional knowledge from Burgeo's residents and the TC to increase the knowledge pool to better understand water concerns and to ensure that solutions presented reflect all actors' experiences and interests. It is also important to note that these knowledge imbalances also translate to staff/labour imbalances. An example of this in Burgeo is the regional water operator for western NL who is only able to meet with TC once a year.

Power is often unevenly dispersed at the outset of collaboration. As noted in Chapter Two, the PG has jurisdiction of its water resources, including those in Burgeo. Although the Town receives its authority to issue by-laws from the PG, it is still required to seek approval from the PG for permits, licenses, and funding thus, indicating a power imbalance, although this may also be regarded as operational protocol between the two levels. When considering power dynamics between the TC and the residents, although the TC is the voice of the community, the residents have the power—through their democratic rights—to influence decision-making.

As mentioned earlier, not all drivers facilitate collaboration. Newer/emerging water concerns in the community have also deterred some groups from engaging in collaboration as they feel that they are fighting a losing battle whereby as one challenge is addressed, another challenge arises. Although knowledge-power-resource imbalances facilitate collaboration as actors work together to complement their deficiencies, these imbalances can also hinder collaboration. Firstly, although attempts to incorporate more traditional/local/experiential knowledge have increased in recent years, scientific and technical knowledge are often still considered the authority in environmental decision-making. Actors who possess less of this knowledge may feel or may be told that their contributions and knowledge forms are less valid, thus deterring them from collaboration. On several occasions, local actors in Burgeo felt that the knowledge they shared based on their lived experiences with the town's water system was dismissed by scientific and technical experts who regarded their own knowledge as superior. In these cases, the result was some resentment towards these experts as some of the decisions they made based on their technical and/or scientific knowledge proved to be the wrong choice for the community and its needs. Regarding staff and labour imbalances, TC reported that they were unable to use their own staff for certain projects that were funded by the PG. Although TC acknowledges that these policies are in place for a reason, they also note that they slow things down:

> I know policy is there to protect people but, sometimes, I think it gets in the way. If you have your own staff but you're not allowed to use your own staff for government-funded projects- those types of policies, although they're there for a reason… But communities could get a lot more done if they could do things themselves. (Community member Barter)

When it is the only avenue that exists for an issue to be addressed, the likelihood of collaboration increases significantly ("forum exclusiveness" as highlighted by Ansell and Gash, 2008). In Burgeo, due primarily to the various imbalances and constraints noted throughout this study, collaboration has been the only means through which the community has been able to address some of its water-related challenges. This further confirms the premise of CG, noted by CG scholars such as Emerson et al. (2012) and Fish et al. (2010), that no single actor/group possesses enough knowledge, power, or resources to successfully address a concern independently.

As noted by Ansell and Gash (2008), Emerson et al. (2012) and Siddiki et al. (2017), ground rules and other policies/protocols are crucial for ensuring that actors engage respectfully with each other, while clarifying their various roles and responsibilities. Ground rules play a role in protecting actors and in Burgeo's case, one example comes to mind where a group of residents—who were upset about the possibility of water meters and a water monitor being introduced into the community—were denied a meeting with the TC as the mayor at that time stated that they would not tolerate intimidation or bullying of members of the TC. Other protocols/ground rules observed during collaboration related to members of the community requesting to be included in the agenda for monthly TC meetings, design and construction permit processes, funding applications, water quality sampling and analysis, and processes for issuing and rescinding BWAs.

Ansell and Gash (200, Emerson et al. (2012), and Siddiki et al. (201 note that facilitative leadership in CG is important as it ensures that ground rules are established and followed, conflicts are resolved effectively, and actors are engaged meaningfully. Most of the leaders identified in the various actor groups in Burgeo generally played a facilitative role. These leaders mediated when conflicts occurred, made necessary linkages with other actors and communities to ensure that water concerns in the town were resolved, and they also remained committed to the process despite the various challenges they faced. However, there were reports of certain leaders over the years who were either dismissive of other groups or did not respond well to being challenged.

Due to the inter-personal nature of CG, studies by Ansell and Gash (2008), Emerson et al. (2012), Kapucu (2005) and Kleinbaum et al. (2008) have indicated that effective and efficient communication and coordination are essential. In Burgeo, a range of communication methods and media were utilised within and across the different actor and groups. TC's open-door policy for residents and regular meetings with other actors when required is especially commendable and highlights open communication within and with that group of actors. Effective communication in CG is especially important for ensuring that all actors are meaningfully engaged in defining the problem, exploring potential solutions, agreeing on the best course of action, and coordinating resources and efforts to achieve shared goals. Burgeo's problem as it relates to water is multifaceted, as is the case with many natural resources. Although there is consensus that the overall goal for all actors involved is ensuring clean, safe, drinking water for the community, there are conflicting views regarding which of the numerous water issues to address first and how. Conflict in CG is to be expected as actors come from different backgrounds with varying (and sometimes opposing) interests and goals. This is highlighted by significant conflict within and across certain actor groups, which has led some actors to feel as though their input is not welcome or valid. However, the key to overcoming conflict, as documented by Emerson et al. (2012) is to ensure that leaders can facilitate effective conflict resolution. In Burgeo, some community leaders welcomed the residents to meet with them to discuss any concerns or issues they had with Town services, including water, and invited them to develop committees with other residents who felt similarly. It is also important to note the need for open and transparent communication. In Burgeo, there were reports of actors/groups whose actions did not reflect their words, as well as concerns regarding how certain actors could agree collectively with others on the best course of action for the community and then turn around and decide on something else that was deemed less optimal for the community and its needs. These situations, amongst others, resulted in diminished trust amongst certain actor groups. Trust levels amongst actors/groups in Burgeo have also been impacted by conflict—a common phenomenon when engaging diverse individuals and groups—thus, reinforcing the need for facilitative leaders who are willing to establish and implement effective conflict resolution strategies. Trust, in turn, affects commitment levels. Some local actors in Burgeo felt that the PG was not as committed to resolving their water issues or that they did not prioritize the community's needs or listen to local voices. This was mostly attributed to slow processes within the PG which, in turn, affected progress in Burgeo, as well as decisions being made by higher levels of government that did not reflect the town's needs or concerns, and certain actors/groups failing to fulfill their obligations/duties. However, many local actors demonstrated tremendous patience and understanding that some of the delays that occurred while addressing water-related concerns in Burgeo were beyond any of the actors'/groups' control. Additionally, despite staffing and fiscal constraints, the PG has made efforts to build its relationship with the community of Burgeo and to provide funding and technical support as their resources permitted. The actors involved—especially the members of the community—have remained committed to achieving the goal of ensuring sufficient, good quality drinking water in Burgeo despite the various challenges they have faced. Furthermore, Burgeo (TC and residents) should be commended for implementing and complying with certain decisions that were made in favour of other actors/groups and did not necessarily reflect the community's needs, such as the size of the WTP.

As is the case with many processes that involve multiple actors from different backgrounds, there is always room for improvement, thus, recommendations for improving communication and coordination and the potential for collaboration in Burgeo as they relate to the water are discussed next. Firstly, levels of engagement (informing, consulting/engaging, collaborating/decision-making) may require clarification to manage expectations amongst actors. Additionally, it is important for actors to understand that consensus does not mean that everyone is in agreement with the decision or that the decision is based on the preferences of the majority but, rather, that consensus-based decision-making reflects the optimal solution for the group at that time. This may resolve concerns expressed by some actors/groups who have previously felt that their concerns or interests were dismissed.

Despite acknowledging that actors cannot solve Burgeo's water problems independently, the concentration of power within certain groups and the inaccurate belief that scientific and technical knowledge provide more value in decision-making continue to affect collaboration in Burgeo. Although equal distribution is not required, there is a need to disperse the power that is concentrated primarily within the PG to prevent monopoly in decision-making. As noted in Chapter Two, more powerful actors typically have difficulty sharing their power. However, this can be combated by continuously reflecting on the inter-dependence shared by the actors and by understanding that all actors are working on the same team to achieve the same goal. CG literature emphasises the importance of incorporating more local, experiential, and traditional knowledge and not relying solely on scientific and technical knowledge to address water (and other environmental and societal) problems. This is also true in the case of Burgeo: all forms of knowledge—especially local/experiential and traditional knowledge—must be sought and welcomed and utilised to create a more diverse knowledge pool. By doing so, actors ensure that all opinions and concerns are expressed and listened to earnestly, thereby ensuring co-generation of optimal solutions from a better, more well-rounded understanding of Burgeo's multi-faceted water problems. Additionally, certain restrictive policies, such as the requirement for PG staff to perform and complete certain water-related projects that are funded by the PG, should be revisited and revised to allow the TC to contract out staff/specialists as needed with PG approval. Actors must also acknowledge that theory and reality are often not the same and that a one-size-fits-all approach, such as water system sizes based on national per capita averages, may not truly reflect the needs of a community.

Burgeo has done well in developing a Town Plan. The TC must continue to collaborate with all actors—especially residents—to review and revise this plan and outline how and when the most pressing issues can be addressed. Actors should also consider establishing or refining existing tools and processes to measure and record performances as they relate to the collaborative process, and to genuinely consider any feedback that is received and use it to adapt policies and processes as needed.

As actors work together to ensure qualitative and quantitative water security in Burgeo, community education/outreach efforts must be intensified to ensure that the public are aware of ways in which water can be used more conservatively, while catering to the needs of the community, as well as engaging the public in discussions regarding potentially unsafe water sources, such as the spring frequented by many residents. Finally, to remain motivated and committed to the goal of ensuring water security in Burgeo, the actors involved should take time to reflect upon and celebrate the small victories or intermediate outcomes. These small wins/prehistory of successful collaboration can facilitate further collaboration as highlighted by Ran and Qi (2019).

