Water Operators Survey Results

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Table of Contents

List of Tables

List of Figures

Abbreviations within the Document

BWA – Boil Water Advisory

COTOL – Community of One Thousand Or Less residents (also referred to as ≤1000 Communities)

DOEC – Department of Environment and Conservation

DWQI – Drinking Water Quality Index

KMb – Knowledge Mobilization

LSD – Local Service District. MNL – Municipalities Newfoundland and Labrador

OIT – Operator in Training

PMA – Professional Municipal Administrators of NL

PVC - Polyvinyl chloride

SPSS – Statistics Package for the Social Sciences

WO – Water Operator

1.0 Project Background

In rural Newfoundland and Labrador (NL), watersheds provide drinking water supplies while also supporting other resources and activities. Consequently, healthy drinking water supplies are dependent on healthy watersheds as well as on supporting water policies, practices and infrastructure. Dr. Kelly Vodden (Environmental Policy Institute, Memorial University, Grenfell Campus) has led this research as Principal Investigator in collaboration with Municipalities Newfoundland and Labrador (MNL), Professional Municipal Administrators (PMA) and a research team with members from diverse areas of expertise related to drinking water. Additionally, funding support from the Harris Centre – RBC Water Research and Outreach Fund as well as the Mitacs Accelerate program has played a crucial role in making this project possible.

This study identified the types of risks and challenges influencing drinking water quality and availability in rural areas, with a particular emphasis on communities of 1,000 residents or less (COTOLs) in NL. There are four major components of this research study that will be assessed:

1. Source Water Quality and Quantity: concerns related to drinking water supplies in the province and associated health risks.
2. Public Perception, Awareness, and Demand: attitudes towards, understanding of and citizen practises related to drinking water in NL.
3. Policy and Governance: policies and governance structures surrounding water and water management as well options for policy and governance solutions to achieve sustainable drinking water systems in rural NL.
4. Water Infrastructure and Operations: current condition of water infrastructure in rural NL, operations of drinking water treatment systems and what investments are needed to improve drinking water systems.

This study addressed knowledge gaps related to drinking water systems in NL by providing a current and comprehensive picture of drinking water issues in small communities from a multitude of angles. This has been accomplished by drawing from current and past research and existing sources at federal, provincial and municipal levels, as well as research from

other jurisdictions. Dialogue with stakeholders has also been a key means of understanding issues and solutions for drinking water systems in NL.

Researchers wanted to collect information from different groups of individuals over the course of study. The groups approached for such information were Community Administrators, Water Operators (WOs), residents, businesses, federal actors, provincial actors and non-governmental organizations. This report reflects the information provided by water system operators.

2.0 Methodology

2.1 Procedure

This survey was conducted in Fall 2013 via email through the MNL list server and an online survey in the case of municipalities, and through mail-out to the 27 Local Services Districts (LSDs) who had filled out the previous survey for Community Administrators' in Summer 2013 and indicated that they operate a water system for their residents. The LSDs who received the survey via mail (the package was sent to their town office/contact to give to the WOs) were given the option to either complete the survey online or to complete a paper copy of the survey. Paper copies were distributed in a package that included a pre-paid return envelope to return the surveys to the researchers.

Due to the low response rate from LSDs in the Community Administrators' survey and because many of those that did respond did not operate a water system and therefore did not have a water system operator, and in the interest of fiscal constraints of mail outs, the research team decided that only those 27 LSDs who answered the first survey and indicated that they operate a water system for their residents would receive the Water Operator (WO) survey via mail. Municipal WOs were invited to participate and complete the Water Operator Survey online via a link to Survey Monkey (an online data collection tool). This survey link was circulated to Community Administrators through the MNL list server with the intention that the administrator would forward the link to their respective WOs. In several situations, WOs submitted a paper copy of the survey to the researchers instead of completing it online. In addition to mailouts to LSDs, the paper survey packages were also distributed at PMA-NL events in Fall 2013, and at several MNL regional meetings. The survey packages were also distributed in January, February and March 2014 and at the Department of Environment and Conservation's (DOEC) Annual

Drinking Water Workshop in March 2014. This non-uniform data collection procedure was adopted to ensure the highest possible participation rate. The data that were collected via paper surveys were uploaded to the Survey Monkey website to ensure the data was centralized, consistent and did not include more than one entry per WO.

Data collection occurred over a period of approximately six months. This fairly lengthy period for data collection was to ensure adequate time to promote the survey throughout the province. This extended data collection window created some concerns about respondents offering differing answers due to seasonal variations. However, it was determined that the only questions for which these effects would be relevant addressed topics from the last four years; therefore, the only questions that would be affected by seasonal variations asked about multiple seasons from multiple years. Therefore the potential for seasonal biases was mitigated by the nature of the questions. Although the likelihood of a serious seasonality/timing issue was considered small, the researchers still wanted to empirically verify that there were no differences in the collected data. Analysis on this topic suggested that there were minimal differences between respondents who replied to the survey in 2013 instead of 2014 (the most notable was that municipalities were more likely to respond in 2014 than in 2013). Overall any differences do not appear to be systematic, but rather, appear to be the product of chance. While it is impossible to determine the full extent of the potential "bias" introduced into the research by the lengthy data collection window, the researchers are doubtful that it created any significant systematic errors.

2.2 Survey

The WO survey was designed by an interdisciplinary team of research professionals (i.e., academics, graduate students, government employees and municipal representatives), many of who had substantial experience in their respective fields. The researchers informed their work by investigating previous surveys that had addressed water-related topics in an effort to ensure that important questions were not being overlooked. Research assistants who had experience in research design performed this background research. This research identified primary topics of interest (i.e., which themes needed to be addressed by the WO survey), and an iterative process was employed to reduce, refine, and refocus the questions that were selected for the survey. This process was used to select the strongest possible questions, and thereby maximize response and

completion rates as well as the usefulness of the information gathered. The questions that the researchers eventually settled upon were similar to ones from similar investigations, which the researchers considered an indication of convergent validity.

After the survey was reduced to a manageable number of questions, the researchers gave the project's Advisory Committee[1] access to the complete survey and solicited their feedback on it. The Advisory Committee indicated that the survey was acceptable, with minor suggested revisions. At this point, the researchers conducted a trial survey with a small sample of WOs to get an estimate of how long it would take the survey to be completed, and to forestall any obvious issues. After the trial procedure was complete, the researchers were then confident that the survey would be an adequate tool for assessing WOs' attitudes, perceptions, and knowledge. The finished survey consisted of 58 questions that addressed demographics, WO characteristics, water system infrastructure, water system maintenance, health and safety issues, and threats to community water systems. There were also several qualitatively-oriented sections that addressed innovative solutions and failures within water systems. With few exceptions, it was expected that all respondents would answer all questions within the survey[2]. Please see the Water Operator Survey Appendix for complete details.

3.0 Data Analysis

3.1 Data Cleaning

At the close of the survey, an analyst exported the data from Survey Monkey to Microsoft Excel 2007 for data cleaning. Data cleaning is a process that prepares the collected data for analysis. Standard procedures for data cleaning include eliminating outliers, eliminating impossible values, eliminating duplicate cases, and coding data for analysis. Only the collected quantitative data was subjected to the analyst's data cleaning process, as qualitative data cannot be "cleaned". Survey Monkey was a useful tool because the software automatically restricts impossible values. Duplicate values occurred when cases (i.e., communities) were inputted more than once into Survey Monkey. These errors were detected by simply identifying which communities had been entered into the Survey Monkey database and eliminating recurrent

[1] The purpose of the Advisory Committee is to provide advice to the Research Team regarding the projects methodologies, design and findings. For a list of organizations represented on the Advisory Committee please visit the project website: http://nlwater.ruralresilience.ca/?page_id=316

[2] Respondents were asked to skip questions that did not apply to them (e.g., if respondents did not have wood pipes, they were not required to answer questions regarding wood pipes).

entries. Duplicates usually occurred when a community started a survey and discontinued it before finishing and then re-started a new online survey. If a community completed the survey more than once (which happened in several situations), then the most recent completed entry was used.

In several situations, communities began a survey but then left the vast majority of the questions blank. In these cases, the respondent communities had only provided demographic information; they failed to provide additional information on the substantive research focuses (e.g., water system infrastructure). Although these communities technically did participate, they did not meaningfully contribute to the investigation of the study's guiding research questions. This selective non-response bias presented a methodological and statistical dilemma, as the researchers were uncertain why these communities had elected not to respond. Since the communities who only provided partial information would affect the reported participation rate, the researchers wanted to ensure that the decision to either include or exclude them was justifiable. The researchers ultimately concluded that regardless of the reason for the non-responses, these mostly null entries could not be used in their analysis. The primary reason for this decision was that including partial answers would artificially inflate the rate of missing data. Additionally, these respondents did not provide any useable data, so there was no concomitant benefit to including them in the analysis. The initial non-cleaned data set consisted of 84 data cases; however, this was reduced to a total of 71 data cases once duplicate cases were eliminated and functionally blank surveys were removed. One respondent returned their survey later than anticipated, but unfortunately, data analysis was already underway at this time so the data could not be used.

A problem that emerged in the final stage of data cleaning was that the Survey Monkey software did not distinguish between negative responses and non-responses within the WO data set. A non-response describes missing data where a respondent failed to answer a question that he/she should have answered (either intentionally or unintentionally). A negative response, by contrast, occurs when a participant does not answer a question because the response does not apply to him/her. The structure of the WO survey was such that respondents were asked to "select all that apply" on several occasions. For example, Question 11 "What method does your municipality use for filtration of source water? Choose all that apply." required select respondents to indicate all methods of filtration used by their communities (see Table 1).

In Table 1, Survey Monkey did not distinguish between a respondent deliberately leaving an option blank because it did not apply to him/her (e.g., the "Nanofiltration" option for Communities 1, 2, and 3 in Table 1), and a respondent simply skipping the entire section (e.g., Community 4 in Table 1). The exported data file would only indicate whether a respondent "agreed" with an option. This created a situation in which the analyst could not distinguish how many times a WO responded negatively to a block of questions or whether he/she skipped the entire section. When the data was exported to analytical software, identical values for negative responses and non-responses made analysis for some questions impossible. The statistical tests used by the analyst required the respondent be able to "count" the negative responses in a block of questions. As a result, the analyst had to recode sections of the survey to distinguish between non-responses and those that were appropriately left blank.

Table 1: Exported Survey Monkey Values

	Q11: What method does your municipality use for filtration of source water?				
	Sand	Microfiltration	Nanofiltration	...	None
Community 1	Yes	Yes			
Community 2					Yes
Community 3		Yes			
Community 4					

Table 2: Negative Responses vs. Non-Response

	Q11: What method does your municipality use for filtration of source water?				
	Sand	Microfiltration	Nanofiltration	...	None
Community 1	Yes	Yes	No	No	No
Community 2	No	No	No	No	Yes
Community 3	No	Yes	No	No	No
Community 4	Missing	Missing	Missing	Missing	Missing

In order to resolve this issue, the analyst had to determine which blank cells were negative responses, and which cells were non-responses. The analyst inferred this from whether the respondent had answered any of the questions in the block. If the respondent had indicated a single option was relevant to his/her community, then the blank responses were interpreted as

negative responses (e.g., Communities 1, 2, and 3 in Table 2). If the respondent had not selected any of the options, then the blank responses were treated as missing values (e.g., Community 4 in Table 2).

It is important to note that this approach to coding the data is not infallible. In situations in which a respondent failed to indicate a relevant option (e.g., the respondent "mis-clicked" or Survey Monkey did not save the information), then their responses to the question would be considered missing data. However, the trade-offs of this approach were deemed reasonable for several reasons:

1. This approach would not add false "positive" responses to the survey. In other words, respondents would never be indicated as using a technology that he/she did not.
2. The worst-case scenario for this approach (i.e., a respondent's negative response being counted as a non-response when he/she appropriately left a question blank) is what would be happening anyway. Hence, there is no "cost" associated with this approach.
3. Without this approach, much of the analysis would be functionally impossible.

Thus, this approach to addressing Survey Monkey's erroneous conflation of non-response and negative responses was seen as both reasonable and necessary for the current project.

3.2 Data Analysis

The analyst used International Business Machines Statistical Package for the Social Sciences (IBM SPSS) version 21 for all quantitative data analysis. This program was chosen as it had sufficient tools for conducting the necessary statistical tests for data analysis (discussed further in the Technical Appendix). Qualitative data analysis was done with Microsoft Excel 2007. The qualitative data could not be coded into categories due to an inadequate number of responses; therefore, qualitative data was reported without additional analyses used to parse the information into groups.

3.3 Missing Value Analysis

The researchers conducted a missing value analysis of the data set to look for patterns in the missing data, and to get an idea of which questions were not being answered. This was challenging for this particular study, as the survey design allowed for respondents to legitimately skip several questions. For example, if the researchers did not identify having "wood pipes"

(Question 27), they were instructed to skip questions regarding the circumference of their "wood pipes" (Question 28). Because of this methodological decision, the researchers first wanted to establish a baseline assessment of missing data in order to understand the upper limit of how much data was potentially missing. To do this, the researchers first analyzed the entire data set for any missing quantitative values that occurred more than 0.001% of the time. This analysis strategy would over-represent the "missing data" problem, as any and all missing data would be counted toward this figure, irrespective of whether respondents should have been answering that question. This preliminary step of examining missing values revealed that 17.53% of all potential values were missing. Although this number reflects a modest amount of missing data, this was expected to decline with subsequent steps.

The researchers went through the survey and eliminated any questions that a respondent would only be required to answer in select circumstances from the missing data analysis. The following questions were omitted from the analysis: Question 21 "What was the reason(s) for your municipality's/LSD's boil water advisory(ies)?" and Question 36 "Which of the following methods does your municipality/LSD use for leak detection?". Not all respondents were expected to answer these questions, which meant that those questions artificially inflated the non-response bias. Once this series of questions were eliminated, missing data values fell to 14.61%.

For the final step of the missing data analysis, the analyst reviewed questions that were commonly skipped. For example, the most commonly skipped question was Question 19 "What are the barriers to repairing your LSD's/Municipality's water treatment system? Choose all that apply." Approximately 80% of respondents did not reply to this question. The reason for this omission may be because the majority of respondents indicated in Question 18 that all parts of their water treatment system were working and not in need of repair, therefore, Question 19 would not have been applicable to most respondents.

Question 35 "Does your municipality/LSD have an organized leak detection program?" was skipped ~50% of the time. The reason for this omission was unclear as it provided an exhaustive list of possibilities. Question 45 "Does your municipality/LSD have a written formal maintenance plan for its water distribution infrastructure (e.g. pipes, valves, etc.)?" was skipped ~15% of the time, even though its options were similarly exhaustive. Ultimately, it is unclear

why these questions were skipped as the researchers cannot determine a motivating factor for their omission.

Question 41 (“How often does the Department of Environment and Conservation test your municipality’s/LSD's water?”) was skipped ~30% of the time and Question 42 (“How often does the Department of Service NL test your municipality’s/LSD's water?”) was skipped ~20% of the time. The survey did not provide a “Never” option for this question (because all public water systems are tested by both Department of Environment and Conservation and Service NL), so it is possible that uninformed respondents could not find an answer that represented their community’s situation. While the researchers *did*, however, provide an “Other” option (which would include any response not listed within the options by default) it is unlikely but conceivable that the options were not perceived as sufficient. In a similar vein, when the researchers asked Question 50 “Who provides you with information about new technologies for drinking water systems? Choose all that apply.” there was no option to reflect the possibility that no one provided the respondent with such information. The absence of such an option could explain why this question was skipped ~20% of the time. Similarly, Question 22 “Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?” was skipped ~20% of the time. This could be due to the lack of an “I don’t know” option for the question.

Approximately 20% of respondents either skipped or declined to answer Question 55 “What is your salary range for your position as water operator?” It may be easier to infer why this question was skipped given its personal nature. The frequency that this question was “skipped” fell below 5% once the researchers separated respondents who indicated that they preferred not to answer the question from those who had skipped the question entirely.

3.4 Approaches to Analyzing the Data

In addition to compiling basic descriptive statistics of the survey results (presented in 10.0 Municipalities/LSD Descriptive Statistics Appendix), the research team employed several approaches to investigate differences in responses between researcher-defined groups. The researchers identified significant group differences (e.g., community type, total population), and compared the groups on variables of interest. These comparisons were largely *a priori* and mirrored the parallel group classification process used in the Community Administrator survey.

Six areas of comparison were used to develop the various questions: 1) municipalities vs. LSDs; 2) whether the population was >1000/≤1000 people; 3) which MNL region a community was from[3] (collapsed into Labrador/Western/Northern, Central, and Eastern/Avalon); 4) whether a WO was certified (i.e., whether the WO had been formally trained or was in the process of being formally trained); 5) whether there was a BWA for the community within the previous four years; and 6) whether the WO was a Full Time employee, Part Time employee, or Volunteer. For each of these areas of comparisons, data was analyzed and the results were used to inform the discussion. For further information on this process, or to search for statistical outcomes on specific analyses, please consult the Technical Appendix.

4.0 Results for Community Types

There are 319 communities in the province with a permit to operate a drinking water system (i.e., communities with a WO). From these communities, a total of 71 surveys were received (a 22.25% response rate).[4] In situations where two complete surveys were submitted (this occurred when surveys were answered by multiple respondents in a community), the most recent survey responses were used.

4.1 Snapshot of LSDs

4.1.1 Demographics and Overview of Water System

A total of 15 LSDs (21.3% of the total respondents) provided information for the WO survey. In general, these communities were equally distributed across the regions of the province and had populations as high as 750 people, although most indicated that their communities consisted of <200 people. WOs in LSDs tended to be Volunteers and were more likely to indicate that they did not have formal training for their position. Additionally, most responding LSDs indicated that they did not filter their source water and did not provide any additional treatment past disinfection. LSDs were mixed in indicating whether they had a standard operating procedures or maintenance plans for the operation of their water systems.

[3] http://nlwater.ruralresilience.ca/wp-content/uploads/2013/04/MNL-Regions.jpg
[4] Please see http://www.env.gov.nl.ca/env/waterres/training/adww/2014/04_Paula_Dawe.pdf for a presentation regarding the role and function of NL Water Operators.

4.1.2 Water Contamination

LSDs generally indicated that all parts of their water treatment system were working properly (92.31%) and were very likely to indicate that they had experienced a BWA during the past four years (93.33%). The reason for these BWAs tended to vary, with individual WOs attributing them to various factors without a strong preference been shown for one reason or another.. WOs from LSDs usually indicated that they were "Always" aware of the provincially-released drinking water quality reports as well as the bacteriological reports. The age of the equipment used by LSDs were varied, but water distribution pipes and chlorination equipment tended to be no older than a decade. Water tended to reach water plants/distribution systems through a pumping system, and LSDs provided divided responses when asked whether demand for water may exceed the design of their water distribution system. LSDs were also similarly divided on whether the piping distance between the last user and the disinfection system presented a problem, with the majority suggesting that distance is not an issue for maintaining disinfection residual.

4.1.3 Leaks and Infrastructure

LSDs were divided on how often leaks occur within their respective communities, but LSDs generally indicated that they did not conduct any proactive leak detection. The majority of LSDs (57.1%) indicated that they do not do leak detection and only 16.7% have an organized leak detection program; 83.3% only do leak detection when leaks or problems occur. When leak detection was performed, LSDs tended to use a variety of methods with no specific preferred method (e.g., Sound Testing 57.14%; Waste Metering 28.57%; Step Testing 28.57%).

LSDs also provided mixed responses when asked whether they have an annual valve operating maintenance program (only 26.67% said "Yes") or whether they flush their water distribution lines regularly (35.71% of LSDs never flushed their lines). WOs tended not to indicate that they tested chlorine residual with any particular frequency (i.e., various communities had their water tested annually, semi-annually, monthly). Additionally, LSDs tended to indicate that Service NL tested their water monthly. The WOs of LSDs tended not to have maps of their piping infrastructure and gave mixed responses when asked whether they had sufficient resources and access to training opportunities. In terms of satisfaction and compensation, WOs reported a variety of outcomes and none were particularly dominant.

When asked about non-financial issues facing their water distribution systems, LSDs tended to provide a variety of answers (see Table 3), with age of the system and leakage being LSD WOs' most dominant concerns.

Table 3: LSDs Indicating the Biggest Non-Financial Issue for their Water System

	Count	%
Age of the system (e.g., corrosion)	11.00	73.30%
Leakage	6.00	40.00%
Lack of maps/drawings (As-Builts) of infrastructure	5.00	33.30%
Maintenance	2.00	13.30%
My water distribution system does not need repairs	2.00	13.30%
Serving small population over large geographic areas	2.00	13.30%
Lack of human resources	2.00	13.30%
Other (please specify)	1.00	6.70%
Source water quality	1.00	6.70%
I don't know	0.00	0.00%
Knowledge of system	0.00	0.00%

4.1.4 Threats to Water Supply

Finally, LSDs tended to give mixed responses when asked about threats to their drinking water sources and drinking water systems. Respondents were presented with a series of potential threats and were asked to indicate whether they were perceived as threats (respondents answered with "Yes" or "No"). Domestic woodcutting (26.67%), Recreational use (26.67%), and Extreme weather events (26.67%) were indicated as the most concerning issues; however, there was a lack of consensus that these things were "threats". In other words, while some activities were more likely to be rated as a threat, there was a lack of general agreement about whether these activities constituted a threat to LSDs' drinking water.

4.2 Snapshot of Municipalities

4.2.1 Demographics and Overview of Water System

A total of 56 Municipalities (78.87% of the respondents) provided information for the WO survey. These communities were most likely to be located in the Avalon and Central regions, and least likely to be located in the Eastern, Northern, and Labrador regions. Municipalities' populations were highly varied, with several having less than 200 residents and

several being home to more than 10 000 people. Generally, WOs from municipalities tended to be full time employees who had worked as a WO between 1 and 20 years, and were more likely to possess Class I certification than any other type of certification.

Municipalities tended to rank their own local water systems as their most used water source and also tended to indicate that they treat their drinking water. Municipalities did not, however, have a uniform method for treating drinking water, and about half of municipalities did not treat their water beyond the disinfection stage. Moreover, there was no uniform method amongst municipalities for disinfecting water, although they more frequently indicated that they used Gas Chlorination (57.7%) over other forms of disinfection. Municipalities tended to indicate that they had standard maintenance plans and operating procedures for their water systems, and also to indicate that all elements of their water treatment systems were operating correctly. When municipalities' drinking water treatment systems were not working correctly, the reasons centred on financial constraints (75.0%) or the availability of parts (25.0%).

The ages of the different pieces of equipment that comprised municipalities' water systems were varied according to respondents, but water distribution pipes, chlorination equipment, and filtration systems tended to be less than a decade old. Municipalities' most common infrastructure material appeared to be Ductile Iron (67.86%), although several municipalities also indicated that they used Polyvinyl Chloride (PVC) (57.14%). Municipalities were also more likely to use a gravity fed system and tended to indicate that the demand for water did not exceed their systems' capacity to provide it. And although the piping distance between the last user and the last chlorine booster tended to vary amongst communities, Municipalities often indicated that the distance did not pose a problem.

4.2.2 Water Contamination

Municipalities were likely (79.2%) to have experienced a BWA during the past four years, and most commonly identified "scheduled maintenance" as the cause (although reasons were varied amongst municipalities). Municipalities indicated that they were unlikely (26.2%) to issue precautionary BWAs (for reasons other than regular flushing and maintenance), and were also likely to indicate that they were "Always" aware of drinking water quality reports as well as bacteriological reports released by the provincial government (86.79%).

4.2.3 Leaks and Infrastructure

Most municipalities indicated that they experienced "1-2" leaks in 2012, and the majority of municipalities indicated that they only conduct leak detection when there is a problem. While there was no clear standout for a "preferred method of leak detection", municipalities tended to use Ground sounding and Manual sounding somewhat frequently. Most municipalities did not perform annual valve operating maintenance, but were more likely than not to flush their distribution lines twice yearly. When asked about the biggest non-financial issue in their water system, municipalities tended to indicate that the Age of the system (e.g., corrosion) was a significant challenge (see Table 4).

Table 4: Municipalities Indicating Biggest Non-Financial Issue to their Water Systems

	Count	%
Age of the system (e.g., corrosion)	39.00	70.90%
Lack of maps/drawings (As-Builts) of infrastructure	14.00	25.50%
Leakage	13.00	23.60%
Source water quality	11.00	20.00%
Maintenance	8.00	14.50%
Serving small population over large geographic areas	7.00	12.70%
Lack of human resources	5.00	9.10%
My water distribution system does not need repairs	4.00	7.30%
Knowledge of system	2.00	3.60%
Other (please specify)	1.00	1.80%
I don't know	0.00	0.00%

Municipalities were likely to report testing the chlorine residual twice daily in two separate locations (76.0%). Additionally, municipalities indicated that they were regularly visited by DOEC as well as Service NL (Quarterly and Monthly, respectively). Municipalities tended to be equally divided on whether or not they possessed a full map of their water distribution system. However, only 14.89% of municipalities indicated that they had a written formal maintenance plan for their water systems. Meanwhile, 75.0% of municipalities indicated that they had a designated office for water system information. Municipalities also tended to indicate that "to some degree" they had sufficient resources to operate their water system, felt that they were provided with adequate training opportunities through the province/local communities, and that information about new technologies for water systems was communicated "reasonably well". Information on these new technologies was not exclusively obtained from any one source;

municipalities provided mixed feedback that suggested that the Atlantic Canada Water and Wastewater Association and Companies/Industries were somewhat frequent sources of information. The most frequently indicated method of disseminating information was Workshops and Conferences, although Email and Other WOs also played an important informational role. Municipal WOs were likely to rate their job satisfaction as "Somewhat content" and "Very content" and to indicate their salary was between $30 000-39 999 (they provided mixed responses as to whether they received benefits).

4.2.4 Threats to Water Supply

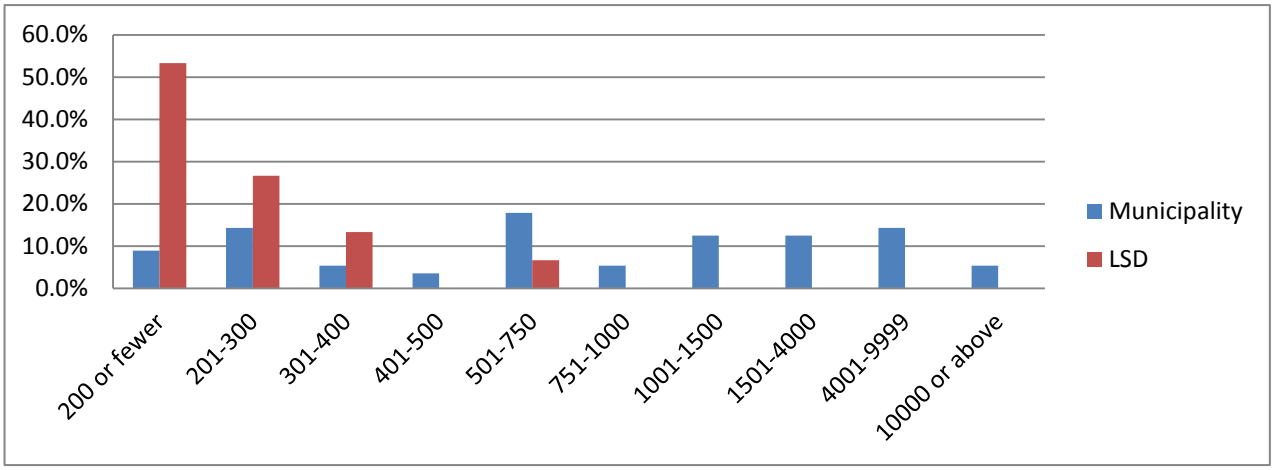
Finally, municipalities tended to give mixed responses when asked about what they saw as threats to their drinking water sources and their drinking water systems. Generally, Aesthetics/visual quality of water (41.5%), Beaver dams (35.8%), and Recreational use (29.4%) were respondents' most pressing concerns. However, there was a lack of consensus on whether these concerns were "threats", and most other "threats" were dismissed as not being an issue. In no situation did municipalities strongly agree about the presence of a specific threat.

5.0 Results for Group Comparisons

5.1 Municipality vs. LSD

Communities were asked to identify as either a Municipality or a LSD (Question 1), and the researchers used this classification to investigate specific differences between community types. Out of 71 respondents, 56 indicated that their community was a municipality (78.87%), while the remaining 15 indicated that their community was a LSD (21.13%). A major distinction between municipalities and LSDs was their relative populations. On average, LSDs were far more likely to report having a population of 200 people or fewer (see Figure 1). Municipalities and LSDs were normally distributed across all of the province's regions, which means that each provincial region had a comparable mix of community types.

Figure 1: LSD/Municipality - Population Comparisons



When asked questions regarding the characteristics of WOs, several important distinctions emerged between the community types. While 82.14% of municipalities had Full time WOs, 73.33% of LSDs reported having Volunteer WOs. Both LSDs and municipalities were similarly likely to have part time WOs. When asked to specify what their position was, many municipal respondents identified as a WO (48.21%). In contrast, LSDs were more likely than municipalities to indicate that their job was "Water Operator/Councillor" (13.33% vs. 0.00%). On average, municipalities and LSDs were comparable in terms of how long their WOs had been in their position; however, municipalities were more likely to report that their WOs were Certified (i.e., possessing at least Operator in Training, or OIT, ranking), as 60.00% of LSDs indicated that they did not have formal training. Both municipalities and LSDs were likely to indicate that their WOs were content with how they were compensated for their services, although municipalities were more likely to indicate that their positions included benefits, and LSDs were more likely to indicate that they were paid less than $10 000 annually.

In general, both LSDs and municipalities indicated that they felt that they had adequate access to WO training opportunities. Furthermore, both community types indicated that they had sufficient resources to operate a water system in their community effectively, and both indicated a comparable level of confidence in terms of how informed they were about new water-related technologies. However, 40.00% of the LSD respondents indicated that they did not know whether new drinking water related technologies were effectively communicated. Municipalities were more likely than LSDs to report that they were provided with new information via

companies and industry as well as through other WOs, which may suggest that LSDs do not have access to the same training resources. Moreover, municipalities were more likely than LSDs to report that they had access to this information via email and workshops/conferences. LSDs were more likely than municipalities to report that they had either never heard of the Annual Drinking Water Workshop, or had never been able to attend this workshop (see Table 5). The fact that well over half of LSDs indicated that they had never attended the Annual Drinking Water Workshop may help explain why such a large percentage of them "did not know" how well information on new technologies was communicated to them.

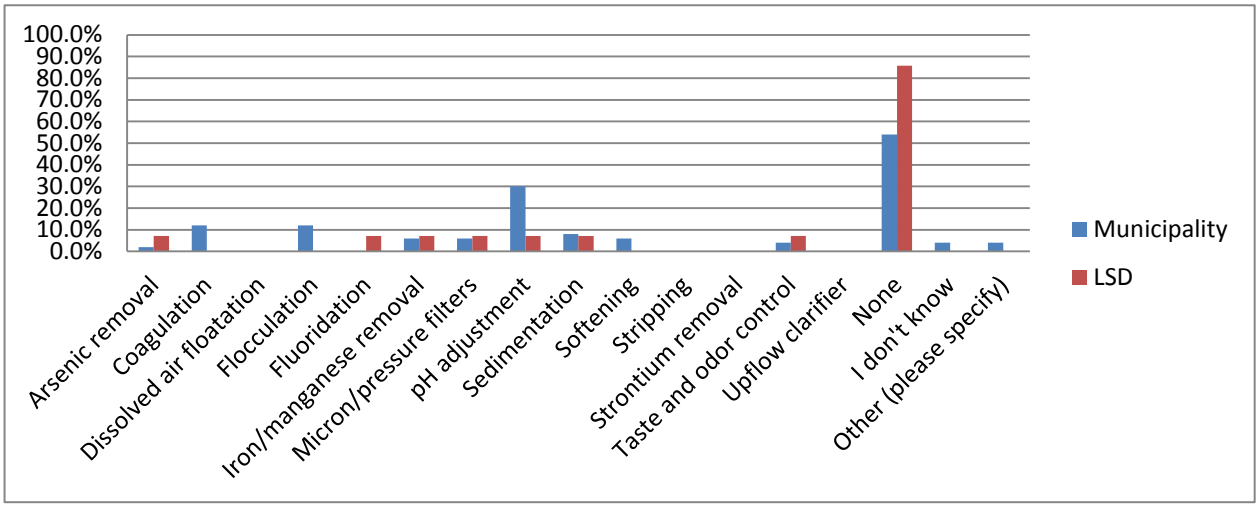
Table 5: LSD/Municipality - Annual Drinking Water Workshop Attendance

	Municipality		LSD	
	Count	%	Count	%
Yes, I attend yearly	24	43.64%	1	6.67%
I attend almost every year	19	34.55%	3	20.00%
I rarely attend	9	16.36%	2	13.33%
Never attended, but have heard of it	3	5.45%	5	33.33%
Never heard of workshop	0	0.00%	3	20.00%
Never had the opportunity to attend	0	0.00%	1	6.67%

In terms of water usage, 91.07% of municipalities reported that the majority of households in their community used the public water system as their primary drinking water source (rather than alternatives such as springs and bottled water). In contrast, while LSDs also rated this water type as the most prevalent, they did so at a significantly lower rate of 64.28%. In other words, although LSDs and municipalities both used the public drinking water system as their primary drinking water source, LSDs were more likely to seek alternative sources (e.g., 21.42% of LSDs also used Private Sources, with the remainder being divided between Spring water and Bottled water).

Municipalities and LSDs demonstrated considerable similarities when asked to provide information on their filtration systems. The only significant difference identified from this series of questions was that LSDs were less likely (on average) than municipalities to filter their water. Community types varied on type of disinfection system used. There was not a single LSD or municipality that indicated that they did not disinfect their water, although many (54% of municipalities and 85.7% of LSDs) did not treat their water past this basic disinfection stage (Figure 2).

