Journal of Rural and Community Development

COVID-19 and Drinking Water Security in Rural, Remote And Indigenous Communities: The Role of Collaboration among Diverse Actors In Responding to A Global Pandemic

Authors: Sondra Eger, Sarah Minnes, Kelly Vodden, Amy Hudson, Kathleen Parewick, & Deatra Walsh

Citation:
Eger, S., Minnes, S., Vodden, K., Hudson, A., Parewick, K., & Walsh, D. (2021). COVID-19 and drinking water security in rural, remote communities and Indigenous communities: The role of collaboration among diverse actors in responding to a global pandemic. *The Journal of Rural and Community Development*, *16*(4), 112–140.

Publisher:
Rural Development Institute, Brandon University.

Editor:
Dr. Doug Ramsey

ISSN: 1712-8277 © Authors
www.jrcd.ca

COVID-19 and Drinking Water Security in Rural, Remote and Indigenous Communities: The Role of Collaboration among Diverse Actors in Responding to a Global Pandemic

Sondra Eger
Memorial University of Newfoundland - Grenfell Campus
Corner Brook, Newfoundland and Labrador, Canada
seger@mun.ca

Sarah Minnes
University of Guelph
Guelph, Ontario, Canada
sminnes@uoguelph.ca

Kelly Vodden
Memorial University of Newfoundland - Grenfell Campus
Corner Brook, Newfoundland and Labrador, Canada
kvodden@grenfell.mun.ca

Amy Hudson
NunatuKavut Community Council
Happy Valley-Goose Bay, Newfoundland and Labrador, Canada
Amyh@nunatukavut.ca

Kathleen Parewick
Municipalities Newfoundland and Labrador
St. John's, Newfoundland and Labrador, Canada
kparewick@municipalnl.ca

Deatra Walsh
Municipalities Newfoundland and Labrador
St. John's, Newfoundland and Labrador, Canada
DWalsh@municipalnl.ca

Abstract

Many rural and remote Indigenous and non-Indigenous communities in Canada lack access to clean, safe drinking water due to inadequate drinking water infrastructure, among other challenges. The case of Newfoundland and Labrador (NL) highlights that water security and water infrastructure challenges can be exacerbated by a pandemic. We examine the impacts of the COVID-19 global pandemic on diverse communities in NL that rely on Potable Water Dispensing Units (PWDUs) as key elements of their drinking water systems. Drawing from the experiences of community leaders and water operators, the study findings suggest that the unique capacities of communities with PWDUs resulted in a spectrum of responses and abilities to adapt. Further, this article provides insight into the relationships across actor groups relevant for drinking water management and governance in NL. Of the

ISSN: 1712-8277

concerns and challenges mentioned, the most common included: evolving guidance and resources; limited capacity to adapt to new guidelines and procedures; COVID-19 related barriers affecting training and construction; and added stress for local jurisdictions to maintain/provide services.

Through a collaborative analysis of community experiences, we conclude that there is a need for a more coordinated and tailored response to effectively support rural and remote communities during a pandemic. Such a response would ideally include a place-specific approach that leverages and brings together local, regional, and provincial capacities. In particular, a community-specific understanding of preferred communications mechanisms and content is required. Additionally, sharing knowledge and resources in advance of an emergency, such as a pandemic, can help create more informed and nimble responses in the case of future crises.

The diverse experiences and responses of communities in NL with PWDU, along with that of other governing agencies and organizations, illustrate that collaboration and communications across multiple actor groups and jurisdictions are key to addressing drinking water challenges in times of crisis. As a result, this research concludes that the capacity of rural and remote communities to provide clean, safe drinking water, during a pandemic and beyond, is strengthened when various levels of governments and organizations (Indigenous and non-Indigenous) with drinking water-related responsibilities adopt a collaborative multi-level governance approach that facilitates connections across diverse actors within the water governance system. This preliminary study by a diverse research group advances our understanding of the complexity of operating small-scale drinking water infrastructure in rural, remote, and Indigenous communities, particularly during a global emergency. The article concludes with recommendations for future research that will continue to add novel insights into collaborative multi-level governance for drinking water security in NL.

Keywords: drinking water, COVID-19, infrastructure, Indigenous, communities

COVID-19 et sécurité de l'eau potable dans les communautés rurales, éloignées et les communautés autochtones: Le rôle de la collaboration entre divers acteurs dans la réponse à une pandémie mondiale

Sondra Eger
Memorial University of Newfoundland - Grenfell Campus
Corner Brook, Newfoundland and Labrador, Canada
seger@mun.ca

Sarah Minnes
University of Guelph
Guelph, Ontario, Canada
sminnes@uoguelph.ca

Kelly Vodden
Memorial University of Newfoundland - Grenfell Campus
Corner Brook, Newfoundland and Labrador, Canada
kvodden@grenfell.mun.ca

Amy Hudson
NunatuKavut Community Council
Happy Valley-Goose Bay, Newfoundland and Labrador, Canada
Amyh@nunatukavut.ca

Kathleen Parewick
Municipalities Newfoundland and Labrador
St. John's, Newfoundland and Labrador, Canada
kparewick@municipalnl.ca

Deatra Walsh
Municipalities Newfoundland and Labrador
St. John's, Newfoundland and Labrador, Canada
DWalsh@municipalnl.ca

Résumé

De nombreuses communautés rurales et éloignées autochtones et non autochtones du Canada n'ont pas accès à de l'eau potable propre et sûre en raison, entre autres, d'une infrastructure d'eau potable inadéquate. Le cas de Terre-Neuve-et-Labrador (T.-N.-L.) met en évidence que les défis liés à la sécurité de l'eau et à l'infrastructure de l'eau peuvent être exacerbés par une pandémie. Nous examinons les impacts de la pandémie mondiale de COVID-19 sur diverses communautés de T.-N.-L qui dépendent des unités de distribution d'eau potable (UDE) comme éléments clés de leurs systèmes d'eau potable. S'appuyant sur les expériences des dirigeants communautaires et des opérateurs de l'eau, les résultats de l'étude suggèrent que les capacités uniques des communautés avec des UDE ont entraîné un éventail de réponses et de capacités d'adaptation. En outre, cet article donne un aperçu des

ISSN: 1712-8277

relations entre les groupes d'acteurs pertinents pour la gestion et la gouvernance de l'eau potable à T.-N.-L. Parmi les préoccupations et les défis mentionnés, les plus courants comprenaient : l'évolution des orientations et des ressources ; une capacité limitée d'adaptation aux nouvelles directives et aux procédures; des obstacles liés à la COVID-19 affectant la formation et la construction ; et, un stress supplémentaire pour les juridictions locales pour maintenir/fournir des services.

Grâce à une analyse collaborative des expériences communautaires, nous concluons qu'il existe un besoin de réponse plus coordonnée et adaptée pour soutenir efficacement les communautés rurales et éloignées pendant une pandémie. Une telle réponse inclurait idéalement une approche propre au lieu qui exploite et rassemble les capacités locales, régionales et provinciales. En particulier, une compréhension propre à la communauté des mécanismes et du contenu de communication préférés est requise. De plus, le partage des connaissances et des ressources avant une urgence, telle qu'une pandémie, peut aider à créer des réponses plus éclairées et plus souple en cas de crises futures.

Les diverses expériences et réponses des communautés de T.-N.-L. avec les UDE, ainsi que celles d'autres agences et organisations gouvernementales, illustrent que la collaboration et les communications entre plusieurs groupes d'acteurs et juridictions sont essentielles pour relever les défis d'eau potable en temps de crise. Par conséquent, cette recherche conclut que la capacité des collectivités rurales et éloignées à fournir de l'eau potable salubre, pendant une pandémie et au-delà, est renforcée lorsque divers niveaux de gouvernements et d'organisations (autochtones et non autochtones) ayant des responsabilités liées à l'eau potable adoptent une approche de gouvernance collaborative à plusieurs niveaux qui facilite les connexions entre les divers acteurs au sein du système de gouvernance de l'eau. Cette étude préliminaire menée par un groupe de recherche diversifié fait progresser notre compréhension de la complexité de l'exploitation de l'eau potable à petite échelle dans les infrastructures des communautés rurales, éloignées et autochtones, en particulier lors d'une urgence mondiale. L'article conclut avec des recommandations sur de futures recherches qui continueront d'apporter de nouvelles connaissances sur la gouvernance collaborative à plusieurs niveaux pour la sécurité de l'eau potable à Terre-Neuve-et-Labrador.