Although many residents have lost confidence in the town's water, Burgeo has achieved significant positive water-related outcomes, and as expressed by some members of the community, although Burgeo's water is not where it needs to be, it is far better now than it was even 5/10 years ago. The community of Burgeo has demonstrated tremendous resilience and commitment to ensuring water security in the face of seemingly never-ending water challenges over the years. Burgeo's case also serves as a reminder that, despite its status as an economically and socially developed nation, Canada's water security is increasingly threatened. The identification of multiple drivers in Burgeo indicates the need and potential for more collaborative approaches to addressing the community's water problems, as suggested by previous water governance studies across NL and Canada (Gibson, 2014; Mitchell, 2017; NRTEE, 2011; Pelley, 2019; Vodden and Minnes, 2014; and more). Despite the representation of a diversity of actors in Burgeo, the three primary groups involved—albeit in different ways and to different extents—are the residents, the TC, and the PG. Additionally, this study highlights that an invitation to the collaborative table does not guarantee meaningful engagement or a direct role in decision-making. Furthermore, the imbalances that drive collaboration can also be the factors that hinder collaboration. The CG framework developed for this study highlights the core CG components, while focusing on the inter-personal nature of collaboration. This framework can be utilised in other studies to explore interactions, particularly communication and coordination, in collaboration to address other societal and/or environmental concerns. Finally, although not exhaustive, especially when considering the newer/emerging water-related concerns in Burgeo, this study has provided a detailed profile of some of Burgeo's main water challenges and concerns, as well as resolutions over the last 20 years, and this will serve as a good foundation for future water governance studies relating to actor interactions, particularly communication and coordination, in Burgeo and for similar studies that might be undertaken in rural NL and/other rural and remote communities across the country.

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Appendix A: Water-related responsibilities for Canada's three tiers of government

(Bereskie et al., 2017a, p. 245-246).

Federal government	Provincial and Territorial governments	Municipalities
Water quality guidelines are developed collaboratively by federal, and provincial and territorial levels of government (CCME, 2004). The guidelines developed by the Fed-Prov-Terr Committee on Drinking Water, a committee with representation from all 3 levels of govt, are published by Health Canada as the Canadian Drinking Water Quality Guidelines (CDWQG) (Health Canada, 2009).		
Lead for developing GCDWQ. Provides scientific and technical expertise to provincial and territorial governments (Heath Canada 2012, p. 50-51)	Manages source water. Regulates treatment plants and distribution systems (Heath Canada 2012, p. 50-51)	Treat and distribute drinking water to the public (Heath Canada 2012, p. 50-51)
Provision of oversight through leadership, research and development, recommendations for safe drinking water practices	Dictate water quality standards and regulations	Administration
Environment and Climate Change Canada administers legislation on water-related activities, e.g., the Canada Water Act	Manage monitoring and enforcement	Performance
CCME provides guidance and recommendations for water utilities to provide safe drinking water through the MBA	Provide provincial and territorial drinking water management systems	Monitoring
Health Canada is also responsible for conducting research and assessing water quality and developing information about drinking water which is made available to the public (CCME, 2004). Health Canada collaborates with provincial and territorial drinking water agents and Environment Canada to develop the Guidelines for		Management

Canadian Drinking Water Quality (GCDWQ) (CCME, 2004). These guidelines address drinking water-related health concerns (CCME, 2004). Provincial and territorial authorities can then use these guidelines to develop their own drinking water quality guidelines (CCME, 2004).		
Public Health and Environment departments are involved in regulation of drinking water or enforcement policies (CCME, 2004).	Provincial and territorial authorities are also responsible for ensuring that suitable legal tools/instruments are available for adequate operator training and certification (CCME, 2004).	Source water protection
Drinking water system owners can receive financial aid from the FG under different expense-sharing programs, e.g., infrastructure development programs (CCME, 2004).	Regional operators are often responsible for monitoring drinking water (CCME, 2004). Centralised specialists bear the responsibility of conducting proposal assessments and approvals (CCME, 2004).	Water treatment and distribution management
	The provincial and territorial authorities are responsible for regulating and overseeing drinking water quality (CCME, 2004).	Maintenance of operations
	The lead agency for drinking water for each jurisdiction coordinates all the activities and programs relating to drinking water	

	to ensure that the drinking water program is successful (CCME, 2004).	

Appendix B: Extracts from the Municipalities Act, 1999

Section 25: (1) of the Municipalities Act (1999) states that "A Town Council may establish the standing or special committees that it considers desirable to consider and make recommendations on matters referred to them by Council" (HA-NL, n.d.).

Section 130 of the Municipalities Act (1999) states that "A council of a municipality served by a water system… shall impose upon the owner of real property located inside or outside the municipality that is connected or is capable of being serviced by that system, a tax, to be known as the water and sewage tax" (HA-NL, n.d.).

Section 156 of the Municipalities Act (1999) states that "A council may, subject to the Water Resources Act and regulations made under that Act, construct, establish, own and operate a) a public water supply system for the distribution of water within, or with the approval of the Minister, outside of the municipality…" (HA-NL, n.d.).

Appendix C: Extracts from the Water Resources Act, SNL (2002)

Section 37: (1) of the Water Resources Act, SNL (2002) states that "A person shall, before the construction of waterworks, or the extension of or change to existing waterworks, submit to the Minister then plans, specifications and an engineer's report of the water supply and the works to be undertaken, together with other information that the Minister may require, and the waterworks shall not be undertaken or proceeded with until the person has been granted a permit under this Act for the proposed waterworks" (HA-NL, n.d.).

Section 37: (5) of the Water Resources Act, SNL (2002) states that "Where, in the opinion of the Minister, an adverse effect has occurred or may occur to water, water is or may be in an unwholesome condition, or an existing waterworks requires alteration, the Minister may direct the person operating the waterworks to alter or make additions to the waterworks, and in the manner and within a time that the Minister considers necessary" (HA-NL, n.d.).

Section 38: (1) of the Water Resources Act, SNL (2002) states that "All waterworks in the province shall at all times be maintained, kept in repair and operated in a manner and with those facilities that the Minister may direct" HA-NL, n.d.).

Section 41: (1) of the Water Resources Act, SNL (2002) states that "The Minister may require and direct the owner, or operator or other person responsible for an undertaking to carry out those tests on which water emitted from, surrounding or connected with that undertaking that the Minister considers necessary" (HA-NL, n.d.).

Section 41: (2) of the Water Resources Act, SNL (2002) states that "Where the Minister requires and directs that an owner, operator or person responsible carry out tests under sub-section (1), that owner, operator or person responsible shall carry out the required tests and shall, in writing, report the results of those tests t the Minister within the time that the Minister may direct" (HA-NL, n.d.).

Appendix D: Guidelines for drinking water quality in Newfoundland and Labrador (2009)

(Municipal Affairs and Environment NL, 2009).

Chemical parameters	MAC	Description
Antimony	0.006 mg/L	Contaminant
Arsenic	0.01 mg/L	Contaminant
Barium	1.0 mg/L	Contaminant
Boron	5 mg/L	Contaminant
Cadmium	0.005 mg/L	Contaminant
Chloride	250 mg/L	Contaminant
Chromium	0.05 mg/L	Contaminant
Copper	1.0 mg/L	Aesthetic
Fluoride	1.5 mg/L	Contaminant
Iron	0.3 mg/L	Aesthetic
Lead	0.01 mg/L	Contaminant
Mercury	0.001 mg/L	Contaminant
Nitrate and nitrite	10 mg/L	Contaminant
Selenium	0.01 mg/L	Contaminant
Sodium	200 mg/L	Aesthetic

Sulphate	500 mg/L	Aesthetic
Uranium	0.02 mg/L	Contaminant
Zinc	5.0 mg/L	Aesthetic
Physical parameters	MAC	Description
Colour	15 TCU	Aesthetic
pH	6.5- 8.5	Aesthetic
Total dissolved solids (TDS)	500 mg/L	Aesthetic
Turbidity	1.0 NTU	Contaminant
DBPs	MAC	Description
THMs	100 µg/L	Contaminant
HAAs	80 µg/L	Contaminant
Bacteriological parameters	MAC	
E. coli	Nondetectable per 100 mL	
Total coliforms	No consecutive samples from the same site no more than 10% of samples from each	

	distribution system in given sample set should show the presence of total coliforms	

Appendix E: Standard reasons for issuing boil water advisories (BWAs) in Newfoundland and Labrador

(Municipal Affairs and Environment NL, 2022)

Reason	Reason code
Water supply has no disinfection system	A
Chlorination system is turned off by the operator due to taste or other aesthetic considerations	B1
Chlorination system is turned off by operator due to perceived health risks	B2
Chlorination system is turned off by operator due to lack of funds to operate	B3
Disinfection system is off due to maintenance or mechanical failure	C1
Disinfection system is off due to lack of chlorine or other disinfectant	C2
Water disinfection system is undergoing maintenance or repairs	D1
A cross-contamination is discovered in the distribution system	D2
Inadequately treated water was introduced into the system due to fire flows, flushing operations, interconnections, minor power outage, or other pressure loss	D3
Water entering the distribution system or facility, after a minimum 20-minute contact time does not have a free chlorine residual of at least 0.3 mg/L or equivalent CT value	E1
No free chlorine residual detected in the water distribution system	E2
Insufficient residual disinfection in water system disinfected by means other than chlorination	E3

Total coliform detected, and repeat samples cannot be taken as required	F2T
E. coli detected, and repeat samples cannot be taken as required	F2E
Total coliforms detected and confirmed in repeat sample	F3
E. coli detected in an initial sample is considered extensive and the water system has other known problems	F4
E. coli detected and confirmed in repeat sample	F5
Viruses detected, e.g., Hepatitis A, Norwalk	F6
Protozoa detected e.g., Giardia, Cryptosporidium	F7
Water supply system integrity compromised due to disaster, e.g., contamination of water source from flooding, gross contamination major power failure, etc.	G
Waterborne disease outbreak in the community	H

Appendix F: Burgeo's governance goals and projects

(TCI and BAE, 2010, p.107, 109, 114).