Figure 2: LSD/Municipality - Water Treatment Beyond Disinfection

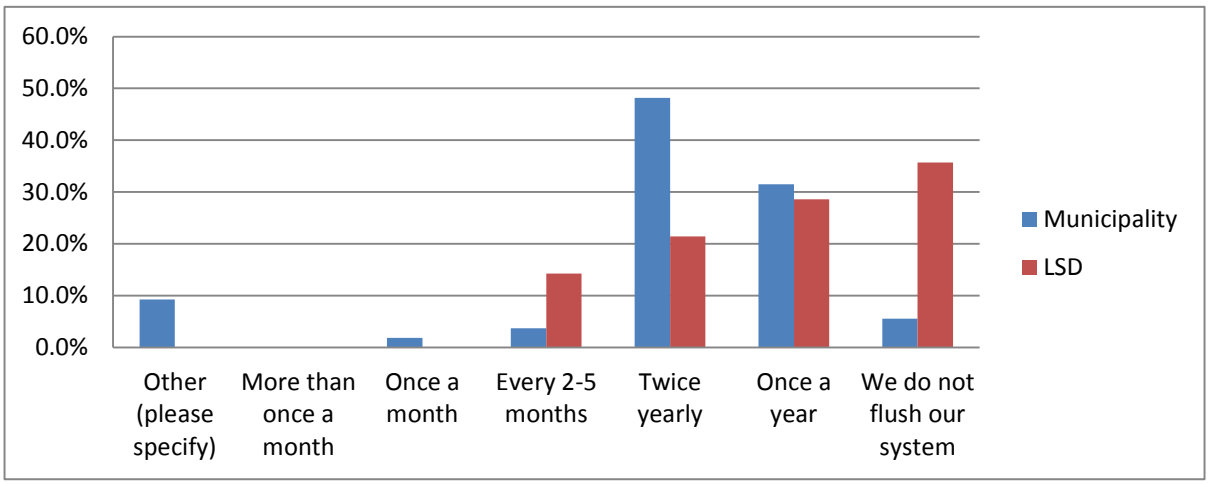


Municipalities were more likely than LSDs to have full maps of their pipe infrastructure, while LSDs were more likely to report that they did not have any maps. Similarly, municipalities were more likely to indicate that they had a designated office or filing area for drinking water system information (75% of municipalities have a designated area vs. 26.7% of LSDs). Municipalities were also more likely to have a maintenance plan for the operation of their water system. Only 14.9% of municipalities had a written formal maintenance plan for their water distribution infrastructure, while no LSDs have such a written plan. Additionally, municipalities were also more likely to report that their water treatment facility was maintained Daily or Weekly, while LSDs were more likely to report their facilities were maintained Twice a Month or Other. However, both community types were just as likely to have a standard operating procedure.

In terms of leaks, LSDs were more likely than municipalities to indicate that there were no leaks in 2012. The two community types were comparable in regards to the frequency with which leak detection was conducted, and whether there was an organized leak detection initiative. While LSDs were more likely than municipalities to use Deacon meters, both community types tended to employ similar leak detection processes and procedures, and both community types tended to answer similarly when asked whether they had an annual valve operating/maintenance program. At the same time, however, LSDs were more likely to indicate

that they did not flush their water systems (see Figure 3) and were more likely to only test the chlorine residual Weekly, compared to municipalities, who checked their chlorine residual twice daily from different locations.

Figure 3: LSD/Municipality - Frequency of Flushing Water Distribution Lines



Both types of communities reported a comparable level of functionality when asked whether their system parts were working correctly, and both communities answered similarly when asked to identify barriers to their systems (see Table 6). Municipalities were more likely than LSDs to indicate that their water pipes were comprised of Ductile Iron or Copper and to use a gravity-fed system. In contrast, LSDs were more likely than municipalities to indicate their pipes were made of Polypropylene and to use a pumping system. Both community types answered similarly when asked whether the current demand for water exceeded their systems' design (13.70% of municipalities and 33.33% of LSDs indicated their water systems were over-capacity). Additionally, both community types responded similarly when asked whether the distance between the disinfection system and the last user was an issue for their water systems (35.80% of municipalities and 26.7% of LSDs indicated that the distance was a problem).

Table 6: LSD/Municipality - Barriers to Repairing Water System

	Municipality		LSD	
	Count	%	Count	%
Lack of financial resources	9	75.00%	3	100.00%
Lack of available parts/supplies for upgrades	3	25.00%	0	0.00%
Lack of available expertise to make changes	1	8.33%	0	0.00%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%

Municipalities and LSDs experienced a comparable number of BWAs in the past four years, and both community types indicated similar rationales for why these BWAs were issued. While there were no *statistically significant differences* between LSDs and municipalities in this regard, 40.5% of municipalities attributed BWAs to disinfection system being shut off due to maintenance, 47.6% indicated the water distribution system undergoing repairs, 23.8% cited inadequately treated water being introduced into the system, and 14.3% attributed BWAs to total coliforms. In contrast, 28.6% LSDs attributed BWAs to total coliforms, 21.4% cited a lack of free chlorine in treatment facility, 14.3% identified a lack of free chlorine in distribution system, 14.3% indicated no disinfection system, and 14.3% attributed BWAs to water distribution system or disinfection system undergoing repairs/maintenance. Additionally, both community types indicated a similar level of awareness and familiarity with water-related reports from the provincial government.

When asked to identify threats to their water supplies, there were no statistically significant differences between municipalities and LSDs. Both community types were equally likely (or unlikely) to perceive various activities, processes, or general concerns as equally threatening (see Table 7). The most common response for both types of communities with respect to land use threats was “None - no threatening land use activities”, followed by Recreational use and Domestic wood cutting. When asked about threats from natural processes, Beaver dams and Extreme weather events topped the list for municipalities, while one-third of LSDs again said “None” (followed by Extreme weather events at 27%). Aesthetics (e.g., water colour) is a concern for 42% of municipalities but only 13% of LSDs.

Table 7: LSD/Municipality - Potential Threats

	Municipality	LSD

Land Use Threats	Count	%	Count	%
Agriculture	2	3.92%	1	6.67%
Commercial forest harvesting	3	5.88%	1	6.67%
Domestic wood cutting	11	21.57%	4	26.67%
Hunting and fishing	7	13.73%	3	20.00%
Hydroelectricity (damming)	1	1.96%	0	0.00%
Mining (including quarrying)	3	5.88%	0	0.00%
Oil/gas exploration/development	3	5.88%	0	0.00%
Recreational use	15	29.41%	4	26.67%
Residential cabin development	6	11.76%	1	6.67%
Transmission lines and roads	6	11.76%	0	0.00%
None - no threatening land use activities	24	47.06%	8	53.33%
Natural Process Threat				
Beaver dams	19	35.85%	2	13.33%
Drought/low water levels	11	20.75%	3	20.00%
Extreme weather events	16	30.19%	4	26.67%
Flooding	4	7.55%	0	0.00%
Freeze/thaw	9	16.98%	3	20.00%
Salt water intrusions	4	7.55%	1	6.67%
None - no threatening natural processes	13	24.53%	5	33.33%
Other Threats				
Aesthetics (e.g., water colour)	22	41.51%	2	13.33%
Metals (e.g., lead, arsenic)	4	7.55%	1	6.67%
Organic carbon content	9	16.98%	3	20.00%
Acidity	9	16.98%	0	0.00%
Microorganisms (e.g., E. Coli)	8	15.09%	2	13.33%
Human pollution (e.g., illegal dumping)	6	11.32%	1	6.67%
Endocrine disrupting chemicals (EDCs)	1	1.89%	0	0.00%
I don't know	6	11.32%	3	20.00%
None - no threatening concerns	17	32.08%	5	33.33%
Other (please specify)	2	3.77%	2	13.33%

Overall, municipalities indicated greater access to human and financial resources that would aid in the maintenance and operation of a drinking water system and are more likely to engage in practices such as having a maintenance plan, infrastructure maps and a designated area for their water system information; regular maintenance of their water treatment systems; flushing and testing their chlorine residual twice daily. Comparatively, LSDs appeared to be content with their systems, but were less likely to maintain their systems with the same regularity that municipalities did. Another important difference between the two community types can be seen by training and access to knowledge. If other WOs are a major source of knowledge, and

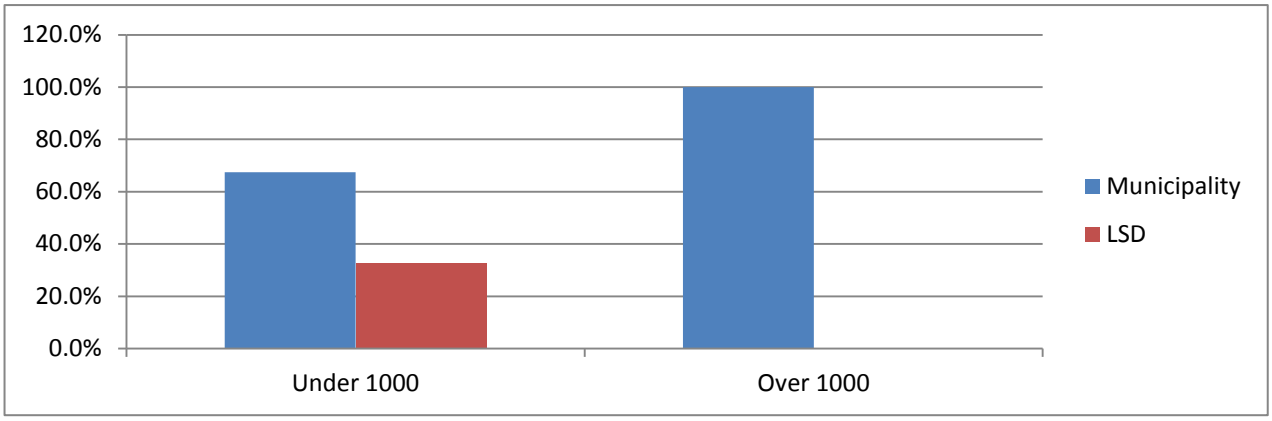
LSDs are less likely to attend WO conferences and workshops, then they may be missing considerable opportunities for knowledge transfer. These differences in the effectiveness and sustainability of water systems may be in part attributable to population differences, as larger communities may have greater access to required resources. Differences according to community size will be investigated in greater detail in the following section.

5.2 Communities of ≤1000 (COTOLs) vs. Communities Over 1000

The researchers next compared communities with more than 1000 people (>1000 Communities) and communities that had 1000 or less people (≤1000 Communities or COTOLs). Communities were classified according to information gathered from Question 3, which asked WOs to select a population interval that accurately represented their respective communities. Population was chosen as a basis of comparison to explore similarities and differences between smaller and larger communities when discussing WO topics. This comparison is not simply a replication of the LSD/Municipality divide. While LSDs were smaller than municipalities on average, municipalities were not invariably larger than LSDs. Indeed, in "Snapshot of Municipalities" section above, it was noted that municipal population sizes varied considerably.

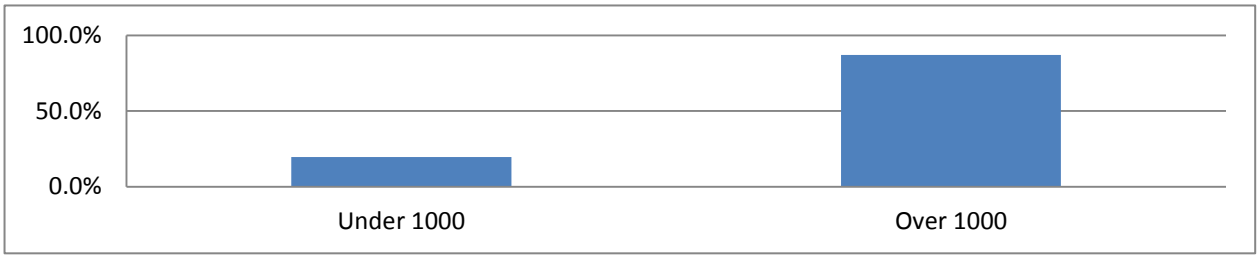
As mentioned above, >1000 Communities were more likely to be municipalities. In fact, the largest LSD community participating in this survey consisted of just 750 people, so the ≤1000 Communities group encompassed all of the LSDs and a significant proportion of the municipalities as well (55.36%). These figures indicate that a large percentage of municipalities were relatively small, and fairly comparable to LSDs in terms of population size. In total, 46 of the participating communities had populations ≤1000 (64.78%), and 25 were >1000 Communities (35.22%) (see Figure 4).

Figure 4: COTOL/>1000 - Municipality or LSD



Significant differences in WO characteristics were identified when communities were compared according to their size. Communities >1000 were more likely to employ Full time WOs while ≤1000 Communities were more likely to use Volunteers. Additionally, ≤1000 Communities were less likely to have certified WOs than the >1000 Communities group. Community size did not appear to affect position title, as WOs held similar titles in both >1000 Communities and ≤1000 Communities. WOs from both community sizes also tended to report that they had held their respective positions for a comparable period of time and both groups indicated that they were content with their compensation. However, ≤1000 Communities were less likely to offer employee benefits to their WOs (see Figure 5), and were likely to offer a significantly lower salary (even when Volunteers are ignored). This suggests that although satisfaction with being a WO may be comparable between small and large communities, the benefits and compensation for being a WO vary dramatically according to community size.

Figure 5: COTOL/>1000 Communities - Water Operator Receives Work Benefits



As for treatment and filtration, 61.9% of ≤1000 Communities but only 31.8% of >1000 Communities indicated that they did not filter their water. Neither type of community indicated they use Nanofiltration; both community sizes tended to use other forms (e.g., sand, granular activated carbon, microfiltration) at comparable rates when filtration is used. The only difference between >1000 Communities and ≤1000 Communities regarding types of filtration was that ≤1000 Communities were more likely to use anthracite coal in their filtration processes. When asked about disinfection procedures, there were several differences between differently sized communities. For example, ≤1000 Communities were more likely to favour Liquid Hypo-Chlorination when compared to >1000 Communities. Communities >1000, on the other hand, were more likely than smaller communities to favour Gas Chlorination. No community indicated that they did not use a disinfection system, although four communities failed to answer that question. When asked about processes other than disinfection that were used to treat water, >1000 Communities and ≤1000 Communities responded comparably to each other across many potential disinfection strategies (e.g., arsenic removal, coagulation, flocculation). However, >1000 Communities were more likely to indicate that they used pH adjustment.

The researchers asked several questions regarding a WO's knowledge of his/her water distribution infrastructure. Communities were provided with several options regarding the presence of maps for the water distribution infrastructure in their communities (e.g., complete map, incomplete map, GIS mapping) (see Figure 6). Both sizes of communities were comparably likely to indicate that they had complete maps of their water distribution infrastructure. However, 41.30% of ≤1000 Communities indicated that they had no maps for their water distribution systems (vs. less than 10% of >1000 Communities).

The researchers also asked a series of questions regarding accessibility of information and water system functionality. Both >1000 Communities and ≤1000 Communities were equally likely to report having a designated office or filing area for water system information. Additionally, both community sizes indicated that there was a standard operating procedure for water plant operations (>1000 81.82%; ≤1000 76.09%) and both reported similar maintenance levels for their treatment plants (e.g., daily, weekly). Furthermore, >1000 Communities and ≤1000 Communities indicated similar level of functionality for all parts of their water systems, and reported similar barriers to repairing their systems (particularly financial barriers, as illustrated in Table 8). However, >1000 Communities were more likely to have a formal

maintenance plan for their water distribution infrastructure and their water treatment systems (28.57% vs. 2.50%).

Figure 6: COTOL/>1000 Communities - Communities Indicating Maps of Infrastructure

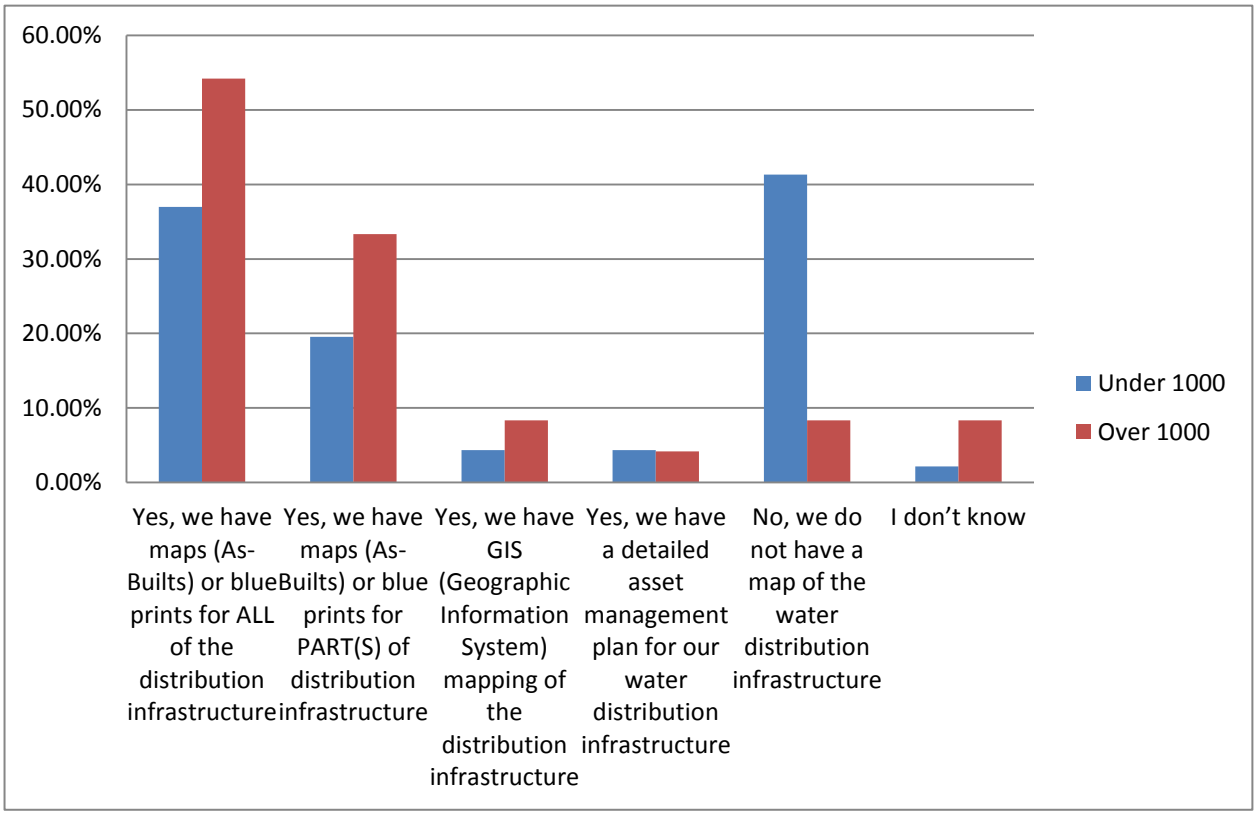


Table 8: COTOL/>1000 Communities - Barriers to Repairing Water System

	≤1000		>1000	
	Count	%	Count	%
Lack of available expertise to make changes	0	0.00%	1	25.00%
Lack of available parts/supplies for upgrades	3	27.27%	0	0.00%
Lack of financial resources	9	81.82%	3	75.00%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%

The researchers also asked a series of questions addressing age of the water distribution infrastructure. Although the >1000 Communities and the ≤1000 Communities responded comparably regarding the age of their water distribution infrastructure, there were some differences. >1000 Communities were more likely to indicate that their pumps were at least 41 years old, while ≤1000 Communities indicated that their pumps were comparably newer. However, >1000 Communities were more likely to indicate that their newest chlorination equipment was relatively young (i.e., 0-10 years old). With regards to material, >1000 Communities were more likely than ≤1000 Communities to indicate their distribution system was made of Steel, Ductile Iron, Cast Iron, or Copper. In terms of water delivery, ≤1000 Communities were more likely to indicate the usage of a Pumping System than >1000 Communities, but it is unclear what effect (if any) this has on service delivery as both community sizes believed their water systems were adequate. Additionally, both communities indicated comparable distances between their system's final chlorine booster station and the last user, and ~70% of >1000 and ≤1000 Communities indicated that maintaining disinfection to the last water user was not a problem.

Other areas of interest were the frequency of BWAs and how a community would deal with a water leak. There were no differences between >1000 Communities and ≤1000 Communities in terms of BWA frequency for the past four years. In other words, whether or not a community would have a BWA issued on its drinking water did not appear to be related to community size. Generally, ≤1000 Communities and >>1000 Communities indicated that when BWAs did occur, they occurred for similar reasons (e.g., disinfection system shut off due to maintenance, water distribution system undergoing maintenance). Both community sizes indicated that they were unlikely to issue precautionary BWAs (≤Communities 33.33%; >1000 Communities 23.53%). Finally, the two community sizes indicated they were comparably aware of provincially-released bacteriological reports/water quality reports.

When asked about leakages, ≤1000 Communities were more likely to report only 3-4 leaks, while >1000 Communities were more likely to report 11+ leaks. The discrepancy in leak frequency is understandable considering the size differences between the two types of communities. While larger communities report more leaks, those same communities generally have a larger water distribution system for leaks to appear in. Several differences existed between the community sizes when it came to leak detection methods: >1000 Communities were

more likely to use Leak Noise Correlator and ≤1000 Communities were more likely to use Step Testing. Besides these differences, both community sizes were similarly likely to use any of the other leak detection approaches. Both community sizes indicated a comparable frequency of operating an annual valve maintenance program. However, >1000 Communities were more likely to flush their lines once a year, while ≤1000 Communities were more likely to indicate that they never flushed their lines. The reason why ≤1000 Communities were more likely to never flush their lines was not investigated in the survey, but could be an interesting topic for future research (it may be lack of technical expertise, lack of equipment, etc.). >1000 Communities were more likely to test chlorine residual at two locations daily, while ≤1000 Communities were less likely to do this. Both community sizes indicated that Service NL and DOEC tested their communities' water at a similar rate (i.e., the rate at which Service NL tested a community's water did not differ based on community size). Finally, the researchers asked about non-financial issues for a water distribution system and both community types responded similarly (see Table 9).

Table 9: COTOL/>1000 Communities - Non-Financial Issues for Water System

	≤1000		>1000	
	Count	%	Count	%
Age of the system (e.g., corrosion)	31	67%	19	79%
Knowledge of system	2	4%	0	0%
Lack of human resources	5	11%	2	8%
Lack of maps/drawings of infrastructure	14	30%	5	21%
Leakage	13	28%	6	25%
Maintenance	5	11%	5	21%
Other (please specify)	1	2%	1	4%
Small population, large geographic area	5	11%	4	17%
Source water quality	7	15%	5	21%
None – my community has no major issues	6	13%	0	0%

Partially because of the differences between LSDs and municipalities regarding professional growth opportunities for WOs, the researchers paid special attention to these particular questions when investigating differences between community sizes. Both >1000 Communities and ≤1000 Communities indicated that they had sufficient resources to effectively operate their water systems and that sufficient provincial/local access was provided for training opportunities. They also saw communication of new water technologies as comparably effective.

However, several differences emerged when WOs were asked "who" provided them with information regarding new technologies for drinking water systems. On average, >1000 Communities were more likely than ≤1000 Communities to indicate that they learned about these technologies from Other professional organizations, Companies/Industries, and Other WOs. When WOs were asked *how* new technologies were communicated to them, >1000 Communities were more likely to indicate Workshops/conferences and Other WOs than ≤1000 Communities were. All >1000 communities had attended the Workshop at least once (100%), while 26.09% of ≤1000 WOs responding to the survey had never attended the workshop (see Table 10).

Table 10: COTOL/>1000 Communities - Workshop Attendance

	≤1000		>1000	
	Count	%	Count	%
Yes, I attend yearly	14	30.43%	11	45.83%
I attend almost every year	12	26.09%	10	41.67%
I rarely attend	8	17.39%	3	12.50%
Never attended, but have heard of it	8	17.39%	0	0.00%
Never heard of workshop	3	6.52%	0	0.00%
Never had the opportunity to attend	1	2.17%	0	0.00%

The researchers asked WOs a series of questions regarding land use threats to drinking water, natural threats to drinking water, and other concerns regarding drinking water/drinking water system. In terms of land use activities, the only difference between the community sizes was that >1000 Communities were more likely to identify Residential Cabin Development as a threat when compared to ≤1000 Communities. With regards to natural processes, ≤1000 Communities seemed decidedly less concerned with such problems as they were more likely than >1000 Communities to indicate that no natural processes were a threat to their drinking water. When asked about other concerns to their drinking water systems, >1000 Communities were more concerned about water aesthetics than ≤1000 Communities, but beyond this there were no significant differences for the communities based on size (see Table 11).

Table 11: COTOL/>1000 Communities - Potential Threats

	≤1000		>1000	
Land Use Threat	Count	%	Count	%
Agriculture	2	4.55%	1	4.55%
Commercial forest harvesting	3	6.82%	1	4.55%
Domestic wood cutting	10	22.73%	5	22.73%
Hunting and fishing	6	13.64%	4	18.18%
Hydroelectricity (damming)	0	0.00%	1	4.55%
Mining (including quarrying)	1	2.27%	2	9.09%
Oil/gas exploration/development	1	2.27%	2	9.09%
Recreational use	11	25.00%	8	36.36%
Residential cabin development	2	4.55%	5	22.73%
Transmission lines and roads	2	4.55%	4	18.18%
None - no threatening land use activities	25	56.82%	7	31.82%
Natural Process Threat				
Beaver dams	12	26.67%	9	39.13%
Drought/low water levels	7	15.56%	7	30.43%
Extreme weather events	11	24.44%	9	39.13%
Flooding	1	2.22%	3	13.04%
Freeze/thaw	5	11.11%	7	30.43%
Salt water intrusions	2	4.44%	3	13.04%
None - no threatening natural processes	16	35.56%	2	8.70%
Other Threats				
Aesthetics (e.g., water colour)	9	20.45%	15	62.50%
Metals (e.g., lead, arsenic)	3	6.82%	2	8.33%
Organic carbon content	7	15.91%	5	20.83%
Acidity	3	6.82%	6	25.00%
Microorganisms (e.g., E. Coli)	6	13.64%	4	16.67%
Human pollution (e.g., illegal dumping)	4	9.09%	3	12.50%
Endocrine disrupting chemicals (EDCs)	1	2.27%	0	0.00%
I don't know	5	11.36%	4	16.67%
None - no threatening concerns	18	40.91%	4	16.67%
Other (please specify)	3	6.82%	1	4.17%

In summary, there appear to be some notable differences between ≤1000 Communities and >1000 Communities. Generally, >1000 Communities appear have WOs who are more likely to be compensated for their work, paid more, and are more trained/educated. Both community sizes were likely to treat their water and often used similar strategies to do so. While >1000 Communities generally performed a higher rate of maintenance on their systems, there tended to be a high degree of overlap in what ≤1000 Communities and >1000 Communities perceived as issues with their systems and how leak detection was usually done. In terms of perceived threats

to drinking water supplies, ≤1000 Communities were more likely to believe that there were few threats to their drinking water systems/sources.

5.3 Region vs. Region

The researchers were curious if regional differences would manifest themselves in responses that WOs gave regarding a variety of topics. Initially, regional data was compiled according to which MNL region respondents had selected to identify their respective communities (Question 4). The response rate across the province was non-uniform and resulted in the following distribution: Avalon (18 respondents), Eastern (8 respondents), Central (22 respondents), Western (13 respondents), Northern (4 respondents), and Labrador (6 respondents). This presented a potential calculation issue when investigating regional differences. Essentially, the low number of respondents for some regions combined with precautions against inflated Type I error (i.e., Bonferroni corrections) would severely reduce the power of these types of analyses. To compensate for this potential issue, the researchers categorized Regions as Avalon/Eastern (26 respondents), Central (22 respondents), and Western/Northern/Labrador (23 respondents). This would "boost" the number of respondents in each category and would reduce the number of cell comparisons (reducing the number of Bonferroni corrections).

It is important to note that while some regions of NL have very different total populations than others, these differences disappeared when regions were collapsed into single categories. As such, the researchers found that there were no significant demographic differences amongst these regions in terms of the proportion of LSDs and municipalities, nor were there any population differences between the regions. These results would suggest that the classification used by the researchers was not unduly affected by community size or community type (see Figure 7).

There were no substantial regional differences for any of the questions pertaining to WO characteristics. Regions were equally likely to have Full time, Part time, and Volunteer employees; have similar job titles; have a comparable rate and levels of certification; be similarly compensated; have similar levels of benefits; and be similarly content with their compensation levels.

Figure 7: Regional - Community Type

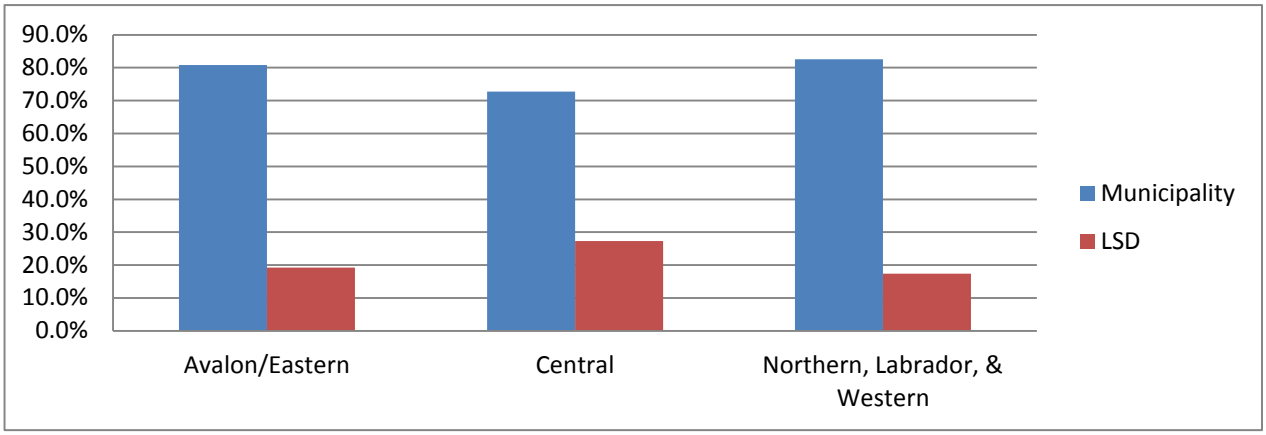
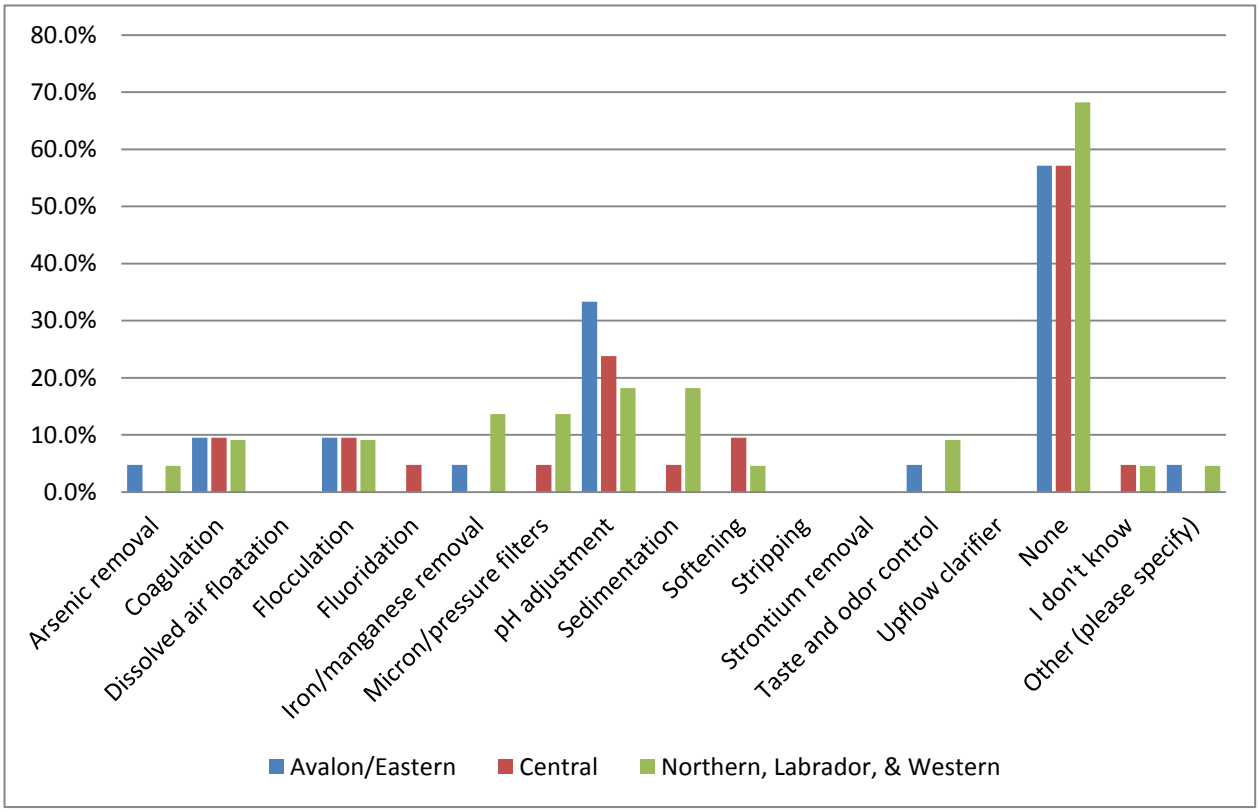


Figure 8: Regional – Water Treatment



When asked about their water supply, the only regional difference was that Western/Northern/Labrador were more likely than Central to indicate Spring Water as their third choice. Regions did not indicate any differences regarding their filtration approaches, nor were there any regional differences regarding whether water was treated/disinfected/filtered. There were several instances in which all participants indicated the same response: no community in any region identified Nanofiltration as a method used to filter water, and no community in any region indicated that they did not disinfect their water. Additionally, there were no communities in any region that used dissolved air floatation, stripping, strontium removal, or up-flow clarifier as an additional method for treating water. Regions were largely homogenous in terms of water treatment (see Figure 8).