Mots clés: eau potable, COVID-19, infrastructures, Autochtones, communautés

1.0 Introduction

The recent COVID-19 global pandemic has heightened the visibility and importance of access to safe and clean potable water. Clean, safe water is needed for hygiene purposes related to reducing COVID-19 transmission, such as more frequent hand washing (Lacey, 2016; Center for Disease Control [CDC], 2020; Public Health Agency of Canada [PHAC], 2020; World Health Organization [WHO], 2020). Yet many rural, remote, and Indigenous communities in Canada are unable to access clean and safe drinking water due to challenges such as the aging, degrading, or absence of infrastructure; difficulties recruiting, training, and retaining certified water operators; and source water quality and quantity problems (Castleden et al., 2016 Minnes & Vodden, 2017; Lam et al., 2017; Norman et al., 2010). These challenges often result in failed or disrupted access to clean and safe drinking water exemplified by long term and chronic boil water advisories, which have

disproportionately affected Northern and Indigenous communities in Canada (White et al., 2012; Hanrahan et al., 2017; Wright et al., 2017 Government of Canada 2021).

When COVID-19 emerged as a global pandemic in March 2020, it exposed weaknesses in existing small-scale water systems across Canada. This included the ongoing reality of unequal access to clean, safe potable water across the country as well as specific challenges surrounding hygiene and physical distancing faced by communities reliant on smaller-scale infrastructure options where people collect clean, safe drinking water from a source outside of their place of residence. Such was the case for Potable Water Dispensing Units (PWDUs), sometimes referred to as Advanced Drinking Water Systems or water kiosks, in the province of Newfoundland and Labrador. PWDUs emerged in NL in recent decades as a small-scale infrastructure option to provide clean and safe drinking water (Lacey, 2016; Minnes & Vodden, 2014). In particular, PWDUs have been implemented in rural and remote communities as a response to boil water advisories and ongoing challenges with water security. Previous studies on PWDUs in NL have focused on user perceptions and perspectives associated with water consumption (Wright et al., 2017; Ochoo et al., 2017). Although PWDUs in NL are overseen and maintained by municipalities, local service districts (LSDs), and Inuit Community Governments (ICGs), the responsibility for drinking water in NL lies with various levels of government at the provincial and federal level (as described further below). These unclear and often overlapping jurisdictions are navigated by multiple institutions, organizations, and authorities.

Using a case study approach, this study focuses on the unique context of operating and maintaining small-scale infrastructure, i.e., PWDUs, during a time of crisis and uncertainty. It aims to share recent experiences of rural, remote, and Indigenous communities with PWDUs as they responded to COVID through the lens of their drinking water infrastructure, and their response through and with other organizations. We highlight the roles of NunatuKavut and Nunatsiavut governments, as well as Municipalities Newfoundland and Labrador (MNL), the advocacy organization representing the 275 municipalities in the province. We also explain the emergence of the PWDU research group, comprised of researchers from various universities across the country, and representatives from NunatuKavut, Nunatsiavut, Nunatsiavut Government and MNL, as key actors in illuminating the PWDU COVID story. We conclude that the fragmented and overlapping jurisdictions surrounding drinking water across Newfoundland and Labrador require collaborative multi-level governance structures to effectively tailor and respond to water security solutions in rural, remote, and Indigenous communities. It equally requires the advocacy work provided by the other organizations involved, including the PWDU research group, to ensure that multi-level governance goes beyond simply provincial/territorial and federal relationships.

1.1 Case Study Context

Many communities in NL, especially those with 1,000 residents or less struggle with providing reliable access to clean drinking water (Minnes & Vodden, 2017). Additionally, access to a reliable supply of clean and safe drinking water is essential for maintaining optimum health, managing existing diseases, and maintaining hygiene (Hanrahan et al., 2014). The province of NL provides an example where issues such as aging, degrading, and inappropriate infrastructure; the use of untreated water sources; limited asset management and water operator certification;

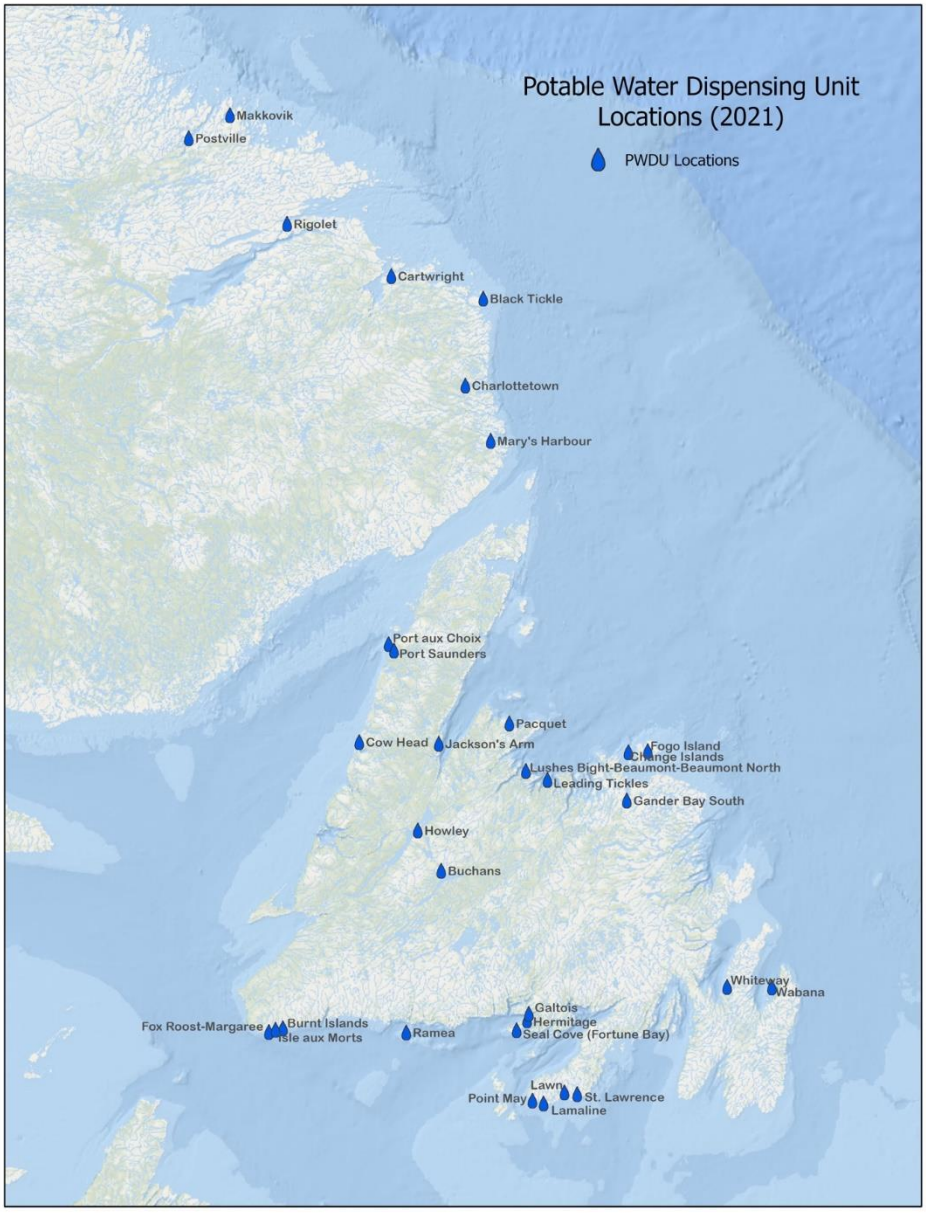
monitoring and policy implementation gaps; and long-term boil water advisories are prevalent in rural and remote communities with few financial and human resources available to address these issues (Minnes & Vodden, 2017).

As a result of the challenges experienced by small, rural, and remote communities in obtaining and safely maintaining costly, large-scale water systems, a growing number of communities have adopted PWDU systems. PWDUs are small-scale water treatment systems that provide treated drinking water from water stored on-site at a centralized location. Treatments used can vary from ozonation, utilization of a multi-media filter consisting of anthracite and sand, activated carbon filters, reverse osmosis, and ultraviolet light (Wright et al., 2017; Lacey, 2016). Water is collected by users from the unit for home storage or can be delivered to residents. At the time of the study, 32 communities had PWDUs in NL, with one additional unit being constructed after the onset of COVID-19 in 2021 (S. Eger, personal communication, April 19, 2021) (see Figure 1). These 32 communities are comprised of 26 municipalities, three LSDs, and three ICGs (Government of NL, 2021), although ten of the 32 identify as Indigenous. While two communities served by PWDUs have populations of over 2,000, two-thirds have 500 or fewer residents (Government of NL, 2019).

Little research has been conducted to date on PWDUs in NL. A 2010 provincially-commissioned evaluation of seven then existing units led to the recommended design and operational guidelines (CBCL, 2010). In 2013-14, a collaborative study that focused on sustainable drinking water solutions for communities of 1,000 residents or less in rural and remote areas of NL explored the following: source water quality and quantity; infrastructure and operations; policy and governance; and public perceptions, awareness, and demand. The project identified the numerous challenges with providing safe and clean drinking in rural and remote communities in NL identified above, adding that these challenges are often interconnected and cumulative. The study called for further research into the perceptions and experiences of communities in NL with PWDUs, a call that was answered during the pandemic due to the unique circumstances that these communities found themselves in (Minnes et al., 2014).