Description	**Goals and projects**		
Goal	To increase communication		To maintain adequate staff to run municipal operations
Number	GOV 1A	GOV 1C	GOV 2C
Project title	Governance committee	Public meetings	Municipal training
Project description	Create a council-supported governance committee that will lobby local issues to higher levels of government	To keep citizens engaged and informed of municipal operations, the council should hold regularly scheduled public meetings	Enroll in the Municipal Training Program that exists to strengthen and improve the leadership, administrative, operational and other job-related skills of municipal councillors, municipal administrators, and other municipal employees
Project lead	Residents and local business owners	Town of Burgeo	Town of Burgeo
Funding source			
Priority			
Partners involved	Town of Burgeo	Residents	Municipal and Provincial Affairs; Municipal Training and Development Corporation; Professional municipal administrators

Role of partners	Support governance committee	Attend public meetings	Provide information and framework to train municipal staff
Capital investment plan outputs			
Gas tax outcomes			

Appendix G: Burgeo's environmental goals and projects

(TCI and BAE, 2010, p.24, 44, 49)

Description	**Goals and projects**		
Goal	To have sustainable municipal operations		
Number	D	ENV 3D	ENV 4B
Project title	Water systems	Water systems	Support water conservation initiatives
Project description		A regular maintenance, inspection and water quality testing program, and associated record keeping of the water system will be undertaken to address the following: • Cycling all mainline valves • Leak detection • Flushing hydrants • Dead end line and low points • Cross-connection control program • Cleaning problems • Water quality testing	Conserve water by implementing measure such as: • Low-flow toilets and faucets • Recycling grey water • Discouraging water bottles Encourage environmental education of rainwater management practices that residents may perform at home
Project lead		Town of Burgeo	Town of Burgeo
Funding source	Gas tax	Gas tax	Gas tax
Priority	Medium		
Partners involved		Environment and Climate Change NL; municipal engineers	Conservation Corporations; Environment and Climate Change NL

Role of partners		Provide information and framework for water system maintenance	Provide information and framework for water conservation programs
Capital investment plan outputs		• Drinking water supply storage systems • Water purification and treatment systems • Water distribution systems	Protection of source water
Gas tax outcomes		Ensure high quality water	Reducing the amount of water needed

Appendix H: Burgeo water quality testing (parameters, nutrients, metals, contaminants)

Chemical/element/parameter	**MAC**	**Burgeo reading September 2021**	**Burgeo reading November 2018**
Nutrients and metals			
Ammonia		0.000 mg/L	0.090 mg/L
Dissolved organic content (DOC)		17.0 mg/L	11.3 mg/L
Nitrate/nitrite	10 mg/L (C)	0.000 mg/L	0.000 mg/L
Kjeldahl nitrogen		0.270 mg/L	0.200 mg/L
Total phosphorous		0.011 mg/L	0.004 mg/L
Aluminium		0.390 mg/L	0.260 mg/L
Antimony	0.006 mg/L (C)	0.00000 mg/L	0.00000 mg/L
Arsenic	0.01 mg/L (C)	0.000 mg/L	0.000 mg/L
Barium	2.0 mg/L (C)	0.003 mg/L	0.000 mg/L
Cadmium	0.007 mg/L (C)	0.00002 mg/L	0.00000 mg/L
Chromium	0.05 mg/L (C)	0.00000 mg/L	0.00000 mg/L
Copper	2.0 mg/L (C) and 1.0 mg/L (A)	0.000 mg/L	0.000 mg/L
Iron	0.3 mg/L (A)	0.550 mg/L	0.360 mg/L
Lead	0.005 mg/L (C)	0.001 mg/L	0.000 mg/L

Magnesium		0.520 mg/L	0.000 mg/L
Manganese	0.12 mg/L (C) and 0.02 mg/L (A)	0.019 mg/L	0.010 mg/L
Mercury	0.001 mg/L (C)	0.00000 mg/L	0.00000 mg/L
Nickel		0.000 mg/L	0.000 mg/L
Selenium	0.01 mg/L (C)	0.000 mg/L	0.000 mg/L
Uranium	0.02 mg/L (C)	0.0000 mg/L	0.0000 mg/L
Zinc	5.0 mg/L (A)	0.000 mg/L	0.000 mg/L
Physical parameters and major ions			
Alkalinity		0.00 mg/L	0.00 mg/L
Colour	15 TCU (A)	220 TCU	157 TCU
Conductivity		34.0 µS/cm	48.0 µS/cm
Hardness		4.30 mg/L	0.00 mg/L
pH	6.5 – 8.5 (A)	5.2	6.3
Total dissolved solids (TDS)	500 mg/L (A)	19	31
Total suspended solids (TSS)		-	-
Turbidity	1.0 NTU (C)	2.50 NTU	1.10 NTU
Boron	5.0 mg/L (C)	0.00 mg/L	0.00 mg/L

Bromide		0.00 mg/L	0.00 mg/L
Calcium		0.88 mg/L	0.00 mg/L
Chloride	250 mg/L (A)	7 mg/L	9 mg/L
Fluoride	1.5 mg/L (C)	0.000 mg/L	0.000 mg/L
Potassium		-	0.000 mg/L
Sodium	200 mg/L (A)	5 mg/L	5 mg/L
Sulphate	500 mg/L (A)	1 mg/L	2 mg/L
Disinfection by-products (DBPs)			
HAAs	80 µg/L	361 µg/L	949 µg/L
THMs	100 µg/L	318 µg/L	743 µg/L
Langelier Index (calcium saturation)	-1 to +1	-5.86	-4.47

Note. Extracted from Environment and Climate Change NL, n.d.(iv).

Appendix I: Burgeo water services funding types, projects, and amounts

Project name	**Funding type/source**	**Amount**		**Year**
		Provincial portion	Federal portion	
Watermain replacement Phase VI	Infrastructure Canada - Investing in Canada	$503,007	$560,792	2021
Watermain Replacement Phase V	Infrastructure Canada	$816,057	$652,846	2020
Watermain Replacement Phase IV	No funding information available.			
Watermain Replacement Phase III- (SCF)	Infrastructure Canada	$270,047	$158 826.00	2018
Water main Replacement Phase II	Federal funding (Clean Water and Wastewater fund)	$453 417.39	$453 417.39	2016
Water line flushing stations	Municipal infrastructure funding	$150,949		2015
Chlorination upgrades	Municipal Capital Works	$350,000 (Government of NL + Town of Burgeo)		2014
17-MCW-14-14110	Municipal capital works	$51,611	-	2013/14

Engineering Design Initiative (EDI) - chlorination upgrade				
17-MCW-14-14025 EDI - water main replacement	Municipal capital works	$30,106	-	2013/14
Replacement of 250 metres of steel main	Government of NL, 2013 Budget	$145,000	-	2013
Water Storage Tank- MRIF	Infrastructure Canada	N/A	$369,091.82	2008
Completion of water treatment plant	Municipal Affairs and Environment NL	$548,480	-	2008
Water Treatment Plant- MRIF	Infrastructure Canada	N/A	$884,239.28	2007
Development of a water treatment plant	Town of Burgeo, Municipal Affairs and Environment NL, Government of Canada	$2.95 million		2001

Note. Extracted from Crocker, 2021; Collingwood, 2008; Donnan, 2013; Donnan, 2014; Infrastructure Canada, 2022; Westcott, 2018.

Appendix J: Burgeo Canada Community-Building Fund allocation (2019-2024)

Year	**Allocation ($)**
2019-20 GTF allocation	$140,313
2020-21 GTF allocation	$62,753
2021-2022 GTF allocation	$65,606
2022-23 GTF allocation	$65,606
2023-24 GTF allocation	$68,458
5-year total	$402,736

Note. Extracted from Municipal and Provincial Affairs NL (n.d.).

Appendix K: Summary of Town of Burgeo's water treatment plant expenses (2014)

(TCD4, 2017)

	Total amount spent ($)							
	Hydro	**BBS**	**Maintenance**	**Salaries**	**Chlorine**	**Caustic soda**	**Freight**	**Total expenses**
Jan	$9,047.62	$108.00	$71.11	$1,531.76				$10,758.49
Feb	$7,642.98	$108.00		$1,246.09			$636.79	$9,633.86
Mar	$5,618.21	$108.00	$11.04	$453.73		$1,587.60	$135.00	$7,913.58
Apr	$4,185.87	$108.00		$806.10		$1,566.00	$683.34	$7,349.31
May	$3,098.63		$46.39	$785.39				$3,930.41
June	$438.15		$16,992.63	$2,944.08		$1,632.96		$22,007.82
July	$5,899.98		$2,132.31	$1,941.67	$5,716.13	$3,175.20	$347.20	$19,212.49
Aug	$5,198.36	$432.00	$380.18	$1,995.20		$3,175.20	$1,840.48	$13,021.42
Sept	$4,933.59	$108.00	$5,750.36	$1,939.38			$90.47	$12,821.80
Oct	$5,241.15	$108.00	$788.82	$2,607.38		$9,525.59	$2,180.20	$20,451.14
Nov	$6,980.21	$108.00	$284.44	$1,641.07	$2,152.13		$723.70	$11,889.55
Dec	$8,484.17	$108.00	$2,323,67	$1,665.85			$263.77	$12,845.46
Total annual expense ($)	$66,768.92	$1,296.00	$28,780.95	$19,557.70	$7,868.26	$20,662.55	$6,900.95	$151,835.33

Appendix L: Summary of Town of Burgeo's water treatment plant expenses (2015)

(TCD4, 2017)