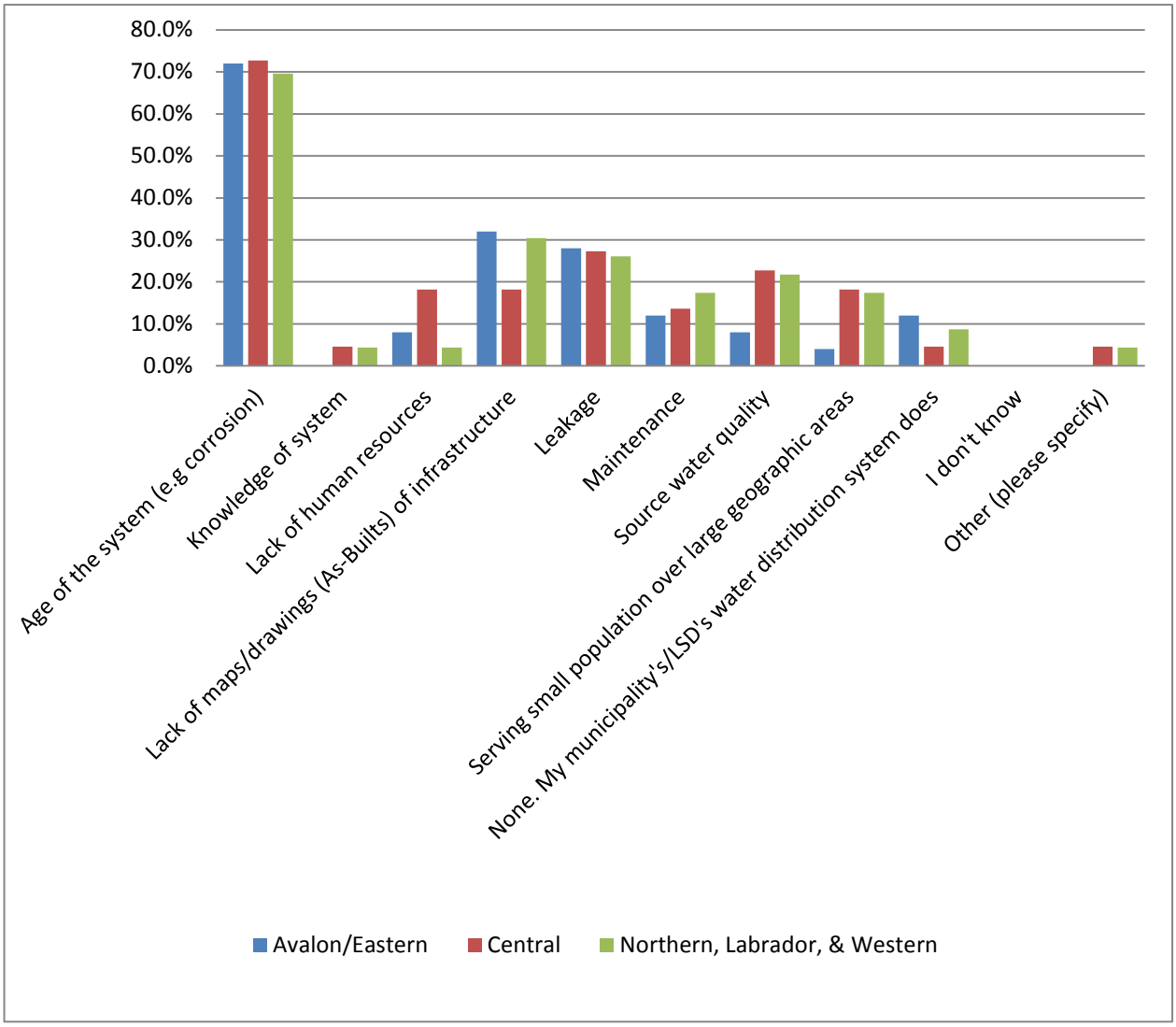
The researchers investigated whether any region-based infrastructure differences existed. Once again, regions were shown to be fairly homogenous. There were no differences amongst regions regarding the availability of maps, the presence of a designated office/filing area for the drinking water information system, and the presence of formal plans for maintenance or procedures. Additionally, the regions tended to indicate that their water systems were working comparably well, that they experienced similar barriers, and that the age of their water systems was consistent. Moreover, regions indicated that their infrastructure material was similar across the province, that their water distribution methods (e.g., gravity fed, pump fed) were comparable, and that the adequacy of their respective systems were functionally identical. The only major differences to emerge from this comparison was that Central was more likely than Avalon/Eastern to indicate a piping distance of 3.1 - 4 kms, and that Central was more likely than Avalon/Eastern to indicate that the distance between the last user and the last disinfectant system posed an issue. There were no differences amongst regions when describing non-financial barriers to repairing/maintaining their water system (see Table 12).

Table 12: Regional - Barriers to Repairing Water System

	Avalon/Eastern		Central		North/Lab/West	
	Count	%	Count	%	Count	%
Lack of available expertise to make changes	1	33.33%	0	0.00%	0	0.00%
Lack of available parts/supplies for upgrades	0	0.00%	1	20.00%	2	28.57%
Lack of financial resources	2	66.67%	5	100.00%	5	71.43%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%	0	0.00%

The researchers investigated whether BWAs could be predicted using regional identifiers. Generally, regions were equally likely to indicate that they had experienced a BWA in the past four years, and the reasons for these BWAs were very similar across the province. However, Central was more likely than Avalon/Eastern to indicate that the reason for their BWA was the presence of coliforms. Despite this difference, regions were equally likely to issue precautionary BWAs and to report similar levels of familiarity with provincially-administered bacteriological and drinking water quality reports. There were no differences amongst regions regarding the number of leaks reported in 2012, which is consistent with the observation that there were few region-based population and infrastructure differences. Additionally, regions were equally likely to have an organized leak detection initiative, and regions tended to use similar methods for leak detection. All regions were equally likely to indicate that their community had an annual valve operating/maintenance program, flush their lines at about the same frequency, as well as be equally likely to test the chlorine residual at about the same rate. While Service NL was reported as testing the drinking water in the regions at a consistent rate, Avalon/Eastern was more likely than Central to indicate that DOEC only tested their drinking water annually (Central was more likely to be tested more frequently than annually). Regions also indicated that they had similar issues (excluding financial constraints) when discussing their water distribution system, primarily focusing on the age of their systems (see Figure 9).

Figure 9: Regional - Biggest Non-Financial Issues with Water Distribution System



Over 80% of all respondents in the regions either indicated "Yes" or "To Some Degree" when asked whether they had sufficient resources to operate their water systems effectively. However, Western/Northern/Labrador were more likely than Central or Avalon/Eastern to indicate that they did not think that the province provided sufficient access to provincial WO training opportunities (Western/Northern/Labrador, 56.52%; Central, 90.48%; Avalon/Eastern, 88.00%). Respondents did not show any proportional differences when asked whether they believed that their local community gave them sufficient access to WO training opportunities (Western/Northern/Labrador, 86.36%; Central, 89.47%; Avalon/Eastern, 96.00%). In other words, each WO believed that their local community provided them with sufficient resources for

professional development, but Western/Northern/Labrador communities thought that provincial opportunities for professional development were lacking. There were no regional differences when respondents were asked to indicate *who* provided them with information regarding new technologies related to drinking water systems, although Avalon/Eastern were more likely to indicate that they received this information via email (when compared to Central). Finally, regions did not differ in terms of their attendance or familiarity with the Annual Drinking Water Workshop (see Table 13).

Table 13: Regional - Workshop Attendance

	Avalon/Eastern		Central		North/Lab/West	
	Count	%	Count	%	Count	%
Yes, I attend yearly	9	36.00%	7	31.82%	9	39.13%
I attend almost every year	7	28.00%	7	31.82%	8	34.78%
I rarely attend	6	24.00%	3	13.64%	2	8.70%
Never attended, but have heard of it	3	12.00%	3	13.64%	2	8.70%
Never heard of workshop	0	0.00%	2	9.09%	1	4.35%
Never had the opportunity to attend	0	0.00%	0	0.00%	1	4.35%

The researchers asked a series of questions to WOs regarding land use threats to drinking water, natural threats to drinking water, and other concerns regarding drinking water/drinking water systems. In terms of land use activities, the only difference between regions was that Central was more likely than Western/Northern/Labrador to identify domestic woodcutting as a potential threat. In terms of concerns over natural processes, no regional differences were identified. No respondent from any region even provided a suggestion for a type of threat that may not have been listed. Overall, it appears that there were few regional differences for WOs, although any "genuine" differences could be obscured by the decision to collapse several areas into more generalized regions. As shown in Table 14, there tended to be a large degree of overlap in responses given by WOs across regions.

Table 14: Regional - Potential Threats

	Avalon/Eastern		Central		North/Lab/West	
Land Use Threat	Count	%	Count	%	Count	%
Agriculture	2	8.33%	0	0.00%	1	4.55%
Commercial forest harvesting	1	4.17%	3	15.00%	0	0.00%
Domestic wood cutting	7	29.17%	7	35.00%	1	4.55%
Hunting and fishing	4	16.67%	3	15.00%	3	13.64%
Hydroelectricity (damming)	1	4.17%	0	0.00%	0	0.00%
Mining (including quarrying)	0	0.00%	1	5.00%	2	9.09%
Oil/gas exploration/development	1	4.17%	0	0.00%	2	9.09%
Recreational use	6	25.00%	7	35.00%	6	27.27%
Residential cabin development	2	8.33%	4	20.00%	1	4.55%
Transmission lines and roads	2	8.33%	1	5.00%	3	13.64%
None - no threatening land use activities	12	50.00%	8	40.00%	12	54.55%
Natural Process Threat						
Beaver dams	7	29.17%	8	36.36%	6	27.27%
Drought/low water levels	7	29.17%	4	18.18%	3	13.64%
Extreme weather events	3	12.50%	8	36.36%	9	40.91%
Flooding	1	4.17%	2	9.09%	1	4.55%
Freeze/thaw	6	25.00%	2	9.09%	4	18.18%
Salt water intrusions	1	4.17%	1	4.55%	3	13.64%
None - no threatening natural processes	8	33.33%	4	18.18%	6	27.27%
Other Threats						
Aesthetics (e.g., water colour)	8	33.33%	11	50.00%	5	22.73%
Metals (e.g., lead, arsenic)	2	8.33%	2	9.09%	1	4.55%
Organic carbon content	2	8.33%	5	22.73%	5	22.73%
Acidity	3	12.50%	4	18.18%	2	9.09%
Microorganisms (e.g., E. Coli)	2	8.33%	4	18.18%	4	18.18%
Human pollution (e.g., illegal dumping)	1	4.17%	2	9.09%	4	18.18%
Endocrine disrupting chemicals (EDCs)	0	0.00%	1	4.55%	0	0.00%
I don't know	4	16.67%	1	4.55%	4	18.18%
None - no threatening concerns	10	41.67%	7	31.82%	5	22.73%
Other (please specify)	2	8.33%	0	0.00%	2	9.09%

5.4 Certified vs. Non-Certified

The researchers were interested in whether WO certification levels would be related to other variables. To investigate this, they inquired about WOs' highest level of training for water systems operations and used that as the basis for a grouping variable (Question 8). Originally,

eight levels of certification were presented as options: 1) (Operator in Training (10 respondents), 2) Class I (19 respondents), 3) Class II (15 respondents), 4) Class III (2 respondents), 5) Class IV (1 respondent), 6) Small Systems (6 respondents), 7) Other (5 respondents), and 8) No Formal Training (12 respondents). The data were then dichotomously classified according to whether a WO had formalized training or not [i.e., Non-Certified (no formal training) vs. Certified (some formal training)][5]. The reason for this divide is similar to the rationale for reducing the number of regions to three from six: having too many non-uniformly distributed categories contributes to errors in statistical analysis. Because of the low number of respondents for the "Non-Certified" group, the researchers investigated the "Other" category in order to determine whether some of those respondents could be reclassified as under the new dichotomous classification. Initially, five respondents indicated "Other" as their level of training. All of these cases were able to be reclassified as either Certified or Non-Certified. The end result of combining and reclassifying the data left a Non-Certified group (14 respondents; 20.00%) and a Certified group (56 respondents; 80.00%).[6]

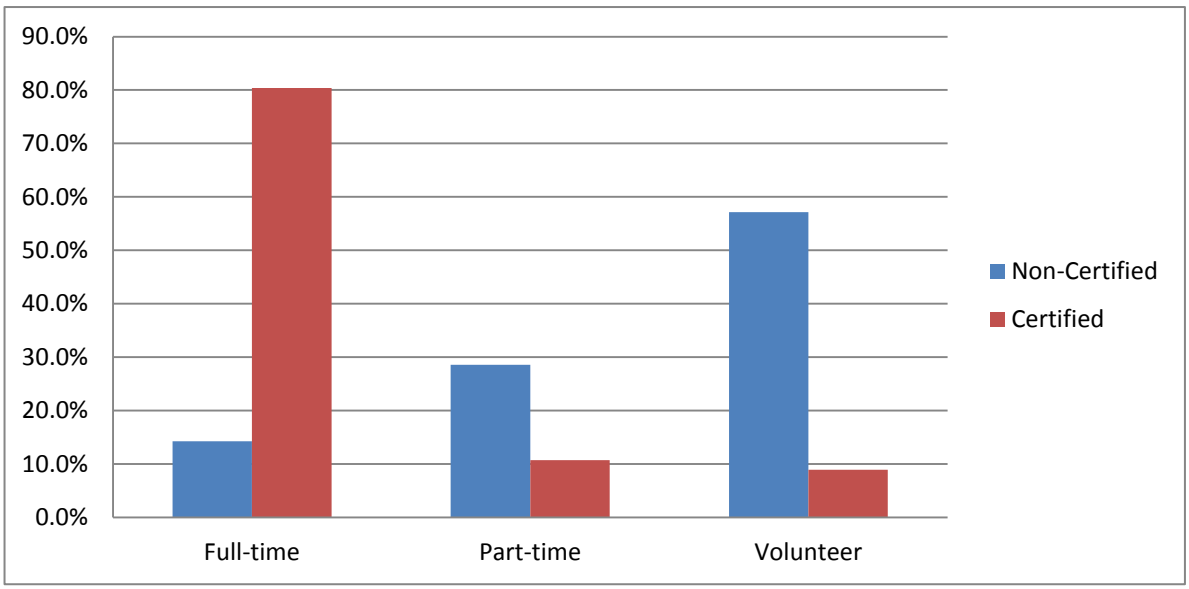
The researchers compared Certified and Non-Certified groups in order to assess whether the grouping variable was related to the outcome variables. It was determined that Certified WOs were more likely to be from municipalities (89.28%) while Non-Certified WOs were more likely to be from LSDs (64.3%). In a related vein, Non-Certified WOs were more likely to be from communities with <200 people (which is consistent with the relationship between certification and community type noted in Section 5.2). There was no difference in certification when it was compared across regions, which suggests that there is not a disproportionate concentration of certified WOs in any one region of NL.

The relationship between certification and WO characteristics was also investigated in this analysis. Certified WOs were more likely to be Full time employees, while Non-Certified WOs were more likely to be Volunteer employees (both were equally likely to be Part time). Non-Certified WOs were more likely to identify as "Water Operator" while Certified WOs were more likely to identify their job title as "Other". Both Certified and Non-Certified WOs showed comparable amount of experience in their positions and both groups indicated that they were

[5] Technically "Certified" includes persons who have not yet been licensed. However, this term was used because it adequately captured the underlying concept for the divide.
[6] This reclassification strategy was not used in the Administrator Survey, as there were higher numbers in the associated groups.

satisfied with the compensation they received. However, Certified WOs were more likely than their Non-Certified counterparts to report having benefits, and Non-Certified WOs (perhaps due to the often voluntary nature of their positions) were more likely to indicate that they were not paid for their work (see Figure 10).

Figure 10: Non-Certified/Certified - Employment Type



When asked about their water supply, Certified WOs were far more likely than Non-Certified WOs to indicate their primary water source was a local water supply. However, both groups indicated their primary drinking source was their communities' drinking water system (Certified 91.07%; Non-Certified 61.53%). In other words, Certified WOs preferred their local water supply more than the Non-Certified WOs, however it was the preferred water source for both groups. Non-Certified WOs were also more likely to list a Private Source of drinking water as the primary source (23.07%). When the researchers inquired about approaches to filtration, both Certified and Non-Certified WOs tended to use similar techniques; however, Non-Certified WOs were more likely to indicate that they did not filter their water (92.31%) than Certified WOs (42.00%). In terms of disinfecting water, several differences emerged between the two groups. Non-Certified WOs were more likely than Certified WOs to use Chloramines and Liquid Hypo-Chlorination, while Certified WOs were more likely to use Gas Chlorination as a disinfectant method. When asked about other methods or forms of treating their water, both

Certified and Non-Certified WOs tended to answer similarly with one exception: Certified WOs indicated that they were more likely to use pH Adjustment as a treatment strategy.

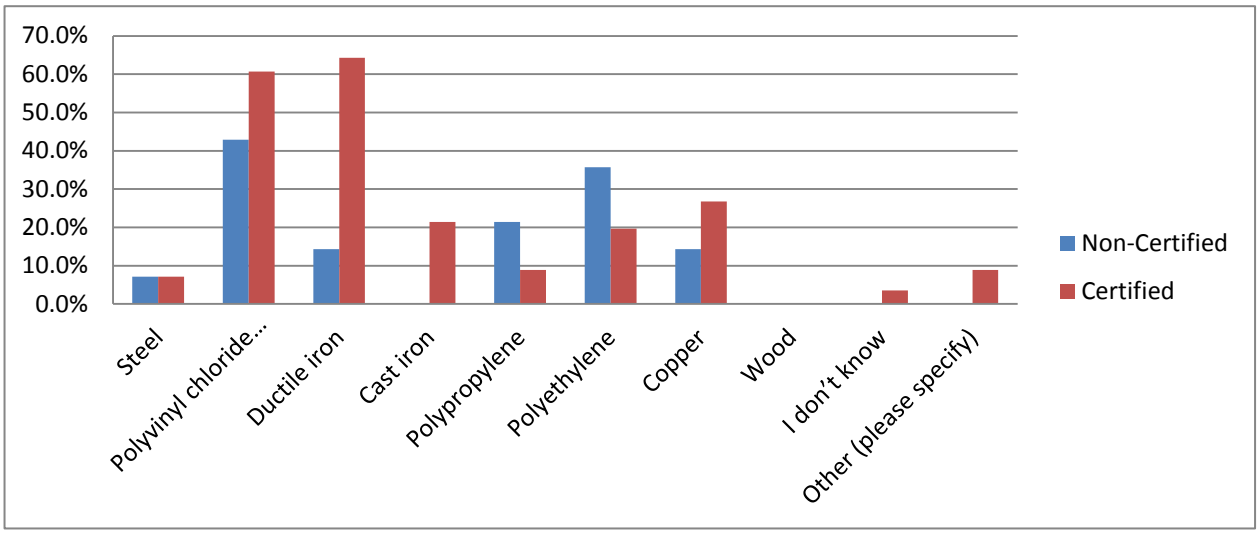
The researchers also investigated whether Certification was related to the state of a community's infrastructure. In particular, Certified WOs were more likely to report that they had complete maps of pipe infrastructure and were also more likely to report having a specific office or filing area for drinking water system information. While both Certified and Non-Certified WOs were equally likely to have a written formal maintenance plan for their water distribution infrastructure, Certified WOs were more likely to have a maintenance plan for the water treatment system/plant operations. There was little variability in how Certified and Non-Certified WOs responded to questions regarding the operability of various components of their water systems, barriers to repairing/maintaining their water distribution systems (see Table 15), or the overall age of their water treatment system/plant. In other words, Certified and Non-Certified WOs were highly similar in these respects. However, Non-Certified WOs were more likely than Certified WOs to indicate their pumps were between 21-30 years old, while Certified WOs were more likely to indicate their pumps were between 31-40 years old. Beyond the age of the pumps, however, both Certified and Non-Certified WOs reported comparable ages for the other equipment.

Table 15: Certified/Non-Certified - Barriers to Repairing Water System

	Non-Certified		Certified	
	Count	%	Count	%
Lack of available expertise to make changes	0	0.00%	1	11.10%
Lack of available parts/supplies for upgrades	0	0.00%	3	33.30%
Lack of financial resources	6	100.00%	6	66.70%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%

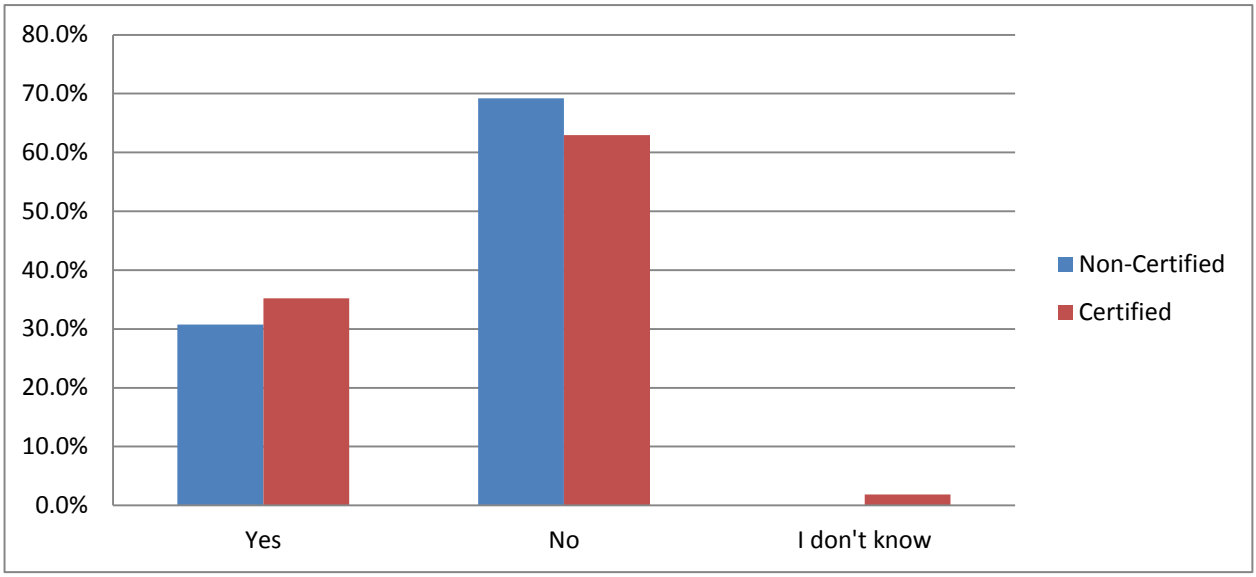
In terms of infrastructure materials, Certified WOs were more likely than Non-Certified WOs to indicate their material was Ductile Iron, but overall there were more similarities between the groups than differences on this topic (see Figure 11).

Figure 11: Non-Certified/Certified - Infrastructure Material



Both groups indicated that water reached their respective distribution systems using the same type of machinery and also answered similarly when asked if the current demand for water exceeded the system's ability (33.33% of Non-Certified said "Yes"; 15.09% of Certified said "Yes"). Finally, both Certified and Non-Certified WOs gave similar responses when asked to indicate the approximate piping distance between the chlorine booster station and the last user, as well as whether this distance represented a problem for the community (see Figure 12).

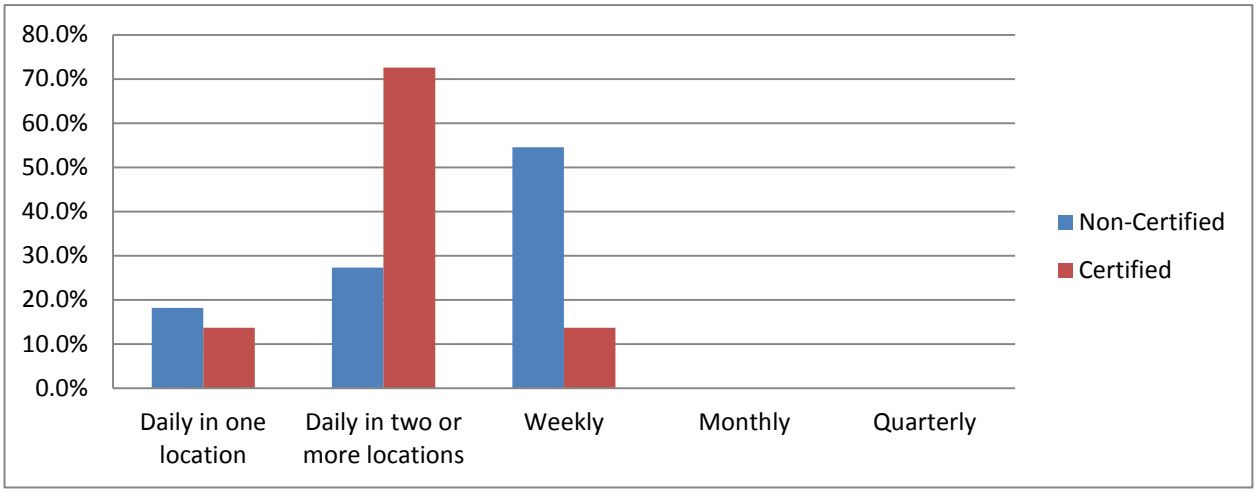
Figure 12: Non-Certified/Certified - Distance is an Issue for Maintaining Disinfection



The researchers posed a series of questions that investigated the BWAs and leaks within water systems, and were curious whether Certification might be related to these issues. From the results, however, there did not appear to be a relationship between Certification and these topics. BWA frequency did not vary as a product of Certification, and the reason for issuing BWAs was consistent across the two groups. Additionally, both Certified and Non-Certified groups reported being equally informed regarding provincially-released drinking water quality information as well as bacteriological reports.

A similar pattern emerged when the researchers delved into the data regarding leaks. Both groups indicated a comparable number of leaks, a comparable frequency of leak detection, and both groups equally indicated the absence of a leak detection program. Additionally, both groups also used similar strategies to detect leaks, were comparably likely to perform annual maintenance on valves, as well as flush their lines at a similar rate. Both Certified and Non-Certified WOs also reported similar (non-financial) concerns with their water systems. The only significant difference between Certified and Non-Certified WOs for this block of questions was the frequency with which chlorine residual was checked. Those in the Certified group were more likely to check for chlorine residual daily in two different locations (72.55%), while Non-Certified were more likely to check only once a week (54.54%) (see Figure 13).

Figure 13: Non-Certified/Certified - Frequency of Checking Chlorine Residual



Several interesting findings emerged in regards to professional growth. Certified and Non-Certified WOs were similarly likely to indicate that they had sufficient resources to operate their water systems, although Certified operators more frequently indicated that this was the case (57.14% indicated of Non-Certified "Yes" or "To some degree"; 85.45% of Certified indicated "Yes" or "To some degree"). Both groups were comparably likely to think the province provided sufficient access to WO training opportunities (84.62% of Non-Certified indicated "Yes"; 76.36% of Certified indicated "Yes"). However, those in the Certified group were more likely to endorse the statement that their community provided adequate training opportunities (96.23%), while their Non-Certified counterparts were less likely to endorse the same statement (66.67%). This could suggest that failure to certify could fall at the municipal, rather than the provincial level.

In terms of knowledge acquisition, both Certified and Non-Certified operators indicated that they received information from similar sources, although the Atlantic Canada Water and Wastewater Association was more likely to provide Certified WOs with information. As for *how* information was shared, Certified WOs were more likely to indicate Newsletters and Workshops/Conferences than Non-Certified WOs. In fact, when asked about attending the Annual Drinking Water Workshop, Non-Certified WOs were most likely to indicate that they had heard of it but never attended it, or never heard of it. In contrast, Certified WOs were most likely to indicate that they attended the conference annually (see Table 16).

Table 16: Certified/Non-Certified - Workshop Attendance

	Non-Certified		Certified	
	Count	%	Count	%
Yes, I attend yearly	0	0.00%	24	43.60%
I attend almost every year	4	28.60%	18	32.70%
I rarely attend	2	14.30%	9	16.40%
Never attended, but have heard of it	4	28.60%	4	7.30%
Never heard of workshop	3	21.40%	0	0.00%
Never had the opportunity to attend	1	7.10%	0	0.00%

The researchers asked WOs a series of questions concerning land use threats to drinking water, natural threats to drinking water, and other concerns regarding drinking water/drinking water system. For all three of these areas of inquiry, the Certified/Non-Certified dichotomy could not be used to predict any specific types of responses. In other words, whether or not a WO was certified had little bearing on whether they perceived certain behaviours as threats to their water supplies or drinking water systems. This is not to say that WOs believed that their drinking water sources/systems were not threatened by any behaviours, only that Certified and Non-Certified WOs did not differ in regards to whether they were perceived as threats (see Table 17). While some differences appear notable for Land Use Threat (e.g., None – No threatening land use activities), these differences did not reach statistical significance due in part to the low sample size of Non-Certified. It is possible with higher numbers within samples that the differences may achieve statistical significance.

In general, there were several differences between the Certified and Non-Certified groups, but also many similarities. Some of the most notable differences included the employment characteristics of the WOs, the more rigorous documentation of water systems in communities with Certified WOs, as well as the greater opportunities for professional growth and development for Certified WOs. Somewhat surprisingly, WOs from both Certified and Non-Certified communities tended to view threats to their communities' water systems similarly, and also indicated a high degree of similarity in terms of BWA issuances and in the occurrences of and responses to leaks within their water systems.

Table 17: Certified/Non-Certified - Potential Threats

	Non-Certified		Certified	
Land Use Threat	Count	%	Count	%
Agriculture	0	0.00%	3	5.70%
Commercial forest harvesting	0	0.00%	4	7.50%
Domestic wood cutting	2	15.40%	13	24.50%
Hunting and fishing	2	15.40%	8	15.10%
Hydroelectricity (damming)	0	0.00%	1	1.90%
Mining (including quarrying)	0	0.00%	3	5.70%
Oil/gas exploration/development	0	0.00%	3	5.70%
Recreational use	3	23.10%	16	30.20%
Residential cabin development	1	7.70%	6	11.30%
Transmission lines and roads	0	0.00%	6	11.30%
None - no threatening land use activities	9	69.20%	23	43.40%
Other threat	0	0.00%	0	0.00%
Natural Process Threat				
Beaver dams	4	28.60%	17	31.50%
Drought/low water levels	2	14.30%	12	22.20%
Extreme weather events	3	21.40%	17	31.50%
Flooding	0	0.00%	4	7.40%
Freeze/thaw	3	21.40%	9	16.70%
Salt water intrusions	1	7.10%	4	7.40%
None - no threatening natural processes	5	35.70%	13	24.10%
Other threat	0	0.00%	0	0.00%
Other Threats				
Aesthetics (e.g., water colour)	2	14.30%	21	39.60%
Metals (e.g., lead, arsenic)	0	0.00%	4	7.50%
Organic carbon content	3	21.40%	9	17.00%
Acidity	1	7.10%	8	15.10%
Microorganisms (e.g., E. Coli)	2	14.30%	7	13.20%
Human pollution (e.g., illegal dumping)	0	0.00%	7	13.20%
Endocrine disrupting chemicals (EDCs)	0	0.00%	1	1.90%
I don't know	4	28.60%	5	9.40%
None - no threatening concerns	4	28.60%	18	34.00%
Other (please specify)	1	7.10%	3	5.70%

5.5 Had BWA/Had Not Had BWA

The researchers tried to determine the extent to which a community's experience with BWAs in the past four years was related to their collection of outcome variables. To investigate this, the researchers used Question 20 "Has your municipality/LSD been under a boil water advisory any time in the last 4 years?" as a dichotomous grouping variable. Two groups were

created under this classification: one with 56 respondents who indicated that a BWA *had* occurred in their community in the past four years (Hads) (82.4%), and another with 12 respondents who indicated that a BWA *had not* occurred in the past four years (Had Nots) (17.6%). Generally speaking, there were very few differences between the Hads and Had Nots in regards to any of the outcome variables. Both were equally likely to be either a Municipality or an LSD, to have similar populations, and each group were comparably represented across regions.

In terms of WO characteristics, the researchers found no significant differences between the Hads and Had Nots. Respondents from both groups were equally likely to be a Full time, Part time, or Volunteer employee (see Figures 14 – 16). Additionally, both groups had comparable certification levels with Class I being the most prevalent (Had 26.78%; Had Nots 36.36%), similar levels of satisfaction with their work (respondents tended to indicate they were satisfied to at least some extent), enjoy benefits from their work, and report approximately equivalent salaries. However, given that the designation of "Certified" was arguably generous (i.e., a respondent only needed to be an OIT to be considered "Certified"), it is possible that certification-determined differences in were masked by the relatively simple binary.

Figure 14: BWA - Employment Type

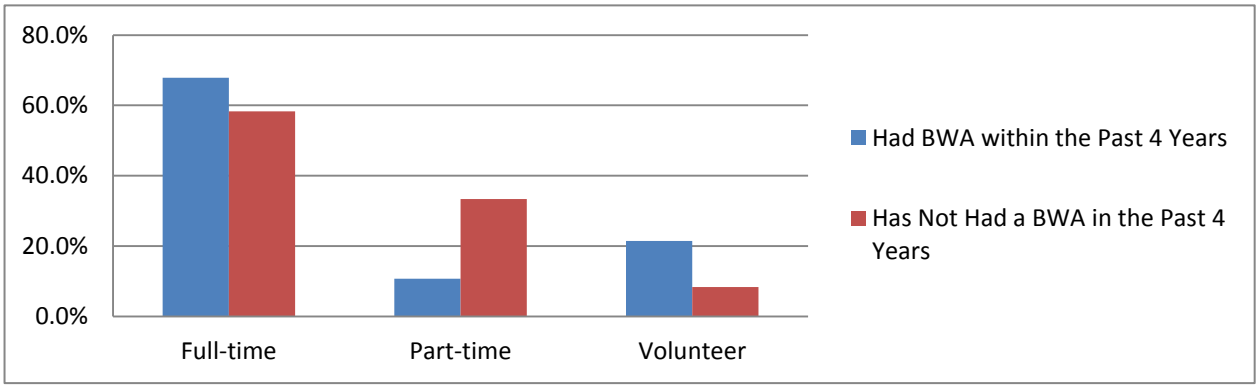
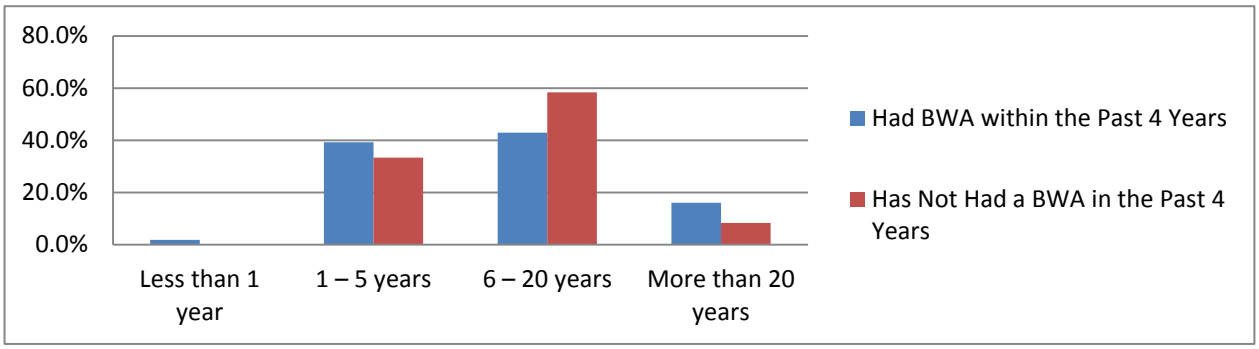
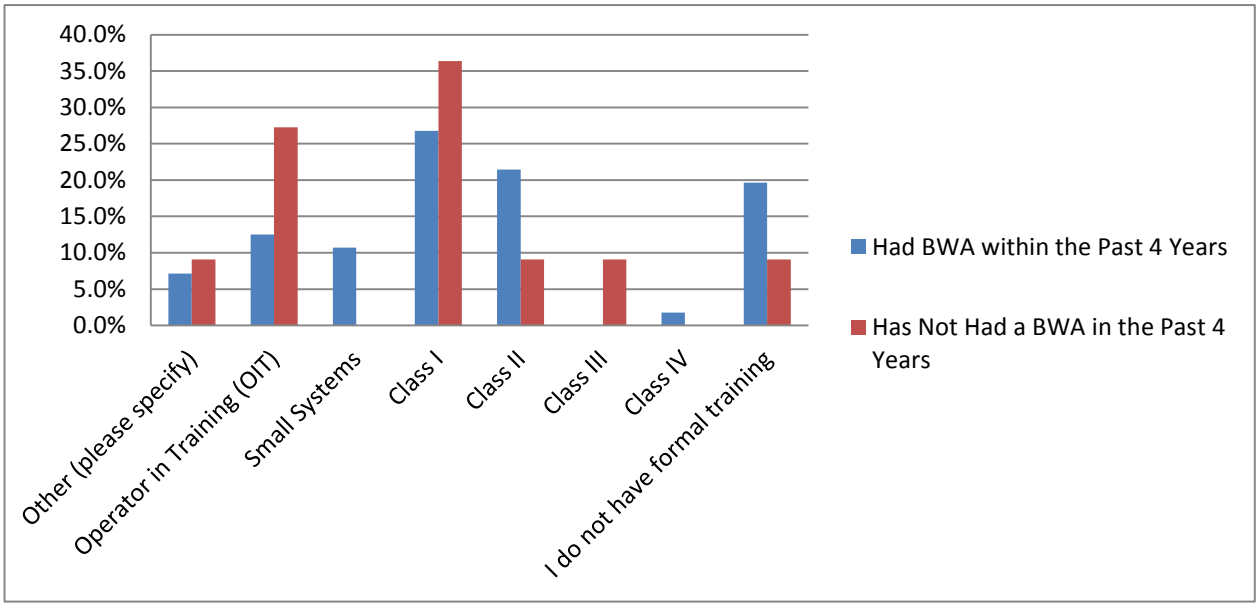


Figure 15: BWA - Experience as Water Operator



When investigating water supply, the researchers discovered that preferences for water sources did not vary between the Hads and Had Nots. All members of both groups indicated that they their treated water, and both groups tended to use the similar filtration strategies. There was one exception to this: Had Nots were more likely to use Green Sand as a filtration strategy. However, this finding was looked upon as being spurious rather than meaningful as it could be just a product of an unusual sample. Both Hads and Had Nots indicated that they used similar strategies for disinfection, and both groups were equally likely to have similar additional processes or treatments for drinking water.