Responsibility for the provision of safe, clean drinking water in NL is shared across various governance structures, processes, and actors, including provincial and local government jurisdictions, with federal and Indigenous governments also playing various roles (Minnes & Vodden 2017). Public drinking water systems in NL are typically overseen by the provincial government, with the responsibility for securing and maintaining infrastructure and daily operations borne by local governing bodies (i.e., municipalities and LSDs incorporated under NL's *Municipalities Act* and Nunatsiavut's ICGs). Most funding for water systems is available through the Federal Government. Infrastructure Canada assists in funding water systems, transferring Gas Tax funds to the municipal level through provincial and territorial governments, for example (Cargnello & Flumian, 2017). The Federal Government also has jurisdiction with providing water guidelines and overseeing water in Indigenous communities (Minnes & Vodden, 2014). Currently, there are no formal coordinated efforts across these jurisdictions to support clean drinking water services and infrastructure across the province although the provincial government has just concluded a public engagement opportunity regarding a drinking water safety action plan (engageNL, 2021).

Figure 1. Communities with PWDUs in NL



Source: Wood, 2021.

The exclusion of Indigenous people from the 1948 Terms of Union between Newfoundland and Canada resulted in some typically federal responsibilities in Indigenous communities, such as drinking water provision becoming a provincial responsibility in NL (Higgins, 2008; Hanrahan, 2003). Today, Indigenous governance in NL is upheld and expressed in diverse and evolving contexts across multiple Indigenous governing bodies that span territories across the island of Newfoundland and throughout Labrador. Each of these governance actors represents the rights, diverse interests, and perspectives of Indigenous peoples in NL. Governance relationships and responsibilities in NL continue to evolve as Indigenous peoples pursue paths of self-government, albeit within an existing

system of colonial governance structures (Nunatsiavut Governemt, 2021; Hudson, 2020). The Nunatsiavut Government (NG), for example, defrays a significant portion of the costs of maintaining and operating the water systems in their communities (Lightfoot, 2014). Significant federal investment and cooperation with Miawpukek First Nation led to a lifting of that community's long-term boil water advisory (Westcott, 2018). Federal funding also helped to support the roles played by the NunatuKavut Community Council (NCC) to ensure drinking water access during the pandemic, as described further below.

Jurisdictional overlap and differences in jurisdictional responsibilities complicate the challenges faced by rural and remote communities, as well as their access to resources and capacity-building opportunities in order to deliver safe and clean drinking water. Governance generally refers to "the way actor groups in society (i.e., individuals and organizations) interact and coordinate to steer social and political processes (e.g., decision-making)" (Eger 2021, p. 1). The research team adopted collaborative multi-level governance (CMLG) as a conceptual lens through which to analyze the experiences of communities with PWDUs during the COVID-19 pandemic as well as related policy, program, and operational responses at various levels. This choice was deemed appropriate given the shared responsibilities and need for collaboration across multiple levels and actors involved in drinking water provision in NL, and in Canada more generally (Cargnello & Flumian, 2017).

1.2 Scholarly Context

Governance, and CMLG more particularly, involves a shift away from reliance on government toward new forms of governing encompassing diverse actors and arrangements across vertical and horizontal linkages (Ansell & Gash, 2007; Emerson et al., 2012; Gibson, 2019). Such arrangements have often meant increased influence of municipal and Indigenous orders of government (Cargnello & Flumian, 2017). Collaborative governance approaches also emphasize collaboration processes of dialogue and trust-building that seek shared understanding and ownership (Gibson, 2011). Facilitative leadership and supporting structures that enable collaborative governance are essential (de Boer et al., 2016), along with respect and use of the diversity of knowledge systems that diverse actor groups can contribute (van Tol Smit et al., 2013). Indigenous knowledge and practices in governance and planning, for example, have much to contribute (Jokhu & Kutay, 2020). Therefore, in order to enhance capacity for implementation of CMLG, learning mechanisms are needed to ensure shared knowledge, accountability, and adaptation (Plummer & Armitage, 2007; Minnes & Vodden, 2017). Adaptive governance may also assist in navigating changing circumstances across various jurisdictions and partner interests as well as facilitating societal learning for broad social consensus to develop (Pahl-Wostl et al., 2011).

CMLG within the realm of drinking water involves structures that span multiple jurisdictions and share decision-making among multiple actors at different levels to set and pursue water management goals (De Boer et al., 2016; Bressers et al., 2013). We can also consider water and infrastructure, in particular PWDUs, as actors themselves in relation with others in the network (Bosco, 2006; Wang & Yau, 2018). Indeed, it is the PWDUs and those that operate them that brought the authors and others in the research team together. A recent study by Minnes (2019) indicates that collaborative water and watershed governance requires legislated process/organized structure; integration of policy tools, programs, data, and actors; knowledge sharing

and learning and evaluation, adaptability, and flexibility within the process, among others. Intermediary or bridging organizations that connect actor groups can assist in essential learning processes by translating sustainable water practices and technologies into local contexts (Marvin & Medd, 2007). Diverse actor groups within the CMLG drinking water network, including such organizations, can play key roles in improving capacity for water systems operation and contributing knowledge across jurisdictions (Van Tol Smit et al., 2013).

COVID-19 can be described similarly to other disasters and emergencies as "a crisis requiring rapid response by multiple jurisdictions and operational areas to a dynamic set of conditions under high levels of collective stress and uncertainty" (Ansell et al., 2010; Nowell et al., 2018, p. 699). Past failures in disaster response have been attributed to centralized management and decision-making (Nowell et al., 2018), suggesting a need to employ CMLG within crisis situations and better prepare for them. Evidence of decentralized/devolved, coordinated, and collaborative emergency responses contributing to community resilience is building in the literature, including growing international evidence from the COVID-19 pandemic itself (Criado & Guevara-Gómez, 2021; Ceresia & Misuraca, 2020; Huang, 2020; Choi, 2020).

Despite the promise of CMLG approaches, there are several note barriers to implementing CMLG that may prevent it from being an ideal approach for emergency situations. For example, challenges include resistance to change and to share power, as well as the increased time frames of collaboration (Gibson, 2011; Ananda & Proctor, 2013; Brisbois & deLoë, 2016). The multitude of relevant organizations and authorities across public, private, and voluntary sectors in rural and remote community CMLG networks can generate additional challenges in delivering services, including concerns related to financial sustainability and transaction costs (e.g., time), shortages in human capital, and misalignment of responsibilities among others (Brown & Bellamy, 2010; Gibson, 2011). Ongoing efforts to ensure reconciliation and legal recognition of Indigenous rights and title, difficulties in communication and understanding related to the physical distance of these communities from centres of government, as well as limited internet speed and access in some locales, are also important considerations.

2.0 Methodology

This research is rooted in a methodological approach attuned to collaboration across research disciplines, stakeholder groups, sectors, and institutions. It is deeply connected to the scholarly context in which it finds itself and, in many ways, reflects it. In early 2020 as COVID-19 began to spread across the country and NL, a group of rural communities (including remote, northern, small island, and Indigenous communities) with PWDUs came forward to their municipal association—Municipalities Newfoundland and Labrador (MNL)—with pandemic-related concerns about the operation of their PWDUs and sanitary requirements as they awaited further guidelines from the Province of NL (MNL, 2020a). This led MNL to reach out to research partners for information from other locales on how drinking water in small communities through the pandemic, and more specifically, any recommendations on PWDUs specifically. University research collaborators Minnes (University of Guelph) and Vodden (Memorial University of Newfoundland) were pleased to assist in seeking such examples, seeing

opportunities to assist communities during the COVID-19 crisis while also providing safe, online work to graduate students negatively affected by the outbreak.

This led to a diverse partnership made up of members from academia (Memorial University of NL and the University of Guelph), MNL, NunatuKavut Community Council (NCC), and Nunatsiavut Government (NG), and with the support of Qalipu First Nation, to better understand the experiences of communities with PWDUs. The partnership complemented and built on nearly a decade of drinking water research collaborations dating back to 2012 (Holisko et al., 2014; Minnes & Vodden, 2014; Daniels & Vodden, 2015; Omosule, 2017; Vodden & Chireh, 2020; Eledi et al., 2016, 2019; http://nlwater.ruralresilience.ca/), and thus followed a collaborative, action research-oriented approach that sought to understand the current situation while also providing suggestions both for more immediate pandemic responses and for future water governance in NL.