	Total amount spent ($)							
	Hydro	**BBS**	**Maintenance**	**Salaries**	**Chlorine**	**Caustic soda**	**Freight**	**Total expenses**
Jan	$10,929.00	$108.00	$1,852.18	$1,685.91		$4,233.60		$18,808.98
Feb	$9,552.27	$108.00	$6,282.13	$2,128.97			$2,926.35	$20,997.72
Mar	$9,558.80	$108.00	$2,251.88	$1,588.87	$2,406.67	$4,475.52	$393.72	$20,783.46
Apr	$9,519.72		$198.67	$2,133.54	$5,970.67		$528.04	$18,350.64
May	$9,122.21		$769.98	$2,041.96			$3,532.48	$15,466.63
June	$6,401.85	$108.00	$26,307.98	$1,800.74	$4,902.90		$448.14	$39,969.61
July	$4,554.06	$108.00	$2,199.42	$2,089.18			$299.19	$9,249.85
Aug	$4,758.09	$108.00	$1,341.64	$2,305.79	$2,406.67	$9,979.19	$1,967.14	$22,866.52
Sept	$4,415.66	$108.00	$21.44	$2,041.55	$2,496.23		$730.78	$9,813.66
Oct	$4,892.85	$108.00	$123.05	$2,281.11			$1,022.99	$8,428.00
Nov	$4,538.01	$108.00	$44.15	$2,928.31	$2,406.67	$9,979.19	$2,434.76	$22,439.09
Dec	$6,352.65	$108.00	$124.47	$3,841.42	$3,750.49		$1,165.11	$15,342.14
Total annual expense ($)	$84,595.46	$1,080.00	$41,516.99	$26,867.35	$24,340.30	$28,667.50	$15,448.70	$222,516.30

Appendix M: Summary of Town of Burgeo's water treatment plant expenses (2016)

(TCD4, 2017)

	Total amount spent ($)							
	Hydro	**BBS**	**Maintenance**	**Salaries**	**Chlorine**	**Caustic soda**	**Freight**	**Total expenses**
Jan	$7,391.67	$108.00		$1,957.07	$2,130.49		$360.89	$11,948.12
Feb	$7,034.74	$108.00	$1,469.47	$1,879.78			$323.15	$10,815.14
Mar	$7,769.83	$108.00		$1,530.31	$2,130.49	$6,652.80	$1,016.73	$19,208.16
Apr	$7,486.92	$108.00	$1,467.68	$1,439.85	$2,162.45		$1,727.48	$14,392.38
May	$6,666.39	$108.00	$924.75	$1,185.59			$1,416.19	$10,300.92
June	$5,321.23	$108.00	$450.30	$1,769.98				$7,649.51
July	$5,245.69	$107.50	$1,419.10	$1,664.73	$2,120.63	$5,080.32	$1,491.62	$17,129.59
Aug	$4,910.44	$107.50		$3,594.47	$2,480.33			$11,092.74
Sept	$4,533.09	$107.50	$1,787.69	$3,770.21		$5,056.80	$1,614.34	$16,869.63
Oct	$4,505.25	$107.50	$23.09	$4,465.00		$11,799.20	$2,475.37	$23,375.41
Nov	$5,855.29	$107.50	$44.89	$2,946.73				$8,954.41
Dec	$6,069.56	$107.50	$791.38	$3,147.84		$6,742.40	$473.00	$17,331.68
Total annual expense ($)	$72,790.10	$1,293.00	$8,378.35	$29,351.56	$11,024.39	$35,331.52	$10,898.77	$169,067.69

Appendix N: Summary of Town of Burgeo's water treatment plant expenses (2017)

(TCD4, 2017)

	Total amount spent ($)							
	Hydro	**BBS**	**Maintenance**	**Salaries**	**Chlorine**	**Caustic soda**	**Freight**	**Total expenses**
Jan	$7,456.07	$107.50		$2,768.83				
Feb	$7,156.31	$104.29	$71.02	$,452.83				
Mar	$7,906.17	$104.29		$1,056.12			$986.35	
Apr	$5,766.77	$104.29		$1,095.33				
May	$1,467.84	$104.29	$6,471.75	$1,125.51			$205.16	

*Data incomplete at time of collection

Appendix O: Town of Burgeo monthly water flow rates (2015)

(TCD4, 2017)

	Flow rates (gallons per minute)											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1				510	340	420	330	195	320	140	217	330
2				510	500	290	280	274	220	140	230	355
3				560	320	300	280	250	140	183	178	380
4				530	375	320	365	210	178	144	170	430
5				520	270	370	330	**	195	170	200	410
6			600	520	280	300	360	245	210	170	240	420
7			560	510	260	340	260	199	173	130	295	410
8			535	530	330	370	270	260	130	150	220	350
9			600	520	335	305	280	224	180	160	250	380
10			540	580	310	280	390	205	300	192	200	400
11			530	590	340	355	320	205	310	178	370	480
12			590	550	320	330	290	180	160	179	200	400
13			600	670	270	305	395	160	190	195	305	420
14			570	510	280	300	330	205	280	150	285	520

15			580	530	300	290	335	160	160	150	270	360
16			590	500	330	250	315	200	170	315	260	325
17			630	540	315	350	350	400	200	161	240	325
18			530	540	345	300	355	170	311	155	200	430
19			570	590	240	240	330	160	141	230	440	380
20			550	560	260	265	300	190	137	130	430	410
21			580	462	290	325	280	210	180	140	316	435
22			575	490	250	290	180s	223	170	160	285	450
23			580	450	315	280	120	221	170	270	250	340
24			560	430	310	260	-	225	170	236	200	350
25			560	480	330	270	330	180	160	186	270	380
26			560	510	290	260	114	200	229	200	300	400
27			560	430	280	300	205	200	192	150	280	390
28			590	365	320	310	130	200	228	175	320	430
29			570	340	280	260	117	234	140	170	420	380
30			570	340	340	280	180	240	145	290	-	400
31			530	-	330	-	190	230	-	151	-	420

Monthly average			570	506	311	304	268	215	196	179	269	396

Appendix P: Town of Burgeo monthly water flow rates (2016)

(TCD4, 2017)

	Flow rates (gallons per minute)											
Day	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1	430	470	440	480	300	170	292	302	*	310	240	300
2	460	420	470	460	362	180	350	310	234	360	240	500
3	430	450	430	430	240	240	290	270	306	260	230	360
4	430	400	470	460	240	235	280	280	280	220	230	380
5	400	450	445	420	240	240	240	260	280	250	370	400
6	390	465	455	420	230	310	220	316	260	270	320	380
7	420	500	500	420	280	190	220	310	270	260	380	380
8	390	480	440	450	360	200	300	500	300	280	230	400
9	425	450	460	435	340	200	275	220	250	290	250	420
10	460	440	490	440	220	280	236	230	340	230	270	470
11	460	420	450	425	230	250	335	240	320	220	275	480
12	400	420	517	360	240	230	220	240	330	280	340	520
13	400	485	490	380	190	220	250	200	260	230	270	470
14	430	456	530	360	230	230	270	250	200	220	250	480

15	436	520	450	360	195	200	230	270	220	270	230	480
16	460	470	440	390	190	260	215	230	280	265	260	540
17	455	440	500	385	200	235	195	250	243	250	310	520
18	440	450	480	420	190	265	270	240	233	215	320	570
19	440	450	510	315	180	267	200	220	270	220	320	580
20	450	485	490	320	160	260	320	230	205	220	270	570
21	430	487	500	300	180	280	280	195	220	230	270	550
22	400	475	440	467	150	280	230	230	220	260	270	550
23	470	400	480	330	220	240	225	295	250	300	300	650
24	490	450	500	300	179	220	220	300	265	250	320	600
25	400	462	480	350	140	270	260	260	260	230	350	510
26	445	440	420	300	160	252	190	250	250	230	300	550
27	445	490	490	260	260	270	220	287	230	240	300	565
28	420	485	440	270	250	240	230	290	225	250	300	540
29	400	470	430	310	218	230	210	270	220	270	-	530
30	450	-	420	316	220	230	380	248	250	270	-	510
31	460	-	430	-	162	-	280	-	-	360	-	520

Monthly average	433	458	467	378	224	239	256	266	258	258	286	493

*System flushing

Appendix Q: Town of Burgeo monthly water flow rates (Jan – June 2017)

(TCD4, 2017)

Day	Jan	Feb	Mar	Apr	May	June
1	524	575	710	640	520	250
2	548	660	740	610	480	230
3	500	-	720	600	470	180
4	470	740	760	630	480	250
5	530	745	760	620	490	220
6	500	690	780	600	490	250
7	493	740	740	560	480	205
8	503	730	730	570	460	220
9	400	760	720	580	470	210
10	400	730	730	600	440	180
11	520	740	730	530	450	202
12	520	750	710	530	500	228
13	520	730	760	530	470	300
14	550	700	720	510	465	230
15	560	680	728	490	479	245

16	670	660	760	495	470	245
17	690	700	730	520	480	240
18	640	700	735	550	470	-
19	660	680	730	500	440	-
20	635	750	740	520	430	-
21	670	700	760	500	450	-
22	660	700	780	520	440	-
23	660	680	730	460	500	-
24	630	730	780	520	450	-
25	610	736	760***	480	450	-
26	**	680	650	490	430	-
27	510	750	680	490	415	-
28	535	700	670	480	430	-
29	505	-	650	500	480	-
30	500	-	630	500	440	-
31	490	-	650	-	445	-
Monthly average	553	709	700	538	463	432

Some data incomplete at time of collection

**Plant switched off

***Plant on bypass

Appendix R: Town of Burgeo's tentative 8-step water plan (2017)

(TCD3, 2017)

1. Pilot project

Buy, install, and monitor 4 water meters on volunteer residences to determine how they function. This would enable TC to establish estimates of water usage patterns in homes.

2. Management of curb stops

Ensure all curb stops are visible, accessible, and clearly marked for Town operations. Ensure residents are aware of this requirement when paving driveways or building driveways.