Figure 16: BWA - Level of Training



When the researchers examined the relationship between BWAs and infrastructure, they again found few differences between the groups. Both Hads and Had Nots reported having similar mapping resources for their water distribution infrastructure, comparable designated office/filing space for water system information, roughly equivalent formal maintenance plans and standard plant operations, as well as similar answers when it came to water system plant maintenance. Moreover, both Hads and Had Nots were more likely to indicate the functionality of the parts of their water systems was comparable, and both groups indicated that they experienced the same types of barriers to repairing their water systems (see Table 18). And while Had Nots were more likely to report that the oldest part of their system was 5-10 years old, both Hads and Had Nots tended to answer similarly when asked about the specific ages of their water systems' components. Additionally, Hads and Had Nots tended to indicate similar choices of infrastructure material, as well as methods for transferring water. Hads and Had Nots also gave similar responses to questions regarding the adequacy of their system and the approximate piping distance water in their communities from the last chlorine booster to the last user. Both groups also tended to indicate that the distance between the last user of their system and where the disinfecting procedure took place did not pose a problem.

Table 18: BWA - Barriers to Repairing Water System

	Hads		Had Nots	
	Count	%	Count	%
Lack of available expertise to make changes	1	6.67%	0	0.00%
Lack of available parts/supplies for upgrades	3	20.00%	0	0.00%
Lack of financial resources	12	80.00%	0	0.00%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%

In regards to their relative knowledge of topics related to BWAs and leaks, both Hads and Had Nots indicated that they were familiar with drinking water quality reports as well as bacteriological reports released by the provincial government. Additionally, both groups indicated similar frequencies of leak detection and both had organized programs to find leaks. The methods to find such leaks did not vary as a consequence of being a Had or a Had Not community. Additionally, both community types indicated that they had similar practices

regarding annual valve maintenance, line-flushing frequency, and had a similar frequency of local and provincial testing. Also, both Hads and Had Nots indicated that they held similar (non-financial) concerns for the water distribution system. Overall, the differentiation between Had and Had Nots seemed unrelated to the outcome variables being assessed.

The researchers found that WOs reported similar levels of access to training programs at both a provincial and local level, and that both Hads and Had Nots reported having sufficient resources to perform their jobs effectively. Both groups indicated that they received information from the same sources from approximately the same method (e.g., newsletter, conference), and both groups indicated comparable attendance patterns for the Annual Drinking Water Workshop (see Table 19). This further suggests that the recency of a BWA is a poor indicator for any of the outcome variables under investigation.

Table 19: BWA - Workshop Attendance

	Hads		Had Nots	
	Count	%	Count	%
Yes, I attend yearly	20	36.36%	4	33.33%
I attend almost every year	17	30.91%	3	25.00%
I rarely attend	9	16.36%	2	16.67%
Never attended, but have heard of it	5	9.09%	3	25.00%
Never heard of workshop	3	5.45%	0	0.00%
Never had the opportunity to attend	1	1.82%	0	0.00%

WOs were asked a series of questions regarding land use threats to drinking water, natural threats to drinking water, and other concerns regarding drinking water/drinking water system (see Table 20). For all three of these topics, the Hads/Had Not distinction did not predict any specific response patterns. In other words, whether or not a BWA had been issued in the past four years had little relevance to whether certain behaviours were perceived as threats to the water supply or drinking water system.

The similarities between Hads and Had Nots far outweighed any differences between the groups. Indeed, the few differences that did emerge between the groups is likely attributable to statistical error, rather than any meaningful differences between the communities. The value of conducting these analyses, however, is that they were able to demonstrate the non-relevance of BWAs on other outcomes related to infrastructure, WO characteristics, and professional

development opportunities. Overall it would appear, according to the survey results, that there is no statistically significant relationship between BWAs and any of the addressed concepts.

Table 20: BWA - Potential Threats

	Hads		Had Nots	
Land Use Threat	Count	%	Count	%
Agriculture	2	3.77%	0	0.00%
Commercial forest harvesting	4	7.55%	0	0.00%
Domestic wood cutting	14	26.42%	1	10.00%
Hunting and fishing	8	15.09%	1	10.00%
Hydroelectricity (damming)	0	0.00%	0	0.00%
Mining (including quarrying)	2	3.77%	1	10.00%
Oil/gas exploration/development	3	5.66%	0	0.00%
Recreational use	17	32.08%	2	20.00%
Residential cabin development	6	11.32%	1	10.00%
Transmission lines and roads	4	7.55%	1	10.00%
None - no threatening land use activities	24	45.28%	7	70.00%
Natural Process Threat				
Beaver dams	17	31.48%	4	36.36%
Drought/low water levels	12	22.22%	0	0.00%
Extreme weather events	19	35.19%	1	9.09%
Flooding	4	7.41%	0	0.00%
Freeze/thaw	10	18.52%	1	9.09%
Salt water intrusions	3	5.56%	1	9.09%
None - no threatening natural processes	12	22.22%	6	54.55%
Other Threats				
Aesthetics (e.g., water colour)	19	35.85%	4	33.33%
Metals (e.g., lead, arsenic)	4	7.55%	1	8.33%
Organic carbon content	11	20.75%	1	8.33%
Acidity	8	15.09%	1	8.33%
Microorganisms (e.g., E. Coli)	9	16.98%	1	8.33%
Human pollution (e.g., illegal dumping)	7	13.21%	0	0.00%
Endocrine disrupting chemicals (EDCs)	1	1.89%	0	0.00%
I don't know	6	11.32%	2	16.67%
None - no threatening concerns	16	30.19%	5	41.67%
Other (please specify)	3	5.66%	0	0.00%

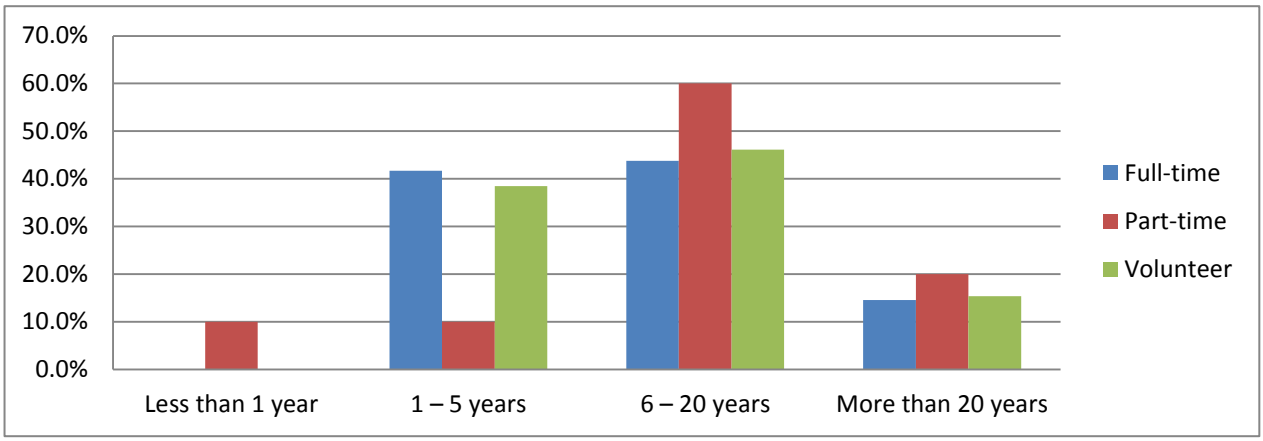
5.6 Employment Type vs. Employment Type

The researchers were curious whether WOs' Employment type (i.e., Part time, Full time, or Volunteer) would be related to specific qualities measured in the WO Survey. Respondents

were divided into groups based on Question 5 (“Are you a full-time, part-time or volunteer water operator in your municipality/LSD?”) and the researchers then examined group differences across the responses. In total, there were 48 Full time employees (67.60%), 10 Part time employees (14.10%), and 13 Volunteers (18.30%). Through investigating demographic features and Employment type, the researchers found that Municipalities were more likely to have Full time and Part time employees than Volunteers. Additionally, Volunteers were more likely to be from communities of less than 200 people, which coincides with what LSDs typically reported as their populations. Employment type was comparably represented across the three regions (i.e., Avalon/Eastern, Central, Western/Northern/Labrador) which suggests that no particular region has a disproportionate share of any specific Employment type.

An important research objective in this subset of the survey analysis was to determine how Employment type was related to WO characteristics or WO qualities. Interestingly, the length of time an individual was employed did not seem to differ across Employment types. This suggests that communities are not simply using Volunteers as a temporary measure until another WO was recruited, but rather that Volunteers are consistently responsible for the entire drinking water system (see Figure 17). This may present an issue in terms of training, as Full time employees were more likely to be Certified when compared to Volunteers (as well as Part time employees). In other words, if Volunteers are often responsible for the entire water system of their community, but Volunteers are also less likely to possess certification. Another point of interest is that although all Employment types reported similar levels of satisfaction with their compensation, Volunteers were more likely to work for <$10 000 yearly and Full time employees were more likely than Volunteers to have benefits. So while job satisfaction may be similar across Employment types, remuneration is not.

Figure 17: Employment Type - Experience as Water Operator

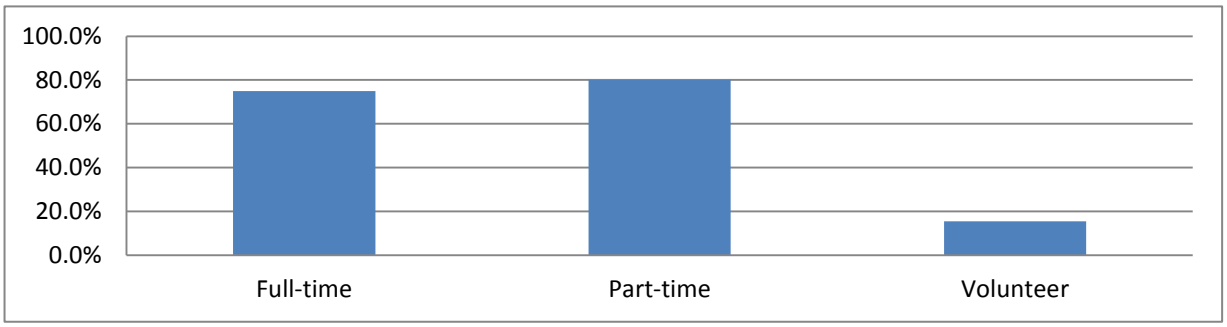


There were differences in how water sources were preferentially ranked when examined according to employment type. While community water supply was the most highly ranked water source for all Employment types, there were substantial differences between this source's prevalence for Full and Part time WOs on the one hand (91.67% and 90.00%, respectively), and Volunteers on the other (58.33%). While Volunteers generally acknowledged that the community water source was the most popular drinking water source, this was only a narrow majority. Volunteers rated Private sources as the primary source 25.00% of the time, with the remainder being split between Bottled water and Spring water. All Employment types were equally likely to treat their water in some way. However, Volunteers more frequently indicated that they did not filter their water when compared to Full time employees, but whether this failure to treat water is due to insufficient technical expertise or a lack of demand for that treatment is unclear. When Volunteers did treat their water, there were no differences between Volunteers, Full time, or Part time employees. However, there were several differences between Employment types regarding the method of disinfection employed by the groups: Full time and Part time were more likely to use Gas Chlorination than Volunteers, and Volunteers were more likely to use Liquid Hypo-Chlorination. In terms of additional water treatment procedures, Full time employees were more likely than Volunteers to use pH adjustment, and Volunteers were more likely to indicate that they did not use additional water treatment procedures (when compared to Full time and Part time employees).

Several differences emerged when the researchers investigated the relationship between Employment type and infrastructure. Full time employees were more likely than Volunteers to possess complete piping infrastructure maps (53.19% vs. 15.38%), while Volunteers were more

likely than Full time employees to indicate that they did not possess any maps (even partial ones) (61.54% vs. 17.02%). Full time and Part time employees were also more likely than Volunteers to indicate that they had a designated office or filing area for drinking water system information (see Figure 18). Although Employment types did not substantially differ in terms of possessing a formal written maintenance plan for their water distribution infrastructure, or in terms of having a standard operating procedure for their water treatment system/plant operations, Full time employees were more likely than Volunteers to indicate that there was a maintenance plan for the water treatment system. In summary, Volunteers appear to have few employment benefits from being a WO, and also frequently cope with shortages in materials necessary for infrastructure management, as well as training resources.

Figure 18: Employment Type - WOs with Designated Office for Drinking Water Quality Information



Employment types did not differ substantially in their responses to questions on whether aspects of their community's drinking water system were in working order, nor did they vary when describing the barriers to fixing their water systems (see Table 21). Additionally, Employment types did not seem to vary substantially in terms of their respective water systems' age, with a few minor exceptions (Part time were more likely than Full time to indicate that their Chlorine Booster system was 31-40 years old; Volunteers were more likely than Full time employees to indicate their Pump was 31-40 years old).

Table 21: Employment Type - Barriers to Repairing Water System

	Full-time		Part-time		Volunteer	
	Count	%	Count	%	Count	%
Lack of available expertise	1	12.50%	0	0.00%	0	0.00%

to make changes						
Lack of available parts/supplies for upgrades	2	25.00%	1	33.33%	0	0.00%
Lack of financial resources	5	62.50%	3	100.00%	4	100.00%
Upgraded system would be too complex to operate	0	0.00%	0	0.00%	0	0.00%
Not a priority	0	0.00%	0	0.00%	0	0.00%
There are no barriers	0	0.00%	0	0.00%	0	0.00%
I don't know	0	0.00%	0	0.00%	0	0.00%
Other (please specify)	0	0.00%	0	0.00%	0	0.00%

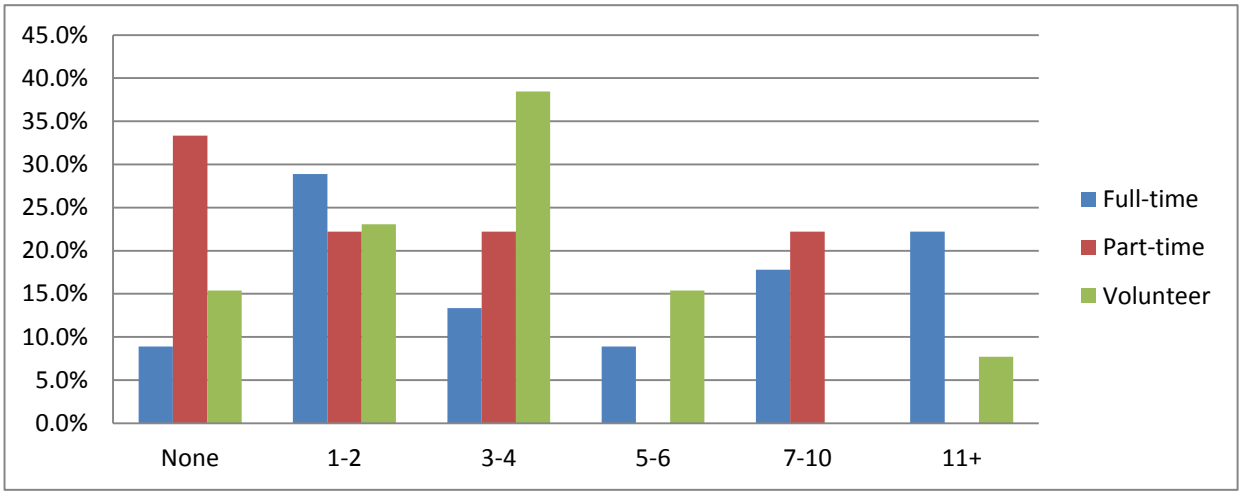
There tended to be some differentiation in how Employment type was related to infrastructure materials. Full time employees were more likely than either Part time employees or Volunteers to indicate that their pipes were made of Ductile Iron, and Full time employees were also more likely to have Copper pipes than Volunteers were (but not Part time employees). Conversely, Volunteers were more likely to indicate that their pipes were made of Polypropylene than Full time employees. Employment type did not seem to influence how water reached a water distribution plant or whether the current demand for water was being met. Additionally, Full time employees, Part time employees, and Volunteers responded similarly when asked what the piping distance between the final Chlorine Booster and the final water user was, and whether this presented a problem. However, given that Volunteers were unlikely to have mapping information, it was unclear how accurate the overall assessment was.

When the researchers investigated BWA occurrences, they found little evidence of a relationship between this variable and Employment type. In other words, Full time employees, Part time employees, and Volunteers did not differ in their response to whether a BWA had been issued in the past four years. Additionally, Employment type could not predict the reasons for issuing BWAs, nor could it predict whether a community would issue a precautionary BWA. Furthermore, all Employment types reported being equally knowledgeable of bacteriological reports and drinking water quality reports released by the provincial government.

When the researchers investigated whether Employment types were related to how respondents answered questions regarding leaks, only a few differences emerged. The respondents generally indicated about the same number of leaks in 2012, and also indicated that they had organized leak detection at about the same frequency. However, given that the number of leaks is not proportionally controlled, this may suggest that smaller communities have a

proportionally larger number of leaks than larger communities do (which would be consistent with the findings reported in the ≤1000/>1000 section) (see Figure 19). In other words, given that Volunteers tend to live in smaller communities and Full time employees tend to live in larger communities, and given that there's no difference between the employment types in terms of leaks, may indicate an actual difference on a proportional basis. Also, Employment types did not vary when it came to the methods used to detect leaks. The minor differences that did emerge between Employment types was that Volunteers were more likely than Full time employees to indicate that they did not flush their systems, and that Full time employees were more likely to test for Chlorine Residual more frequently (and in different locations) while Volunteers were only likely to check for Chlorine Residual on a weekly basis. More specifically, 75.56% of Full time employees checked Chlorine Residual twice daily in two locations, 57.14% of Part time employees did this, and only 27.27% of Volunteers did this. All employment types suggested Service NL and DOEC tested their community's water supplies at about the same rate, with most communities indicating a weekly or monthly rate for Service NL; and a monthly, quarterly, or annual rate for DOEC.

Figure 19: Employment Type - Number of Leaks in 2012



In terms of professional growth and professional development opportunities, there were few differences amongst the Employment types. Full time employees, Part time employees, and Volunteers answered similarly when asked if they had sufficient resources to operate their water systems (29.79% Full time, 50.00% Part time, 15.38% Volunteer said "Yes"; 55.32% Full time,

30.00% Part time, 46.15% Volunteer said “To some degree”), and also indicated that they felt the province and their local area had provided them with adequate training opportunities. Employment types did not differ in how they received information about new technologies for drinking water systems, nor were there any substantial differences in who communicated information about these new technologies to them. The only major difference in this series of questions was that Volunteers were more likely to indicate that they had never heard of the Annual Drinking Water Workshop, or had heard of the workshop but simply had not attended. It is curious that Volunteers WOs indicated that they perceived adequate access to professional development opportunities, but still indicated a lower attendance rate for provincially hosted development workshops (see Table 22).

Table 22: Employment Type - Workshop Attendance

	Full-time		Part-time		Volunteer	
	Count	%	Count	%	Count	%
Yes, I attend yearly	21	44.68%	1	10.00%	3	23.08%
I attend almost every year	17	36.17%	4	40.00%	1	7.69%
I rarely attend	6	12.77%	4	40.00%	1	7.69%
Never attended, but have heard of it	3	6.38%	1	10.00%	4	30.77%
Never heard of workshop	0	0.00%	0	0.00%	3	23.08%
Never had the opportunity to attend	0	0.00%	0	0.00%	1	7.69%

The researchers asked WOs a series of questions regarding land use threats to drinking water, natural threats to drinking water, and other concerns regarding drinking water/drinking water systems. All three Employment types offered relatively similar responses to these thematic questions. In other words, whether or not a WO was a Full time employee, Part time employee, or a Volunteer had little effect on whether he/she perceived different external factors as threatening to their local drinking water supply or drinking water system (see Table 23). The researchers were somewhat surprised by the extent of these similarities, as they had expected that Employment types’ concerns (which was related to community size) would show some degree of differences. Additionally, researchers had suspected that there may be some threats that Full time employees were more aware of than Volunteer employees.

Table 23: Employment Type - Potential Threats

	Full-time		Part-time		Volunteer	
Land Use Threat	Count	%	Count	%	Count	%

Agriculture	2	4.65%	0	0.00%	1	7.69%
Commercial forest harvesting	2	4.65%	1	10.00%	1	7.69%
Domestic wood cutting	9	20.93%	2	20.00%	4	30.77%
Hunting and fishing	8	18.60%	0	0.00%	2	15.38%
Hydroelectricity (damming)	1	2.33%	0	0.00%	0	0.00%
Mining (including quarrying)	3	6.98%	0	0.00%	0	0.00%
Oil/gas exploration/development	3	6.98%	0	0.00%	0	0.00%
Recreational use	14	32.56%	2	20.00%	3	23.08%
Residential cabin development	5	11.63%	2	20.00%	0	0.00%
Transmission lines and roads	6	13.95%	0	0.00%	0	0.00%
None - no threatening land use activities	17	39.53%	7	70.00%	8	61.54%
Natural Process Threat						
Beaver dams	16	35.56%	3	30.00%	2	15.38%
Drought/low water levels	10	22.22%	1	10.00%	3	23.08%
Extreme weather events	16	35.56%	0	0.00%	4	30.77%
Flooding	4	8.89%	0	0.00%	0	0.00%
Freeze/thaw	10	22.22%	0	0.00%	2	15.38%
Salt water intrusions	4	8.89%	0	0.00%	1	7.69%
None - no threatening natural processes	7	15.56%	7	70.00%	4	30.77%
Other Threats						
Aesthetics (e.g., water colour)	19	42.22%	2	20.00%	3	23.08%
Metals (e.g., lead, arsenic)	3	6.67%	1	10.00%	1	7.69%
Organic carbon content	8	17.78%	1	10.00%	3	23.08%
Acidity	6	13.33%	3	30.00%	0	0.00%
Microorganisms (e.g., E. Coli)	8	17.78%	2	20.00%	0	0.00%
Human pollution (e.g., illegal dumping)	6	13.33%	1	10.00%	0	0.00%
Endocrine disrupting chemicals (EDCs)	0	0.00%	1	10.00%	0	0.00%
I don't know	6	13.33%	0	0.00%	3	23.08%
None - no threatening concerns	12	26.67%	6	60.00%	4	30.77%
Other (please specify)	2	4.44%	0	0.00%	2	15.38%

6.0 Results for Qualitative Responses from Operators

Several of the survey's questions inquired about the strategies employed by WOs to combat or address various issues with their water systems. Unfortunately, only a small percentage of respondents actually provided data on this topic. Because of the low response rate

for these specific questions, the researchers did not code the information into categories (see Qualitative Data Appendix for raw responses). It is important to note that the low response rate for this question is probably due to the survey instructions, which asked respondents not to respond if they did not have experiences that were relevant to the questions.

The researchers felt that the most significant information gleaned from the qualitative data were responses to *"Are there any other comments regarding drinking water systems in your municipality/LSD or elsewhere that you would like to include? Please explain any problems either covered or not in the survey".* In their responses to this question, WOs focused on their inability to afford the cost of improving their water systems. These responses coincided with the quantitative data collected on the topic of perceived barriers, which suggested that the most pressing issues identified by communities were primarily related to financial concerns and the age of their water systems. The researchers were unsurprised but disheartened by the low number of responses associated with the first two qualitative questions (see Section 12.0). Only six communities had attempted to ameliorate their drinking water-related issues, which is only a small fraction of the respondents who had indicated that their water systems were experiencing problems to some degree.

7.0 Discussion

Although the analysis of the survey results has highlighted numerous differences within and between the established group variables, it is important to consider the many underlying commonalities demonstrated by all respondents. Many of these similarities were related to asset management in the context of infrastructure. Communities on average tended to not have *complete* maps of their communities' water infrastructure. However, many of the larger communities across the province tended to have some mapping information that pertained to their drinking water supply system. Similarly, communities were extremely unlikely (regardless of size, type, certification, etc.) to have a formal written maintenance plan for their water distribution infrastructure. In other words, many of the respondents may not have a comprehensive or technically accurate understanding of their water distribution systems. Moreover, maintenance plans are presumably managed through ad hoc means, rather than

through formalized processes and documented plans. Accordingly, the researchers are unsure of how communities would communicate and implement these plans without their current WOs.

Regionally speaking, the analyses revealed far more similarities than differences. The researchers were conflicted about how to interpret this data. While many similarities between communities probably do exist, the researchers suspect that at least some of these could be a result of collapsing different regions into a single category during the data analysis process. Although this was a necessary practice, it could have obscured genuine differences amongst regions regarding their practices and experiences. Perceptions of threats would be particularly vulnerable to this type of reclassification, as threats are heavily influenced by regional features (e.g., beaver dams, recreational cabins, oil/gas exploration). Research emphasizing regional differences should be conducted while ensuring adequate numbers of communities in each region participate.

The researchers noted that certain communities tended to be associated with specific positive traits or advantages. This is not to say that that these communities do not experience any issues, only that they appear to be experiencing fewer issues than dissimilar community types. For example, larger communities (i.e., >1000 Communities, Municipalities) appear to have distinct advantages. These types of communities are more likely to have a Full time (and Certified) WOs who enjoys a comparatively higher wage than his/her counterparts in smaller communities (i.e., ≤1000 Communities, LSDs). Additionally, or perhaps consequently, these community types are more likely to have a designated filing office and maintenance plan. Certified WOs are also associated with flushing the water system annually, and a higher frequency of chlorine level testing, which means that these larger communities tend to have these behaviours occur for their water supply. However, even with these advantages, many of these communities still do not have complete maps of their water distribution system, nor do they have formal maintenance plans. In other words, the advantages associated with having a Certified WO and living in a larger community is significant, they are not a panacea for all of the drinking water challenges facing NL's communities.

The researchers also noted that certain community types were more likely to report a wider range of problems and be significantly less advantaged. These communities tended to be either a COTOL or an LSD. While the types of issues faced by individual communities are varied, it is noteworthy that many of these smaller communities relied on Volunteer WOs.

Indeed, Volunteers were disproportionately used by these smaller communities overall. Volunteer characteristics tended to be fairly consistent between communities. These WOs were often Non-Certified and were likely to not have any maps of their water distribution infrastructure (42.86% of Non-Certified reported having no maps, and 61.54% of Volunteers reported having no maps). They were also less likely to have dedicated space for drinking water information, and perform less frequent maintenance on their distribution system than their Full time and Part time counterparts do.

Volunteer WOs' lack of remuneration may be related to the broader issue of water security. The ability to procure and distribute water is an essential service for communities, and one that should not be taken for granted. If a Volunteer becomes disinterested in serving as a WO, or perhaps finds another type of employment, this could threaten the drinking water supply for an entire community. Some communities' reliance on Volunteers does not seem to be a stopgap measure; rather, it seems to a frequently used, long-term approach to retaining a WO. The apparent necessity of Volunteer WOs in some communities may imply that they are unable to achieve water security for their residents.

The researchers are curious as to whether a potential lack of water security would substantially affect residents within communities (often LSDs). Unfortunately, the specific cause and effects of having Volunteer, Non-Certified WOs, is difficult to determine. Causality is complicated, especially within a complex paradigm relating to many different communities. However, it is worth reiterating that a substantial proportions of LSD residents still use external non-regulated sources, residents in LSDs will not (or cannot) drink their community's public drinking water, and 21.42% of LSDs appear to prefer unregulated private sources (e.g., personal wells). This further complicates water quality issues, as the private well owners are expected to ensure the quality of their well water. This private testing falls outside the provincial government's regulatory authority, which means that provincial reporting mechanisms (e.g. the DWQI) do not address private wells. Ultimately, testing a drinking water supply and then assessing its quality is less meaningful if residents are do not actually consume the water from that supply. If residents rely on external water sources to replace or supplement their public sources, then reports measuring water quality in public water supplies may be a misleading indicator of the quality of the water that residents are actually consuming.

Another recurring theme from the survey analysis is that smaller communities (e.g., LSDs) are less likely to be involved in Knowledge Mobilization (KMb) activities. WOs within LSDs are less likely to attend or have heard of the Annual Drinking Water Workshop hosted by the provincial government (61.54% of Volunteers had *never* attended this event; 60.00% of LSDs had *never* attended this event; 26.09% of COTOLs had *never* attended this event). These sorts of conferences are an excellent opportunity to engage in KMb. However, since Volunteers often do not attend these events, they have fewer opportunities to share their experiences with a broader audience. This limits the chances of meaningful change, as these types of communities may be lacking an accessible forum in which to express concerns about water-related topics. Additionally, professional development conferences are an opportunity to acquire information about new technologies, or to simply network with knowledgeable peers. In contrast, larger communities report regular attendance at this event and also seem to benefit from KMb with other WOs. This trend holds true when the population variable is adjusted (see Figure 20): when COTOLs are split into ≤500 Communities and 501-1000 Communities, the trend indicates that Volunteers are more likely to cluster within the smaller community subset (92.30%). In essence, the gap between paid employees and Volunteers may be growing in part because of the access to informational resources that paid employees appear to have.

Figure 20: Discussion - Employment Type within Communities ≤1000

	Employment Type					
	Full-time		Part-time		Volunteer	
	Count	%	Count	%	Count	%
<500	14	58.33%	6	66.66%	12	92.31%
501-1000	10	41.66%	3	33.33%	1	7.69%

The researchers are curious why Volunteers are not electing to attend these types of events. Is there a lack of information and awareness about them? Is there insufficient funding to allow these Volunteer WOs to attend? Are Volunteer WOs simply uninterested? Or are Volunteers unable to leave their communities because there is no one else to operate their water systems? Further research on this topic is needed, as it appears as though the individuals who most need of this type of event are consistently disengaged from it.

Limitations

A potential limitation of the current study was the self-selection or participation. Communities were not randomly sampled from the province, and elected to provide information by their own volition. In other words, communities experienced different motivational forces for participation within the study. While this does not invalidate the current findings, it may limit the generalizability of the findings to those who participated in the study. WOs had to go through the administrators e-mail or mail box in order to provide data on the current study. The reliance on a third party may have presented a barrier to participation. This approach was used because researchers did not have access to the contact information for WOs. Researchers attempted to ameliorate this problem by attending DOEC's Clean and Safe Drinking Water Workshop in an attempt to promote participation in the current study.

8.0 Conclusion

This report outlines the state of drinking water systems in NL from the perspective of Water Operators who answered the survey. It should be noted that the researchers expected that those communities who are experiencing the greatest challenges most likely did not answer this survey, as they may not have the human resources to do so. The data would suggest that issues regarding certification, remuneration, and KMb are disproportionately bore by smaller communities. These issues are can be resolved but will require cooperation amongst the interested parties in the pursuit of this goal.

For more information on this research project as well as other reports, such as the community administrator's survey analysis, please visit the project website: http://nlwater.ruralresilience.ca/?page_id=17

9.0 Water Operator Survey Appendix

Survey Consent

You are being asked to participate voluntarily in a survey as part of a project entitled Exploring Solutions for Sustainable Rural Drinking Water Systems, led by Dr. Kelly Vodden (Environmental Policy Institute, Grenfell Campus, Memorial University) in collaboration with the Professional Municipal Administrators (PMA) and Municipalities Newfoundland and Labrador (MNL). This study is being conducted to identify the types of risks and challenges influencing drinking water quality and availability in rural areas, with a particular emphasis on communities of 1,000 residents or less in Newfoundland and Labrador (NL). This research project is funded by the Harris Centre – RBC Water Research and Outreach Fund.

This survey is being used to collect data related to the realities municipalities and local service districts (LSDs) are facing with their drinking water systems. More information on the project can be found on the project's website: http://nlwater.ruralresilience.ca. Also, the results of the survey will be compiled into a report which will be available on the project's website.

The survey will take approximately 15-20 minutes to complete. Your participation in this survey is entirely voluntary and there will be no negative consequences if you refuse to participate in it, withdraw from it, or refuse to answer certain questions. Your participation/identity in the survey will be confidential. All comments and answers you provide will not be attributed to your identity and comments will be generalized to prevent identification of specific municipalities/LSDs.

The survey is designed so that it can be answered without needing any background documentation if being answered by the WATER OPERATOR. Upon completion of the survey responses will be stored in a secure location, will be kept in strict confidence, and only reviewed by members of the research team who have signed a confidentiality agreement. By proceeding with this survey you are indicating your consent to participate.

The proposal for this research has been reviewed by the Grenfell Research Ethics Board 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 Research Ethics Board through the Grenfell Research Office (dwstrickland@grenfell.mun.ca).

If you have any questions or concerns regarding this survey or the research project in general, please contact Sarah Minnes, project coordinator (sminnes@grenfell.mun.ca).

Thank you for your time and help in improving Newfoundland and Labrador's drinking water systems, your contribution is truly appreciated!

General Information

1. Which type of organization do you represent?
   - Municipality
   - LSD

2. What is the name of your municipality/LSD?

3. What is the current population of your municipality/LSD?
   - 200 or fewer
   - 201-300
   - 301-400
   - 401-500
   - 501-750
   - 751-1000
   - 1001-1500
   - 1501-4000
   - 4001-9999
   - 10000 or above

4. In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?
   - Avalon
   - Central
   - Eastern
   - Labrador
   - Northern
   - Western

5. Are you a fulltime, parttime or volunteer water operator in your municipality/LSD?
   - Fulltime
   - Parttime
   - Volunteer

6. What is your primary position within your municipality/LSD? Please only select ONE option.
   - Water operator
   - Councillor/water operator
   - Chair person/water operator
   - Municipal/LSD administrator/water operator
   - Mayor/water operator
   - Other (please specify)

7. How long have you been a water operator for?

- Less than 1 year
- 1 – 5 years
- 6 – 20 years
- More than 20 years

8. What is your highest level of water operating certification? Please only select ONE option.

- Operator in Training (OIT)
- Small Systems (Very Small Water Systems and Small Wastewater Systems)
- Class I
- Class II
- Class III
- Class IV
- I do not have formal training as administered by the Department of Environment and Conservation
- Other (please specify)

9. Where do the majority of households in your municipality/LSD get their main source of drinking water? Rank choices from 1 (used as main source) to 4 (least used source)?