2.1 Methods

In 2020, following a review of available secondary data and a process of collaborative research design through dialogue within the research team, all 32 communities with PWDUs in NL were approached to participate in the study. First, semi-structured interviews were conducted by telephone and recorded upon oral or written consent. All participants were anonymous and indicated if they consented to have their position and community linked with their interview data. Questions related to operations and maintenance during the pandemic but also more general reflections on their PWDUs (see Appendix 1). As appropriate, interviews were conducted in conjunction with interested staff members from the NG and NCC. The study has approval from the Grenfell Campus Research Ethics Board (GC-REB) (Approval number: 20210127) as well as relevant ethics bodies at NG and NCC.

In total, 21 interviews were conducted with town councillors, mayors, and PWDU operators from 15 of 32 communities. In some cases, both town councillors (or mayors or AngajukKaks in ICGs) and PWDU operators were interviewed. One additional interview was conducted with a PWDU expert in NL to further understand the context. Recorded interviews were then transcribed and organized into NVIVO. The interview transcripts were iteratively analyzed with all partner organizations across a series of weekly meetings to ensure local context and accurate meaning were derived. Thematic coding was used to analyze the transcripts relating to COVID- 19, and preliminary themes were then reported.

Next, all 32 communities were then invited to attend a webinar that took place via Zoom April 22, 2021. The purpose of the webinar, administered by MNL staff, was to validate preliminary findings related to not only COVID-related findings, but also additional themes that emerged during the interviews, such as local capacity building and operator training. In total, 12 community participants across nine PWDU communities, eight partners, and one expert attended the webinar. This webinar also provided an opportunity to hear from communities that were unable to participate in the interview portion of the study. Findings were also disseminated during an MNL Symposium presentation to members (Eger & Minnes, 2021).

3.0 Results

Across the 32 communities served by PWDUs, local leaders expressed concerns regarding PWDU maintenance, operation, and sanitization as a result of the

pandemic. In communities where PWDUs may be the only public infrastructure that provides clean drinking water, interruptions in service have a particularly severe impact on human health and sanitation efforts to prevent or slow the spread of disease. This section presents and discusses the findings of the semi-structured interviews conducted in 2020 and the webinar in 2021 with communities who use PWDUs throughout the COVID-19 pandemic. We first review the experiences and responses of communities with PWDUs in NL during COVID-19, followed by a more detailed discussion of three responses from other organizations and partners seeking to support them.

While our findings suggest that PWDUs have provided a stable source of drinking water in numerous communities throughout the pandemic, almost all (n=14/15) of the communities who participated in interviews reported challenges relating to the COVID-19 pandemic. PWDU challenges varied from community to community due to their unique contexts (e.g., demographic, access, distance, water quality). The primary challenges that were mentioned include: access to up-to-date guidelines and programs; limited capacity (financial, human) to adapt to new guidelines and procedures; COVID-19 as a barrier for access to training and construction; and COVID-19 as added stress for local jurisdictions to maintain/provide services. To highlight the diversity of responses, sample quotes related to the various challenges are provided in Appendix 2 and are separated by those that indicated their community had been negatively impacted and those who had not been.

One of the main challenges noted, particularly during the onset of COVID-19, were changes in procedures and guidelines from the Province of NL as well as from the constant influx of emerging information and scientific evidence. Evolving guidelines required increased cleaning and disinfection of public spaces, the availability of sanitizer products, and PPE such as masks and gloves for both workers and users. In some communities, this also led to challenges relating to access and funds to ensure the staff and supplies were available. In other instances, COVID-19 resulted in reduced access to training and delays in the installation of new units.

In addition to new challenges posed by COVID-19, many of the rural, remote, and Indigenous communities acknowledged that COVID-19 had been yet another additional encumbrance for municipalities that are already balancing the responsibility of providing many services. The Federation of Canadian Municipalities (2020) estimates that foregone revenues and unanticipated costs due to COVID-19 have created a gap of $10–15 billion for municipalities across Canada, many of which were struggling with financial sustainability and infrastructure deficits even before the pandemic. While the Federal Government did provide emergency operational funding to municipalities in October 2020 to help offset costs associated with the pandemic, many faced financial and other challenges that predated it (MNL, 2021). Participating communities expressed concerns that even before COVID-19, municipalities were overwhelmed with responsibilities and had little capacity, including staff and funds, to keep up. As one participant stated, “My job is difficult, managing a town, but then you add the pandemic response on top of it, and it just…it’s been challenging.” (Community #9)

Nevertheless, results demonstrate that communities are able to adapt. In many cases, they continue to operate and use their PWDUs in accordance with new public health guidelines, often with little disturbance. Community #9 continues to reflect on how COVID-19 is impacting them but also how they still manage to prepare for and anticipate guideline changes in their community:

> I'm pretty sure we're going to be dealing with COVID-19 for at least the first six months of next year... Unless something changes, we're going to have to pass all these costs on to taxpayers… We've reduced services where we can, but I can honestly say in my case I'm probably going to end up in a deficit. … We were ready to man our unit eight hours a day and have someone on site, and have the water dispensed outside of the unit so you didn't actually have to go inside. So we had taken steps to ensure we were ready to offer that level of protection and still provide the essential service. We did not get that far, that would have meant changing some piping and valves which would have brought the water outside the unit. (Community # 9)

Diverse actor groups took action to support rural and remote communities during the COVID-19 pandemic, providing PPE, water, and information to help communities adapt. Some of these efforts are described further below.

3.1 Province-wide response of Municipalities Newfoundland and Labrador (MNL)

Despite the complex governance framework related to drinking water in NL, MNL supported communities with PWDUs during the pandemic early on and in a variety of ways. In particular, their role in mobilizing information started by identifying COVID operational guidance gaps identified during MNL regional membership calls, which functioned to connect diverse actor groups across the province. Over 123 municipalities were represented in the calls, with 217 people who participated in total (MNL, 2020a).

During the early COVID-19 period consultations with their municipal membership, MNL received questions about the recommended operating procedures for the sanitization and safety of their PWDU facilities during the pandemic (MNL, 2020a). MNL brought these questions and concerns to the provincial department responsible for municipal legislation and support, then known as Municipal Affairs and Environment (MNL, 2020b). In light of these concerns, the department recommended that PWDUs remain open and provided an updated guidance document on standard operating procedures for PWDUs during the pandemic (Department of Municipal Affairs and Environment, 2020, p. 1), stating that:

> These options may need to be altered given each community's individual needs and circumstances. PWDUs provide high quality drinking water to users. MAE recommends that communities continue to operate their PWDUs and not shut them down.

MNL continued its support for municipalities throughout the pandemic through regional calls, a fall 2020 conference, and its spring symposium, all of which were held virtually. The organization also responded to the concerns of these communities by providing webinars to members on key areas of concern and interest (MNL, 2021). MNL acknowledged concerns also raised by community representatives that

the COVID-19 pandemic added to the municipal issues that predated it, and exposed vulnerabilities in the sector, including infrastructure, as well as the fiscal, human, and knowledge resources needed for supporting this infrastructure (MNL, 2021).

3.2 Response of NunatuKavut Community Council (NCC) within NunatuKavut and NCC Communities

In March 2020, the Government of Canada announced the Indigenous Community Support Fund (ICSF) as a pandemic response measure for First Nations, Inuit, and Metis recognizing that Indigenous peoples in Canada are among the most vulnerable during a time of global health pandemic (Government of Canada, 2020). The fund is designed to allow Indigenous leaders and communities the flexibility to identify priority needs and to develop Indigenous nation and community-specific programming and supports to respond to these needs during the course of the pandemic. This has been followed by multiple subsequent calls for funding to respond to the immediate needs of Indigenous communities as well as urban and off-reserve Indigenous organizations.

The COVID-19 pandemic highlighted inequities and inequalities across a range of areas that adversely impact the health and well-being of NCC members in NunatuKavut and throughout NL. As one example, challenges with access to safe and clean drinking water in various parts of the territory became pronounced. Such impacts are demonstrated in the remote Inuit community and LSD of Black Tickle on the southeast coast of Labrador, where the PWDU unit serves as the sole source of potable drinking water infrastructure (Sarkar et al., 2015).

As a result of COVID-19 impacts in NunatuKavut, NCC developed an initial COVID-19 program response proposal and sought financial resources from the ICSF to support an immediate response based on needs throughout NunatuKavut. NCC submitted multiple proposals thereafter and as funding calls were announced by the federal government, to continue to address impacts to Inuit health and well-being during the pandemic. NCC also assisted with the supply of sanitation products to the PWDU site and hired community workers (short term) to assist with access to clean drinking water and other priority matters impacting elders and vulnerable persons in the community (e.g., Community #3). Further, to address water access issues in Black Tickle specifically, for example, NCC chartered multiple twin otter flights from Happy Valley-Goose Bay to Black Tickle to deliver bottled water for use as an emergency source. At the time of interviews (August 2020), there had been one PWDU system interruption for a period of approximately one week in the community.