3. Leak management

The Town will check for and fix leaks in the main line regularly. Sections of town will be isolated to measure flow rates. Small leaks cause a water loss of 20 gallons per minute, while larger leaks cause losses of 60- 70 gallons per minute.

4. Unoccupied homes

The Town will shut off water that is running in vacant homes. Homeowners will be notified prior to the water shut off.

5. Unattended homes/homeowners who work away

The Town's policy states that homes that are vacant for more than 4 weeks must be registered as having their water turned off at the Town office. In 2017, the Town reported 24 vacant homes, of which 16 had shut off their water. Town staff would go around and check the remaining 8 houses and turn off running water, and the homeowner would be required to pay a fee when they wish to have their water turned back on. Also, residents must be reminded that they can turn their water off inside their homes, rather than waiting for the Town to switch it off.

6. Education

The Town will ensure that residents have immediate access to resources on water conservation.

7. Meters

There are some towns/cities in NL (Torbay, Corner Brook) that have similar water treatment systems that are also considering installing water meters in households. Water meters would cost $425 to purchase and must be installed by an electrician and tied to a fuse panel. However, water metering is an unpopular option with most residents, especially those who do not run their water and those who run it conservatively. Thus, TC provided 2 options:

A. Part-time monitor

To work with residents to encourage/teach them how to conserve and run less water and to check household water flow regularly and advise residents whether it is acceptable. The water monitor would be required to keep TC abreast of the households that have been checked and their flow rates.

B. For residents who are not comfortable with the idea of bringing in a water monitor, they would be required to install a water meter in their homes.

8. Policy review

The pre-existing policy on new home construction would be reviewed to ensure that there is explicit mention of having all replacement and new lines inspected and signed off by Town staff prior to covering the line. Additionally, occupying of new homes would only be approved once water and sewer lines have been approved by the Town.

Appendix S: Burgeo Town Council voting results for operational water plant (May 2017)

(TCD8, 2017)

1. Step 1: Install and monitor 4 water meters in households with appropriate spacing

   In favour: 5

   Opposed: 1

   Motion carried

2. Step 2: Ensure all curb stops are visible, accessible, and clearly marked for town operations at the cost of the resident

   In favour: 6

   Opposed: 0

   Motion carried

3. Step 3: Town workers to check main lines for leaks on ongoing basis and fix efficiently. Town staff to also isolate sections of town to measure flow rates

   In favour: 6

   Opposed: 0

   Motion carried

4. Step 4: Owners of vacant homes who leave water running to be notified that curb stops will be shut off by the Town

   In favour: 6

   Opposed: 0

5. Step 5: Homes vacant for more than 4 weeks to be registered at Town office as having water shut. If water is running, curb stops to be shut off by Town and homeowners will be required to pay a fee to have water turned back on
6. Step 6: Town to provide residents with information on how to conserve water through BBS, household flyers, Council reports

    In favour: 6

    Opposed: 0

    Motion carried
7. Step 7: Mandated water meters: either work with water monitor to determine household flow rate and implement measures to conserve water, or if monitor not welcome, household to have meter installed

    In favour: 5

    Opposed: 1

    Motion carried
8. Step 8: Review existing policy on building new homes and ensuring that permit explicitly states that all replacements and new lines must be inspected and signed off by Town staff before covering line. Residents will not be allowed to occupy new homes until water and sewer lines have been inspected and approved by the Town

    In favour: 6

    Opposed: 0

    Motion carried

Informed Consent Form- Key Informant Interviews
(Government of NL Representatives)

Project Title: *Influences on collaboration in water governance: The case of Burgeo, NL*

Researcher/ Student: Rumbidzai Kanyangarara- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland

Co-supervisors: Dr. Kelly Vodden- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

Dr. Wade Bowers- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

My name is Rumbidzai Kanyangarara and I am a Masters student in the Environmental Policy program with the Environmental Policy Institute (EPI) at Grenfell Campus, Memorial University of Newfoundland. As part of my Masters thesis, I am conducting research under the co-supervision of Dr. Wade Bowers and Dr. Kelly Vodden.

The purpose of my research is to learn about the various water-related issues that the Town of Burgeo has faced, and to gain a better understanding of the relationships within water governance in the Town, by exploring the impact of various drivers and system conditions on the process.

You are invited to participate in the study by consenting to a digitally recorded face-to face interview. The interview will last approximately 60 minutes, but you may end the interview at any time. You are being asked to describe your role (or your organization's role) and experience in providing safe drinking water to the Town of Burgeo, as well as to reflect on how certain drivers and system conditions have affected collaboration in addressing water-related issues in the Town. Your decision to participate, refuse, or withdraw is completely voluntary and will have no negative consequences.

Every effort will be made to protect your identity should you wish to remain anonymous. You have the option of being identified using your position title or a coded identity in the interview as well as in any publications. The researcher will retain a master list that links the names (real or coded) of participants to the corresponding interview transcripts. This master list will be stored separately from the interview transcripts in a locked filing cabinet and will not be included in the dissemination of results.

All transcripts, consent forms, and participant identification lists will be stored on a password-protected computer and any hard copies will be stored in a locked filing cabinet at Grenfell Campus. Co-supervisors, Dr. Vodden and Dr. Bowers, may have access to these materials. All materials will be kept for a minimum of 5 years in accordance with Memorial University's policy on Integrity in Scholarly Research.

The proposal for this research has been reviewed by the Grenfell Campus-Research Ethics Board (GC-REB) and are in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the GC-REB through the Grenfell Research Office (GCREB@grenfell.mun.ca) or by calling (709) 639-2399. If you would like more information about this study, please contact: Rumbidzai Kanyangarara, rkanyangarara@grenfell.mun.ca, (709) 638-5739.

Your signature on this form means that:

- You have read and understand the information about the research contained in this document.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and this does not release the researcher from their professional responsibilities.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

☐ I agree to be audio-recorded during the interview

☐ I agree to the use of quotations and that my name be identified in any publications resulting from this study.

☐ I agree to the use of quotations but do not want my name to be identified in any publications resulting from this study.

☐ I do not agree to the use of quotations or to my name being identified in any publications resulting from this study.

Would you like to receive a report on the results of this study?

Yes ☐

No ☐

If yes, what is the best way to reach you?

I have read what this study is about, and I have understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered. A copy of this Informed Consent Form has been given to me for my records.

______________________________ ______________________________

Signature of participant Date

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_________________________________ _________________________________

Signature of Researcher Date

Government of NL officials: Interview questions

1. Can you tell me about your experience in your position as ___________________?
    a. How long have you held this position for?
    b. What are some of your general responsibilities/ duties in this position? How do these responsibilities relate to drinking water systems in NL and, more specifically, in Burgeo?
2. I understand that the Town of Burgeo has faced various water-related issues over the years. Can you give me a few details about some of the water issues with which you are familiar? (What were they? What caused them? When did they occur? Were they resolved? If so, how and by whom?)
    a. From the research I've conducted, it appears that the previous long-term boil water advisory has probably been the most notable water issue. Can you tell me about it? What led to its being put in place? What solutions were attempted to resolve this problem? When? Who was involved?
3. How about today—what are the water-related issues that the Town is now facing? How is the Town coping with these issues?
4. The use of collaborative governance approaches in resource management has been increasing steadily. According to Emerson et al. (2012), decisions which are reached collaboratively are more likely to be implemented.

In my research, collaborative governance is a governing arrangement where one or more public agencies directly engage a mix of people, including different levels of government and other interested private sector and citizen groups in a collective, consensus-oriented decision-making process with the aim of carrying out a public purpose that could not otherwise be achieved—in this case, finding solutions to Burgeo's water issues (adapted from Ansell and Gash, 2008, and Emerson et al., 2012). Considering this definition and your experiences, would you say that water governance in Burgeo has been collaborative overall?

5. Who have been the various actors involved in the process of trying to resolve drinking water issues in the Town of Burgeo? To the best of your knowledge, who determines which stakeholders are to be represented in this process of water management? Have any stakeholders been excluded? If so, can you tell me which ones and why?
6. Are objectives clearly identified? If so, what have been some of the objectives of the process? Are these objectives the same for all parties involved? Please explain if they have differed at times and how so?
7. Can you tell me about the distribution of power among the different parties involved? Are they similar or different? Please explain.
8. How about knowledge and resources—are they different amongst the various parties involved? Again, please explain.

9. If some of the parties involved have fewer or more resources, power, or knowledge than other stakeholders, how has this affected collaboration? How is this dealt with? Can you provide me with one or more examples?
10. Why are you interested in addressing water issues in Burgeo? What about your organisation?
11. How committed are you to the process? What are some of the factors that influence your level of commitment? How about your organisation—how committed is the organisation as a whole and why?
12. What about constraints—do you feel that there are some factors that prevent you or other stakeholders from fully engaging in the process of addressing Burgeo's water issues?
13. A) Has collaboration in providing drinking water in Burgeo been successful in the past? If so, how has this impacted subsequent negotiations and efforts to resolve water issues?

    B) Have there been conflicts? If so, what has been the nature of the conflict(s)? Who was involved? What protocols, if any, are used to resolve conflicts?

14. Let's talk about leadership. Who has taken on the role of leader for this process? How was this decided? What is their style of leadership? (e.g., top down or dictatorial, or bottom up/ collaborative/ facilitative, or other).
15. What are some of the ground rules that have been used throughout the process? Do those involved generally adhere to these rules?
16. Has the process been transparent i.e., plans/ proposed actions and necessary information is made openly available, dealings are fair and timely? Please explain.
17. Do you feel there has been shared understanding and mutual respect for others' positions and interests, even when those involved are not in agreement? Do the parties involved take time to thoughtfully examine and evaluate each others' perspectives?
18. Do you find that there is a good level of trust amongst participants? If not, what have been some common causes of mistrust?
19. Is there a sense of shared ownership of the process- a sense that everyone involved has a role to play? Or do some stakeholders feel that the process is someone else's responsibility and that they are present merely as silent representatives?
20. How often do you meet about drinking water issues? Who do you meet with? How are meeting dates decided upon and by whom? How are invitations to meetings issued? Do you have to be physically present for these meetings or are accommodations made for skype of telephone participation? How important would you say physical presence is when it comes to meeting with other stakeholders to address drinking water issues? Are there any negative consequences for absenteeism?
21. Are there any other methods of communication that stakeholders can use to share information or work on solutions besides scheduled meetings? (e.g., skype, email, newsletter).
22. Are there any other avenues/ procedures that could be used to address water issues or to provide water services to the community besides collaboration?