- Municipal/LSD water supply
- Private source (e.g. personal well)
- Spring
- Bottled water

Water Filtration and Treatment

10. Does your municipality/LSD treat (e.g. any treatment, disinfection or filtration) its drinking water supplied to residents?

- Yes
- No, but it does have water distribution infrastructure (e.g. pipes). Please answer the comment box below.
- My municipality/LSD only has a Potable Water Dispensing Unit (PWDU).
- No, my municipality/LSD does not have any kind of municipal/LSD water treatment or water infrastructure.
- If your municipality/LSD does not treat it's water but has municipal/LSD water distribution infrastructure, why do you not treat your water?

_____

11. What method does your municipality/LSD use for filtration of source water? Choose all that apply.

- Water Filtration and Treatment
- Type anthracite coal
- Sand
- Granular activated carbon
- Green sand
- Microfiltration
- Nanofiltration
- Reverse osmosis
- Ultrafiltration
- My municipality/LSD does not use filtration
- I don't know
- Other (please specify)

12. What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.

- Arsenic removal
- Coagulation
- Dissolved air floatation
- Flocculation
- Fluoridation
- Iron/manganese removal
- Micron/pressure filters
- pH adjustment
- Sedimentation
- Softening
- Stripping
- Strontium removal
- Taste and odor control
- Upflow clarifier

- None
- I don't know
- Other (please specify)

13. What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.

- Calcium hypochlorite (powder)
- Chloramines
- Gas chlorination
- Liquid hypochlorination
- Mixed oxidants (MIOX)
- Ozone
- Ultraviolet light (UV)
- None
- I don't know
- Other (please specify)

14. How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?

- Less than 5 years old
- 5-10 years old
- More than 10 years – 25 years old
- More than 25 years – 35 years old
- Over 35 years old
- I don't know

15. Does your municipality/LSD have a maintenance plan for its water treatment system/plant operations?

- Yes
- No
- I don't know

16. Does your municipality/LSD have standard operating procedures for its water treatment system/plant operations?

- Yes
- No
- I don't know

17. How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?

- Daily
- Weekly
- Twice a month
- Monthly
- Other (please specify)

18. Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.

- Yes.
- No, because it is undergoing maintenance or repair
- No, because of a lack of qualified operators
- No, because of taste complaints
- No, because of a lack of funds to operate
- I don't know
- No, because of other reasons (please specify)

19. What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.

- Lack of expertise/contractors to make upgrades or repairs
- Lack of availability of parts or supplies needed for upgrades or repairs
- Lack of financial resources
- No one qualified to operate system if upgrades or repairs are made
- Not a priority
- There are no barriers
- I don't know
- Other (please specify)

20. Has your municipality/LSD been under a boil water advisory any time in the last 4 years?

- Yes
- No

21. What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.

- Water supply has no disinfection system
- Chlorination system is turned off by the operator, due to taste or other aesthetic considerations.
- Chlorination system is turned off by operator, due to perceived health risks.
- Chlorination system is turned off by operator, due to lack of funds to operate.
- Disinfection system is off due to maintenance or mechanical failure.
- Disinfection system is off due to lack of chlorine or other disinfectant.
- Water distribution system is undergoing maintenance or repairs.
- A cross connection is discovered in the distribution system.
- Inadequately treated water was introduced into the system due to fireflows, flushing operations, interconnections, minor power outage or other pressure loss.
- 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.
- No free chlorine residual detected in the water distribution system.
- Insufficient residual disinfectant in water system primarily disinfected by means other than chlorination.

- Total coliform detected AND repeat samples cannot be taken as required
- Escherichia coli (E. coli) detected AND repeat samples cannot be taken as required
- Total coliforms detected and confirmed in repeat sample.
- Escherichia coli (E.coli) detected in an initial sample(s) is considered extensive and the water system has other known problems.
- Escherichia coli (E.coli) detected and confirmed in repeat sample.
- Viruses detected (eg, Hepatitis A, Norwalk).
- Protozoa detected (eg, Giardia, Cryptosporidium).
- Water supply system integrity compromised due to disaster (e.g. contamination of water source from flooding, gross contamination, major
- power failure, etc.).
- Waterborne disease outbreak in the community.
- Other (please specify)

22. Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?

- Yes
- No
- If you answered "yes" what was the reason for the precautionary boil water advisory?

23. Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?

- Always
- Sometimes
- Never

24. Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?

- Always
- Sometimes
- Never

Water Distribution and Maintenance

25. How old is the OLDEST part of your water distribution system for each part of your water distribution system? Answer all that apply.

- Age (in years)
- Water distribution pipes
- Chlorination equipment
- Pump
- Other treatment equipment other than chlorination
- Filtration system (e.g. screens)
- Chlorine booster station
- Water storage tank
- Man made dams

26. How old is the NEWEST part of your water distribution system for each part of your water distribution system? Answer all that apply.

- Age (in years)
- Water distribution pipes
- Chlorination equipment
- Pump
- Other treatment equipment other than chlorination
- Filtration system (e.g. screens)
- Chlorine booster station
- Water storage tank
- Man made dams

27. What material is your water distribution pipes made of? Choose all that apply.

- Steel
- Polyvinyl chloride
- (PVC/uPVC)
- Ductile iron
- Cast iron
- Polypropylene
- Polyethylene
- Copper
- Wood
- I don’t know
- Other (please specify)

28. What is the average size of your water distribution pipes not including service connections? Choose all that apply.

29. How does water reach the water plant/distribution system in your municipality/LSD?

- Gravity fed
- Pumping system
- Combination of gravity fed and pumping system (e.g. a water tower)
- Other (please specify)

30. Does the current water demand in your municipality/LSD exceed the design capacity of your water system?

- Yes
- No
- I don't know

31. What is the approximate piping distance from the disinfection system or closest chlorine booster station to the last user on your municipal/LSD system?

- 1km or less
- 1.1km-2km
- 2.1 km-3km
- 3.1km4km
- 4.1 km5km
- Over 5km
- N/A

32. Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?

- Yes
- No
- I don't know
- N/A
- If you answered “yes”, what measures (if any) have you taken to deal with the distance issue?

33. In 2012, how many leaks were there in your municipality’s/LSD's water infrastructure that required repair?

- None
- 1-2
- 3-4
- 5-6
- 7-10
- 11+
- I don't know

34. How often does your municipality/LSD do leak detection?

- Once a month
- Every 2-3 months
- Every 4-5 months
- Twice a year
- Yearly
- My municipality/LSD does not do leak detection
- I don't know

Water Distribution and Maintenance

35. Does your municipality/LSD have an organized leak detection program?

- Yes
- No, we only do leak detection when leaks or problems occur
- I don't know

36. Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.

- Acoustic loggers
- Combined acoustic logger & correlator
- Deacon meter (waste metering)
- Digital correlator
- District meter area analyzing
- Ground microphones
- Ground penetrating radar
- Helical vane meters
- Leak noise correlator
- Manual sounding
- Step testing
- I don't know
- Other (please specify)

37. Does your municipality/LSD have an annual valve operating/maintenance program? Water Distribution and Maintenance

- Yes
- No
- I don't know

38. How often does your municipality/LSD flush it's water distribution lines?

- More than once a month
- Once a month
- Every 2-5 months
- Twice yearly
- Once a year
- We do not flush our system
- I don't know
- Other (please specify)

39. What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.

- Age of the system (e.g corrosion)
- Knowledge of system
- Lack of human resources
- Lack of maps/drawings (AsBuilts) of infrastructure
- Leakage
- Maintenance
- Source water quality
- Serving small population over large geographic areas
- None. My municipality's/LSD's water distribution system does not have any issues.
- I don't know
- Other (please specify)

40. How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?

- Operational Issues
- Daily in one location
- Daily in two or more locations
- Weekly
- Monthly
- Quarterly
- I don't know
- Other (please specify)

41. How often does the Department of Environment and Conservation test your municipality's/LSD's water?

- Daily
- Weekly
- Monthly
- Quarterly
- Annually
- I don't know
- Other (please specify)

42. How often does the Department of Service NL test your municipality's/LSD's water?

- Daily
- Weekly
- Monthly
- Quarterly
- Annually
- I don't know
- Other (please specify)

43. Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.

- Yes, we have maps (AsBuilts) or blue prints for ALL of the water distribution infrastructure
- Yes, we have maps (AsBuilts) or blue prints for PART(S) of the water distribution infrastructure
- Yes, we have GIS (Geographic Information System) mapping of the infrastructure
- Yes, we have a detailed asset management plan for our water system which maps out the system
- No, we do not have a map of the water distribution infrastructure
- I don’t know

44. Is there a designated office/filing area in your municipality/LSD for drinking water system information?

- Yes
- No
- I don't know

45. Does your municipality/LSD have a written formal maintenance plan for it's water distribution infrastructure (e.g. pipes, valves, etc)?

- Yes
- No
- I don't know

Human Resources and Training

46. Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?

- Yes
- To some degree
- No
- I don't know
- If you answered "no", what resources do you need to operate the system sufficiently?

47. Do you feel the province provides enough access to provincial water operator training opportunities?

- Yes
- No
- If you answered "no", what could the province improve in regards to their training opportunities?

48. Do you feel that your municipality/LSD provides you with adequate training opportunities to do your job as a water operator?

- Yes
- No
- I don't know

49. Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.

- Communicated highly effectively
- Communicated reasonably well
- Communicated adequately
- Communicated very poorly
- Not communicated at all
- I don't know

50. Who provides you with information about new technologies for drinking water systems? Choose all that apply.

- Human Resources and Training
- Atlantic Canada Water and Wastewater Association
- Companies/industry
- Municipalities Newfoundland and Labrador (MNL)
- Municipality/LSD (e.g. your mayor or councillors)
- Other professional associations (e.g. NEIA)
- Other water operators
- Professional Municipal Administrators (PMA)

- Provincial agencies

51. How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.

- Newsletters
- Email
- Mail
- Workshops and conferences
- By Mayors, councillors or municipal/LSD administrators
- Websites
- Discussion with other water operators/colleagues
- Other (please specify)

52. Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?

- Yes every year
- Almost every year
- Rarely
- Never, however I have heard of the Annual Drinking Water Workshop
- I have never heard of the Annual Drinking Water Workshop
- I haven't had the opportunity to go to the Annual Drinking Water Workshop (I am still new to my position)

53. How content are you with your compensation for your duties as water operator?

- Very content
- Somewhat content
- Neutral
- Somewhat discontent
- Very discontent

54. Do you have employee benefits from your job as a water operator (e.g. medical benefits)?

- Yes
- No
- I don't know

55. What is your salary range for your position as water operator?

- $0 (volunteer without any compensation)
- 1-9,999
- $10,000$-19,999
- $20,000$-29,999
- $30,000$-39,999
- $40,000$-49,999
- $50,000$-59,999
- $60,000$-69,999
- $70,000 and above
- I would prefer not to share this information
- I am compensated in other ways that does not include a salary (e.g. having your taxes paid for you). Please specify: _____

56. Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.

- Agriculture
- Commercial forest harvesting
- Domestic wood cutting
- Hunting and fishing
- Hydroelectricity (damming)
- Mining (including quarrying)
- Oil and gas exploration and development (including hydraulic fracturingfracking)
- Recreational use (e.g. swimming, snowmobiling, boating)
- Residential cabin development
- Transmission lines and roads
- None there are no land use activities that I believe are threats to my municipal/LSD water supply
- Other (please specify)

57. Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.

- Source Water Threats
- Beaver dams
- Drought/low water levels
- Extreme weather events (e.g. high winds, heavy rains)
- Flooding
- Freeze/thaw
- Salt water intrusions
- None there are no natural processes that I believe are threats to my municipal/LSD's water supply
- Other (please specify)

58. Which of the following are concerns for your municipal/LSD water system? Choose all that apply.

- Aesthetics visual qualities of colour and cloudiness
- Naturally occurring metals (e.g. lead, arsenic)
- Organic carbon content
- Acidity
- Presence of disease causing microorganism (e.g. E.Coli and Giardia)
- Human pollution (e.g. car wrecks, garbage, illegal dumping)
- Endocrine disrupting chemicals (EDCs) (e.g. drugs, cosmetics, and pesticides)
- I don't know
- None there are no concerns that I believe are threats to my municipal/LSD's water supply
- Other (please specify)

59. Are there any new or innovative drinking water solutions that your municipality/LSD has implemented or considered? If no, please skip question. _____

60. Are there actions that your municipality/LSD has tried in the past to address drinking water issues that have not worked or not worked well? If no, please skip question. _____

61. Are there any other comments regarding drinking water systems in your municipality/LSD or elsewhere that you would like to include? Please explain any problems either covered or not in the survey. _____

10.0 Municipalities/LSD Descriptive Statistics Appendix

Note: Question #2 was "Community Name", which was confidential.

		Municipality	LSD
Q1 Which type of organization do you represent?	Municipality	100.0%	0.0%
	LSD	0.0%	100.0%
		Municipality	LSD
Q3 What is the current population of your municipality/LSD?	200 or fewer	8.9%	53.3%
	201-300	14.3%	26.7%
	301-400	5.4%	13.3%
	401-500	3.6%	0.0%
	501-750	17.9%	6.7%
	751-1000	5.4%	0.0%
	1001-1500	12.5%	0.0%
	1501-4000	12.5%	0.0%
	4001-9999	14.3%	0.0%
	10000 or above	5.4%	0.0%
		Municipality	LSD
Q4 In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?	Avalon	28.6%	13.3%
	Central	28.6%	40.0%
	Eastern	8.9%	20.0%
	Labrador	8.9%	6.7%
	Northern	5.4%	6.7%
	Western	19.6%	13.3%
		Municipality	LSD
Q5 Are you a full-time, part-time or volunteer water operator in your municipality/LSD?	Full-time	82.1%	13.3%
	Part-time	14.3%	13.3%
	Volunteer	3.6%	73.3%
		Municipality	LSD
Q6 What is your primary position within your municipality/LSD? Please only select ONE option.	Other (please specify)	46.4%	0.0%
	Water operator	48.2%	53.3%
	Councillor/water operator	0.0%	13.3%
	Chair person/water operator	0.0%	33.3%
	Municipal/LSD administrator/water operator	5.4%	0.0%
	Mayor/ water operator	0.0%	0.0%
		Municipality	LSD

Q7 How long have you been a water operator for?	Less than 1 year	1.8%	0.0%
	1 – 5 years	39.3%	26.7%
	6 – 20 years	44.6%	53.3%
	More than 20 years	14.3%	20.0%
Q8 What is your highest level of water operating certification? Please only select ONE option.	Other (please specify)	7.3%	6.7%
	Operator in Training (OIT)	16.4%	6.7%
	Small Systems (Very Small Water Systems and Small Wastewater	9.1%	6.7%
	Class I	32.7%	6.7%
	Class II	23.6%	13.3%
	Class III	3.6%	0.0%
	Class IV	1.8%	0.0%
	I do not have formal training as administered by the Department of Environment and Conservation	5.5%	60.0%
q0009_0001 Municipal/LSD water supply (INPUT MISSING VALUES FOR THESE ONES)	Jan-00	7.10%	0.00%
	1	64.30%	91.10%
	2	7.10%	5.40%
	3	21.40%	1.80%
	4	0.00%	1.80%
q0009_0002 Private source (e.g. personal well)	0	42.90%	35.70%
	1	21.40%	5.40%
	Jan-00	21.40%	32.10%
	3	0.00%	14.30%
	4	14.30%	12.50%
q0009_0003 Spring	0	57.10%	51.80%
	1	7.10%	1.80%
	2	7.10%	12.50%
	3	14.30%	19.60%
	Jan-00	14.30%	14.30%
q0009_0004 Bottled water	0	50.00%	35.70%
	1	7.10%	1.80%
	2	28.60%	28.60%
	3	7.10%	23.20%
	4	7.10%	10.70%

		Municipality	LSD
Q10 Does your municipality/ LSD treat (e.g. any treatment, disinfection or filtration) its drinking water supplied to residents?	Yes	94.5%	100.0%
	No, but it does have water distribution infrastructure (e.g. pipes).	5.5%	0.0%
	My municipality/LSD only has a Potable Water Dispensing Unit (PWDU)	0.0%	0.0%
	No, my municipality/LSD does not have any kind of municipal/LSD water treatment or water infrastructure.	0.0%	0.0%

		Municipality	LSD
Q11_1 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Type anthracite coal	12.0%	0.0%
Q11_2 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Sand	20.0%	7.1%
Q11_3 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Granular activated carbon	10.0%	7.1%
Q11_4 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Green sand	4.0%	0.0%
Q11_5 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Microfiltration	14.0%	7.1%
Q11_6 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Nanofiltration	0.0%	0.0%
Q11_7 What method does your municipality/LSD use for filtration of source water?	Reverse osmosis	4.0%	7.1%

Choose all that apply.			
Q11_8 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Ultrafiltration	0.0%	7.1%
Q11_9 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	My municipality/LSD does not use filtration	40.0%	92.9%
Q11_10 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	I don't know	6.0%	0.0%
Q11_11 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Other (please specify)	18.0%	7.1%

		Municipality	LSD
Q12_1 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Arsenic removal	2.0%	7.1%
Q12_2 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Coagulation	12.0%	0.0%
Q12_3 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Dissolved air floatation	0.0%	0.0%
Q12_4 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Flocculation	12.0%	0.0%
Q12_5 What kind of drinking water treatment processes or	Fluoridation	0.0%	7.1%

treatments does your municipality/LSD use other than disinfection? Choose all that apply.			
Q12_6 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Iron/manganese removal	6.0%	7.1%
Q12_7 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Micron/pressure filters	6.0%	7.1%
Q12_8 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	pH adjustment	30.0%	7.1%
Q12_9 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Sedimentation	8.0%	7.1%
Q12_10 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Softening	6.0%	0.0%
Q12_11 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Stripping	0.0%	0.0%
Q12_12 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Strontium removal	0.0%	0.0%

Q12_13 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Taste and odor control	4.0%	7.1%
Q12_14 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Upflow clarifier	0.0%	0.0%
Q12_15 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	None	54.0%	85.7%
Q12_16 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	I don't know	4.0%	0.0%
Q12_17 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Other (please specify)	4.0%	0.0%

		Municipality	LSD
Q13_1 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Calcium hypochlorite (powder)	9.6%	6.7%
Q13_2 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Chloramines	0.0%	13.3%
Q13_3 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Gas chlorination	57.7%	0.0%
Q13_4 What kind of drinking	Liquid hypo-	30.8%	80.0%

water disinfection system does your municipality/LSD use? Choose all that apply.	chlorination		
Q13_5 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Mixed oxidants (MIOX)	5.8%	0.0%
Q13_6 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Ozone	7.7%	0.0%
Q13_7 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Ultraviolet light (UV)	7.7%	13.3%
Q13_8 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	None	0.0%	0.0%
Q13_9 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	I don't know	3.8%	0.0%
Q13_10 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Other (please specify)	3.8%	13.3%

		Municipality	LSD
Q14 How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?	Less than 5 years old	15.7%	14.3%
	5-10 years old	11.8%	14.3%
	More than 10 years-25 years old	31.4%	35.7%
	More than 25 years-35 years old	25.5%	21.4%
	Over 35 years old	15.7%	14.3%
		Municipality	LSD
Q15 Does your municipality/ LSD have a maintenance plan for its water treatment system/plant operations?	Yes	78.8%	42.9%
		Municipality	LSD
Q16 Does your municipality/ LSD have standard operating	Yes	81.1%	66.7%

procedures for its water treatment system/plant operations?			
		Municipality	LSD
Q17 How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?	Other (please specify)	15.4%	53.3%
	Daily	34.6%	6.7%
	Weekly	34.6%	6.7%
	Twice a month	0.0%	13.3%
	Monthly	15.4%	20.0%

		Municipality	LSD
Q18_1 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Yes.	76.9%	92.3%
Q18_2 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because it is undergoing maintenance or repair	9.6%	0.0%
Q18_3 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of a lack of qualified operators	0.0%	0.0%
Q18_4 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of taste complaints	0.0%	0.0%
Q18_5 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of a lack of funds to operate	5.8%	0.0%
Q18_6 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	I don't know	0.0%	0.0%
Q18_7 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of other reasons (please specify)	7.7%	7.7%

		Municipality	LSD
Q19_1 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	Lack of expertise/ contractors to make upgrades or repairs	8.3%	0.0%
Q19_2 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	Lack of availability of parts or supplies needed for upgrade	25.0%	0.0%
Q19_3 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	Lack of financial resources	75.0%	100.0%
Q19_4 What are the barriers to repairing your municipality's/	No one qualified to operate system if	0.0%	0.0%

LSD's water treatment system? Choose all that apply.	upgrades or repairs are made		
Q19_5 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	Not a priority	0.0%	0.0%
Q19_6 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	There are no barriers	0.0%	0.0%
Q19_7 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	I don't know	0.0%	0.0%
Q19_8 What are the barriers to repairing your municipality's/ LSD's water treatment system? Choose all that apply.	Other (please specify)	0.0%	0.0%
		Municipality	LSD
Q20 Has your municipality/LSD been under a boil water advisory any time in the last 4 years?	Yes	79.2%	93.3%

		Municipality	LSD
Q21_1 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water supply has no disinfection system	0.0%	14.3%
Q21_2 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by the operator, due to taste or other aesthetic considerations.	0.0%	0.0%
Q21_3 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by operator, due to perceived health risks	0.0%	0.0%
Q21_4 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by operator, due to lack of funds to operate	0.0%	7.1%
Q21_5 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Disinfection system is off due to maintenance or mechanical failure	40.5%	14.3%

Q21_6 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Disinfection system is off due to lack of chlorine or other disinfectant	11.9%	0.0%
Q21_7 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water distribution system is undergoing maintenance or repair.	47.6%	14.3%
Q21_8 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	A cross connection is discovered in the distribution system.	0.0%	0.0%
Q21_9 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Inadequately treated water was introduced into the system due to fireflows, flushing operations, interconnections, minor power outage or other pressure loss	23.8%	0.0%
Q21_10 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual	11.9%	21.4%
Q21_11 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No free chlorine residual detected in the water distribution system	21.4%	14.3%
Q21_12 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Insufficient residual disinfectant in water system primarily disinfected by means other than chlorination	7.1%	0.0%
Q21_13 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Total coliform detected AND repeat samples cannot be taken as required	9.5%	0.0%
Q21_14 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E. coli) detected AND repeat samples cannot be taken as required	4.8%	0.0%
Q21_15 What was the reason(s) for your municipality's/LSD's	Total coliforms detected and	14.3%	28.6%

boil water advisory(ies)? Choose all that apply.	confirmed in repeat sample.		
Q21_16 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E.coli) detected in an initial sample(s) is considered extensive and the water system is known to have other problems	0.0%	0.0%
Q21_17 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E.coli) detected and confirmed in repeat samples	4.8%	0.0%
Q21_18 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Viruses detected (eg, Hepatitis A, Norwalk).	0.0%	0.0%
Q21_19 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Protozoa detected (eg, Giardia, Cryptosporidium).	0.0%	0.0%
Q21_20 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water supply system integrity compromised due to disaster (e.g. contamination of water source from flooding, gross contamination, major power failure, etc.)	9.5%	0.0%
Q21_21 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Waterborne disease outbreak in the community.	0.0%	0.0%

		Municipality	LSD
Q22 Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?	Yes	26.2%	42.9%
		Municipality	LSD
Q23 Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?	Always	90.6%	86.7%
	Sometimes	7.5%	6.7%
	Never	1.9%	6.7%
		Municipality	LSD
Q24 Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?	Always	86.8%	66.7%
	Sometimes	9.4%	20.0%
	Never	3.8%	13.3%

		LSD	Municipality
		Column N %	Column N %
q0025_0001_0001 Water distribution pipes - Age (in years)	0-10	86.70%	90.60%
	Nov-20	6.70%	7.50%
	21-30	6.70%	1.90%
	31-40	0.00%	0.00%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	0.00%	0.00%
q0025_0002_0001 Chlorination equipment - Age (in years)	0-10	66.70%	86.80%
	Nov-20	20.00%	9.40%
	21-30	13.30%	3.80%
	31-40	0.00%	0.00%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	0.00%	0.00%
q0025_0003_0001 Pump - Age (in years)	0-10	7.10%	1.90%
	Nov-20	14.30%	3.80%
	21-30	42.90%	28.80%

	31-40	28.60%	30.80%
	41-50	7.10%	23.10%
	51+	0.00%	11.50%
	N/A	0.00%	0.00%
q0025_0004_0001 Other treatment equipment other than chlorination - Age (in years)	0-10	33.30%	42.00%
	Nov-20	60.00%	36.00%
	21-30	6.70%	14.00%
	31-40	0.00%	6.00%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	0.00%	2.00%
q0025_0005_0001 Filtration system (e.g. screens) - Age (in years)	0-10	71.40%	42.60%
	Nov-20	21.40%	27.70%
	21-30	7.10%	17.00%
	31-40	0.00%	4.30%
	41-50	0.00%	0.00%
	51+	0.00%	2.10%
	N/A	0.00%	6.40%
q0025_0006_0001 Chlorine booster station - Age (in years)	0-10	20.00%	35.90%
	Nov-20	20.00%	28.20%
	21-30	0.00%	7.70%
	31-40	0.00%	2.60%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	60.00%	25.60%
q0025_0007_0001 Water storage tank - Age (in years)	0-10	25.00%	26.30%
	Nov-20	0.00%	28.90%
	21-30	25.00%	15.80%
	31-40	0.00%	7.90%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	50.00%	21.10%
q0025_0008_0001 Man made dams - Age (in years)	0-10	50.00%	23.70%
	Nov-20	0.00%	15.80%
	21-30	0.00%	0.00%
	31-40	0.00%	2.60%

	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	50.00%	57.90%
q0026_0001_0001 Water distribution pipes - Age (in years)	0-10	30.00%	23.90%
	Nov-20	30.00%	13.00%
	21-30	20.00%	13.00%
	31-40	10.00%	15.20%
	41-50	10.00%	6.50%
	51+	0.00%	2.20%
	N/A	0.00%	26.10%
q0026_0002_0001 Chlorination equipment - Age (in years)	0-10	20.00%	12.80%
	Nov-20	0.00%	2.60%
	21-30	40.00%	7.70%
	31-40	0.00%	12.80%
	41-50	20.00%	7.70%
	51+	0.00%	2.60%
	N/A	20.00%	53.80%
q0026_0003_0001 Pump - Age (in years)	0-10	41.70%	62.50%
	Nov-20	25.00%	14.60%
	21-30	8.30%	18.80%
	31-40	16.70%	0.00%
	41-50	8.30%	2.10%
	51+	0.00%	0.00%
	N/A	0.00%	2.10%
q0026_0004_0001 Other treatment equipment other than chlorination - Age (in years)	0-10	66.70%	69.60%
	Nov-20	33.30%	21.70%
	21-30	0.00%	4.30%
	31-40	0.00%	2.20%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	0.00%	2.20%
q0026_0005_0001 Filtration system (e.g. screens) - Age (in years)	0-10	76.90%	65.10%
	Nov-20	15.40%	25.60%
	21-30	7.70%	2.30%
	31-40	0.00%	0.00%
	41-50	0.00%	0.00%

	51+	0.00%	0.00%
	N/A	0.00%	7.00%
q0026_0006_0001 Chlorine booster station - Age (in years)	0-10	66.70%	51.50%
	Nov-20	16.70%	12.10%
	21-30	0.00%	3.00%
	31-40	0.00%	0.00%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	16.70%	33.30%
q0026_0007_0001 Water storage tank - Age (in years)	0-10	25.00%	36.80%
	Nov-20	0.00%	15.80%
	21-30	25.00%	18.40%
	31-40	0.00%	5.30%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	50.00%	23.70%
q0026_0008_0001 Man made dams - Age (in years)	0-10	40.00%	33.30%
	Nov-20	0.00%	13.90%
	21-30	0.00%	0.00%
	31-40	0.00%	0.00%
	41-50	0.00%	0.00%
	51+	0.00%	0.00%
	N/A	60.00%	52.80%

		Municipality	LSD
Q27_1 What material is your water distribution pipes made of? Choose all that apply.	Steel	7.1%	6.7%
Q27_2 What material is your water distribution pipes made of? Choose all that apply.	Polyvinyl chloride (PVC/uPVC)	57.1%	60.0%
Q27_3 What material is your water distribution pipes made of? Choose all that apply.	Ductile iron	67.9%	6.7%
Q27_4 What material is your water distribution pipes made of? Choose all that apply.	Cast iron	21.4%	0.0%
Q27_5 What material is your water distribution pipes made of? Choose all that apply.	Polypropylene	5.4%	33.3%

Q27_6 What material is your water distribution pipes made of? Choose all that apply.	Polyethylene	21.4%	33.3%
Q27_7 What material is your water distribution pipes made of? Choose all that apply.	Copper	32.1%	0.0%
Q27_8 What material is your water distribution pipes made of? Choose all that apply.	Wood	0.0%	0.0%
Q27_9 What material is your water distribution pipes made of? Choose all that apply.	I don’t know	3.6%	0.0%
Q27_10 What material is your water distribution pipes made of? Choose all that apply.	Other (please specify)	8.9%	0.0%

		LSD	Municipality
q0028_0001_0001 Steel - Size (inches)	1-3 inches	100.00%	40.00%
	4 inches	0.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	40.00%
	8-9 inches	0.00%	0.00%
	10-11 inches	0.00%	0.00%
	12 inches or more	0.00%	20.00%
q0028_0002_0001 Polyvinyl chloride (PVC/uPVC) - Size (inches)	1-3 inches	50.00%	11.40%
	4 inches	25.00%	14.30%
	5 inches	0.00%	0.00%
	6-7 inches	12.50%	28.60%
	8-9 inches	12.50%	25.70%
	10-11 inches	0.00%	11.40%

	12 inches or more	0.00%	8.60%
q0028_0003_0001 Ductile iron - Size (inches)	1-3 inches	0.00%	0.00%
	4 inches	100.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	38.50%
	8-9 inches	0.00%	43.60%
	10-11 inches	0.00%	10.30%
	12 inches or more	0.00%	7.70%
q0028_0004_0001 Cast iron - Size (inches)	1-3 inches	100.00%	0.00%
	4 inches	0.00%	7.70%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	30.80%
	8-9 inches	0.00%	23.10%
	10-11 inches	0.00%	15.40%
	12 inches or more	0.00%	23.10%
q0028_0005_0001 Polypropylene - Size (inches)	1-3 inches	100.00%	50.00%
	4 inches	0.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	0.00%
	8-9 inches	0.00%	50.00%
	10-11 inches	0.00%	0.00%
	12 inches or more	0.00%	0.00%
q0028_0006_0001 Polyethylene - Size (inches)	1-3 inches	60.00%	40.00%

	4 inches	40.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	20.00%
	8-9 inches	0.00%	30.00%
	10-11 inches	0.00%	10.00%
	12 inches or more	0.00%	0.00%
q0028_0007_0001 Copper - Size (inches)	1-3 inches	0.00%	100.00%
	4 inches	0.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	0.00%
	8-9 inches	0.00%	0.00%
	10-11 inches	0.00%	0.00%
	12 inches or more	0.00%	0.00%
q0028_0008_0001 Wood - Size (inches)	1-3 inches	0.00%	0.00%
	4 inches	0.00%	0.00%
	5 inches	0.00%	0.00%
	6-7 inches	0.00%	0.00%
	8-9 inches	0.00%	0.00%
	10-11 inches	0.00%	0.00%
	12 inches or more	0.00%	0.00%

		Municipality	LSD
Q29 How does water reach the water plant/distribution system in your municipality/LSD?	Other (please specify)	5.5%	0.0%
	Gravity fed	41.8%	13.3%
	Pumping system	27.3%	80.0%
	Combination of gravity fed and pumping system (e.g. a water tower)	25.5%	6.7%
		Municipality	LSD
Q30 Does the current water demand in your municipality/ LSD exceed the design capacity of your water system?	Yes	13.7%	33.3%
		Municipality	LSD
Q31 What is the approximate piping distance from the disinfection system or closest chlorine booster station to the last user on your municipal/LSD system?	1km or less	10.0%	46.7%
	1.1km- 2km	14.0%	20.0%
	2.1 km-3 km	22.0%	13.3%
	3.1km-4km	16.0%	13.3%
	4.1 km-5km	18.0%	6.7%
	Over 5km	20.0%	0.0%
		Municipality	LSD
Q32 Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?	Yes	35.8%	26.7%
	No	62.3%	73.3%
	I don't know	1.9%	0.0%
		Municipality	LSD
Q33 In 2012, how many leaks were there in your municipality's/LSD's water infrastructure that required repair?	None	7.7%	33.3%
	1-2	30.8%	13.3%
	3-4	15.4%	33.3%
	5-6	7.7%	13.3%
	7-10	19.2%	0.0%
	11+	19.2%	6.7%
		Municipality	LSD
Q34 How often does your municipality/LSD do leak detection?	Once a month	4.3%	14.3%
	Every 2-3 months	0.0%	14.3%
	Every 4-5 months	2.2%	0.0%
	Twice a year	13.0%	7.1%
	Yearly	21.7%	7.1%
	My municipality/LSD does not do leak detection	58.7%	57.1%
		Municipality	LSD

Q35 Does your municipality/ LSD have an organized leak detection program?	Yes	18.5%	16.7%
	No, we only do leak detection when leaks or problems occur	81.5%	83.3%

		Municipality	LSD
Q36_1 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Acoustic loggers	12.0%	0.0%
Q36_2 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Combined acoustic logger & correlator	4.0%	0.0%
Q36_3 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Deacon meter (waste metering)	0.0%	28.6%
Q36_4 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Digital correlator	8.0%	14.3%
Q36_5 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	District meter area analyzing	0.0%	14.3%
Q36_6 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Ground microphones	32.0%	0.0%
Q36_7 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Ground penetrating radar	4.0%	0.0%
Q36_8 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Helical vane meters	0.0%	0.0%
Q36_9 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Leak noise correlator	28.0%	0.0%
Q36_10 Which of the following methods does your municipality/LSD use for leak	Manual sounding	36.0%	57.1%

detection? Choose all that apply.			
Q36_11 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Step testing	12.0%	28.6%
Q36_12 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	I don't know	8.0%	0.0%
Q36_13 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Other (please specify)	24.0%	14.3%
		Municipality	LSD
Q37 Does your municipality/ LSD have an annual valve operating/ maintenance program?	Yes	28.3%	26.7%
		Municipality	LSD
Q38 How often does your municipality/LSD flush it's water distribution lines?	Other (please specify)	9.3%	0.0%
	More than once a month	0.0%	0.0%
	Once a month	1.9%	0.0%
	Every 2-5 months	3.7%	14.3%
	Twice yearly	48.1%	21.4%
	Once a year	31.5%	28.6%
	We do not flush our system	5.6%	35.7%