All communities with PWDUs in NunatuKavut were supplied with PPE such as masks and gloves and hand sanitizer and cleaning supplies to keep common PWDU surfaces disinfected. Participants acknowledged these donations and welcomed the presence of NCC in their communities:

> We were really lucky at that time because NCC sent in some water because of COVID [19] and we were able to give some of this to the people so that they would be able to have water until the problem was fixed… [There was] no, additional cost to us because our sanitary products and all that stuff was given to us by NCC… The LSD hasn't been involved because NCC is getting

> involved, and they're taking very, very, very good care of it...I've been on almost every week with NCC on our update meetings. (Community #1)

NCC also developed and administered first-time programming in other areas, undertaking frequent community engagement events to increase understanding of the urgent and evolving needs of NunatuKavut Inuit during the course of the pandemic (NunatuKavut, 2021). NCC mobilized and responded quickly to address food and heat insecurity, Elder and mental wellness supports, supports to encourage land-based activities (hunting/harvesting), education supports, and personal care grants, among others.

NCC's quick leadership and governance response on matters related to the health and well-being of NunatuKavut Inuit across a range of areas impacted by COVID-19, including water security matters, illustrates the capacity to govern and navigate crisis events in its region. NCC does not yet have a self-government agreement with Canada, and, as a result, direct services related to health (water, food, infrastructure, etc.) are the responsibility of the federal and provincial governments. However, in a time of urgency and great need, the Government of Canada announced funding opportunities that would see Indigenous communities (both with and without self-government agreements) addressing the most urgent and immediate needs of their people for themselves. For many Indigenous governing or community organizations without a land claim or self-government agreement, including NCC, this meant taking on self-government, as a response to COVID, in a time of crisis.

3.3 Response from PWDU research partnership

In addition to the mentioned parallel efforts, a swift research response from the research partnership described above was undertaken to further understand the impacts of COVID-19 facing communities that had been raised with MNL and NCC. This occurred as Memorial University sought research opportunities for students whose research plans and employment opportunities were impacted by COVID-19, as well as ways to assist communities in the province through their research and other capabilities. The resulting partnership, which built upon several previous drinking water related and other research collaborations, continues to explore community experiences with PWDUs in NL even beyond COVID-19. Thus far, the partnership has identified jurisdictional elements, challenges, and opportunities for PWDU operations and maintenance during the COVID-19 pandemic. They have also validated results through an online webinar with PWDU community members and recently presented preliminary findings at the Annual MNL Symposium/AGM (Eger & Minnes., 2021).

The value of such a diverse partnership within a complex jurisdictional context during an emergency is apparent through the speed and nimbleness with which the research team brought together information and gaps from multiple jurisdictional perspectives and mobilized a research program during the COVID -19 pandemic. The partnership not only functioned to share information across horizontal and vertical linkages within the CMLG network for drinking water but also continued to strengthen relationships between diverse actor groups as they worked towards common goals.

The coming together of diverse actor groups in this research provides evidence of the value of various governance entities during the COVID-19 pandemic as well as

their collaboration. While the research itself did not function to help the COVID-19 situation it did enable the partners to work collaboratively to better understand experiences of rural, remote and Indigenous communities who are operating their PWDU in a pandemic.

4.0 Discussion and Conclusions

This study explored experiences of rural, remote, and Indigenous communities who have been running their PWDUs during the pandemic despite several ongoing issues with drinking water security, such as boil water advisories, infrastructure, and operational challenges. Maintaining drinking water systems safely during a pandemic to ensure a clean, safe water supply creates added responsibilities for staff and volunteers who are often already overloaded with responsibilities and may not have the information needed to respond safely and effectively. In many cases, we found that COVID-19 further strained the capacity and functioning of communities as they were expected, for example, to keep up with changing information and guidelines and budgeting for COVID-19 related costs on top of already existing struggles to cover annual maintenance and operating costs of the PWDU and other municipal operations. However, the ability of communities to mobilize and adapt to address changing health guidelines relating to COVID, as well as associated additional costs and increased demand on staff capacity, was apparent and varied between the participating communities.

A key finding relating to operating PWDUs during the COVID-19 pandemic was that the diversity of rural, remote, and Indigenous communities of NL resulted in a spectrum of perspectives and outcomes with respect to ensuring safe drinking water provision during a pandemic. Essentially, the unique characteristics and context led to varied responses as well as capacities to respond. Further, leadership and responses from diverse actor groups from across jurisdictions were critical in aiding communities to adapt and maintain access to clean drinking water. This supports the findings of previous studies noted above (e.g., Criado & Guevara-Gómez, 2021; Ceresia & Misuraca, 2020; Huang, 2020; Choi, 2020) that emphasize the importance of diverse actors who collaborate and communicate effectively with one another in water governance and in response to the COVID-19 pandemic and other emergencies. Thus, the applicability of the CMLG approach within rural, remote, and Indigenous communities with PWDUs within the complex jurisdictional context of NL is illustrated. As Criado and Guerva-Gomez (2021) found, this includes the key role of citizens in collaborating with governments and building networks during the COVID-19 pandemic.

In particular, the responses from MNL, NCC, and even this research partnership further emphasize the importance of CMLG across relevant organizations as it relates to water security in rural, remote, and Indigenous communities. We found that MNL and NCC played critical roles in assisting with community-level responses while also stimulating responses from the province, sharing guidelines, as well as distributing valued PPE and sanitation products. These actor groups served a bridging function to link others across vertical and horizontal dimensions and were able to mobilize/be nimble to respond to the unique needs of their communities (Dressel et al., 2020).

The study findings related to administrative, communications, and logistical burdens faced by these communities due to their small size, staff, budgets, and remoteness allows us to gain a new perspective on the realities of operating small-scale drinking

water in such contexts during emergency situations. Multiple institutional and governance actors, many located far from the geographic area, are relevant for ensuring robust, appropriate, and (particularly amid a pandemic) timely decisions. Thus, the experience of the COVID-19 pandemic further highlights the need for multiple actors working together across scales in rural, remote, and Indigenous communities in Newfoundland and Labrador and beyond to ensure water security.

As suggested by the CMLG literature, external drivers can either facilitate or hinder collaboration in CMLG (Emerson et al., 2012). In this instance, COVID-19 helped to bring these actors groups together, with each other and with the communities they serve and represent. The flexibility and responsiveness of both MNL and NCC actor groups allowed for the prevention and mitigation of challenges in many PWDU communities during COVID, allowing the PWDUs to stay open and remain operational. MNL's actions started a province-wide response, and NCC took action with communities within NunatuKavut territory. As suggested by other studies, access to additional funding from provincial and federal governments played an important role in these actions (Choi, 2020). However, future responses would benefit by being further coordinated across all actor groups, including Indigenous governments, to ensure an efficient and effective response plan/strategy is relevant and/or tailored to the particular circumstances of rural and remote communities.

It is critical to acknowledge that despite the types of actors involved being similar across many Newfoundland and Labrador communities (recognizing and respecting the presence of unique Indigenous governance structures and organizations within their Indigenous territories), the role those various actors play in drinking water can and does vary given individual community situations, and different types of drinking water challenges. We suggest that CMLG can provide the much-needed "administrative and institutional flexibility to allow issues to determine institutional structures, behaviours and relationships" (Cargnello & Flumian, 2017, p. 611). Thus, we suggest further collaboration across multiple levels and actors involved in drinking water provision in NL is both needed and be achieved through both formal and informal multi-jurisdictional governance structures that span the multiple jurisdictions in the context of drinking water security. Such mechanisms include collaborative structures that enable dialogue and decisions across governments and scales of jurisdiction relating specifically to tackling water insecurity and to more specific issues such as those related to BWAs or PWDU operations and maintenance opportunities in rural, remote, and Indigenous communities.

Additionally, this research highlights that traditional approaches to community planning and services in the municipal sphere are insufficient in responding to crises in isolation. In particular, timely, coordinated, and appropriate communication mechanisms are important for a successful actor response (Le et al., 2021; Gibson, 2011). For instance, numerous parallel communications during pandemics or other emergencies from across the various Indigenous and non-Indigenous jurisdictions could be further tailored to increase relevance to rural, remote, and Indigenous communities and reduce the overload of irrelevant information being received. Participants illustrate the diversity of rural and remote communities and that their capacity, geography, and demographics can influence the communication mechanisms that are most appropriate. As a result, we heard a multitude of communication preferences from social media, bulletin boards, emails, telephone, and newsletters. Future responses would benefit from further coordination across actor groups and jurisdictions to ensure an efficient and effective response

plan/strategy as seen in Le et al. (2021) with social media, music, film, and poetry and Huang (2020 with daily press conferences. This will require an understanding of the breadth and scope of actors relevant to drinking water issues in each jurisdiction, especially organizations that are place-specific and that can connect across various jurisdictions and actors' groups (e.g., bridging, or intermediary organizations, as noted by Dressel et al., 2009; Marvin & Medd, 2007). Knowledge of local contexts can help to ensure that these plans/strategies are relevant and tailored to rural, remote, and Indigenous communities.