23. Do you have any closing remarks or recommendations for the future related to drinking water in Burgeo and the relationships between the various groups involved?

    Thank you for your time.

Informed Consent Form- Key Informant Interviews
(Business operators/owners)

Project Title: *Influences on collaboration in water governance: The case of Burgeo, NL*

Researcher/ Student: Rumbidzai Kanyangarara**-** Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland

Co-supervisors: Dr. Kelly Vodden- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

Dr. Wade Bowers- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

My name is Rumbidzai Kanyangarara and I am a Masters student in the Environmental Policy program with the Environmental Policy Institute (EPI) at Grenfell Campus, Memorial University of Newfoundland. As part of my Masters thesis, I am conducting research under the co-supervision of Dr. Wade Bowers and Dr. Kelly Vodden.

The purpose of my research is to learn about the various water-related issues that the Town of Burgeo has faced, and to gain a better understanding of the relationships within water governance in the Town, by exploring the impact of various drivers and system conditions on the process.

You are invited to participate in the study by consenting to a digitally recorded face-to face interview. The interview will last approximately 60 minutes, but you may end the interview at any time. You are being asked to describe your role and experience in providing safe drinking water to the Town of Burgeo, as well as to reflect on how certain drivers and system conditions have affected collaboration in addressing water-related issues in the Town. Your decision to participate, refuse, or withdraw is completely voluntary and will have no negative consequences.

Because you are being asked to participate in this research in your capacity as a business operator, and given that the community is small, anonymity cannot be guaranteed. However, every effort will be made to protect your identity should you wish to remain anonymous. You have the option of being identified using your position title or a coded identity in the interview as well as in any publications. I will retain a master list that links the names (real or coded) of participants to the corresponding interview transcripts. This master list will be stored separately from the interview transcripts in a locked filing cabinet and will not be included in the dissemination of results.

All transcripts, consent forms, and participant identification lists will be stored on a password-protected computer and any hard copies will be stored in a locked filing cabinet at Grenfell Campus. Co-supervisors, Dr. Vodden and Dr. Bowers, may have access to these materials. All materials will be kept for a minimum of 5 years in accordance with Memorial University's policy on Integrity in Scholarly Research.

The proposal for this research has been reviewed by the Grenfell Campus-Research Ethics Board (GC-REB) and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the GC-REB through the Grenfell Research Office (GCREB@grenfell.mun.ca) or by calling (709) 639-2399. If you would like more information about this study, please contact me, Rumbidzai Kanyangarara, at rkanyangarara@grenfell.mun.ca, (709) 638-5739.

Your signature on this form means that:

- You have read and understand the information about the research contained in this document.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and this does not release the researcher from their professional responsibilities.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

☐ I agree to be audio-recorded during the interview
☐ I agree to the use of quotations and that my name be identified in any publications resulting from this study.
☐ I agree to the use of quotations but do not want my name to be identified in any publications resulting from this study.
☐ I do not agree to the use of quotations or to my name being identified in any publications resulting from this study.

Would you like to receive a report on the results of this study?

Yes ☐

No ☐

If yes, what is the best way to reach you?

I have read what this study is about, and I have understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered. A copy of this Informed Consent Form has been given to me for my records.

______________________________ ______________________________

Signature of participant Date

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

____________________________________ __________________________________

Signature of Researcher Date

Business operator interview questions

1. Can you tell me about yourself- where you are originally from and for how long you've lived in Burgeo?
2. Can you tell me about your business?
   a. How long have you been operating for?
   b. What goods/ services do you provide?
3. I understand that the Town of Burgeo has faced various water-related issues over the years. Can you give me a few details about some of the water issues with which you are familiar? (What were they? What caused them? When did they occur? Were they resolved? If so, how and by whom?)
   a. From the research I've conducted, it appears that the previous long-term boil water advisory has probably been the most notable water issue. Can you tell me about it? What led to its being put in place? What solutions were attempted to resolve this problem? When? Who was involved?
   b. How did this long-term boil water advisory impact your business?
4. How about today—what are the water-related issues that the Town is now facing? How is the Town coping with these issues? How is your business coping?
5. The use of collaborative governance approaches in resource management has been increasing steadily. According to Emerson et al. (2012), decisions which are reached collaboratively are more likely to be implemented.

In my research, collaborative governance is a governing arrangement where one or more public agencies directly engage a mix of people, including different levels of government and other interested private sector and citizen groups in a collective, consensus-oriented decision-making process with the aim of carrying out a public purpose that could not otherwise be achieved—in this case, finding solutions to Burgeo's water issues (adapted from Ansell and Gash, 2008, and Emerson et al., 2012). Considering this definition and your experiences, would you say that water governance in Burgeo has been collaborative overall?

6. Can you tell me about the people who have been involved in addressing water issues in the community? Which levels of government, businesses or organisations do they represent? Do you think that all stakeholders (e.g., water providers, managers, consumers) are well-represented within this group? If not, can you tell me which groups are not represented and why? Have you been involved in any discussions or decision-making processes regarding the quality of drinking water in Burgeo?
7. Are you interested in addressing water issues in Burgeo? What about your organisation?
8. How committed are you to the process? What are some of the factors that influence your level of commitment? How about your organisation—how committed is the organisation as a whole and why?

9. Do you feel that there are some factors that prevent you or other stakeholders from fully engaging in the process of addressing Burgeo's water issues?
10. A) Would you say that collaborative efforts to address and improve drinking water quality in Burgeo have been successful in the past? If so, how has this impacted subsequent negotiations and efforts to resolve water issues?

    B) Have there been conflicts? If so, what has been the nature of the conflict(s)? Who was involved?

11. Do you feel there has been shared understanding and mutual respect for others' positions and interests, even when those involved are not in agreement?
12. Let's talk about leadership. Who has taken on the role of leader for this process? How was this decided? What is their style of leadership? (e.g., top down or dictatorial, or bottom up/ collaborative/ facilitative, or other)
13. Has the process been transparent i.e., plans/ proposed actions and necessary information is made openly available, dealings are fair and timely? Please explain. (Esp. with regards to BWAs).
14. Do you find that there is a good level of trust amongst participants? If not, what have been some common causes of mistrust?
    a. Do you as a business operator/ consumer trust that those responsible for providing safe, good quality drinking water are doing so to the best of their abilities?
15. Is there a sense of shared ownership of the process- a sense that everyone involved has a role to play? Or do some stakeholders feel that the process is someone else's responsibility and that they are present merely as silent representatives?
16. How often are meetings held to discuss drinking water issues? Who attends? Have you attended any of these meetings? How are meeting dates decided upon and by whom? How are invitations to meetings issued? Do participants have to be physically present for these meetings or are accommodations made for skype of telephone participation? Are there any negative consequences for absenteeism?
17. Are there any other methods of communication that stakeholders can use to share information or work on solutions besides scheduled meetings? (e.g., skype, email, newsletter).
18. Are there any other avenues/ procedures that could be used to address water issues or to provide water services to the community besides collaboration?
19. Do you have any closing remarks or recommendations for the future related to drinking water in Burgeo and the relationships between the various groups involved?

Thank you for your time.

Informed Consent Form- Key Informant Interviews
(Town councillors)

Project Title: *Influences on collaboration in water governance: The case of Burgeo, NL*

Researcher/ Student: Rumbidzai Kanyangarara**-** Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland

Co-supervisors: Dr. Kelly Vodden- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

Dr. Wade Bowers- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

My name is Rumbidzai Kanyangarara and I am a Masters student in the Environmental Policy program with the Environmental Policy Institute (EPI) at Grenfell Campus, Memorial University of Newfoundland. As part of my Masters thesis, I am conducting research under the co-supervision of Dr. Wade Bowers and Dr. Kelly Vodden.

The purpose of my research is to learn about the various water-related issues that the Town of Burgeo has faced, and to gain a better understanding of the relationships within water governance in the Town, by exploring the impact of various drivers and system conditions on the process.

You are invited to participate in the study by consenting to a digitally recorded face-to face interview. The interview will last approximately 60 minutes, but you may end the interview at any time. You are being asked to describe your role and experience in providing safe drinking water to the Town of Burgeo, as well as to reflect on how certain drivers and system conditions have affected collaboration in addressing water-related issues in the Town. Your decision to participate, refuse, or withdraw is completely voluntary and will have no negative consequences.

Because you are being asked to participate in this research in your capacity as Town councillor, and given that the community is small, anonymity cannot be guaranteed. However, every effort will be made to protect your identity should you wish to remain anonymous. You have the option of being identified using your position title or a coded identity in the interview as well as in any publications. I will retain a master list that links the names (real or coded) of participants to the corresponding interview transcripts. This master list will be stored separately from the interview transcripts in a locked filing cabinet and will not be included in the dissemination of results.

All transcripts, consent forms, and participant identification lists will be stored on a password-protected computer and any hard copies will be stored in a locked filing cabinet at Grenfell Campus. Co-supervisors, Dr. Vodden and Dr. Bowers, may have access to these materials. All materials will be kept for a minimum of 5 years in accordance with Memorial University's policy on Integrity in Scholarly Research.