		Municipality	LSD
Q39_1 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Age of the system (e.g corrosion)	70.9%	73.3%
Q39_2 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Knowledge of system	3.6%	0.0%
Q39_3 What are the biggest issues, other than financial	Lack of human resources	9.1%	13.3%

constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.			
Q39_4 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Lack of maps/drawings (As-Builts) of infrastructure	25.5%	33.3%
Q39_5 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Leakage	23.6%	40.0%
Q39_6 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Maintenance	14.5%	13.3%
Q39_7 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Source water quality	20.0%	6.7%
Q39_8 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Serving small population over large geographic areas	12.7%	13.3%
Q39_9 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	None. My municipality's/LSD's water distribution system does not have any issues	7.3%	13.3%
Q39_10 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	I don't know	0.0%	0.0%

Q39_11 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Other (please specify)	1.8%	6.7%
		Municipality	LSD
Q40 How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?	Daily in one location	14.0%	15.4%
	Daily in two or more locations	76.0%	23.1%
	Weekly	10.0%	61.5%
	Monthly	0.0%	0.0%
	Quarterly	0.0%	0.0%
		Municipality	LSD
Q41 How often does the Department of Environment and Conservation test your municipality's/LSD's water?	Daily	0.0%	0.0%
	Weekly	18.6%	0.0%
	Monthly	20.9%	38.5%
	Quarterly	46.5%	30.8%
	Annually	14.0%	30.8%
		Municipality	LSD
Q42 How often does the Department of Service NL test your municipality's/LSD's water?	Daily	0.0%	0.0%
	Weekly	23.7%	0.0%
	Monthly	63.2%	80.0%
	Quarterly	10.5%	10.0%
	Annually	2.6%	10.0%

		Municipality	LSD
Q43_1 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have maps (As-Builts) or blue prints for ALL of the water distribution infrastructure	50.9%	13.3%
Q43_2 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have maps (As-Builts) or blue prints for PART(S) of the water distribution infrastructure	27.3%	13.3%
Q43_3 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have GIS (Geographic Information System) mapping of the water distribution infrastructure	3.6%	13.3%
Q43_4 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have a detailed asset management plan for our water distribution infrastructure	1.8%	13.3%
Q43_5 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	No, we do not have a map of the water distribution infrastructure	21.8%	60.0%
Q43_6 Does your municipality/ LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	I don’t know	3.6%	6.7%

		Municipality	LSD
Q44 Is there a designated office/filing area in your municipality/LSD for drinking water system information?	Yes	75.0%	26.7%
		Municipality	LSD
Q45 Does your municipality/ LSD have a written formal maintenance plan for it's water distribution infrastructure (e.g. pipes, valves, etc)?	Yes	14.9%	0.0%
		Municipality	LSD
Q46 Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?	Yes	32.7%	20.0%
	To some degree	50.9%	46.7%
		Municipality	LSD
Q47 Do you feel the province provides enough access to provincial water operator training opportunities?	Yes	80.0%	71.4%
		Municipality	LSD
Q48 Do you feel that your municipality/LSD provides you with adequate training opportunities to do your job as a water operator?	Yes	94.3%	76.9%
		Municipality	LSD
Q49 Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.	1- Communicated highly effectively	9.3%	20.0%
	2- Communicated reasonably well	38.9%	6.7%
	3- Communicated adequately	35.2%	33.3%
	4- Communicated very poorly	7.4%	0.0%
	5- Not communicated at all	3.7%	0.0%
	I don't know	5.6%	40.0%

		Municipality	LSD
Q50_1 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Provincial agencies	24.5%	33.3%
Q50_2 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipality/LSD (e.g. your mayor or councillors)	8.2%	44.4%
Q50_3 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Professional Municipal Administrators (PMA)	10.2%	22.2%
Q50_4 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities Newfoundland and Labrador (MNL)	34.7%	11.1%
Q50_5 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Atlantic Canada Water and Wastewater Association	44.9%	22.2%
Q50_6 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Other professional associations (e.g. NEIA)	14.3%	0.0%
Q50_7 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Companies/industry	46.9%	11.1%
Q50_8 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Other water operators	34.7%	0.0%

		Municipality	LSD
Q51_1 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Newsletters	32.7%	22.2%
Q51_2 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	E-mail	44.9%	0.0%
Q51_3 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Mail	24.5%	55.6%
Q51_4 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Workshops and conferences	77.6%	33.3%
Q51_5 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	By Mayors, councillors or municipal/LSD administrators	26.5%	33.3%
Q51_6 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Websites	16.3%	22.2%
Q51_7 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Discussion with other water operators/colleagues	46.9%	11.1%
Q51_8 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Other (please specify)	0.0%	0.0%

		Municipality	LSD
Q52 Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?	Yes every year	43.6%	6.7%
	Almost every year	34.5%	20.0%
	Rarely	16.4%	13.3%
	Never, however I have heard of the Annual Drinking Water Workshop	5.5%	33.3%
	I have never heard of the Annual Drinking Water Workshop	0.0%	20.0%
	I haven't had the opportunity to go to the Annual Drinking Workshop	0.0%	6.7%
		Municipality	LSD
Q53 How content are you with your compensation for your duties as water operator?	Very content	30.9%	33.3%
	Somewhat content	43.6%	26.7%
	Neutral	18.2%	20.0%
	Somewhat discontent	3.6%	13.3%
	Very discontent	3.6%	6.7%
		Municipality	LSD
Q54 Do you have employee benefits from your job as a water operator (e.g. medical benefits)?	Yes	53.7%	0.0%
		Municipality	LSD
Q55 What is your salary range for your position as water operator?	I am compensated in other ways that does not include a salar	7.4%	0.0%
	$0 (volunteer without any compensation)	1.9%	50.0%
	$1-$9,999	5.6%	35.7%
	$10,000-$19,999	1.9%	7.1%
	$20,000- $29,999	7.4%	0.0%
	$30,000- $39,999	20.4%	0.0%
	$40,000-$49,999	14.8%	0.0%
	$50,000-$59,999	5.6%	0.0%
	$60,000-$69,999	7.4%	0.0%
	$70,000 and above	7.4%	0.0%
	I would prefer not to share this information	20.4%	7.1%

		Municipality	LSD
Q56_1 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Agriculture	3.9%	6.7%
Q56_2 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Commercial forest harvesting	5.9%	6.7%
Q56_3 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Domestic wood cutting	21.6%	26.7%
Q56_4 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Hunting and fishing	13.7%	20.0%
Q56_5 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Hydroelectricity (damming)	2.0%	0.0%
Q56_6 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Mining (including quarrying)	5.9%	0.0%
Q56_7 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Oil and gas exploration and development (including hydraulic	5.9%	0.0%
Q56_8 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Recreational use (e.g. swimming, snowmobiling, boating)	29.4%	26.7%
Q56_9 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Residential cabin development	11.8%	6.7%

Q56_10 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Transmission lines and roads	11.8%	0.0%
Q56_11 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	None- there are no land use activities that I believe are th	47.1%	53.3%
Q56_12 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Other (please specify)	0.0%	0.0%

		Municipality	LSD
Q57_1 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Beaver dams	35.8%	13.3%
Q57_2 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Drought/low water levels	20.8%	20.0%
Q57_3 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Extreme weather events (e.g. high winds, heavy rains)	30.2%	26.7%
Q57_4 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Flooding	7.5%	0.0%
Q57_5 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Freeze/thaw	17.0%	20.0%
Q57_6 Which of these natural processes are currently threats to your municipality's/LSD's main	Salt water intrusions	7.5%	6.7%

water supply. Choose all that apply.			
Q57_7 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	None- there are no natural processes that I believe are threats to my municipal/LSD's water supply	24.5%	33.3%
Q57_8 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Other (please specify)	0.0%	0.0%

		Municipality	LSD
Q58_1 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Aesthetics visual qualities of colour and cloudiness	41.5%	13.3%
Q58_2 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Naturally occurring metals (e.g. lead, arsenic)	7.5%	6.7%
Q58_3 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Organic carbon content	17.0%	20.0%
Q58_4 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Acidity	17.0%	0.0%
Q58_5 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Presence of disease causing microorganism (e.g. E.Coli and Giardia	15.1%	13.3%
Q58_6 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Human pollution (e.g. car wrecks, garbage, illegal dumping)	11.3%	6.7%
Q58_7 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Endocrine disrupting chemicals (EDCs) (e.g. drugs, cosmetics, and pesticides)	1.9%	0.0%
Q58_8 Which of the following are concerns for your municipal/LSD water system?	I don't know	11.3%	20.0%

Choose all that apply.			
Q58_9 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	None- there are no concerns that I believe are threats to my municipal/LSD's water supply	32.1%	33.3%
Q58_10 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Other (please specify)	3.8%	13.3%

11.0 Operator Trinary Appendix

		LSD	≤1000	>1000
Q1 Which type of organization do you represent?	Municipality	0.0%	100.0%	100.0%
	Local Service District (LSD)	100.0%	0.0%	0.0%
		LSD	≤1000	>1000
Q3 What is the current population of your municipality/LSD?	200 or fewer	53.3%	16.1%	0.0%
	201-300	26.7%	25.8%	0.0%
	301-400	13.3%	9.7%	0.0%
	401-500	0.0%	6.5%	0.0%
	501-750	6.7%	32.3%	0.0%
	751-1000	0.0%	9.7%	0.0%
	1001-1500	0.0%	0.0%	28.0%
	1501-4000	0.0%	0.0%	28.0%
	4001-9999	0.0%	0.0%	32.0%
	10000 or above	0.0%	0.0%	12.0%
		LSD	≤1000	>1000
Q4 In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?	Avalon	13.3%	22.6%	36.0%
	Central	40.0%	29.0%	28.0%
	Eastern	20.0%	6.5%	12.0%
	Labrador	6.7%	9.7%	8.0%
	Northern	6.7%	9.7%	0.0%
	Western	13.3%	22.6%	16.0%
		LSD	≤1000	>1000
Q5 Are you a full-time, part-time or volunteer water operator in your municipality/LSD?	Full-time	13.3%	71.0%	96.0%
	Part-time	13.3%	22.6%	4.0%
	Volunteer	73.3%	6.5%	0.0%
		LSD	≤1000	>1000
Q6 What is your primary position within your municipality/LSD? Please only select ONE option.	Other (please specify)	0.0%	38.7%	56.0%
	Water operator	53.3%	54.8%	40.0%
	Councillor/water operator	13.3%	0.0%	0.0%
	Chair person/water operator	33.3%	0.0%	0.0%

	Municipal/LSD administrator/water operator	0.0%	6.5%	4.0%
	Mayor/ water operator	0.0%	0.0%	0.0%

		LSD	≤1000	>1000
Q7 How long have you been a water operator for?	Less than 1 year	0.0%	3.2%	0.0%
	1 – 5 years	26.7%	32.3%	48.0%
	6 – 20 years	53.3%	48.4%	40.0%
	More than 20 years	20.0%	16.1%	12.0%
		LSD	≤1000	>1000
Q8 What is your highest level of water operating certification? Please only select ONE option.	Other (please specify)	6.7%	9.7%	4.2%
	Operator in Training (OIT)	6.7%	25.8%	4.2%
	Small Systems (Very Small Water Systems and Small Wastewater	6.7%	12.9%	4.2%
	Class I	6.7%	32.3%	33.3%
	Class II	13.3%	9.7%	41.7%
	Class III	0.0%	0.0%	8.3%
	Class IV	0.0%	0.0%	4.2%
	I do not have formal training as administered by the Department of	60.0%	9.7%	0.0%
		LSD	≤1000	>1000
Q10 Does your municipality/LSD treat (e.g. any treatment, disinfection or filtration) its drinking water supplied to residents?	No, but it does have water distribution infrastructure (e.g. pipes).	100.0%	100.0%	88.0%
	My municipality/ LSD only has a Potable Water Dispensing Unit (PWDU)	0.0%	0.0%	12.0%
	No, my municipality/LSD does not have any kind of municipal/ LSD water	0.0%	0.0%	0.0%

	treatment or water infrastructure.			
	No, but it does have water distribution infrastructure (e.g. pipes).	0.0%	0.0%	0.0%

		LSD	≤1000	>1000
Q11_1 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Type anthracite coal	0.0%	3.6%	22.7%
Q11_2 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Sand	7.1%	14.3%	27.3%
Q11_3 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Granular activated carbon	7.1%	3.6%	18.2%
Q11_4 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Green sand	0.0%	0.0%	9.1%
Q11_5 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Microfiltration	7.1%	14.3%	13.6%
Q11_6 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Nanofiltration	0.0%	0.0%	0.0%
Q11_7 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Reverse osmosis	7.1%	7.1%	0.0%

Q11_8 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Ultrafiltration	7.1%	0.0%	0.0%
Q11_9 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	My municipality/LSD does not use filtration	92.9%	46.4%	31.8%
Q11_10 What method does your municipality/ LSD use for filtration of source water? Choose all that apply.	I don't know	0.0%	10.7%	0.0%
Q11_11 What method does your municipality/ LSD use for filtration of source water? Choose all that apply.	Other (please specify)	7.1%	21.4%	13.6%

		LSD	≤1000	>1000
Q12_1 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Arsenic removal	7.1%	3.4%	0.0%
Q12_2 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Coagulation	0.0%	6.9%	19.0%
Q12_3 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Dissolved air floatation	0.0%	0.0%	0.0%
Q12_4 What kind of drinking water treatment	Flocculation	0.0%	6.9%	19.0%

processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.				
Q12_5 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Fluoridation	7.1%	0.0%	0.0%
Q12_6 What kind of drinking water treatment processes or treatments does your municipality /LSD use other than disinfection? Choose all that apply.	Iron/manganese removal	7.1%	0.0%	14.3%
Q12_7 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Micron/pressure filters	7.1%	10.3%	0.0%
Q12_8 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	pH adjustment	7.1%	10.3%	57.1%
Q12_9 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Sedimentation	7.1%	3.4%	14.3%
Q12_10 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all	Softening	0.0%	6.9%	4.8%

that apply.				
Q12_11 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Stripping	0.0%	0.0%	0.0%
Q12_12 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Strontium removal	0.0%	0.0%	0.0%
Q12_13 What kind of drinking water treatment processes or treatments does your municipality /LSD use other than disinfection? Choose all that apply.	Taste and odor control	7.1%	3.4%	4.8%
Q12_14 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	Upflow clarifier	0.0%	0.0%	0.0%
Q12_15 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	None	85.7%	69.0%	33.3%
Q12_16 What kind of drinking water treatment processes or treatments does your municipality/ LSD use other than disinfection? Choose all that apply.	I don't know	0.0%	6.9%	0.0%
Q12_17 What kind of drinking water treatment processes or treatments	Other (please specify)	0.0%	6.9%	0.0%

does your municipality/ LSD use other than disinfection? Choose all that apply.				

		LSD	≤1000	>1000
Q13_1 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Calcium hypochlorite (powder)	6.7%	16.1%	0.0%
Q13_2 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Chloramines	13.3%	0.0%	0.0%
Q13_3 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Gas chlorination	0.0%	41.9%	81.0%
Q13_4 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Liquid hypo-chlorination	80.0%	41.9%	14.3%
Q13_5 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Mixed oxidants (MIOX)	0.0%	6.5%	4.8%
Q13_6 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Ozone	0.0%	6.5%	9.5%
Q13_7 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Ultraviolet light (UV)	13.3%	6.5%	9.5%
Q13_8 What kind of drinking water disinfection system does	None	0.0%	0.0%	0.0%

your municipality/LSD use? Choose all that apply.				
Q13_9 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	I don't know	0.0%	3.2%	4.8%
Q13_10 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Other (please specify)	13.3%	6.5%	0.0%
		LSD	≤1000	>1000
Q14 How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?	Less than 5 years old	14.3%	6.7%	28.6%
	5-10 years old	14.3%	13.3%	9.5%
	More than 10 years-25 years old	35.7%	33.3%	28.6%
	More than 25 years-35 years old	21.4%	30.0%	19.0%
	Over 35 years old	14.3%	16.7%	14.3%
		LSD	≤1000	>1000
Q15 Does your municipality/LSD have a maintenance plan for its water treatment system/plant operations?	Yes	42.9%	67.7%	95.2%
		LSD	≤1000	>1000
Q16 Does your municipality/LSD have standard operating procedures for its water treatment system/plant operations?	Yes	66.7%	80.6%	81.8%

		LSD	≤1000	>1000
Q17 How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?	Other (please specify)	53.3%	20.0%	9.1%
	Daily	6.7%	33.3%	36.4%
	Weekly	6.7%	33.3%	36.4%
	Twice a month	13.3%	0.0%	0.0%
	Monthly	20.0%	13.3%	18.2%
		LSD	≤1000	>1000
Q18_1 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Yes.	92.3%	73.3%	81.8%
Q18_2 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because it is undergoing maintenance or repair	0.0%	6.7%	13.6%
Q18_3 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of a lack of qualified operators	0.0%	0.0%	0.0%
Q18_4 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of taste complaints	0.0%	0.0%	0.0%
Q18_5 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of a lack of funds to operate	0.0%	10.0%	0.0%
Q18_6 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	I don't know	0.0%	0.0%	0.0%
Q18_7 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No, because of other reasons (please specify)	7.7%	10.0%	4.5%

		LSD	≤1000	>1000
Q19_1 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Lack of expertise/contractors to make upgrades or repairs	0.0%	0.0%	25.0%
Q19_2 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Lack of availability of parts or supplies needed for upgrade	0.0%	37.5%	0.0%
Q19_3 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Lack of financial resources	100.0%	75.0%	75.0%
Q19_4 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No one qualified to operate system if upgrades or repairs are made	0.0%	0.0%	0.0%
Q19_5 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Not a priority	0.0%	0.0%	0.0%
Q19_6 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	There are no barriers	0.0%	0.0%	0.0%
Q19_7 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	I don't know	0.0%	0.0%	0.0%
Q19_8 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Other (please specify)	0.0%	0.0%	0.0%

		LSD	≤1000	>1000
Q20 Has your municipality/LSD been under a boil water advisory any time in the last 4 years?	Yes	93.3%	80.6%	77.3%

		LSD	≤1000	>1000
Q21_1 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water supply has no disinfection system	14.3%	0.0%	0.0%
Q21_2 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by the operator, due to taste or other aesthetic considerations.	0.0%	0.0%	0.0%
Q21_3 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by operator, due to perceived health risks	0.0%	0.0%	0.0%
Q21_4 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Chlorination system is turned off by operator, due to lack of funds to operate	7.1%	0.0%	0.0%
Q21_5 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Disinfection system is off due to maintenance or mechanical failure	14.3%	32.0%	52.9%
Q21_6 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Disinfection system is off due to lack of chlorine or other disinfectant	0.0%	12.0%	11.8%
Q21_7 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water distribution system is undergoing maintenance or repair.	14.3%	52.0%	41.2%

Q21_8 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	A cross connection is discovered in the distribution system.	0.0%	0.0%	0.0%
Q21_9 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Inadequately treated water was introduced into the system due to fireflows, flushing operations, interconnections, minor power outage or other pressure loss	0.0%	32.0%	11.8%
Q21_10 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water entering the distribution system or facility, after a minimum 20 minute contact time does not have a free chlorine residual	21.4%	8.0%	17.6%
Q21_11 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No free chlorine residual detected in the water distribution system	14.3%	24.0%	17.6%
Q21_12 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Insufficient residual disinfectant in water system primarily disinfected by means other than chlorination	0.0%	12.0%	0.0%
Q21_13 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Total coliform detected AND repeat samples cannot be taken as required	0.0%	12.0%	5.9%
Q21_14 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E. coli) detected AND repeat samples cannot be taken as required	0.0%	8.0%	0.0%
Q21_15 What was the reason(s) for your municipality's/LSD's boil	Total coliforms detected and confirmed in repeat	28.6%	12.0%	17.6%

water advisory(ies)? Choose all that apply.	sample.			
Q21_16 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E.coli) detected in an initial sample(s) is considered extensive and the water system is known to have other problems	0.0%	0.0%	0.0%
Q21_17 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Escherichia coli (E.coli) detected and confirmed in repeat samples	0.0%	4.0%	5.9%
Q21_18 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Viruses detected (eg, Hepatitis A, Norwalk).	0.0%	0.0%	0.0%
Q21_19 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Protozoa detected (eg, Giardia, Cryptosporidium).	0.0%	0.0%	0.0%
Q21_20 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Water supply system integrity compromised due to disaster (e.g. contamination of water source from flooding, gross contamination, major power failure, etc.)	0.0%	4.0%	17.6%
Q21_21 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Waterborne disease outbreak in the community.	0.0%	0.0%	0.0%
		LSD	≤1000	>1000
Q22 Does your municipality/LSD ever release precautionary boil water advisories (for	Yes	42.9%	28.0%	23.5%

reasons other than regular flushing and maintenance)?				
		LSD	≤1000	>1000
Q23 Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?	Always	86.7%	96.8%	81.8%
	Sometimes	6.7%	3.2%	13.6%
	Never	6.7%	0.0%	4.5%
		LSD	≤1000	>1000
Q24 Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?	Always	66.7%	90.3%	81.8%
	Sometimes	20.0%	9.7%	9.1%
	Never	13.3%	0.0%	9.1%

		LSD	≤1000 Municipality	>1000 Municipality
q0025_0001_0001 Water distribution pipes - Age (in years)	0-10	86.70%	96.80%	81.80%
	Nov-20	6.70%	3.20%	13.60%
	21-30	6.70%	0.00%	4.50%
	31-40	0.00%	0.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	0.00%	0.00%	0.00%
q0025_0002_0001 Chlorination equipment - Age (in years)	0-10	66.70%	90.30%	81.80%
	Nov-20	20.00%	9.70%	9.10%
	21-30	13.30%	0.00%	9.10%
	31-40	0.00%	0.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	0.00%	0.00%	0.00%
q0025_0003_0001 Pump - Age (in years)	0-10	7.10%	3.30%	0.00%

	Nov-20	14.30%	6.70%	0.00%
	21-30	42.90%	36.70%	18.20%
	31-40	28.60%	40.00%	18.20%
	41-50	7.10%	13.30%	36.40%
	51+	0.00%	0.00%	27.30%
	N/A	0.00%	0.00%	0.00%
q0025_0004_0001 Other treatment equipment other than chlorination - Age (in years)	0-10	33.30%	33.30%	55.00%
	Nov-20	60.00%	36.70%	35.00%
	21-30	6.70%	20.00%	5.00%
	31-40	0.00%	10.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	0.00%	0.00%	5.00%
q0025_0005_0001 Filtration system (e.g. screens) - Age (in years)	0-10	71.40%	53.60%	26.30%
	Nov-20	21.40%	25.00%	31.60%
	21-30	7.10%	17.90%	15.80%
	31-40	0.00%	3.60%	5.30%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	5.30%
	N/A	0.00%	0.00%	15.80%
q0025_0006_0001 Chlorine booster station - Age (in years)	0-10	20.00%	36.40%	35.30%
	Nov-20	20.00%	22.70%	35.30%
	21-30	0.00%	9.10%	5.90%
	31-40	0.00%	4.50%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	60.00%	27.30%	23.50%
q0025_0007_0001 Water storage tank - Age (in years)	0-10	25.00%	19.00%	35.30%
	Nov-20	0.00%	28.60%	29.40%
	21-30	25.00%	19.00%	11.80%
	31-40	0.00%	9.50%	5.90%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	50.00%	23.80%	17.60%

q0025_0008_0001 Man made dams - Age (in years)	0-10	50.00%	19.00%	29.40%
	Nov-20	0.00%	9.50%	23.50%
	21-30	0.00%	0.00%	0.00%
	31-40	0.00%	4.80%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	50.00%	66.70%	47.10%
q0026_0001_0001 Water distribution pipes - Age (in years)	0-10	30.00%	24.00%	23.80%
	Nov-20	30.00%	12.00%	14.30%
	21-30	20.00%	16.00%	9.50%
	31-40	10.00%	24.00%	4.80%
	41-50	10.00%	0.00%	14.30%
	51+	0.00%	0.00%	4.80%
	N/A	0.00%	24.00%	28.60%
q0026_0002_0001 Chlorination equipment - Age (in years)	0-10	20.00%	0.00%	29.40%
	Nov-20	0.00%	4.50%	0.00%
	21-30	40.00%	13.60%	0.00%
	31-40	0.00%	13.60%	11.80%
	41-50	20.00%	0.00%	17.60%
	51+	0.00%	4.50%	0.00%
	N/A	20.00%	63.60%	41.20%
q0026_0003_0001 Pump - Age (in years)	0-10	41.70%	51.90%	76.20%
	Nov-20	25.00%	14.80%	14.30%
	21-30	8.30%	25.90%	9.50%
	31-40	16.70%	0.00%	0.00%
	41-50	8.30%	3.70%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	0.00%	3.70%	0.00%
q0026_0004_0001 Other treatment equipment other than chlorination - Age (in years)	0-10	66.70%	65.40%	75.00%
	Nov-20	33.30%	23.10%	20.00%
	21-30	0.00%	7.70%	0.00%
	31-40	0.00%	3.80%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%

	N/A	0.00%	0.00%	5.00%
q0026_0005_0001 Filtration system (e.g. screens) - Age (in years)	0-10	76.90%	65.20%	65.00%
	Nov-20	15.40%	30.40%	20.00%
	21-30	7.70%	4.30%	0.00%
	31-40	0.00%	0.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	0.00%	0.00%	15.00%
q0026_0006_0001 Chlorine booster station - Age (in years)	0-10	66.70%	40.00%	61.10%
	Nov-20	16.70%	6.70%	16.70%
	21-30	0.00%	6.70%	0.00%
	31-40	0.00%	0.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	16.70%	46.70%	22.20%
q0026_0007_0001 Water storage tank - Age (in years)	0-10	25.00%	20.00%	55.60%
	Nov-20	0.00%	15.00%	16.70%
	21-30	25.00%	30.00%	5.60%
	31-40	0.00%	10.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	50.00%	25.00%	22.20%
q0026_0008_0001 Man made dams - Age (in years)	0-10	40.00%	16.70%	50.00%
	Nov-20	0.00%	11.10%	16.70%
	21-30	0.00%	0.00%	0.00%
	31-40	0.00%	0.00%	0.00%
	41-50	0.00%	0.00%	0.00%
	51+	0.00%	0.00%	0.00%
	N/A	60.00%	72.20%	33.30%

		LSD	≤1000	>1000
Q27_1 What material is your water distribution pipes made of? Choose all that apply.	Steel	6.7%	0.0%	16.0%
Q27_2 What material is	Polyvinyl chloride	60.0%	61.3%	52.0%

your water distribution pipes made of? Choose all that apply.	(PVC/uPVC)			
Q27_3 What material is your water distribution pipes made of? Choose all that apply.	Ductile iron	6.7%	58.1%	80.0%
Q27_4 What material is your water distribution pipes made of? Choose all that apply.	Cast iron	0.0%	0.0%	48.0%
Q27_5 What material is your water distribution pipes made of? Choose all that apply.	Polypropylene	33.3%	3.2%	8.0%
Q27_6 What material is your water distribution pipes made of? Choose all that apply.	Polyethylene	33.3%	22.6%	20.0%
Q27_7 What material is your water distribution pipes made of? Choose all that apply.	Copper	0.0%	22.6%	44.0%
Q27_8 What material is your water distribution pipes made of? Choose all that apply.	Wood	0.0%	0.0%	0.0%
Q27_9 What material is your water distribution pipes made of? Choose all that apply.	I don’t know	0.0%	6.5%	0.0%
Q27_10 What material is your water distribution pipes made of? Choose all that apply.	Other (please specify)	0.0%	3.2%	16.0%

q0028_0001_0001 Steel - Size (inches)	1-3 inches	100.00%	0.00%	50.00%
	4 inches	0.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	100.00%	25.00%
	8-9 inches	0.00%	0.00%	0.00%
	10-11 inches	0.00%	0.00%	0.00%
	12 inches or more	0.00%	0.00%	25.00%
q0028_0002_0001	1-3 inches	50.00%	15.00%	6.70%

Polyvinyl chloride (PVC/uPVC) - Size (inches)				
	4 inches	25.00%	20.00%	6.70%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	12.50%	35.00%	20.00%
	8-9 inches	12.50%	20.00%	33.30%
	10-11 inches	0.00%	5.00%	20.00%
	12 inches or more	0.00%	5.00%	13.30%
q0028_0003_0001 Ductile iron - Size (inches)	1-3 inches	0.00%	0.00%	0.00%
	4 inches	100.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	52.60%	25.00%
	8-9 inches	0.00%	42.10%	45.00%
	10-11 inches	0.00%	0.00%	20.00%
	12 inches or more	0.00%	5.30%	10.00%
q0028_0004_0001 Cast iron - Size (inches)	1-3 inches	100.00%	0.00%	0.00%
	4 inches	0.00%	0.00%	8.30%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	100.00%	25.00%
	8-9 inches	0.00%	0.00%	25.00%
	10-11 inches	0.00%	0.00%	16.70%
	12 inches or more	0.00%	0.00%	25.00%
q0028_0005_0001 Polypropylene - Size (inches)	1-3 inches	100.00%	50.00%	50.00%
	4 inches	0.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	0.00%	0.00%
	8-9 inches	0.00%	50.00%	50.00%
	10-11 inches	0.00%	0.00%	0.00%
	12 inches or more	0.00%	0.00%	0.00%
q0028_0006_0001 Polyethylene - Size (inches)	1-3 inches	60.00%	33.30%	50.00%
	4 inches	40.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	33.30%	0.00%

	8-9 inches	0.00%	33.30%	25.00%
	10-11 inches	0.00%	0.00%	25.00%
	12 inches or more	0.00%	0.00%	0.00%
q0028_0007_0001 Copper - Size (inches)	1-3 inches	0.00%	100.00%	100.00%
	4 inches	0.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	0.00%	0.00%
	8-9 inches	0.00%	0.00%	0.00%
	10-11 inches	0.00%	0.00%	0.00%
	12 inches or more	0.00%	0.00%	0.00%
q0028_0008_0001 Wood - Size (inches)	1-3 inches	0.00%	0.00%	0.00%
	4 inches	0.00%	0.00%	0.00%
	5 inches	0.00%	0.00%	0.00%
	6-7 inches	0.00%	0.00%	0.00%
	8-9 inches	0.00%	0.00%	0.00%
	10-11 inches	0.00%	0.00%	0.00%
	12 inches or more	0.00%	0.00%	0.00%

		LSD	≤1000	>1000
Q29 How does water reach the water plant/distribution system in your municipality/LSD?	Other (please specify)	0.0%	3.2%	8.3%
	Gravity fed	13.3%	41.9%	41.7%
	Pumping system	80.0%	35.5%	16.7%
	Combination of gravity fed and pumping system (e.g. a water tower)	6.7%	19.4%	33.3%
		LSD	≤1000	>1000
Q30 Does the current water demand in your municipality/LSD exceed the design capacity of your water system?	Yes	33.3%	17.2%	9.1%
		LSD	≤1000	>1000
Q31 What is the approximate piping distance from the disinfection system or closest chlorine booster	1km or less	46.7%	10.7%	9.1%
	1.1km- 2km	20.0%	17.9%	9.1%
	2.1 km-3 km	13.3%	28.6%	13.6%
	3.1km-4km	13.3%	14.3%	18.2%
	4.1 km-5km	6.7%	17.9%	18.2%

station to the last user on your municipal/LSD system?	Over 5km	0.0%	10.7%	31.8%
		LSD	≤1000	>1000
Q32 Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?	Yes	26.7%	31.0%	41.7%
	No	73.3%	69.0%	54.2%
	I don't know	0.0%	0.0%	4.2%
		LSD	≤1000	>1000
Q33 In 2012, how many leaks were there in your municipality's/LSD's water infrastructure that required repair?	None	33.3%	10.0%	4.5%
	1-2	13.3%	40.0%	18.2%
	3-4	33.3%	23.3%	4.5%
	5-6	13.3%	10.0%	4.5%
	7-10	0.0%	10.0%	31.8%
	11+	6.7%	6.7%	36.4%

		LSD	≤1000	>1000
Q34 How often does your municipality/LSD do leak detection?	Once a month	14.3%	0.0%	10.0%
	Every 2-3 months	14.3%	0.0%	0.0%
	Every 4-5 months	0.0%	3.8%	0.0%
	Twice a year	7.1%	7.7%	20.0%
	Yearly	7.1%	19.2%	25.0%
	My municipality/LSD does not do leak detection	57.1%	69.2%	45.0%
		LSD	≤1000	>1000
Q35 Does your municipality/LSD have an organized leak detection program?	Yes	16.7%	8.3%	26.7%
	No, we only do leak detection when leaks or problems occur	83.3%	91.7%	73.3%

		LSD	≤1000	>1000
Q36_1 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Acoustic loggers	0.0%	10.0%	13.3%

Q36_2 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Combined acoustic logger & correlator	0.0%	0.0%	6.7%
Q36_3 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Deacon meter (waste metering)	28.6%	0.0%	0.0%
Q36_4 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Digital correlator	14.3%	10.0%	6.7%
Q36_5 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	District meter area analyzing	14.3%	0.0%	0.0%
Q36_6 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Ground microphones	0.0%	20.0%	40.0%
Q36_7 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Ground penetrating radar	0.0%	10.0%	0.0%
Q36_8 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Helical vane meters	0.0%	0.0%	0.0%
Q36_9 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Leak noise correlator	0.0%	10.0%	40.0%
Q36_10 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Manual sounding	57.1%	40.0%	33.3%
Q36_11 Which of the	Step testing	28.6%	30.0%	0.0%

following methods does your municipality/LSD use for leak detection? Choose all that apply.				
Q36_12 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	I don't know	0.0%	10.0%	6.7%
Q36_13 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Other (please specify)	14.3%	40.0%	13.3%
		LSD	≤1000	>1000
Q37 Does your municipality/LSD have an annual valve operating/maintenance program?	Yes	26.7%	23.3%	34.8%
		LSD	≤1000	>1000
Q38 How often does your municipality/LSD flush it's water distribution lines?	Other (please specify)	0.0%	6.5%	13.0%
	More than once a month	0.0%	0.0%	0.0%
	Once a month	0.0%	3.2%	0.0%
	Every 2-5 months	14.3%	6.5%	0.0%
	Twice yearly	21.4%	61.3%	30.4%
	Once a year	28.6%	12.9%	56.5%
	We do not flush our system	35.7%	9.7%	0.0%

		LSD	≤1000	>1000
Q39_1 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Age of the system (e.g corrosion)	73.3%	64.5%	79.2%
Q39_2 What are the biggest issues, other than financial constraints, for your water distribution	Knowledge of system	0.0%	6.5%	0.0%

system (e.g. infrastructure)? Choose all that apply.				
Q39_3 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Lack of human resources	13.3%	9.7%	8.3%
Q39_4 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Lack of maps/drawings (As-Builts) of infrastructure	33.3%	29.0%	20.8%
Q39_5 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Leakage	40.0%	22.6%	25.0%
Q39_6 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Maintenance	13.3%	9.7%	20.8%
Q39_7 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Source water quality	6.7%	19.4%	20.8%
Q39_8 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Serving small population over large geographic areas	13.3%	9.7%	16.7%