Additionally, given that this research focused primarily on perspectives provided at the local level, future research that explores responses and perspectives from provincial and federal level agencies with drinking water responsibilities could provide further beneficial insights from scales beyond the rural, remote, and Indigenous communities focused on in this study, with specifically related to PWDU infrastructure or the aspiration of CMLG for enhanced drinking water security more generally. For instance, interviews with key individuals with responsibilities for drinking water services at these levels would complement this study and provide further insights into feasible next steps for the role of PWDUs in helping secure drinking water across Newfoundland and Labrador.

In summary, based on our findings related to COVID-19 and PWDU operations, we recommend that drinking water actors within the CMLG network in NL:

- understand the preferred method of communication of communities within their jurisdiction and check those channels regularly;
- tailor communication mechanisms, guidelines, and support strategies to each rural or remote community during future crises; and,
- maintain ongoing contact with other relevant governance actors to coordinate responses.

Additionally, leaders in rural, remote, and Indigenous communities are encouraged to maintain and build resilience and adaptive capacity to respond to crises in the future by:

- seeking assistance and guidance from provincial government representatives and/or municipal associations and other advocacy organizations' for maintaining drinking water infrastructure; and,
- building operational capacity through engaging other communities with PWDUs and sharing experiences.

Concerns related to the COVID-19 pandemic expose gaps in water systems and access to clean drinking water in rural and remote communities, but also can further contribute to concentrated efforts to address unequal access to potable water in NL and in Canada.

The recent experience from the COVID-19 pandemic highlights the need for continual and proactive attention to navigate responses across jurisdictions so that actors can mobilize quickly and avoid challenges relating to CMLG (Criado & Guevara-Gómez, 2021; Gibson, 2011). This research can help inform more effective, timely and coordinated responses to emergencies and crises in the future to keep PWDUs operational and provide greater water security to rural, remote and Indigenous communities.

References

Ananda, J., & Proctor, W. (2013). Collaborative approaches to water management and planning: An institutional perspective. *Ecological Economics, 86*, 97–106. https://doi.org/10.1016/j.ecolecon.2012.10.018

Ansell, C., & Gash, A. (2007). Collaborative governance in theory and practice. *Journal of Public Administration Research and Theory*, *18*(4), 543–571. https://doi.org/10.1093/jopart/mum032

Ansell, C., Boin, A., & Keller, A. (2010). Managing transboundary crises: Identifying the building blocks of an effective response system. *Journal of Contingencies and Crisis Management*, *18*(4), 195–207. https://doi.org/10.1111/j.1468-5973.2010.00620.x

Bosco, F. J. (2006). Actor-network theory, networks, and relational approaches in human geography. In S. Aitken, G. Valentine (Eds.), *Approaches to human geography* (pp. 136–146). London: Sage.

Bressers, H., de Boer, C., Lordkipanidze, M., Özerol, G., Vinke-De Kruijf, J., Furusho, C., Lajeunesse, C., Larrue, C., Ramos, M.-H., Kampa, E., Stein, U., Tröltzsch, J., Vidaurre, R., & Browne, A. (2013). *Water governance assessment tool: with an elaboration for drought resilience.* Report to the DROP Project. CSTM University of Twente: Enschede

Brisbois, M. C., & de Loë, R. C. (2016). State roles and motivations in collaborative approaches to water governance: A power theory-based analysis. *Geoforum, 74*, 202–212. https://doi.org/10.1016/j.geoforum.2016.06.012

Brown, A. J., & Bellamy, J. A. (2010). In the shadow of federalism: Dilemmas of institutional design in Australian rural and remote regional governance. *Australasian Journal of Regional Studies, 16*(2), 151–181.

Cargnello, D. P., & Flumian, M. (2017). Canadian governance in transition: Multilevel governance in the digital era. *Canadian Public Administration, 60*(4), 605–626. https://doi.org/10.1111/capa.12230

Castleden, H., Hart, C., Cunsolo, A., Harper, S., & Martin, D. (2016). Reconciliation and relationality in water research and management in Canada: Implementing indigenous ontologies, epistemologies, and methodologies. In S. Renzetti, & D. P. Dupont (Eds.), *Water policy and governance in Canada* (pp. 69–95). Springer International Publishing.

CBCL Limited. (2010). *Evaluation of existing potable water dispensing units and recommendations for design and operational guidelines*. Report. Retrieved from https://www.gov.nl.ca/ecc/files/waterres-reports-drinking-water-093017-00-pwdu-study-final-report.pdf

Center for Disease Control and Prevention. (CDC). (2020). When and how to wash your hands. Retrieved June 4, 2020, from https://www.cdc.gov/handwashing/when-how-handwashing.html

Ceresia, F., & Misuraca, R. (2020). Critical issues in the management of the first phase of the COVID-19 pandemic in Italy: The role of some organizational flaws on the adoption of collaborative governance models. *Revista de Ciencias Sociales (Ve), XXVI*(3), 11–19.

Choi, Y. J. (2020). The Power of collaborative governance: The case of South Korea responding to COVID-19 pandemic. *World Medical & Health Policy*, *12*(4), 430–442. https://doi.org/10.1002/wmh3.376

Criado, J. I., & Guevara-Gómez, A. (2021), "Public sector, open innovation, and collaborative governance in lockdown times. A research of Spanish cases during the COVID-19 crisis". *Transforming Government: People, Process and Policy*, *15*(4), 612–626. https://doi.org/10.1108/TG-08-2020-0242

Daniels, J., Baldacchino, G., & Vodden, K. (2015). Matters of place: The making of place and identity. In K. Vodden, G. Baldacchino, & R. Gibson (Eds.), *Place peripheral: Place-based development in rural, island, and remote regions* (pp.23–40). Newfoundland and Labrador: ISER Books.

de Boer, C., Vinke-de Kruijf, J., Özerol, G., & Bressers, H. (2016). Collaborative water resource management: What makes up a supportive governance system?: Supportive governance for collaborative WRM. *Environmental Policy and Governance*, *26*(4), 229–241. https://doi.org/10.1002/eet.1714

Department of Municipal Affairs and Environment. (2020). Guidance for Potable Water Dispensing Unit (PWDU) Operation during COVID-19. Retrieved from https://www.gov.nl.ca/ecc/files/waterres-waste-pdf-pwdu-guidance-document-covid-19.pdf

Dressel, S., Johansson, M., Ericsson, G., & Sandström, C. (2020). Perceived adaptive capacity within a multi-level governance setting: The role of bonding, bridging, and linking social capital. *Environmental Science & Policy*, *104*(February 2020), 88–97. https://doi.org/10.1016/j.envsci.2019.11.011

Eger, S. (2020). Learning from experience to operationalize integrated coastal and marine management. *UWSpace - Waterloo's Institutiona Depository.* Retrieved from https://uwspace.uwaterloo.ca/handle/10012/16564

Eger, S., & Minnes, S. (2021, May). *NL sustainable drinking water research for rural, remote, and Indigenous communities.* [Conference presentation]. MNL Symposium & AGM, St Johns, Newfoundland and Labrador, Canada.

Eledi, S. B. (2019). *Examining policy implementation gaps in source water protection in Newfoundland and Labrador.* [Unpublished master's thesis]. Memorial University of Newfoundland - Grenfell Campus, Corner Brook, Newfoundland and Labrador, Canada.

Eledi, S., Vodden, K., & Brade, W. (2016, Oct. 26). *Black Duck Brook-Winterhouse drinking water survey.* Report. NL Sustainable Drinking Water Research for rural, remote, and Indigenous communities.

engageNL. (2021). *Drinking water safety action plan consultations.* Retrieved December 17, 2021, from https://www.engagenl.ca/engagement-initiatives/drinking-water-safety-action-plan-consultations

Emerson, K., Nabatchi, T., & Balogh, S. (2012). An integrative framework for collaborative governance. *Journal of Public Administration Research and Theory*, *22*(1), 1–29. https://doi.org/10.1093/jopart/mur011

Federation of Canadian Municipalities. (2020). Protecting vital municipal services: Urgent federal recommendations to address the financial crisis in our cities and communities due to COVID-19**.** Retrieved from https://data.fcm.ca/documents/resources/reports/protecting-vital-municipal-services.pdf

Gibson, R. (2011, May). A primer on collaborative multi-level governance. Retrieved from https://research.library.mun.ca/310/1/primer_collaborative.pdf

Gibson, R. (2019). Searching for multi-level collaborative governance. In K. Vodden, D. Douglas, S. Markey, S. Minnes, & W. Reimer (Eds), *The theory, practice and potential of regional development: The case of Canada* (pp. 84–103). Abingdon, United Kingdom: Routledge.