The proposal for this research has been reviewed by the Grenfell Campus-Research Ethics Board (GC-REB) and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the GC-REB through the Grenfell Research Office (GCREB@grenfell.mun.ca) or by calling (709) 639-2399. If you would like more information about this study, please contact: Rumbidzai Kanyangarara, rkanyangarara@grenfell.mun.ca, (709) 638-5739.

Your signature on this form means that:

- You have read and understand the information about the research contained in this document.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and this does not release the researcher from their professional responsibilities.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

☐ I agree to be audio-recorded during the interview
☐ I agree to the use of quotations and that my name be identified in any publications resulting from this study.
☐ I agree to the use of quotations but do not want my name to be identified in any publications resulting from this study.
☐ I do not agree to the use of quotations or to my name being identified in any publications resulting from this study.

Would you like to receive a report on the results of this study?
Yes ☐
No ☐
If yes, what is the best way to reach you?

I have read what this study is about, and I have understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered. A copy of this Informed Consent Form has been given to me for my records.

______________________________ ______________________________
Signature of participant Date

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

______________________________ ______________________________

Signature of Researcher Date

Town of Burgeo municipal representatives interview questions

1. Can you tell me about yourself- where you are originally from and for how long you've lived in Burgeo.
2. Can you tell me about your experience in your position as ______________________?
    a. How long have you held this position for?
    b. What are some of your general responsibilities/ duties in this position? How do these responsibilities relate to the drinking water system in Burgeo?
3. I understand that the Town of Burgeo has faced various water-related issues over the years. Can you give me a few details about some of the water issues with which you are familiar? (What were they? What caused them? When did they occur? Were they resolved? If so, how and by whom?)
    a. From the research I've conducted, it appears that the previous long-term boil water advisory has probably been the most notable water issue. Can you tell me about it? What led to its being put in place? What solutions were attempted to resolve this problem? When? Who was involved?
4. How about today—what are the water-related issues that the Town is now facing? How is the Town coping with these issues?
5. The use of collaborative governance approaches in resource management has been increasing steadily. According to Emerson et al. (2012), decisions which are reached collaboratively are more likely to be implemented.

In my research, collaborative governance is a governing arrangement where one or more public agencies directly engage a mix of people, including different levels of government and other interested private sector and citizen groups in a collective, consensus-oriented decision-making process with the aim of carrying out a public purpose that could not otherwise be achieved—in this case, finding solutions to Burgeo's water issues (adapted from Ansell and Gash, 2008, and Emerson et al., 2012). Considering this definition and your experiences, would you say that water governance in Burgeo has been collaborative overall?

6. Who have been the various actors involved in the process of trying to resolve drinking water issues in the Town of Burgeo? To the best of your knowledge, who determines which stakeholders are to be represented in this process of water management? Have any stakeholders been excluded? If so, can you tell me which ones and why?
7. Are objectives clearly identified? If so, what have been some of the objectives of the process? Are these objectives the same for all parties involved? Please explain if they have differed at times and how so?
8. Can you tell me about the distribution of power among the different parties involved? Are they similar or different? Please explain.
9. How about knowledge and resources—are they different amongst the various parties involved? Again, please explain.

10. If some of the parties involved have fewer or more resources, power, or knowledge than other stakeholders, how has this affected collaboration? How is this dealt with? Can you provide me with one or more examples?
11. Why are you interested in addressing water issues in Burgeo? What about your organisation?
12. How committed are you to the process? What are some of the factors that influence your level of commitment? How about your organisation—how committed is the organisation as a whole and why?
13. What about constraints—do you feel that there are some factors that prevent you or other stakeholders from fully engaging in the process of addressing Burgeo's water issues?
14. A) Has collaboration in providing drinking water in Burgeo been successful in the past? If so, how has this impacted subsequent negotiations and efforts to resolve water issues?

    B) Have there been conflicts? If so, what has been the nature of the conflict(s)? Who was involved? What protocols, if any, are used to resolve conflicts?

15. Let's talk about leadership. Who has taken on the role of leader for this process? How was this decided? What is their style of leadership? (e.g., top down or dictatorial, or bottom up/ collaborative/ facilitative, or other)
16. What are some of the ground rules that have been used throughout the process? Do those involved generally adhere to these rules?
17. Has the process been transparent i.e., plans/ proposed actions and necessary information is made openly available, dealings are fair and timely? Please explain.
18. Do you feel there has been shared understanding and mutual respect for others' positions and interests, even when those involved are not in agreement? Do the parties involved take time to thoughtfully examine and evaluate each others' perspectives?
19. Do you find that there is a good level of trust amongst participants? If not, what have been some common causes of mistrust?
20. Is there a sense of shared ownership of the process- a sense that everyone involved has a role to play? Or do some stakeholders feel that the process is someone else's responsibility and that they are present merely as silent representatives?
21. How often do you meet about drinking water issues? Who do you meet with? How are meeting dates decided upon and by whom? How are invitations to meetings issued? Do you have to be physically present for these meetings or are accommodations made for skype of telephone participation? How important would you say physical presence is when it comes to meeting with other stakeholders to address drinking water issues? Are there any negative consequences for absenteeism?
22. Are there any other methods of communication that stakeholders can use to share information or work on solutions besides scheduled meetings? (e.g., skype, email, newsletter).
23. Are there any other avenues/ procedures that could be used to address water issues or to provide water services to the community besides collaboration?

24. Do you have any closing remarks or recommendations for the future related to drinking water in Burgeo and the relationships between the various groups involved?

Thank you for your time.

Informed Consent Form- Key Informant Interviews (Residents)

Project Title: *Influences on collaboration in water governance: The case of Burgeo, NL*

Researcher/ Student: Rumbidzai Kanyangarara**-** Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland

Co-supervisors: Dr. Kelly Vodden- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

Dr. Wade Bowers- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

My name is Rumbidzai Kanyangarara and I am a Masters student in the Environmental Policy program with the Environmental Policy Institute (EPI) at Grenfell Campus, Memorial University of Newfoundland. As part of my Masters thesis, I am conducting research under the co-supervision of Dr. Wade Bowers and Dr. Kelly Vodden.

The purpose of my research is to learn about the various water-related issues that the Town of Burgeo has faced, and to gain a better understanding of the relationships within water governance in the Town, by exploring the impact of various drivers and system conditions on the process.

You are invited to participate in the study by consenting to a digitally recorded face-to face interview. The interview will last approximately 60 minutes, but you may end the interview at any time. You are being asked to describe your role and experience in providing safe drinking water to the Town of Burgeo, as well as to reflect on how certain drivers and system conditions have affected collaboration in addressing water-related issues in the Town. Your decision to participate, refuse, or withdraw is completely voluntary and will have no negative consequences.

Because you are being asked to participate in this research in your capacity as a resident of Burgeo, and given that the community is small, anonymity cannot be guaranteed. However, every effort will be made to protect your identity should you wish to remain anonymous. You have the option of being identified using your position title or a coded identity in the interview as well as in any publications. I will retain a master list that links the names (real or coded) of participants to the corresponding interview transcripts. This master list will be stored separately from the interview transcripts in a locked filing cabinet and will not be included in the dissemination of results.

All transcripts, consent forms, and participant identification lists will be stored on a password-protected computer and any hard copies will be stored in a locked filing cabinet at Grenfell Campus. Co-supervisors, Dr. Vodden and Dr. Bowers, may have access to these materials. All materials will be kept for a minimum of 5 years in accordance with Memorial University’s policy on Integrity in Scholarly Research.

The proposal for this research has been reviewed by the Grenfell Campus-Research Ethics Board (GC-REB) and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the GC-REB through the Grenfell Research Office (GCREB@grenfell.mun.ca) or by calling (709) 639-2399. If you would like more information about this study, please contact me, Rumbidzai Kanyangarara, at rkanyangarara@grenfell.mun.ca, (709) 638-5739.

Your signature on this form means that:

- You have read and understand the information about the research contained in this document.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and this does not release the researcher from their professional responsibilities.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

☐ I agree to be audio-recorded during the interview
☐ I agree to the use of quotations and that my name be identified in any publications resulting from this study.
☐ I agree to the use of quotations but do not want my name to be identified in any publications resulting from this study.
☐ I do not agree to the use of quotations or to my name being identified in any publications resulting from this study.

Would you like to receive a report on the results of this study?

Yes ☐

No ☐

If yes, what is the best way to reach you?

I have read what this study is about, and I have understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered. A copy of this Informed Consent Form has been given to me for my records.

______________________________ ______________________________

Signature of participant Date

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

__________________________________ ________________________________

Signature of Researcher Date

Town of Burgeo residents interview questions

1. Can you tell me about yourself- where you are originally from and for how long you've lived in Burgeo? (NB- the latter part of the question may not be applicable to some of the informants).
2. I understand that the Town of Burgeo has faced various water-related issues over the years. Can you give me a few details about some of the water issues with which you are familiar? (What were they? What caused them? When did they occur? Were they resolved? If so, how and by whom?)
    a. From the research I've conducted, it appears that the previous long-term boil water advisory has probably been the most notable water issue. Can you tell me about it? What led to its being put in place? What solutions were attempted to resolve this problem? When? Who was involved?
    b. How did this affect you and your household? How did you cope—did you boil drinking water or did you seek alternatives to the town's water for consumption?
3. How about today—what are the water-related issues that the Town is now facing? How is the Town coping with these issues?
4. The use of collaborative governance approaches in resource management has been increasing steadily. According to Emerson et al. (2012), decisions which are reached collaboratively are more likely to be implemented.

In my research, collaborative governance is a governing arrangement where one or more public agencies directly engage a mix of people, including different levels of government and other interested private sector and citizen groups in a collective, consensus-oriented decision-making process with the aim of carrying out a public purpose that could not otherwise be achieved—in this case, finding solutions to Burgeo's water issues (adapted from Ansell and Gash, 2008, and Emerson et al., 2012). Considering this definition and your experiences, would you say that water governance in Burgeo has been collaborative overall?