Q39_9 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	None. My municipality's/LSD's water distribution system does not have any issues	13.3%	12.9%	0.0%
Q39_10 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	I don't know	0.0%	0.0%	0.0%
Q39_11 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Other (please specify)	6.7%	0.0%	4.2%
		LSD	≤1000	>1000
Q40 How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?	Daily in one location	15.4%	21.4%	4.5%
	Daily in two or more locations	23.1%	67.9%	86.4%
	Weekly	61.5%	10.7%	9.1%
	Monthly	0.0%	0.0%	0.0%
	Quarterly	0.0%	0.0%	0.0%

		LSD	≤1000	>1000
Q41 How often does the Department of Environment and Conservation test your municipality's/LSD's water?	Daily	0.0%	0.0%	0.0%
	Weekly	0.0%	24.0%	11.1%
	Monthly	38.5%	24.0%	16.7%
	Quarterly	30.8%	32.0%	66.7%
	Annually	30.8%	20.0%	5.6%
		LSD	≤1000	>1000
Q42 How often does the Department of Service NL test your municipality's/LSD's water?	Daily	0.0%	0.0%	0.0%
	Weekly	0.0%	25.0%	21.4%
	Monthly	80.0%	66.7%	57.1%
	Quarterly	10.0%	8.3%	14.3%
	Annually	10.0%	0.0%	7.1%

		LSD	≤1000	>1000
Q43_1 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have maps (As-Builts) or blue prints for ALL of the water distribution infrastructure	13.3%	48.4%	54.2%
Q43_2 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have maps (As-Builts) or blue prints for PART(S) of the water distribution infrastructure	13.3%	22.6%	33.3%
Q43_3 Does your municipality/LSD have an updated and accurate map of your municipality's/ LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have GIS (Geographic Information System) mapping of the water distribution infrastructure	13.3%	0.0%	8.3%
Q43_4 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Yes, we have a detailed asset management plan for our water distribution infrastructure	13.3%	0.0%	4.2%
Q43_5 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all	No, we do not have a map of the water distribution infrastructure	60.0%	32.3%	8.3%

that apply.				
Q43_6 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	I don't know	6.7%	0.0%	8.3%
		LSD	≤1000	>1000
Q44 Is there a designated office/filing area in your municipality/LSD for drinking water system information?	Yes	26.7%	72.4%	78.3%
		LSD	≤1000	>1000
Q45 Does your municipality/LSD have a written formal maintenance plan for it's water distribution infrastructure (e.g. pipes, valves, etc)?	Yes	0.0%	3.8%	28.6%
		LSD	≤1000	>1000
Q46 Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?	Yes	20.0%	32.3%	33.3%
	To some degree	46.7%	48.4%	54.2%
	No	33.3%	19.4%	12.5%
		LSD	≤1000	>1000
Q47 Do you feel the province provides enough access to provincial water operator training opportunities?	Yes	71.4%	77.4%	83.3%

		LSD	≤1000	>1000
Q48 Do you feel that your municipality/LSD provides you with adequate training opportunities to do your job as a water operator?	Yes	76.9%	93.3%	95.7%
		LSD	≤1000	>1000
Q49 Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.	1- Communicated highly effectively	20.0%	6.7%	12.5%
	2- Communicated reasonably well	6.7%	40.0%	37.5%
	3- Communicated adequately	33.3%	36.7%	33.3%
	4- Communicated very poorly	0.0%	10.0%	4.2%
	5- Not communicated at all	0.0%	0.0%	8.3%
	I don't know	40.0%	6.7%	4.2%

		LSD	≤1000	>1000
Q50_1 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Provincial agencies	33.3%	14.3%	38.1%
Q50_2 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipality/LSD (e.g. your mayor or councillors)	44.4%	7.1%	9.5%
Q50_3 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Professional Municipal Administrators (PMA)	22.2%	10.7%	9.5%
Q50_4 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities Newfoundland and Labrador (MNL)	11.1%	35.7%	33.3%
Q50_5 Who provides you with information about	Atlantic Canada Water and	22.2%	39.3%	52.4%

new technologies for drinking water systems? Choose all that apply.	Wastewater Association			
Q50_6 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Other professional associations (e.g. NEIA)	0.0%	3.6%	28.6%
Q50_7 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Companies/industry	11.1%	32.1%	66.7%
Q50_8 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Other water operators	0.0%	25.0%	47.6%

		LSD	≤1000	>1000
Q51_1 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Newsletters	22.2%	21.4%	47.6%
Q51_2 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	E-mail	0.0%	42.9%	47.6%
Q51_3 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Mail	55.6%	17.9%	33.3%
Q51_4 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Workshops and conferences	33.3%	64.3%	95.2%
Q51_5 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	By Mayors, councillors or municipal/LSD administrators	33.3%	35.7%	14.3%
Q51_6 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Websites	22.2%	7.1%	28.6%
Q51_7 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Discussion with other water operators/colleagues	11.1%	35.7%	61.9%
Q51_8 How are new technologies related to drinking water systems	Other (please specify)	0.0%	0.0%	0.0%

communicated to water operators? Choose all that apply.				
		LSD	≤1000	>1000
Q52 Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?	Yes every year	6.7%	41.9%	45.8%
	Almost every year	20.0%	29.0%	41.7%
	Rarely	13.3%	19.4%	12.5%
	Never, however I have heard of the Annual Drinking Water Workshop	33.3%	9.7%	0.0%
	I have never heard of the Annual Drinking Water Workshop	20.0%	0.0%	0.0%
	I haven't had the opportunity to go to the Annual Drinking W	6.7%	0.0%	0.0%
		LSD	≤1000	>1000
Q53 How content are you with your compensation for your duties as water operator?	Very content	33.3%	32.3%	29.2%
	Somewhat content	26.7%	41.9%	45.8%
	Neutral	20.0%	19.4%	16.7%
	Somewhat discontent	13.3%	6.5%	0.0%
	Very discontent	6.7%	0.0%	8.3%
		LSD	≤1000	>1000
Q54 Do you have employee benefits from your job as a water operator (e.g. medical benefits)?	Yes	0.0%	29.0%	87.0%

		LSD	≤1000	>1000
Q55 What is your salary range for your position as water operator?	I am compensated in other ways that does not include a salary	0.0%	9.7%	4.3%
	$0 (volunteer without any compensation)	50.0%	3.2%	0.0%
	$1-$9,999	35.7%	9.7%	0.0%
	$10,000-$19,999	7.1%	3.2%	0.0%
	$20,000- $29,999	0.0%	9.7%	4.3%
	$30,000- $39,999	0.0%	29.0%	8.7%
	$40,000-$49,999	0.0%	6.5%	26.1%
	$50,000-$59,999	0.0%	3.2%	8.7%
	$60,000-$69,999	0.0%	0.0%	17.4%
	$70,000 and above	0.0%	0.0%	17.4%
	I would prefer not to share this information	7.1%	25.8%	13.0%

		LSD	≤1000	>1000
Q56_1 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Agriculture	6.7%	3.4%	4.5%
Q56_2 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Commercial forest harvesting	6.7%	6.9%	4.5%
Q56_3 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Domestic wood cutting	26.7%	20.7%	22.7%
Q56_4 Which of these land use activities do you	Hunting and fishing	20.0%	10.3%	18.2%

think are currently threats to your main municipal/LSD's water supply? Choose all that apply.				
Q56_5 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Hydroelectricity (damming)	0.0%	0.0%	4.5%
Q56_6 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Mining (including quarrying)	0.0%	3.4%	9.1%
Q56_7 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Oil and gas exploration and development (including hydraulic fracturing – fracking)	0.0%	3.4%	9.1%
Q56_8 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Recreational use (e.g. swimming, snowmobiling, boating)	26.7%	24.1%	36.4%
Q56_9 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Residential cabin development	6.7%	3.4%	22.7%
Q56_10 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that	Transmission lines and roads	0.0%	6.9%	18.2%

apply.				
Q56_11 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	None- there are no land use activities that I believe are threats to my municipal/LSD water supply	53.3%	58.6%	31.8%
Q56_12 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Other (please specify)	0.0%	0.0%	0.0%

		LSD	≤1000	>1000
Q57_1 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Beaver dams	13.3%	33.3%	39.1%
Q57_2 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Drought/low water levels	20.0%	13.3%	30.4%
Q57_3 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Extreme weather events (e.g. high winds, heavy rains)	26.7%	23.3%	39.1%
Q57_4 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Flooding	0.0%	3.3%	13.0%
Q57_5 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Freeze/thaw	20.0%	6.7%	30.4%
Q57_6 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Salt water intrusions	6.7%	3.3%	13.0%
Q57_7 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	None- there are no natural processes that I believe are threats	33.3%	36.7%	8.7%
Q57_8 Which of these natural processes are currently threats to your	Other (please specify)	0.0%	0.0%	0.0%

municipality's/LSD's main water supply. Choose all that apply.				

		LSD	≤1000	>1000
Q58_1 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Aesthetics visual qualities of colour and cloudiness	13.3%	24.1%	62.5%
Q58_2 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Naturally occurring metals (e.g. lead, arsenic)	6.7%	6.9%	8.3%
Q58_3 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Organic carbon content	20.0%	13.8%	20.8%
Q58_4 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Acidity	0.0%	10.3%	25.0%
Q58_5 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Presence of disease causing microorganism (e.g. E.Coli and Giardia)	13.3%	13.8%	16.7%
Q58_6 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Human pollution (e.g. car wrecks, garbage, illegal dumping)	6.7%	10.3%	12.5%
Q58_7 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Endocrine disrupting chemicals (EDCs) (e.g. drugs, cosmetics	0.0%	3.4%	0.0%
Q58_8 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	I don't know	20.0%	6.9%	16.7%

Q58_9 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	None- there are no concerns that I believe are threats to my	33.3%	44.8%	16.7%
Q58_10 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Other (please specify)	13.3%	3.4%	4.2%

12.0 Qualitative Data Appendix

"Are there any new or innovative drinking water solutions that your municipality/LSD has implemented or considered?"

1. Automatic Flushing Device
2. Do not permit development near water source.
3. Started using MIOX in 2009 as well as a lead removal filtration system
4. Water Tower; Chlorine booster
5. Water treatment plant
6. Yes, water treatment plant, green sand.

"Are there actions that your municipality/LSD has tried in the past to address drinking water issues that have not worked or not worked well?"

1. Flushing the system does not work as there are not enough flush points on the system
2. Yes, again operation of farm near water source polluted ground source. Finally farm has collapsed (closed down).

"Are there any other comments regarding drinking water systems in your municipality/LSD or elsewhere that you would like to include? Please explain any problems either covered or not in the survey."

1. Capacity is not big enough for the expanding town: If you job was water only it would be better but when you are a lone worker trying to keep everything going it becomes very different. $$$
2. If a water supply is to be put in place make sure outside developers have to be up front with their proposals. Not allowed to proceed unless notifying LSD.
3. In 2013, the town hired a Consultant to prepare a report on the town's water- Water Quality and Consumption-Analysis and Report, this was report was prepared to assist the town when exploring the option of a more extensive water filtration system.
4. More Training and more Provincial Funding available.
5. Need a water treatment plant at the pumphouse
6. Need filtration system
7. Our LSD acts totally on volunteer basis. We have a water distribution system that is 30+ years of age, with minimum upgrades in that time. We had a upgrade on our pumphouse

11 years ago, done by a professional contractor which was completely insufficient to our needs. Since then we have been trying to provide water to our community the best way we can. I guess we are like many other small communities in this Province, the majority of our population is seniors, a small percentage of people who commute for jobs all over, and a few like myself are left to try and keep things moving the best we can.

8. Our system is falling apart, we need government funds to upgrade the system if not done we will have at least 3 communities without water. Just imagine a pump running 25 years + for 24-7.
9. problems with chlorinator and no funding for repairs
10. Water lines and equipment are old and need to be replaced (45 years since 1969).
11. Working fine for me.

13.0 Technical Appendix

Statistical analysis was performed by a research analyst who used SPSS 21 for all testing and analysis. Data analysis was largely exploratory, although some specific hypotheses were tested. A two-tailed alpha level of p=.05 was used for all analyses unless otherwise specified. The research analyst used the generated Monte Carlo exact significance level for all cross-tabs procedures. General analysis strategies are discussed below, while specific information regarding the statistics generated appear afterward.

Non-Continuous Data Analysis

Tests. When comparing groups to one another a Chi-Square Test of Independence (TOI) was used. This test assessed whether one group were more likely to answer a question differently from another group(s). The majority of the analyses performed used a grouping variable (i.e., column variable) and compared differences across groups for outcome variables. For example, dividing communities into either ≤1000 people and >1000 people would allow for population to be used as a grouping variable. The research analyst assumed for all TOI tests that there were no group differences. This is the default null hypothesis for this type of analysis. Due to the nature and volume of these tests, there was a concern for an increased Type I error rate.

Error. To compensate for the possibility of an increased Type I error rate within TOI, the research analyst used two approaches: 1. Bonferroni corrections and 2. Fisher's test. Both of these approaches are conservative and therefore reduce the likelihood of Type I error.

Bonferroni corrections. Statistical analysis defines error terms as the probability of drawing a wrong conclusion about a population, due to an unlikely sample. This error level is traditionally set at 1/20. That is to say, the likelihood of drawing the wrong conclusion about the population (because of the sample) will happen approximately 5% of the time. Because a TOI will compare all columns to each other, the overall alpha level for a single question does not remain at 5%, but grows as a product of the number of comparisons made. Because of this, Bonferroni corrections were used to lower the likelihood of making Type I error. These corrections occasionally produced situations in which a significant Chi-Square statistic was generated, but there were no recognized cell differences. In these situations, a non-significant test statistic was reported.

Fisher's test. Statistics for Chi Square are dependent on cells containing an expected number of minimum observations. In situations where this expectation is not met, the Chi-Square statistic is no longer as accurate. In situations where SPSS produced a caution regarding a violation of minimum cell values, the analyst used the generated Fisher's test in order to assess the TOI. Fisher's test does not produce a statistic for a 2x2 table, only an associated alpha value.

Continuous Data Analysis

Although some continuous data was collected within the current survey, the questions seeking this type of data did not have to be completed by all respondents. Because of this completion selectivity, the resulting distributions were very irregular. The data analyst elected to use non-parametric Chi-Square TOI which would allow the data to be assessed and inferences to be

drawn. The analyst used the same procedure and decision criteria as what was described in the non-continuous data analysis section.

Specific Project Data

In the subsequent section, analyses for each question is provided for each grouping variable used. The analyst examined the differences between LSDs and Municipalities, Under/Over 1000 persons, whether a boil water advisory had been issued in the past four years, whether the Water Operator was certified, what region a Water Operator represented, and whether the Water Operator was Full Time/Part Time/Volunteer.

Only comparisons which were significant were reported in full. In that situation a description of the finding and a statistic is provided to evince the conclusion.

In situations where all respondents gave identical answers, no statistic was generated as there was no variability. These situations are denoted by "No variability, all respondents indicated..." and reflect the unanimity in the responses.

In situations where there was no statistical differences between the compared groups, the term "...did not differ in their responses to this question" is used.

In situations where the grouping variable is related to the independent variable, analysis was not conducted.

	Municipalities vs. LSDs	Over/Under 1000	BWA	Certified vs. Non-certified	Region	Employment Type
Year Returned	Municipalities were more likely to return their surveys in 2014, LSDs were more likely to return their surveys in 2013; F=Significant, p=.007	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q01 Which type of organization do you represent?	Analysis was not performed; grouping variable was related to outcome variable;	F=Significant, p=.001; Over1000 are more likely be Municipalities; ≤1000 are more likely to be LSDs	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p<.001; Certified were more likely to be Municipalities; Non-Certified were more likely to be LSDs	Regions did not differ in their responses to this question	F=33.948, p<.001; Part and Full were more likely than Volunteers to be from Municipalities
Q03 What is the current population of your municipality/LSD?	F=18.700, p=.005; LSD were more likely to be in communities <200 persons	Analysis was not performed; grouping variable was related to outcome variable;	Communities who had varying recency of BWA did not differ in their responses to this question	F=15.967, p=.02; Non-Certified were more likely to be <200 or 201-300	Regions did not differ in their responses to this question	F=29.856, p=.003; Volunteers were more likely than Part and Full to be from communities <200 people
Q04 In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable;	Employment types did not differ in their responses to this question
Q05 Are you a full-time, part-time or volunteer water operator in your municipality/LSD?	F=33.948, p<.001; Municipalities were more likely to have Full Time personnel; LSDs were more likely to have Volunteers	F=15.481, p<.001; Over 1000 are more likely to be Full; Under 1000 are more likely to be Volunteer	Communities who had varying recency of BWA did not differ in their responses to this question	F=22.325, p<.001; Certified were more likely to be Full; Non-Certified were more likely to be Volunteer	Regions did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable;
Q06 What is your primary position	F=28.816, p<.001; Municipalities were	Under and Over 1000 did not differ	Communities who had varying recency	F=9.101, p=.036; Certified were more	Regions did not differ in their	F=20.485, p=.002; Full & Part were

within your municipality/LSD?	more likely to be "Other"; LSDs were more likely to be "Water Operator/Councillor"	in their responses to this question	of BWA did not differ in their responses to this question	likely to be "Other"; Non-Certified were more likely to report being a "Water Operator"	responses to this question	more likely to report "Other" than Volunteer; Volunteer was more likely to report "WO/Councillor" and "WO/Chairperson" than Full
Q06 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q07 How long have you been a water operator for?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q08 What is your highest level of water operating certification?	F=Significant, p<.001; Municipalities were more likely to have Certification	F=Significant, p<.001; Under 1000 were more likely to be Non-Certified; Over 1000 were more likely to be Certified	Communities who had varying recency of BWA did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable;	Regions did not differ in their responses to this question	F=22.235, p<.001; Full were more likely than Part and Volunteer to have certification
Q08 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q09_01 Municipal/LSD water supply	F=10.772, p=.011; Municipalities were more likely to indicate their primary source of water was the local	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=10.72, p=.016; Certified were more likely to report their primary water source was the local water supply	Regions did not differ in their responses to this question	F=16.241, p=.01; Full was more likely to rate Local Water Supply as their primary source than Volunteer;

	water supply					Volunteer was more likely to rank this third
Q09_02 Private source (e.g. personal well)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q09_03 Spring	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=15.183, p=.029; Northern/Labrador/ Western were more likely to rank Spring Water as #3 compared to Central	Employment types did not differ in their responses to this question
Q09_04 Bottled water	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q10 Does your municipality/LSD treat (e.g. any treatment, disinfection or filtration) its drinking water supplied to residents?	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.044; Under 1000 were more likely to indicate that they treated their water supply	No variability, all respondents indicated "Yes"	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_01 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.016; Under 1000 were more likely to indicate that they treated their water supply with Anthracite coal	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_02 What method does your municipality/LSD use for filtration of source water? Choose all that	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

apply.			question			
Q11_03 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_04 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	F=Significant, p=.027; Communities that had not issued a BWA were more likely to use "Green Sand" as a filtration approach	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_05 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_06 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q11_07 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_08 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q11_09 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=12.235$, p=.001; LSDs were more likely to indicate their communities did not use filtration	$\chi 2(1)=5.233$, p=.035; Under 1000 were more likely to indicate that they did not use filtration	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=10.469$, p=.001; Non-Certified were more likely to report that their community did not use filtration	Regions did not differ in their responses to this question	F=17.39, p<.001; Volunteer were more likely than Full to indicate that they did not use filtration
Q11_10 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q11_11 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_01 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_02 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_03 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"

disinfection? Choose all that apply.						
Q12_04 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_05 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_06 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_07 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_08 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=17.223$, $p<.001$; Over 1000 were more likely to indicate that they used pH adjustment	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.027; Certified were more likely to say "pH adjustment"	Regions did not differ in their responses to this question	F=6.967, p=.026; Full were more likely to indicate that they used pH adjustment than Volunteer

disinfection? Choose all that apply.						
Q12_09 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_10 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_11 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q12_12 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q12_13 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

disinfection? Choose all that apply.						
Q12_14 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q12_15 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=10.005$, p=.003; Under 1000 were more likely to indicate that they did not use any additional processes in conjunction with disinfection	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=12.353, p=.002; Volunteer were more likely to pick "None" than Full or Part
Q12_16 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q12_17 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q13_01 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

apply.						
Q13_02 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	F=Significant, p=.047; LSDs were more likely to indicate they used "Chloramines"	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.041; Non-Certified were more likely to report "Chloramines"	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q13_03 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=15.67$, p<.001; Municipalities were more likely to use Gas Chlorination	$\chi 2(1)=16.189$, p<.001; Over 1000 were more likely to use "Gas Chlorination"	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=10.137$, p=.002; Certified were more likely to report "Gas Chlorination"	Regions did not differ in their responses to this question	F=16.153, p=.001; Full/Part were more likely to use Gas Chlorination than Volunteer
Q13_04 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=11.599$, p=.001; LSDs were more likely to use "Liquid Hypo-Chlorination"	$\chi 2(1)=9.513$, p=.003; Under 1000 were more likely to use "Liquid Hypo-Chlorination"	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=6.391$, p=.016; Non-Certified were more likely to report "Liquid Hypo-Chlorination"	Regions did not differ in their responses to this question	F=16.207, p<.001; Volunteer were more likely to use "Liquid Hypo-Chlorination" than Full
Q13_05 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q13_06 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q13_07 What kind of drinking water disinfection system	Municipalities and LSDs did not differ in their responses to	Under and Over 1000 did not differ in their responses to	Communities who had varying recency of BWA did not	Certified vs. Non-Certified Operators did not differ in	Regions did not differ in their responses to this	Employment types did not differ in their responses to

does your municipality/LSD use? Choose all that apply.	this question	this question	differ in their responses to this question	their responses to this question	question	this question
Q13_08 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q13_09 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q13_10 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q14 How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	F=11.614, p=.006; Communities that had not issued a BWA were more likely to report that their water filtration plant was "5-10 years" old when the oldest component was installed	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q15 Does your municipality/LSD have a maintenance plan for its water treatment system/plant	F=Significant, p=.017; Municipalities were more likely to indicate they had a	$\chi 2(1)=8.673$, p=.003; Over 1000 were more likely to indicate that they had a maintenance	Communities who had varying recency of BWA did not differ in their responses to this	F=Significant, p=.014; Certified were more likely to indicate that they had a maintenance	Regions did not differ in their responses to this question	F=8.749, p=.01; Full were more likely to indicate they had a maintenance plan

operations?	maintenance plan	plan for their water system	question	plan		than Volunteer
Q16 Does your municipality/LSD have standard operating procedures for its water treatment system/plant operations?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q17 How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?	F=18.14, p<.001; LSDs were more likely to indicate "Other" and "Twice a month"; Municipalities were more likely to indicate "Daily" or "Weekly"	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=17.749, p=.008; Part/Volunteer were more likely to report "Other" than Full
Q17 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q18_01 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q18_02 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q18_03 Are all parts of your	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents

municipality's/LSD's water treatment system currently working? Choose all that apply.	indicated "No"	indicated "No"	indicated "No"	indicated "No"	indicated "No"	indicated "No"
Q18_04 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q18_05 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q18_06 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q18_07 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q19_01 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	No variability, all respondents indicated "No"	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q19_02 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	No variability, all respondents indicated "No"	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q19_03 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	No variability, all respondents indicated "No"	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q19_04 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q19_05 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q19_06 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q19_07 What are the barriers to repairing your municipality's/LSD's water treatment	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"

system? Choose all that apply.						
Q19_08 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q20 Has your municipality/LSD been under a boil water advisory any time in the last 4 years?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_01 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_02 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21_03 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21_04 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q21_05 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_06 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_07 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_08 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21_09 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_10 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_11 What was the reason(s) for your municipality's/LSD's boil water	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to	Certified vs. Non-Certified Operators did not differ in their responses to	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

advisory(ies)? Choose all that apply.			outcome variable	this question		
Q21_12 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_13 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_14 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_15 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=8.611, p=.011; Central was more likely than Avalon/Eastern to report coliforms as being too high	Employment types did not differ in their responses to this question
Q21_16 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21_17 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_18 What was the reason(s) for your	No variability, all respondents	No variability, all respondents	Analysis was not performed;	No variability, all respondents	No variability, all respondents	No variability, all respondents

municipality's/LSD's boil water advisory(ies)? Choose all that apply.	indicated "No"	indicated "No"	grouping variable was related to outcome variable	indicated "No"	indicated "No"	indicated "No"
Q21_19 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21_20 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q21_21 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	Analysis was not performed; grouping variable was related to outcome variable	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q21 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q22 Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q22 If you answered "yes" what was the reason for the precautionary boil water advisory?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

			question			
Q23 Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q24 Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_01_01 Water distribution pipes - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_02_01 Chlorination equipment - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_03_01 Pump - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	$F=20.846$, $p<.001$; Over 1000 were more likely to indicate that their pumps were "41-50" years and "51+" years	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_04_01 Other treatment equipment	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

other than chlorination - Age (in years)	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question
Q25_05_01 Filtration system (e.g. screens) - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	F=11.753, p=.017; Under 1000 were more likely to indicate that their filtration screens were "0-10 years" and Over 1000 were more likely to indicate "NA"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_06_01 Chlorine booster station - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=15.745, p=.009; Part were more likely to indicate that their Chlorine Booster station was between 31-40 than Full were
Q25_07_01 Water storage tank - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q25_08_01 Man made dams - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_01_01 Water distribution pipes - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q26_02_01 Chlorination equipment - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	F=11.359, p=.033; Over 1000 were more likely to indicate their chlorination equipment was "0-10 years";	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_03_01 Pump - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=12.208, p=.014; Non-Certified were more likely to report the age of their pump between 21-30 years and 31-40 years	Regions did not differ in their responses to this question	F=16.391, p=.034; Volunteer were more likely than Full to indicate 31-40 years of age
Q26_04_01 Other treatment equipment other than chlorination - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_05_01 Filtration system (e.g. screens) - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_06_01 Chlorine booster station - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_07_01 Water storage tank - Age (in years)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q26_08_01 Man made dams - Age (in	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

years)	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question
Q27_01 What material is your water distribution pipes made of? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.049; Over 1000 were more likely to indicate that their pipes were made of "Steel"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q27_02 What material is your water distribution pipes made of? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q27_03 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=17.893$, $p<.001$; Municipalities were more likely to indicate their water distribution pipes were comprised of "Ductile Iron"	$\chi 2(1)=9.796$, $p=.003$; Over 1000 were more likely to indicate that their pipes were made of "Ductile Iron"	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=11.283$, $p=.001$; Certified were more likely to indicate that their pipes were made of "Ductile Iron"	Regions did not differ in their responses to this question	$F=20.988$, $p<.001$; Full was more likely than Part or Volunteer to use "Ductile Iron"
Q27_04 What material is your water distribution pipes made of? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p<.001; Over 1000 were more likely to indicate that their pipes were made of "Cast Iron"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q27_05 What material is your water distribution pipes made of? Choose all that apply.	F=Significant, p=.009; LSDs were more likely to indicate their water distribution pipes were comprised of "Polypropylene"	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	$F=5.363$, $p=.033$; Volunteer were more likely to use "Polypropylene" than Full
Q27_06 What material is your water distribution pipes	Municipalities and LSDs did not differ in their responses to	Under and Over 1000 did not differ in their responses to	Communities who had varying recency of BWA did not	Certified vs. Non-Certified Operators did not differ in	Regions did not differ in their responses to this	Employment types did not differ in their responses to

made of? Choose all that apply.	this question	this question	differ in their responses to this question	their responses to this question	question	this question
Q27_07 What material is your water distribution pipes made of? Choose all that apply.	F=Significant, p=.008; Municipalities were more likely to indicate their water distribution pipes were comprised of "Copper"	$\chi 2(1)=7.09$, p=.011; Over 1000 were more likely to indicate that their pipes were made of "Copper"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=11.887, p=.001; Full were more likely to indicate that their water distribution pipes were "Copper" than Volunteer were
Q27_08 What material is your water distribution pipes made of? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q27_09 What material is your water distribution pipes made of? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q27_10 What material is your water distribution pipes made of? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.049; Over 1000 were more likely to indicate that their pipes were made of "Other"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q28_01_01 Steel - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q28_02_01 Polyvinyl chloride (PVC/uPVC) - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q28_03_01 Ductile iron - Size (inches)	F=10.546, p=.028; LSDs were more likely to indicate their pipes had a 4" diameter	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=15.538, p=.025; Volunteer were more likely to indicate their Ductile Iron pipes were 4 inches
Q28_04_01 Cast iron - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=15.915, p=.01; Part were more likely to indicate that their pipes were 4 inches
Q28_05_01 Polypropylene - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q28_06_01 Polyethylene - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q28_07_01 Copper - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q28_08_01 Wood - Size (inches)	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q29 How does water reach the water plant/distribution system in your	F=12.017, p=.003; Municipalities were more likely to indicate their water	F=9.006, p=.023; Under 1000 were more likely to indicate a "Pumping	Communities who had varying recency of BWA did not differ in their	Certified vs. Non-Certified Operators did not differ in their responses to	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

municipality/LSD?	distribution system used a "Gravity fed" process; LSDs were more likely to indicate they used a "Pumping System"	System"	responses to this question	this question		
Q29 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q30 Does the current water demand in your municipality/LSD exceed the design capacity of your water system?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q31 What is the approximate piping distance from the disinfection system or closest chlorine booster station to the last user on your municipal/LSD system?	F=11.443, p=.027; LSDs were more likely to indicate the maximum distance between the last water user and a chlorine boosting station was 1km or less	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=19.798, p=.021; Central was more likely than Avalon/Eastern to report a piping distance of 3.1-4 kms	Employment types did not differ in their responses to this question
Q32 Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=11.529, p=.008; Central was more likely than Avalon/Eastern to report the distance between the disinfectant and the last home to be a problem	Employment types did not differ in their responses to this question
Q32 If you answered “yes”, what measures (if any) have you taken to deal with the	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their	Certified vs. Non-Certified Operators did not differ in their responses to	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

distance issue?			responses to this question	this question		
Q33 In 2012, how many leaks were there in your municipality's/LSD's water infrastructure that required repair?	F=12.309, p=.016; LSDs were more likely to indicate that there were "No leaks" in 2012	F=19.765, p=.001; Under 1000 were more likely to report 3-4 leaks; Over 1000 were more likely to indicate 11+ leaks	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q34 How often does your municipality/LSD do leak detection?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q35 Does your municipality/LSD have an organized leak detection program?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_01 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_02 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_03 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	F=Significant, p=.042; LSDs were more likely to use a "Deacon Meter"	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q36_04 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_05 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_06 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_07 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_08 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q36_09 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.033; Over 1000 were more likely to use a "Leak noise correlator"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_10 Which of the following methods does your municipality/LSD use	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their	Certified vs. Non-Certified Operators did not differ in their responses to	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

for leak detection? Choose all that apply.			responses to this question	this question		
Q36_11 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.046; Under 1000 were more likely to use "Step testing"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_12 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q36_13 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q37 Does your municipality/LSD have an annual valve operating/maintenance program?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q38 How often does your municipality/LSD flush it's water distribution lines?	F=12.053, p=.016; LSDs were more likely to indicate that they "Did not flush their systems"	F=15.906, p=.002; Over 1000 were more likely to flush their systems "Once a year"; Under 1000 were more likely to report they "Never flushed their systems"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=20.106, p=.008; Volunteer were more likely than Full to state that they did not flush their systems
Q38 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

			question			
Q39_01 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_02 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_03 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_04 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_05 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Choose all that apply.						
Q39_06 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_07 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_08 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q39_09 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=5.655, p=.034; Part were more likely than Full to indicate there were "None" problems
Q39_10 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)?	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"