Government of Canada. (2021). *Ending long-term drinking water advisories*. Retrieved June 14, 2021, from https://www.sac-isc.gc.ca/eng/1506514143353/1533317130660

Government of Canada. (2020). *Drinking water advisories*. Retrieved August 6, 2020, from https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/drinking-water-advisories.html

Government of Newfoundland and Labrador. (2019). Newfoundland and Labrador Potable Water Dispensing Units (PWDUs). Newfoundland and Labrador Water Resources Portal. Accessed December 20, 2019, from https://maps.gov.nl.ca/water/reports/getreport.aspx?reportid=1013

Government of Newfoundland and Labrador. (2021). Municipal Directory. Retrieved June 14, 2020, from https://www.gov.nl.ca/mpa/municipal-directory/

Hanrahan, M. (2003). *The lasting breach: The omission of Aboriginal people from the terms of union between Newfoundland and Canada and its ongoing impacts.* Research Paper for the Royal Commission on Renewing and Strengthening Our Place in Canada.

Hanrahan, M. (2017). Water (in) security in Canada: National identity and the exclusion of Indigenous peoples. *British Journal of Canadian Studies, 30*(1), 69–89. https://doi.org/10.3828/bjcs.2017.4

Hanrahan, M., Sarkar, A., & Hudson, A. (2014). Exploring water insecurity in a northern Indigenous community in Canada: The "never-ending job" of the Southern Inuit of Black Tickle, Labrador. *Arctic Anthropology, 51*(2), 9–22. Retrieved June 17, 2021, from http://www.jstor.org/stable/24475826

Higgins, J. (2008). *Innu rights & government*. Retrieved from http://www.innu.ca/index.php?option=com_content&view=article&id=10&Itemid=7&lang=en

Holisko, S., Speed, D., Vodden, K., & Sarkar, A. (2014). *Developing a community-based monitoring program for drinking water supplies in the Indian Bay Watershed: A baseline study of surface water quality, contamination sources and resident practices and perceptions.* Memorial University of Newfoundland, St John's, Newfoundland and Labrador, Canada. https://www.mun.ca/harriscentre/reports/arf/2012/12-13-DWARF-Final-Vodden.pdf

Huang, I. Y.-F. (2020). Fighting against COVID-19 through government initiatives and collaborative governance: Taiwan experience. *Public Administration Review*, *80*(4), 665–670. https://doi.org/10.1111/puar.13239

Hudson, A. (2020). Reclaiming Inuit governance: Planning for a sustainable future [Unpublished doctoral dissertation]. Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, Canada.

Jokhu, P.D., & C. Kutay. (2020). Observations on appropriate technology application in Indigenous community using system dynamics modelling. *Sustainability, 12*(6), 2245. https://doi.org/10.3390/su12062245

Lacey, W. (2016, March). Advanced drinking water systems [Power Point slides] Retrieved from https://www.gov.nl.ca/ecc/files/waterres-training-adww-2016-19-william-lacey.pdf

Lam S., Cunsolo, A., Sawatzky, A., Ford, J., & Harper, S. L. (2017). How does the media portray drinking water security in Indigenous communities in Canada? An analysis of Canadian newspaper coverage from 2000-2015, *BMC Public Health, 17*(282), 1–14. https://doi.org/10.1186/s12889-017-4164-4

Le, T.-A. T., Vodden, K., Wu, J., & Atiwesh, G. (2021). Policy responses to the COVID-19 pandemic in Vietnam. *International Journal of Environmental Research and Public Health*, *18*(2), 559. https://doi.org/10.3390/ijerph18020559

Lightfoot, T. J. (2014). *"We got it good here": Exploring the drinking water system in Makkovik, Nunatsiavut*. Report for the Exploring Solutions for Sustainable Rural Drinking Water Systems Project. Memorial University of Newfoundland, Grenfell Campus, Corner Brook, Canada. http://nlwater.ruralresilience.ca/wp-content/uploads/2014/11/Makkovik-Long-Case_FINAL.pdf

Marvin, S., & Medd, W. (2007). Strategic intermediation: Between regional strategy and local practice. *Sustainable Development*, *15*(5), 318–327. https://doi.org/10.1002/sd.345

Minnes, S. (2019) Watershed governance or intake governance? Implications of Ontario's *Clean Water Act* on collaborative watershed governance in rural areas. *Canadian Water Resources Journal/Revue Canadienne des ressources hydriques, 44*(4), 401–422. https://doi.org/10.1080/07011784.2019.1661791

Minnes, S., & Vodden, K, (2014). *Infrastructure and operations of drinking water systems in rural Newfoundland and Labrador.* Policy Brief. Retrieved from http://nlwater.ruralresilience.ca/wp-content/uploads/2013/04/Infrastructure_Sept15.pdf

Minnes, S., & Vodden, K. (2017). The capacity gap: Understanding impediments to sustainable drinking water systems in rural Newfoundland and Labrador. *Canadian Water Resources Journal / Revue canadienne des ressources hydriques, 42*(2), 63–178. https://doi.org/10.1080/07011784.2016.1256232

Minnes, S., Breen, S.-P., Markey, S., & Vodden, K. (2018). Pragmatism versus potential: New regionalism and rural drinking water management. *Journal of Rural and Community Development, 13*(2), 76–99.

Minnes, S., Vodden, K. & Team. (2014). *Exploring solutions for sustainable rural drinking water systems: A study of rural Newfoundland & Labrador drinking water systems*. Report. Retrieved from https://www.mun.ca/harriscentre/Rural_Water_Report.pdf

Municipalities Newfoundland and Labrador (MNL). (2020a, March). *COVID-19: Regional conference call summary*. Report. Retrieved from https://municipalnl.ca/site/uploads/2020/03/Round-One-Summary-Report.pdf

Municipalities Newfoundland and Labrador (MNL). (2020b, April). *COVID-19: Regional conference call summary Round Two.* Report. Retrieved from https://municipalnl.ca/site/uploads/2020/04/Round-Two-Summary-Report.pdf

Municipalities Newfoundland and Labrador (MNL). (2021, April). *COVID 19 in Newfoundland and Labrador: Municipal responses, impacts and recommendations for recovery*. Report. Retrieved from https://municipalnl.ca/site/uploads/2021/04/Municipal-COVID-Rpt.pdf

Municipalities Newfoundland and Labrador. (2021). On demand webinars. Retrieved from https://municipalnl.ca/membership/webinars/on-demand-webinars/

Norman, E., Bakker, K. Cook, C., Dunn, G., & Allen, D. (2010). *Water security: A primer*. Policy Report. Vancouver, British Columbia, Canada: Program on Water Governance, University of British Columbia.

Nowell, B., Steelman, T., Velez, A.-L. K., & Yang, Z. (2018). The structure of effective governance of disaster response networks: Insights from the field. *The American Review of Public Administration*, *48*(7), 699–715. https://doi.org/10.1177%2F0275074017724225

Nunatsiavut Government. (2021). *The path to self-government: How we got to where we are today.* Retrieved from https://www.nunatsiavut.com/government/the-path-to-self-government/

Nunatukavut. (2021). *COVID-19.* Retrieved June 8, 2021, from https://nunatukavut.ca/covid-19/

Omosule, A. (2017) *Exploring water insecurity situation in Canadian indigenous communities: The efforts of the Flat Bay Indian Band to resolve its water challenges.* [Unpublished master's thesis]. St. John's, Newfoundland and Labrador, Canada: Memorial University of Newfoundland.

Pahl-Wostl, C., Nilsson, C., Gupta, J., & Tockner, K. (2011). Societal learning needed to face the water challenge. *AMBIO, 40*(5), 549–553. https://doi.org/10.1007/s13280-011-0149-1

Plummer, R., & Armitage, D. (2007). Charting the new territory of adaptive Co-management: A delphi study. *Geography and Environmental Studies Faculty Publications, 12*(2), 10. Retrieved from https://www.ecologyandsociety.org/vol12/iss2/art10/

Public Health Agency of Canada (PHAC). (2020, April 20). *Reduce the spread of COVID-19: Wash your hands infographic*. Retrieved May 27, 2020, from https://www.canada.ca/en/public-health/services/publications/diseases-conditions/reduce-spread-covid-19-wash-your-hands.html

Robins, L. (2007). Nation-wide decentralized governance arrangements and capacities for integrated watershed management: Issues and insights from Canada. *Environments, 35*(2), 1–47.