5. Who have been the various actors involved in the process of trying to resolve drinking water issues in the Town of Burgeo? To the best of your knowledge, who determines which stakeholders are to be represented in this process of water management? Have any stakeholders been excluded? If so, can you tell me which ones and why?
    a. What about residents? Are there any platforms available for residents of the Town to voice their concerns and participate in meaningful discussions about the Town's water?
6. Are objectives clearly identified? If so, what have been some of the objectives of the process? Are these objectives the same for all parties involved? Please explain if they have differed at times and how so?
7. Are you interested in addressing water issues in Burgeo? If so, how committed are you to the process? What are some of the factors that influence your level of commitment?

8. A) Has collaboration in providing drinking water in Burgeo been successful in the past? If so, how has this impacted subsequent negotiations and efforts to resolve water issues?

   B) Have there been conflicts? If so, what has been the nature of the conflict(s)? Who was involved? What protocols, if any, are used to resolve conflicts?

9. Let's talk about leadership. Who has taken on the role of leader for this process? How was this decided? What is their style of leadership? (e.g., top down or dictatorial, or bottom up/ collaborative/ facilitative, or other)
10. Has the process been transparent i.e., plans/ proposed actions and necessary information is made openly available, dealings are fair and timely—especially during the time of the BWA? Please explain.
11. Do you feel there has been shared understanding and mutual respect for others' positions and interests, even when those involved are not in agreement? Do the parties involved take time to thoughtfully examine and evaluate each others' perspectives?
12. Do you trust that those who are responsible for providing water and addressing issues with water are doing so to the best of their abilities, with the consumer's best interests in mind?
13. Is there a sense of shared ownership of the process- a sense that everyone involved has a role to play? Or do some stakeholders feel that the process is someone else's responsibility and that they are present merely as silent representatives?
14. How often are meetings about drinking water issues held? Have you had the opportunity to attend any of these? Who is usually present?
15. Are there any other methods of communication that stakeholders can use to share information or work on solutions besides scheduled meetings? (e.g., skype, email, newsletter).
16. Are there any other avenues/ procedures that could be used to address water issues or to provide water services to the community besides collaboration?
17. Do you have any closing remarks or recommendations for the future related to drinking water in Burgeo and the relationships between the various groups involved?

Thank you for your time.

Informed Consent Form- Key Informant Interviews
(Water operator)

Project Title: *Influences on collaboration in water governance: The case of Burgeo, NL*

Researcher/ Student: Rumbidzai Kanyangarara**-** Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland

Co-supervisors: Dr. Kelly Vodden- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

Dr. Wade Bowers- Environmental Policy Institute (Grenfell Campus, Memorial University of Newfoundland)

My name is Rumbidzai Kanyangarara and I am a Masters student in the Environmental Policy program with the Environmental Policy Institute (EPI) at Grenfell Campus, Memorial University of Newfoundland. As part of my Masters thesis, I am conducting research under the co-supervision of Dr. Wade Bowers and Dr. Kelly Vodden.

The purpose of my research is to learn about the various water-related issues that the Town of Burgeo has faced, and to gain a better understanding of the relationships within water governance in the Town, by exploring the impact of various drivers and system conditions on the process.

You are invited to participate in the study by consenting to a digitally recorded face-to face interview. The interview will last approximately 60 minutes, but you may end the interview at any time. You are being asked to describe your role and experience in providing safe drinking water to the Town of Burgeo, as well as to reflect on how certain drivers and system conditions have affected collaboration in addressing water-related issues in the Town. Your decision to participate, refuse, or withdraw is completely voluntary and will have no negative consequences.

Because you are being asked to participate in this research in your capacity as a water operator, and given that the community is small, anonymity cannot be guaranteed. However, every effort will be made to protect your identity should you wish to remain anonymous. You have the option of being identified using your position title or a coded identity in the interview as well as in any publications. I will retain a master list that links the names (real or coded) of participants to the corresponding interview transcripts. This master list will be stored separately from the interview transcripts in a locked filing cabinet, and will not be included in the dissemination of results.

All transcripts, consent forms, and participant identification lists will be stored on a password-protected computer and any hard copies will be stored in a locked filing cabinet at Grenfell Campus. Co-supervisors, Dr. Vodden and Dr. Bowers, may have access to these materials. All materials will be kept for a minimum of 5 years in accordance with Memorial University's policy on Integrity in Scholarly Research.

The proposal for this research has been reviewed by the Grenfell Campus-Research Ethics Board (GC-REB) and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research (such as the way you have been treated or your rights as a participant), you may contact the Chairperson of the GC-REB through the Grenfell Research Office (GCREB@grenfell.mun.ca) or by calling (709) 639-2399. If you would like more information about this study, please contact me, Rumbidzai Kanyangarara, at rkanyangarara@grenfell.mun.ca, (709) 638-5739.

Your signature on this form means that:

- You have read and understand the information about the research contained in this document.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw from the study at any time, without having to give a reason, and that doing so will not affect you now or in the future.

If you sign this form, you do not give up your legal rights and this does not release the researcher from their professional responsibilities.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation at any time.

☐ I agree to be audio-recorded during the interview
☐ I agree to the use of quotations and that my name be identified in any publications resulting from this study.
☐ I agree to the use of quotations but do not want my name to be identified in any publications resulting from this study.
☐ I do not agree to the use of quotations or to my name being identified in any publications resulting from this study.

Would you like to receive a report on the results of this study?
Yes ☐
No ☐
If yes, what is the best way to reach you?

I have read what this study is about, and I have understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered. A copy of this Informed Consent Form has been given to me for my records.

______________________________ ______________________________

Signature of participant Date

I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

________________________________ ________________________________

Signature of Researcher Date

Water operator interview questions

1. Can you tell me about yourself- where you are originally from and for how long you've lived in Burgeo?
2. Can you tell me about your experience in your position as water operator?
    a. How long have you held this position for?
    b. What are some of your general responsibilities/ duties in this position?
3. I understand that the Town of Burgeo has faced various water-related issues over the years. Can you give me a few details about some of the water issues with which you are familiar? (What were they? What caused them? When did they occur? Were they resolved? If so, how and by whom?)
    a. From the research I've conducted, it appears that the previous long-term boil water advisory has probably been the most notable water issue. Can you tell me about it? What led to its being put in place? What solutions were attempted to resolve this problem? When? Who was involved?
4. How about today—what are the water-related issues that the Town is now facing? How is the Town coping with these issues?
5. The use of collaborative governance approaches in resource management has been increasing steadily. According to Emerson et al. (2012), decisions which are reached collaboratively are more likely to be implemented.

In my research, collaborative governance is a governing arrangement where one or more public agencies directly engage a mix of people, including different levels of government and other interested private sector and citizen groups in a collective, consensus-oriented decision-making process with the aim of carrying out a public purpose that could not otherwise be achieved—in this case, finding solutions to Burgeo's water issues (adapted from Ansell and Gash, 2008 and, Emerson et al., 2012). Considering this definition and your experiences, would you say that water governance in Burgeo has been collaborative overall?

6. Who have been the various actors involved in the process of trying to resolve drinking water issues in the Town of Burgeo? To the best of your knowledge, who determines which stakeholders are to be represented in this process of water management? Have any stakeholders been excluded? If so, can you tell me which ones and why?
7. Are objectives clearly identified? If so, what have been some of the objectives of the process? Are these objectives the same for all parties involved? Please explain if they have differed at times and how so?
8. Can you tell me about the distribution of power among the different parties involved? Are they similar or different? Please explain.
9. How about knowledge and resources—are they different amongst the various parties involved? Again, please explain.

10. If some of the parties involved have fewer or more resources, power, or knowledge than other stakeholders, how has this affected collaboration? How is this dealt with? Can you provide me with one or more examples?
11. Why are you interested in addressing water issues in Burgeo? What about your organisation?
12. How committed are you to the process? What are some of the factors that influence your level of commitment? Why?
13. What about constraints—do you feel that there are some factors that prevent you or other stakeholders from fully engaging in the process of addressing Burgeo's water issues?
14. A) Has collaboration in providing drinking water in Burgeo been successful in the past? If so, how has this impacted subsequent negotiations and efforts to resolve water issues?

    B) Have there been conflicts? If so, what has been the nature of the conflict(s)? Who was involved? What protocols, if any, are used to resolve conflicts?

15. Let's talk about leadership. Who has taken on the role of leader for this process? How was this decided? What is their style of leadership? (e.g., top down or dictatorial, or bottom up/ collaborative/ facilitative, or other)
16. What are some of the ground rules that have been used throughout the process? Do those involved generally adhere to these rules?
17. Has the process been transparent i.e., plans/ proposed actions and necessary information is made openly available, dealings are fair and timely? Please explain.
18. Do you feel there has been shared understanding and mutual respect for others' positions and interests, even when those involved are not in agreement? Do the parties involved take time to thoughtfully examine and evaluate each others' perspectives?
19. Do you find that there is a good level of trust amongst participants? If not, what have been some common causes of mistrust?
20. Is there a sense of shared ownership of the process- a sense that everyone involved has a role to play? Or do some stakeholders feel that the process is someone else's responsibility and that they are present merely as silent representatives?
21. How often do you meet about drinking water issues? Who do you meet with? How are meeting dates decided upon and by whom? How are invitations to meetings issued? Do you have to be physically present for these meetings or are accommodations made for skype of telephone participation? How important would you say physical presence is when it comes to meeting with other stakeholders to address drinking water issues? Are there any negative consequences for absenteeism?
22. Are there any other methods of communication that stakeholders can use to share information or work on solutions besides scheduled meetings? (e.g., skype, email, newsletter).
23. Are there any other avenues/ procedures that could be used to address water issues or to provide water services to the community besides collaboration?
24. Do you have any closing remarks or recommendations for the future related to drinking water in Burgeo and the relationships between the various groups involved?

Thank you for your time.