Choose all that apply.						
Q39_11 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q40 How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?	F=15.533, p<.001; Municipalities were more likely to indicate that water was tested for chlorine residual "Daily in 2 locations"; LSDs were more likely to indicate that water was tested "Weekly"	F=6.409, p=.038; Over 1000 were more likely to indicate that they tested their water system for chlorine residual daily at two different locations	Communities who had varying recency of BWA did not differ in their responses to this question	F=9.299, p=.004; Certified were more likely to indicate they tested their water for chlorine residual Daily in two or more locations; Non-Certified were more likely to only test their water weekly	Regions did not differ in their responses to this question	F=9.86, p=.021; Full were more likely to test their water for chlorination twice daily in two separate spots than Volunteers; while Volunteers were more likely than Full to only check weekly
Q40 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q41 How often does the Department of Environment and Conservation test your municipality's/LSD's water?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=12.465, p=.041; Avalon/Eastern were more likely to report "Annually" than Central	Employment types did not differ in their responses to this question
Q41 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q42 How often does the Department of Service NL test your municipality's/LSD's water?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=8.200, p=.03; Non-Certified were more likely to indicate that Service NL tested their water supply on a quarterly basis	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q42 Other	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q43_01 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=6.795$, p=.017; Municipalities were more likely to have maps for entire water system	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=5.548$, p=.031; Certified were more likely to report having maps for all infrastructure	Regions did not differ in their responses to this question	F=6.645, p=.035; Full were more likely to have complete maps than Volunteers
Q43_02 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q43_03 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Q43_04 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q43_05 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	F=Significant, p=.009; LSDs were more likely to indicate that they did not have a map of the water distribution system	$\chi 2(1)=8.164$, p=.005; Under 1000 were more likely to indicate that they did not have a map of their distribution infrastructure	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=11.451, p=.002; Volunteers were more likely than Full to indicate that they did not have a full map
Q43_06 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q44 Is there a designated office/filing area in your municipality/LSD for drinking water system information?	$\chi 2(1)=11.83$, p=.001; Municipalities were more likely to indicate there was a designated office in their community for drinking water systems' information	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.01; Certified were more likely to have a designated office for drinking water system information	Regions did not differ in their responses to this question	F=15.808, p<.001; Full and Part were more likely to indicate that there was a designated office
Q45 Does your municipality/LSD have a written formal	Municipalities and LSDs did not differ in their responses to	F=Significant, p=.005; Over 1000 were more likely to	Communities who had varying recency of BWA did not	Certified vs. Non-Certified Operators did not differ in	Regions did not differ in their responses to this	Employment types did not differ in their responses to

maintenance plan for it's water distribution infrastructure (e.g. pipes, valves, etc)?	this question	indicate that they had a formal maintenance plan	differ in their responses to this question	their responses to this question	question	this question
Q45 If you answered "yes", what are the top three priorities of this maintenance plan?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q46 Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q46 If you answered "no", what resources do you need to operate the system sufficiently?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q47 Do you feel the province provides enough access to provincial water operator training opportunities?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=8.568, p=.011; Northern/Labrador/ Western were more likely to say "No" than Central and Avalon/Eastern	Employment types did not differ in their responses to this question
Q47 If you answered "no", what could the province improve in regards to their training opportunities?	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q48 Do you feel that your	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	F=Significant, p=.009; Certified	Regions did not differ in their	Employment types did not differ in

municipality/LSD provides you with adequate training opportunities to do your job as a water operator?	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	were more likely to feel as though they had adequate training opportunities	responses to this question	their responses to this question
Q49 Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.	Municipalities and LSDs did not differ in their responses to this question when excluding the "I don't know option"; when "I don't know" is included as an option the results become significant: F=14.809, p=.004 with LSDs more likely to indicate that they did not know	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this when excluding the "I don't know option"; when "I don't know" is included as an option the results become significant: F=13.200, p=.008 with Certified less likely to indicate "I don't know" and more likely to indicate "Communicated reasonably well"	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_01 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_02 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	F=Significant, p=.015; LSDs were more likely to hear about new drinking water technologies from companies and industry	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_03 Who provides	Municipalities and	Under and Over	Communities who	Certified vs. Non-	Regions did not	Employment types

you with information about new technologies for drinking water systems? Choose all that apply.	LSDs did not differ in their responses to this question	1000 did not differ in their responses to this question	had varying recency of BWA did not differ in their responses to this question	Certified Operators did not differ in their responses to this question	differ in their responses to this question	did not differ in their responses to this question
Q50_04 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_05 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.016; Certified were more likely to indicate that Atlantic Canada Water and Wastewater Association provided them within information	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_06 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.007; Over 1000 were more likely to indicate that their information came from "Other professional organizations"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_07 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=8.678$, p=.005; Over 1000 were more likely to indicate that their information came from "Companies/Industries"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q50_08 Who provides	F=Significant,	$\chi 2(1)=5.326$,	Communities who	Certified vs. Non-	Regions did not	Employment types

you with information about new technologies for drinking water systems? Choose all that apply.	p=.047; Municipalities were more likely to hear about new drinking water technologies from "Other operators"	p=.035; Over 1000 were more likely to indicate that their information came from "Other Water Operators"	had varying recency of BWA did not differ in their responses to this question	Certified Operators did not differ in their responses to this question	differ in their responses to this question	did not differ in their responses to this question
Q51_01 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.046; Certified were more likely to indicate that they were provided with infromation from Newsletters	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q51_02 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	F=Significant, p=.01; Municipalities were more likely to indicate that they heard about water technologies via email	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	$\chi 2(2)=8.652$, p=.016; Avalon/Eastern were more likely indciate email than Central	Employment types did not differ in their responses to this question
Q51_03 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q51_04 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	F=Significant, p=.014; Municipalities were more likely to indicate that they heard about water technologies via workshops and conferences	$\chi 2(1)=9.575$, p=.002; Over 1000 were more likely to indicate new technologies were communicated through "Workshops and conferences"	Communities who had varying recency of BWA did not differ in their responses to this question	F=Significant, p=.043; Certified were more likely to indicate that they were provided with infromation from Workshops and Conferences	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q51_05 How are new technologies related to	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

drinking water systems communicated to water operators? Choose all that apply.	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question
Q51_06 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q51_07 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=5.717$, $p=.026$; Over 1000 were more likely to indicate new technologies were communicated through "Other Water operators"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q51_08 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q52 Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?	$F=23.324$, $p<.001$; Municipalities were more likely to indicate they attended ADWWs every year; LSDs were more likely to report "Never, but have heard of them" and "Never, I have never heard of them"	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	$F=23.346$, $p<.001$; Certified were more likely to attend every year; Non-Certified were more likely to report "Never attended, but have heard of it" and "Never heard of it"	Regions did not differ in their responses to this question	$F=26.446$, $p<.001$; Volunteers were more likely to indicate they had "Never heard" or had "Heard but never gone"
Q53 How content are	Municipalities and	Under and Over	Communities who	Certified vs. Non-	Regions did not	Employment types

you with your compensation for your duties as water operator?	LSDs did not differ in their responses to this question	1000 did not differ in their responses to this question	had varying recency of BWA did not differ in their responses to this question	Certified Operators did not differ in their responses to this question	differ in their responses to this question	did not differ in their responses to this question
Q54 Do you have employee benefits from your job as a water operator (e.g. medical benefits)?	$\chi 2(1)=13.896$, $p<.001$; Municipalities were more likely to indicate that they had job benefits	$\chi 2(1)=28.581$, $p<.001$; Over 1000 were more likely to indicate they had benefits	Communities who had varying recency of BWA did not differ in their responses to this question	$\chi 2(1)=8.431$, $p=.005$; Certified were more likely to report having job benefits	Regions did not differ in their responses to this question	$F=18.188$, $p<.001$; Full were more likely to have benefits than Part
Q55 What is your salary range for your position as water operator?	$F=29.972$, $p<.001$; LSDs were more likely to suggest that their position was "Voluntary" or "<$10000"; Municipalities were more likely to indicate their position was between $30000-40000	$F=30.928$, $p<.001$; Under 1000 were more likely to be "Volunteer" or "$≤10000"; Over 1000 were more likely to indicate "$40000-50000" and "$60000-70000" and "$70000+"	Communities who had varying recency of BWA did not differ in their responses to this question	$F=17.122$, $p=.007$; Non-Certified were more likely to volunteer;	Regions did not differ in their responses to this question	$F=46.567$, $p<.001$; Part were more likely than Full to be compensated in other ways, Volunteers were more likely to be paid $0 or <$10000
Q55 I am compensated in other ways that does not include a salary (e.g. having your taxes paid for you). Please specify:	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Analysis was not performed; grouping variable was related to outcome variable
Q56_01 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_02 Which of these land use	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question
Q56_03 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	F=6.967, p=.03; Central was more likely to indicate domestic woodcutting posed a threat than Northern/Labrador/ Western	Employment types did not differ in their responses to this question
Q56_04 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_05 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	No variability, all respondents indicated "No"	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_06 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_07 Which of these land use	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question
Q56_08 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_09 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	F=Significant, p=.036; Over 1000 were more likely to indicate "Residential Cabin Development" was a threat	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_10 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_11 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q56_12 Which of these land use	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents	No variability, all respondents

activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	indicated "No"	indicated "No"	indicated "No"	indicated "No"	indicated "No"	indicated "No"
Q57_01 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q57_02 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q57_03 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q57_04 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q57_05 Which of these natural processes are currently threats to your municipality's/LSD's main water supply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

Choose all that apply.						
Q57_06 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q57_07 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=5.642$, p=.021; Under 1000 were more likely to indicate that there were "No natural processes that were a threat"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	F=11.329, p=.002; Part were more likely than Full to indicate there were "No problems"
Q57_08 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"	No variability, all respondents indicated "No"
Q58_01 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	$\chi 2(1)=12.021$, p=.001; Over 1000 were more likely to indicate that they were concerned over "Water aesthetics"	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_02 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_03 Which of the following are concerns for your municipal/LSD water	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their	Certified vs. Non-Certified Operators did not differ in their responses to	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question

system? Choose all that apply.			responses to this question	this question		
Q58_04 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_05 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_06 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_07 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_08 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_09 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	Municipalities and LSDs did not differ in their responses to this question	Under and Over 1000 did not differ in their responses to this question	Communities who had varying recency of BWA did not differ in their responses to this question	Certified vs. Non-Certified Operators did not differ in their responses to this question	Regions did not differ in their responses to this question	Employment types did not differ in their responses to this question
Q58_10 Which of the following are concerns	Municipalities and LSDs did not differ	Under and Over 1000 did not differ	Communities who had varying recency	Certified vs. Non-Certified Operators	Regions did not differ in their	Employment types did not differ in

for your municipal/LSD water system? Choose all that apply.	in their responses to this question	in their responses to this question	of BWA did not differ in their responses to this question	did not differ in their responses to this question	responses to this question	their responses to this question

LSD Chi Squares

Q03 What is the current population of your municipality/LSD?	No statistical differences.
Q04 In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?	No statistical differences.
Q05 Are you a full-time, part-time or volunteer water operator in your municipality/LSD?	$\chi 2(2)=10.8$, p=.005; More likely to say "Volunteer"
Q06 What is your primary position within your municipality/LSD? Please only select ONE option.	No statistical differences.
Q07 How long have you been a water operator for?	No statistical differences.
Q08 What is your highest level of water operating certification? Please only select ONE option.	$\chi 2(5)=20.6$, p=.002; More likely to say "I do not have formal training"
Q09_01 Municipal/LSD water supply (INPUT MISSING VALUES FOR THESE ONES)	$\chi 2(3)=12.286$, p=.007; More likely to rate local water supply as first
Q09_02 Private source (e.g. personal well)	No statistical differences.
Q09_03 Spring	$\chi 2(4)=12.429$, p=.018; More likely to say "NA"
Q09_04 Bottled water	$\chi 2(4)=10.286$, p=.037; More likely to say "NA"
Q11_02 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q11_03 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q11_05 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q11_07 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q11_08 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q11_09 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; Most said "My municipality/LSD does not use filtration"
Q11_11 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_01 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_05 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_06 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"

Q12_07 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_08 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_09 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_13 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q12_15 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=7.143$, p=.012; More likely to "None"
Q13_01 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q13_02 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q13_04 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "Yes"
Q13_07 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q13_10 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q14 How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?	No statistical differences.
Q15 Does your municipality/LSD have a maintenance plan for its water treatment system/plant operations?	No statistical differences.
Q16 Does your municipality/LSD have standard operating procedures for its water treatment system/plant operations?	No statistical differences.
Q17 How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?	$\chi 2(4)=11.333$, p=.027; More likely to say "Other"
Q18_01 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=9.308$, p=.003; More likely to say "Yes"
Q18_07 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=9.308$, p=.003; More likely to say "No"
Q20 Has your municipality/LSD been under a boil water advisory any time in the last 4 years?	$\chi 2(1)=11.267$, p=.001; More like to say "Yes"
Q21_01 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=7.143$, p=.012; More likely to say "No"
Q21_04 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=10.286$, p=.002; More likely to say "No"
Q21_05 What was the reason(s) for your municipality's/LSD's boil water	$\chi 2(1)=7.143$, p=.012; More likely to say "No"

advisory(ies)? Choose all that apply.	
Q21_07 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=7.143$, p=.012; More likely to say "No"
Q21_10 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No statistical differences.; More likely to say "No"
Q21_11 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=7.143$, p=.012; More likely to say "No"
Q21_15 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No statistical differences.
Q22 Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?	No statistical differences.
Q23 Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?	$\chi 2(2)=19.2$, p<.001; More likely to say "Always"
Q24 Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?	$\chi 2(2)=7.6$, p=.033; More likely to say "Always"
Q25_01_01 Water distribution pipes - Age (in years)	$\chi 2(2)=19.2$, p<.001; More likely to say "0-10"
Q25_02_01 Chlorination equipment - Age (in years)	$\chi 2(2)=7.6$, p=.033; More likely to say "0-10"
Q25_03_01 Pump - Age (in years)	No statistical differences.
Q25_04_01 Other treatment equipment other than chlorination - Age (in years)	$\chi 2(2)=6.4$, p=.045; More likely to say "11-20"
Q25_05_01 Filtration system (e.g. screens) - Age (in years)	$\chi 2(2)=9.571$, p=.009; More likely to say "0-10"
Q25_06_01 Chlorine booster station - Age (in years)	No statistical differences.
Q25_07_01 Water storage tank - Age (in years)	No statistical differences.
Q25_08_01 Man made dams - Age (in years)	No statistical differences.
Q26_01_01 Water distribution pipes - Age (in years)	No statistical differences.
Q26_02_01 Chlorination equipment - Age (in years)	No statistical differences.
Q26_03_01 Pump - Age (in years)	No statistical differences.
Q26_04_01 Other treatment equipment other than chlorination - Age (in years)	No statistical differences.
Q26_05_01 Filtration system (e.g. screens) - Age (in years)	$\chi 2(2)=11.231$, p=.005; More likely to say "0-10"
Q26_06_01 Chlorine booster station - Age (in years)	No statistical differences.
Q26_07_01 Water storage tank - Age (in years)	No statistical differences.
Q26_08_01 Man made dams - Age (in years)	No statistical differences.
Q27_01 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q27_02 What material is your water distribution pipes made of? Choose all that apply.	No statistical differences.

Q27_03 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q27_05 What material is your water distribution pipes made of? Choose all that apply.	No statistical differences.
Q27_06 What material is your water distribution pipes made of? Choose all that apply.	No statistical differences.
Q28_02_01 Polyvinyl chloride (PVC/uPVC) - Size (inches)	No statistical differences.
Q28_06_01 Polyethylene - Size (inches)	No statistical differences.
Q29 How does water reach the water plant/distribution system in your municipality/LSD?	$\chi 2(2)=14.8$, p=.001; More likely to say "Pumping system"
Q30 Does the current water demand in your municipality/LSD exceed the design capacity of your water system?	No statistical differences.
Q31 What is the approximate piping distance from the disinfection system or closest chlorine booster station to the last user on your municipal/LSD system?	No statistical differences.
Q32 Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?	No statistical differences.
Q33 In 2012, how many leaks were there in your municipality's/LSD's water infrastructure that required repair?	No statistical differences.
Q34 How often does your municipality/LSD do leak detection?	$\chi 2(4)=12.429$, p=.018; More likely to say "Does not do leak detection"
Q35 Does your municipality/LSD have an organized leak detection program?	No statistical differences.
Q36_03 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q36_04 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q36_05 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q36_10 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q36_11 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q36_13 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.
Q37 Does your municipality/LSD have an annual valve operating/maintenance program?	No statistical differences.
Q38 How often does your municipality/LSD flush it's water distribution lines?	No statistical differences.
Q39_01 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	No statistical differences.
Q39_03 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"

Q39_04 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	No statistical differences.
Q39_05 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	No statistical differences.
Q39_06 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q39_07 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q39_08 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q39_09 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q39_11 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q40 How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?	No statistical differences.
Q41 How often does the Department of Environment and Conservation test your municipality's/LSD's water?	No statistical differences.
Q42 How often does the Department of Service NL test your municipality's/LSD's water?	$\chi 2(2)=9.8$, p=.012; More likely to say "Monthly"
Q43_01 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q43_02 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q43_03 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q43_04 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q43_05 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	No statistical differences.
Q43_06 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q44 Is there a designated office/filing area in your municipality/LSD for drinking	No statistical differences.

water system information?	
Q46 Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?	No statistical differences.
Q47 Do you feel the province provides enough access to provincial water operator training opportunities?	No statistical differences.
Q48 Do you feel that your municipality/LSD provides you with adequate training opportunities to do your job as a water operator?	No statistical differences.
Q49 Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.	No statistical differences.
Q50_01 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_02 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_03 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_04 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=5.444$, p=.036; More likely to say "No"
Q50_05 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_07 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=5.444$, p=.036; More likely to say "No"
Q51_01 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.;
Q51_03 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q51_04 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q51_05 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q51_06 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q51_07 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=5.444$, p=.036; More likely to say "No"
Q52 Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?	No statistical differences.
Q53 How content are you with your compensation for your duties as water operator?	No statistical differences.

Q55 What is your salary range for your position as water operator?	No statistical differences.
Q56_01 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q56_02 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q56_03 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	No statistical differences.
Q56_04 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "No"
Q56_08 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	No statistical differences.;
Q56_09 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q56_11 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	No statistical differences.
Q57_01 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q57_02 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "No"
Q57_03 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	No statistical differences.
Q57_05 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "No"
Q57_06 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q57_07 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	No statistical differences.
Q58_01 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q58_02 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q58_03 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "No"
Q58_05 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"
Q58_06 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=11.267$, p=.001; More likely to say "No"
Q58_08 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=5.4$, p=.033; More likely to say "No"

Q58_09 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	No statistical differences.
Q58_10 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=8.067$, p=.007; More likely to say "No"

Municipality

Q03 What is the current population of your municipality/LSD?	No statistical differences.
Q04 In what Municipalities Newfoundland and Labrador (MNL) region is your municipality/LSD located?	$\chi 2(5)=18.143$, $p=.003$; Avalon and central were over-represented, Eastern, Labrador, and Northern were under-represented
Q05 Are you a full-time, part-time or volunteer water operator in your municipality/LSD?	$\chi 2(2)=61$, $p<.001$; Full time was over-represented
Q06 What is your primary position within your municipality/LSD? Please only select ONE option.	$\chi 2(2)=19.75$, $p<.001$; Municipal/LSD administrator/water operator was under-represented
Q07 How long have you been a water operator for?	$\chi 2(3)=27.857$, $p<.001$; 1-5 years and 6-20 years were over-represented
Q08 What is your highest level of water operating certification? Please only select ONE option.	$\chi 2(7)=36.491$, $p<.001$; Class I had the highest number of respondents
Q09_01 Municipal/LSD water supply (INPUT MISSING VALUES FOR THESE ONES)	$\chi 2(3)=130.571$, $p<.001$; Municipal water supply was the top ranked water source
Q09_02 Private source (e.g. personal well)	$\chi 2(4)=19.536$, $p=.001$; Personal well was the second most highly rated source
Q09_03 Spring	$\chi 2(4)=40.071$, $p<.001$; Most persons indicated Spring was N/A
Q09_04 Bottled water	$\chi 2(4)=20.964$, $p<.001$; Bottled Water was under-rated as a first and fourth choice, and over-rated as N/A
Q10 Does your municipality/LSD treat (e.g. any treatment, disinfection or filtration) its drinking water supplied to residents?	$\chi 2(1)=43.655$, $p<.001$; More likely to say "Yes"
Q11_01 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=28.88$, $p<.001$; More likely to say "No"
Q11_02 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=18$, $p<.001$; More likely to say "No"
Q11_03 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=32$, $p<.001$; More likely to say "No"
Q11_04 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=42.32$, $p<.001$; More likely to say "No"
Q11_05 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=25.92$, $p<.001$; More likely to say "No"
Q11_07 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=42.32$, $p<.001$; More likely to say "No"
Q11_09 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	No statistical differences.
Q11_10 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=38.72$, $p<.001$; More likely to say "No"

Q11_11 What method does your municipality/LSD use for filtration of source water? Choose all that apply.	$\chi 2(1)=20.48$, $p<.001$; More likely to say "No"
Q12_01 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=46.08$, $p<.001$; More likely to say "No"
Q12_02 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=28.88$, $p<.001$; More likely to say "No"
Q12_04 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=28.88$, $p<.001$; More likely to say "No"
Q12_06 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=38.72$, $p<.001$; More likely to say "No"
Q12_07 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=38.72$, $p<.001$; More likely to say "No"
Q12_08 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=8$, $p=.009$; More likely to say "No"
Q12_09 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=35.28$, $p<.001$; More likely to say "No"
Q12_10 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=38.72$, $p<.001$; More likely to say "No"
Q12_13 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=42.32$, $p<.001$; More likely to say "No"
Q12_15 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	No statistical differences.
Q12_16 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=42.32$, $p<.001$; More likely to say "No"
Q12_17 What kind of drinking water treatment processes or treatments does your municipality/LSD use other than disinfection? Choose all that apply.	$\chi 2(1)=42.32$, $p<.001$; More likely to say "No"
Q13_01 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=33.923$, $p<.001$; More likely to say "No"
Q13_03 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	No statistical differences.
Q13_04 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=7.692$, $p=.01$; More likely to say "No"
Q13_05 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=40.692$, $p<.001$; More likely to say "No"
Q13_06 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=37.231$, $p<.001$; More likely to say "No"
Q13_07 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=37.231$, $p<.001$; More likely to say "No"
Q13_09 What kind of drinking water disinfection system does your municipality/LSD	$\chi 2(1)=44.308$, $p<.001$; More likely to say "No"

use? Choose all that apply.	
Q13_10 What kind of drinking water disinfection system does your municipality/LSD use? Choose all that apply.	$\chi 2(1)=44.308$, $p<.001$; More likely to say "No"
Q14 How old is your municipality's/LSD's water treatment system/plant (when was the oldest component installed)?	No statistical differences.
Q15 Does your municipality/LSD have a maintenance plan for its water treatment system/plant operations?	$\chi 2(1)=17.308$, $p<.001$; More likely to say "Yes"
Q16 Does your municipality/LSD have standard operating procedures for its water treatment system/plant operations?	$\chi 2(1)=20.547$, $p<.001$; More likely to say "Yes"
Q17 How often is your municipality's/LSD's water treatment facility maintained (cleaning, part replacement, etc)?	No statistical differences.
Q18_01 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=15.077$, $p<.001$; More likely to say "Yes"
Q18_02 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=33.923$, $p<.001$; More likely to say "No"
Q18_05 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=40.692$, $p<.001$; More likely to say "No"
Q18_07 Are all parts of your municipality's/LSD's water treatment system currently working? Choose all that apply.	$\chi 2(1)=37.231$, $p<.001$; More likely to say "No"
Q19_01 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	$\chi 2(1)=8.333$, $p=.007$; More likely to say "No"
Q19_02 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No statistical differences.
Q19_03 What are the barriers to repairing your municipality's/LSD's water treatment system? Choose all that apply.	No statistical differences.
Q20 Has your municipality/LSD been under a boil water advisory any time in the last 4 years?	$\chi 2(1)=18.132$, $p<.001$; More likely to say "Yes"
Q21_05 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No statistical differences.
Q21_06 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=24.381$, $p<.001$; More likely to say "No"
Q21_07 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	No statistical differences.
Q21_09 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=11.524$, $p=.001$; More likely to say "No"
Q21_10 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=24.381$, $p<.001$; More likely to say "No"
Q21_11 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=13.714$, $p=.001$; More likely to say "No"

Q21_12 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=30.857$, $p<.001$; More likely to say "No"
Q21_13 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=27.524$, $p<.001$; More likely to say "No"
Q21_14 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=34.381$, $p<.001$; More likely to say "No"
Q21_15 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=21.429$, $p<.001$; More likely to say "No"
Q21_17 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=34.381$, $p<.001$; More likely to say "No"
Q21_20 What was the reason(s) for your municipality's/LSD's boil water advisory(ies)? Choose all that apply.	$\chi 2(1)=27.524$, $p<.001$; More likely to say "No"
Q22 Does your municipality/LSD ever release precautionary boil water advisories (for reasons other than regular flushing and maintenance)?	$\chi 2(1)=9.524$, $p=.004$; More likely to say "No"
Q23 Are you made aware of the results of your municipality`s/LSD's drinking water quality reports from the Department of Environment and Conservation?	$\chi 2(2)=78.377$, $p<.001$; More likely to say "Always"
Q24 Are you made aware of the bacteriological water quality results from monthly monitoring performed by the Department of Service NL?	$\chi 2(2)=68.415$, $p<.001$; More likely to say "Always"
Q25_01_01 Water distribution pipes - Age (in years)	$\chi 2(2)=78.377$, $p<.001$; More likely to say "0-10"
Q25_02_01 Chlorination equipment - Age (in years)	$\chi 2(2)=68.415$, $p<.001$; More likely to say "0-10"
Q25_03_01 Pump - Age (in years)	$\chi 2(5)=24.846$, $p<.001$; More likely to say "21-30" or "31-40"
Q25_04_01 Other treatment equipment other than chlorination - Age (in years)	$\chi 2(4)=32.4$, $p<.001$; More likely to say "0-10"
Q25_05_01 Filtration system (e.g. screens) - Age (in years)	$\chi 2(5)=35.596$, $p<.001$; More likely to say "0-10"
Q25_06_01 Chlorine booster station - Age (in years)	$\chi 2(4)=15.744$, $p=.003$; Less likely to be "21-30" or "31-40"
Q25_07_01 Water storage tank - Age (in years)	No statistical differences.
Q25_08_01 Man made dams - Age (in years)	$\chi 2(3)=25.368$, $p<.001$; More likely to say "NA"
Q26_01_01 Water distribution pipes - Age (in years)	$\chi 2(6)=14.261$, $p=.029$; More likely to say "NA" or "0-10"
Q26_02_01 Chlorination equipment - Age (in years)	$\chi 2(6)=52.718$, $p<.001$; More likely to say "NA"
Q26_03_01 Pump - Age (in years)	$\chi 2(4)=59.5$, $p<.001$; More likely to say "0-10"
Q26_04_01 Other treatment equipment other than chlorination - Age (in years)	$\chi 2(4)=76.826$, $p<.001$; More likely to say "0-10"
Q26_05_01 Filtration system (e.g. screens) - Age (in years)	$\chi 2(3)=42.116$, $p<.001$; More likely to say "0-10"
Q26_06_01 Chlorine booster station - Age (in years)	$\chi 2(3)=18.758$, $p<.001$; More likely to say "0-10"
Q26_07_01 Water storage tank - Age (in years)	$\chi 2(4)=10.158$, $p=.039$; More likely to say "0-10"
Q26_08_01 Man made dams - Age (in years)	$\chi 2(2)=8.167$, $p=.019$; More likely to say "NA"

Q27_01 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=41.143$, $p<.001$; More likely to say "No"
Q27_02 What material is your water distribution pipes made of? Choose all that apply.	No statistical differences.
Q27_03 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=7.143$, $p=.012$; More likely to say "Ductile Iron"
Q27_04 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=18.286$, $p<.001$; More likely to say "No"
Q27_05 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=44.643$, $p<.001$; More likely to say "No"
Q27_06 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=18.286$, $p<.001$; More likely to say "No"
Q27_07 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=7.143$, $p=.012$; More likely to say "No"
Q27_09 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=48.286$, $p<.001$; More likely to say "No"
Q27_10 What material is your water distribution pipes made of? Choose all that apply.	$\chi 2(1)=37.786$, $p<.001$; More likely to say "No"
Q28_01_01 Steel - Size (inches)	No statistical differences.
Q28_02_01 Polyvinyl chloride (PVC/uPVC) - Size (inches)	No statistical differences.
Q28_03_01 Ductile iron - Size (inches)	$\chi 2(3)=16.282$, $p=.001$; More likely to be "6-7 inches" or "8-9 inches"
Q28_04_01 Cast iron - Size (inches)	No statistical differences.
Q28_05_01 Polypropylene - Size (inches)	No statistical differences.
Q28_06_01 Polyethylene - Size (inches)	No statistical differences.
Q29 How does water reach the water plant/distribution system in your municipality/LSD?	$\chi 2(3)=14.745$, $p=.002$; More likely to be "Gravity Fed"
Q30 Does the current water demand in your municipality/LSD exceed the design capacity of your water system?	$\chi 2(1)=26.843$, $p<.001$; More likely to say "No"
Q31 What is the approximate piping distance from the disinfection system or closest chlorine booster station to the last user on your municipal/LSD system?	No statistical differences.
Q32 Is the distance from the disinfection system to the last user on your municipal/LSD system an issue for maintaining disinfection residual?	$\chi 2(2)=29.132$, $p<.001$; More likely to say "No"
Q33 In 2012, how many leaks were there in your municipality's/LSD's water infrastructure that required repair?	$\chi 2(5)=11.692$, $p=.038$; More likely to be "1-2"
Q34 How often does your municipality/LSD do leak detection?	$\chi 2(4)=48.565$, $p<.001$; More likely to be "Does not do leak detection"
Q35 Does your municipality/LSD have an organized leak detection program?	$\chi 2(1)=10.704$, $p=.001$; More likely to say "No"
Q36_01 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=14.44$, $p<.001$; More likely to say "No"
Q36_02 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=21.16$, $p<.001$; More likely to say "No"
Q36_04 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=17.64$, $p<.001$; More likely to say "No"
Q36_06 Which of the following methods does your municipality/LSD use for leak	No statistical differences.

detection? Choose all that apply.	
Q36_07 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=21.16$, $p<.001$; More likely to say "No"
Q36_09 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=4.84$, $p=.045$; More likely to say "No"
Q36_10 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	No statistical differences.;
Q36_11 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=14.44$, $p<.001$; More likely to say "No"
Q36_12 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=17.64$, $p<.001$; More likely to say "No"
Q36_13 Which of the following methods does your municipality/LSD use for leak detection? Choose all that apply.	$\chi 2(1)=6.76$, $p=.016$; More likely to say "No"
Q37 Does your municipality/LSD have an annual valve operating/maintenance program?	$\chi 2(1)=9.981$, $p=.003$; More likely to say "No"
Q38 How often does your municipality/LSD flush it's water distribution lines?	$\chi 2(5)=57.556$, $p<.001$; More likely to say "Twice Yearly"
Q39_01 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=9.618$, $p=.003$; More likely to say "Age of system (e.g., corrosion)"
Q39_02 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=47.291$, $p<.001$; More likely to say "No"
Q39_03 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=36.818$, $p<.001$; More likely to say "No"
Q39_04 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=13.255$, $p=.001$; More likely to say "No"
Q39_05 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=15.291$, $p<.001$; More likely to say "No"
Q39_06 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=27.655$, $p<.001$; More likely to say "No"
Q39_07 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=19.8$, $p<.001$; More likely to say "No"
Q39_08 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=30.564$, $p<.001$; More likely to say "No"
Q39_09 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=40.164$, $p<.001$; More likely to say "No"
Q39_11 What are the biggest issues, other than financial constraints, for your water distribution system (e.g. infrastructure)? Choose all that apply.	$\chi 2(1)=51.073$, $p<.001$; More likely to say "No"
Q40 How often do you as the water operator test your municipality's/LSD's drinking water for chlorine residual?	$\chi 2(2)=41.08$, $p<.001$; More likely to say "Daily in two or more locations"

Q41 How often does the Department of Environment and Conservation test your municipality's/LSD's water?	$\chi 2(3)=11.047$, p=.011; More likely to say "Quarterly"
Q42 How often does the Department of Service NL test your municipality's/LSD's water?	$\chi 2(3)=32.947$, p<.001; More likely to say "Monthly"
Q43_01 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	No statistical differences.
Q43_02 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=11.364$, p=.001; More likely to say "No"
Q43_03 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=47.291$, p<.001; More likely to say "No"
Q43_04 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=51.073$, p<.001; More likely to say "No"
Q43_05 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=17.473$, p<.001; More likely to say "No"
Q43_06 Does your municipality/LSD have an updated and accurate map of your municipality's/LSD's water distribution infrastructure (e.g. pipes, valves, etc)? Choose all that apply.	$\chi 2(1)=47.291$, p<.001; More likely to say "No"
Q44 Is there a designated office/filing area in your municipality/LSD for drinking water system information?	$\chi 2(1)=13$, p=.001; More likely to say "Yes"
Q45 Does your municipality/LSD have a written formal maintenance plan for it's water distribution infrastructure (e.g. pipes, valves, etc)?	$\chi 2(1)=23.17$, p<.001; More likely to say "No"
Q46 Do you think you have sufficient resources (e.g. financial, human or infrastructure resources) to operate the water system in your municipality/LSD effectively?	$\chi 2(2)=9.855$, p=.007; More likely to say "To some degree"
Q47 Do you feel the province provides enough access to provincial water operator training opportunities?	$\chi 2(1)=19.8$, p<.001; More likely to say "Yes"
Q48 Do you feel that your municipality/LSD provides you with adequate training opportunities to do your job as a water operator?	$\chi 2(1)=41.679$, p<.001; More likely to say "Yes"
Q49 Do you think new technologies related to drinking water systems are communicated effectively to water operators either by the Province, the municipality/LSD or other sources (e.g. professional associations)? Please rate your experience from 1-5.	$\chi 2(5)=41.111$, p<.001; More likely to say "Communicated reasonably well" and "Communicated adequately"
Q50_01 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=12.755$, p=.001; More likely to say "No"

Q50_02 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=34.306$, $p<.001$; More likely to say "No"
Q50_03 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=31.041$, $p<.001$; More likely to say "No"
Q50_04 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=4.592$, $p=.049$; More likely to say "No"
Q50_05 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_06 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=25$, $p<.001$; More likely to say "No"
Q50_07 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	No statistical differences.
Q50_08 Who provides you with information about new technologies for drinking water systems? Choose all that apply.	$\chi 2(1)=4.592$, $p=.049$; More likely to say "No"
Q51_01 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=5.898$, $p=.025$; More likely to say "No"
Q51_02 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q51_03 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=12.755$, $p=.001$; More likely to say "No"
Q51_04 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=14.878$, $p<.001$; Most likely to say "Workshops and conferences"
Q51_05 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=10.796$, $p=.002$; More likely to say "No"
Q51_06 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	$\chi 2(1)=22.224$, $p<.001$; More likely to say "No"
Q51_07 How are new technologies related to drinking water systems communicated to water operators? Choose all that apply.	No statistical differences.
Q52 Do you attend the Annual Drinking Water Workshop put on by the Department of Environment and Conservation?	$\chi 2(3)=19.691$, $p<.001$; More likely to say "Yes every year and less likely to say "Never, however I have heard of teh Annual Drinking Water Workshop"
Q53 How content are you with your compensation for your duties as water operator?	$\chi 2(4)=33.455$, $p<.001$; More likely to say "Somewhat content" and "Very content"
Q54 Do you have employee benefits from your job as a water operator (e.g. medical benefits)?	No statistical differences.
Q55 What is your salary range for your position as water operator?	$\chi 2(9)=19.558$, $p=.023$; More likely to say $30000-39999"
Q56_01 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=43.314$, $p<.001$; More likely to say "No"
Q56_02 Which of these land use activities do you think are currently threats to your	$\chi 2(1)=39.706$, $p<.001$; More likely to say "No"

main municipal/LSD's water supply? Choose all that apply.	
Q56_03 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=16.49$, $p<.001$; More likely to say "No"
Q56_04 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=26.843$, $p<.001$; More likely to say "No"
Q56_05 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=47.078$, $p<.001$; More likely to say "No"
Q56_06 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=39.706$, $p<.001$; More likely to say "No"
Q56_07 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=39.706$, $p<.001$; More likely to say "No"
Q56_08 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=8.647$, $p=.006$; More likely to say "No"
Q56_09 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=29.824$, $p<.001$; More likely to say "No"
Q56_10 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	$\chi 2(1)=29.824$, $p<.001$; More likely to say "No"
Q56_11 Which of these land use activities do you think are currently threats to your main municipal/LSD's water supply? Choose all that apply.	No statistical differences.
Q57_01 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	No statistical differences.
Q57_02 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=18.132$, $p<.001$; More likely to say "No"
Q57_03 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=8.321$, $p=.007$; More likely to say "No"
Q57_04 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=38.208$, $p<.001$; More likely to say "No"
Q57_05 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=23.113$, $p<.001$; More likely to say "No"
Q57_06 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=38.208$, $p<.001$; More likely to say "No"
Q57_07 Which of these natural processes are currently threats to your municipality's/LSD's main water supply. Choose all that apply.	$\chi 2(1)=13.755$, $p=.001$; More likely to say "No"
Q58_01 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	No statistical differences.
Q58_02 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=38.208$, $p<.001$; More likely to say "No"
Q58_03 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=23.113$, $p<.001$; More likely to say "No"

Q58_04 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=23.113$, $p<.001$; More likely to say "No"
Q58_05 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=25.83$, $p<.001$; More likely to say "No"
Q58_06 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=31.717$, $p<.001$; More likely to say "No"
Q58_07 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=49.075$, $p<.001$; More likely to say "No"
Q58_08 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=31.717$, $p<.001$; More likely to say "No"
Q58_09 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=6.811$, $p=.015$; More likely to say "No"
Q58_10 Which of the following are concerns for your municipal/LSD water system? Choose all that apply.	$\chi 2(1)=45.302$, $p<.001$; More likely to say "No"