Sarkar A., Hanrahan, M., & Hudson, A. (2015, April). *Water quality in Aboriginal communities in Labrador: A study of the Southern Inuit community of Black Tickle*. Report. St John's, Newfoundland and Labrador, Canada: Memorial University of Newfoundland. Retrieved from https://www.mun.ca/harriscentre/reports/Sarkar_Water_12_13_Final.pdf

van Tol Smit, E., de Loë, R., & Plummer, R. (2015). How knowledge is used in collaborative environmental governance: Water classification in New Brunswick, Canada. *Journal of Environmental Planning and Management*, *58*(3), 423–444. https://doi.org/10.1080/09640568.2013.860017

Vodden, K. (2015). Governing sustainable coastal development: The promise and challenge of collaborative governance in Canadian coastal watersheds. *The Canadian Geographer/Le Géographe Canadien*, *59*(2), 167–180. https://doi.org/10.1111/cag.12135

Vodden, K., & V. Chireh (2020). *Exploring regional approaches to drinking water management in the Strait of Belle Isle, Newfoundland and Labrador*. Report. Corner Brook, Newfoundland and Labrador, Canada: Memorial University, Harris Centre RBC Water Research and Outreach Fund.

Wang, J. J., & Yau, S. (2018). Case studies on transport infrastructure projects in belt and road initiative: An actor network theory perspective. *Journal of Transport Geography*, *71*(C), 213–223. http://dx.doi.org/10.1016/j.jtrangeo.2018.01.007

Westcott, T. (2018, June 21). Miawpukek First Nation ends long-term drinking water advisory. *Water Canada*. Retrieved June 20, 2021, from https://www.watercanada.net/miawpukek-first-nation-ends-long-term-drinking-water-advisory/

White, J., Murphy, L., & Spence, N. (2012). Water and Indigenous peoples: Canada's paradox. *International Indigenous Policy Journal*, *3*(3), 1–25. https://doi.org/10.18584/iipj.2012.3.3.3

World Health Organization (WHO). (2020, April 23). Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19. Retrieved May 27, 2020, from https://www.who.int/publications/i/item/WHO-2019-nCoV-IPC-WASH-2020.4

Wright, C. J., Sargeant, J. M., Edge, V. L., Ford, J. D., Farahbakhsh, K., RICG, Shiwak, I., Flowers, C., IHACC Research Team, & Harper, S. L. (2017). Water quality and health in northern Canada: Stored drinking water and acute gastrointestinal illness in Labrador Inuit. *Environmental Science and Pollution Research*, *25*, 32975–32987. https://doi.org/10.1007/s11356-017-9695-9

Appendix 1: Interview Protocol 2020

1. Identification:
    a. What community do you represent?
    b. What do you call your unit?
    c. What is your role in your community?
2. Does your community have a certified water operator?
    a. Is your operator shared with any other communities?
3. What type of Potable Water Dispensing Unit (PWDU) does your community have?
    a. What is the brand and model? And who did you purchase it from?
    b. For administrators: what was the cost of purchasing and installing your system? And what are your typical annual costs of operating the PWDU?
    c. What were some of the reasons the PWDU was put in place?
4. Is the PWDU your only source of clean and safe drinking water for your community?
    a. If no, what is/are your other source(s)?
5. Does your community ever experience issues with water shortages (i.e., lack of access to sufficient supply of clean, safe drinking water)? If yes, please explain.
6. We understand from provincial information that you have operated your PWDU since (include year). Is this correct? If no, please explain.
    a. Have there been any interruptions in operations since this time?
    b. If yes, why was there an interruption?
7. Who uses the PWDU?
    a. Do residents from other communities use your PWDU?
    b. If yes, where are those people from?
8. What measures have you taken to ensure public safety at your PWDU during the pandemic?

9. Are there any changes in your responsibilities due to the pandemic? Please explain.

    a. If yes, how are you tackling those?

10. Have the costs of operation risen during the pandemic? If yes, could you please explain the specific reasons of the increased cost?

    a. Have operators been working longer hours?

    b. Have you had to buy more sanitizers and wipes? Other changes in costs?

    c. Did you have to reduce some other services or part of your operations to pay for these increased costs of your PWDU due to COVID-19 related protocols?

11. Have you found the guidelines provided by MAE been sufficient during the pandemic?

    a. If no, please explain

    b. If yes, which information or communications have been most useful?

    c. Do you need any further supports from either MAE or anyone else that would help with the operation of your PWDU during the pandemic? If yes, please explain.

12. Do you have any concerns at this time about the operation of your PWDU, either related to the pandemic or otherwise? If yes, please describe.

    a. Did you have these concerns about your PWDU prior to the pandemic?

13. Have you heard any concerns from your residents about PWDUs? If yes,

    a. Concerns prior to the pandemic?

    b. Concerns during the pandemic?

14. Is there anyone else in your community we should speak to about your PWDU? If yes, who?

15. Do you have any further suggestions to share about operating a PWDU?

    a. Anything about specifically operating a PWDU during a pandemic? If yes, please explain.

16. Is there anything else you would like to add? Do you have any follow-up questions for us or additional comments?

17. Would you like to hear back from us about the results of the study? If yes,

    a. How would you like to get the results? (e.g., webinar, presentation at an MNL event, executive summary, etc.)

Appendix 2: Common challenges related to PWDU operation in NL during the 2020 COVID-19 pandemic

S Challenge	Description	Sample of related quotes	
		Evidence that communities were not impacted or able to adapt	**Evidence that communities were impacted**
Evolving guidance and resources	Overwhelming number of new guidelines coming in every day (related to multiple aspects of running a municipality)		"We didn't require assistance after the original health order, so it was pretty easy to adapt to, you know, public buildings as a whole… There's been so much out over the last six months. We've just been following the general rules…. Well we just got so much correspondence over that time, you know. I do find it funny. Like the government sends out all these emails or whatever, with regards to COVID-19, which is awesome, but we're a one-man office. I'm not going to spend all day in the office reading government correspondence about COVID. Some of it's redundant, some of it's repetitive." (Community # 3) It's difficult for us to anticipate what the requirements would be in time to make our changes with the announcement." (Community #14)
	Irrelevant or poor access to guidelines	"I'll plead ignorance, I didn't know that [new guideline] was out." (Community #3)	"We've followed the guidelines as much as we thought was necessary in the community... I get daily updates from the provincial government with my LSD webmail address, that's registered with municipal affairs." Community #1
Limited capacity (financial, human) to adapt	Staffing, referred to as 'man power'- some communities reported a limited staff	"Can keep it up for now, not sure if she can keep it up in the winter. If the government	As far as man power goes…people don't realize we're spending about two and half to three hours a day sanitizing and intervening in the water unit." (Community #9)

to new guidelines and procedures	(trained or not), or funds to pay staff - resulting in town councillors doing cleaning, operators doing cleaning or volunteers coming in to clean	said you had to clean it after every use, we just do not have the man power for that." (Community #14)	"You know, we can't man it 24/7" (Community #3)
	Access to PPE or materials (rural/remote)		"The only thing that changed is the use of sanitary items to keep it clean. Obviously there are more thorough cleanings with more frequency, mostly Lysol wipes." (Community #13)
	Costs - direct: cost of PPE, staff hours; indirect - increase demand/ PWDU use from people being at home, increase cost of parts	" I can't say that we've had increased costs because of COVID." (Community #4)	"Well it has risen a little bit, because we've had to get PPE. You know, and cleaning, more cleaning supplies and disinfectant, hand sanitizers, face masks, everything like that." (Community #2)
		"It's not like my budget is blown for the year because I had to buy some wipes, that's just going into town costs I think." (Community #13)	"I would estimate it's probably an additional $3000/year in supply costs…. an extra $700/week in man power. We're looking at an extra $35,000 in man power, in additional to the $20,000 to annual costs of just running it. So plus the supplies, we're looking at $57,750." (Community #9)
		"Thanks to Nunatukavut, we didn't have to pay for a lot of those sanitizing items. But the cost will increase because this is something we are going to	

		have to continue long term." (Community #3)	
COVID-19 as a barrier for access to training and construction	Delayed installation of PWDU on Fogo Island Interruption of training for operators		"We were supposed to do training, but the pandemic put a hold on all training." (Community #6) "Well the Fogo one is ongoing, we got built one unit, supposed to put another one this year, but COVID-19 kind of sorted that out" (PWDU expert, 2020)
COVID-19 as added stress for local jurisdictions to maintain/provide services	Budget and responsibilities of municipalities are already limited COVID-19 is yet another added pressures of running a municipality COVID-19 yet another issue municipalities with already limited capacity and strained budgets need to address		"But the municipality is responsible for so many services. There are no guidelines that does not escape the municipality. We have an arena, that has a canteen, that's also licensed. So I have to read the guidelines not just for arenas, but also for restaurants and bars. We have sports fields, we have day camps, office buildings, we provide rental space. We have a water system, a sewer system. We have so many services we provide to the community. So, every stinking guideline that comes out from the government, we have to be aware of, and meet those requirements. We're also an employer, so we need to meet health and safety standard. And we have a fire department! I do a lot of reading these days!" (Community # 14)