Drinking Water Safety in Newfoundland and Labrador

Annual Report 2007

Newfoundland Labrador

Drinking Water Safety
in
Newfoundland and Labrador

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For additional copies, please contact:

Water Resources Management Division
Department of Environment and Conservation
Government of Newfoundland and Labrador
PO Box 8700
St. John's NL A1B 4J6
Telephone: (709) 729-2563
Fax: (709) 729-0320

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Message from the Minister

As the Minister of Environment and Conservation, I am pleased to introduce the 2007 annual report on Drinking Water Safety in Newfoundland and Labrador. The sixth annual report outlines accomplishments and activities for 2006-2007 under the Multi Barrier Strategic Action Plan for drinking water safety. The report highlights 319 of our designated protected water supply areas; 146 on-site training sessions provided by mobile training units; approximately 19,000 bacteriological samples collected and analyzed; 2,845 samples collected and analyzed for various chemical parameters including trihalomethanes (THMs) and haloacetic acids (HAAs); and a continuing downward trend in the number of boil water advisories.

Government's pro-active approach to drinking water safety will ensure long-term integrity of our drinking water quality. Government is committed to addressing drinking water quality issues in a sustainable and affordable manner while keeping our communities and the general public informed about all aspects of drinking water safety. This year, my department introduced real-time source water quality monitoring at the Miapukek First Nations Community and the data is made public via the internet.

I commend the Water Resources Management staff for their commitment and hard work to drinking water safety. I also appreciate the effort and dedication from the Technical Working Group. The Working Group consists of representatives from the departments of Environment and Conservation, Health and Community Services, Government Services and Municipal Affairs. Each department contributes uniquely to the Multi-Barrier Strategic Action Plan by means of their respective mandates and programs.

Following the Multi-Barrier Strategic Action Plan, Government will continue to keep drinking water safe and help build a better place for future generations.

Charlene Johnson
MINISTER

Executive Summary

This sixth annual report on drinking water safety in Newfoundland and Labrador outlines accomplishments and activities for 2006-07 under the Multi-Barrier Strategic Action Plan (MBSAP) for drinking water safety.

The introductory chapter, Chapter 1 of the report, explains the components and objectives of the MBSAP and outlines the contents of the other chapters of the report.

Source water, whether it is a pond, brook or well, water treatment systems and the distribution system are the physical components where the first level of the MBSAP is applied. There are 319 protected water supplies in the province. Source protection is an important way to protect the original natural quality of water from impacts due to land use activities and development. Water treatment which is comprised of 437 chlorination systems, 14 water treatment plants and several other systems with filtration or other treatments are operated to remove or inactivate microbiological contamination, remove chemical substances or to improve upon aesthetic parameters. The water distribution system itself is an important determinant of water safety, but there are many challenges with this component as there are 535 water supply systems serving all types of communities from cities to small local service districts. Ageing infrastructure is being cited as one of the main issues that Government addressed in 2006-07 by investing $13.4 million for water supply infrastructure projects.

The second level of the MBSAP includes chemical, physical and bacteriological water quality monitoring as well as, reporting, inspection and operator training. Statistics in Chapter 3 show that there were 2,318 tap water samples and 527 source water samples analyzed for over 30 parameters including THMs and HAAs as well as 19,149 samples for bacteriological water quality. Special sampling was undertaken for Chlorite and Chlorate and Radionuclides in anticipation of new drinking water guidelines. Whenever test results exceeded provincial standards appropriate action was taken. The number of boil advisories on public water supplies, of which there were 215 as of March 31, 2007, continues to draw attention but this number is slowly declining. Apart from direct infrastructure improvements, inspections, issuing of construction and operating permits, and operator training are all helping to make continuous improvements to public water supplies.

The third and last level of the MBSAP deals with legislative and policy frameworks; public involvement and awareness; setting guidelines, standards and water quality objectives; and research and development. Some of the highlights in this area include enforcement of the Water Resources Act, as well as other applicable legislation. Government continues to make significant strides in providing information to the public about drinking water at the community level. For example, the Department of Environment and Conservation has introduced real-time source water quality monitoring at the Miapukek First Nations Community and the data is made public via the internet.

In conclusion, Government is committed to ensuring drinking water safety by following a Multi-Barrier Strategic Action Plan. This plan will involve activities to be undertaken by four line departments; Environment and Conservation, Municipal Affairs, Health and Community Services and Government Services; each contributing uniquely to the plan by means of their respective mandates and programs. Coordination between the departments is ensured by a Technical Working Group which meets frequently and which reports to a committee of senior government officials.

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Glossary of Terms

Bacteria:
Microscopic unicellular organisms having a rigid cell wall structure.

Chlorination:
An oxidation process that is initiated through the addition of chlorine to water. Chlorine oxidizes microbiological material, organic compounds and inorganic compounds.

Chlorine:
A chemical used as a disinfectant and oxidizing agent for drinking water.

Coliform:
A group of bacteria commonly found in the environment and also in the intestinal tract of mammals, including humans, whose presence in water may indicate contamination by disease-causing microorganisms.

Colour:
A physical characteristic of water attributed to the presence of coloured organic substances, or metals.

Disinfection:
The process of inactivating pathogenic organisms (disease causing bacteria, viruses, fungi and protozoa) by either a chemical or physical means.

Geographic Information System (GIS):
An information system that is used to input, store, retrieve, manipulate, analyze and output geographically referenced data or geospatial data, in order to support decision making for planning and management of land use, natural resources, environment, transportation, urban facilities, and other administrative records.

Haloacetic acids (HAAs):
A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation).The haloacetic acids most commonly found in drinking water are monochloroacetic acid (MCA), dichloroacetic acid (DCA), trichloroacetic acid (TCA), monobromoacetic acid (MBA) and dibromoacetic acid (DBA).

Inorganic:
Relating or belonging to the class of chemical compounds that do not contain carbon as the principal element and are of mineral origins such as salt and iron.

Glossary of Terms

Organic:

Relating or belonging to the class of chemical compounds having a carbon basis such as hydrocarbons.

pH:

A measure on a scale from 0 to 14 of the acidity or alkalinity of a solution where 7 is neutral, greater than 7 is more basic and less than 7 is more acidic.

Protected Water Supply Area:

An area surrounding a public water supply source, either surface water or groundwater, which has the activities that take place in the area regulated by government. The area is protected under Section 39(1) of the *Water Resources Act*.

Public Water Supply System:

A water supply system operated by a community.

Trihalomethanes (THMs):

A group of compounds that can form when the chlorine used to disinfect drinking water reacts with naturally occurring organic matter (e.g., decaying leaves and vegetation). The trihalomethanes most commonly found in drinking water are chloroform, bromodichloromethane (BDCM), dibromochloromethane (DBCM) and bromoform.

Turbidity:

A measure of the cloudiness of water.

Water Supply System:

Term to describe the entire network (i.e. pumps, pipes, valves, water treatment units etc.) used to transport water from a water supply source to the consumer.

Water Treatment Plant:

The portion of a public water system which is designed to alter the physical, chemical, biological or radiological quality of the water or to remove any contaminants.

List of Acronyms

AO	Aesthetic Objective
BCDM	Bromodichloromethane
BWA	Boil Water Advisory
CFS	Canadian Forestry Service
DBP	Disinfection byproduct
DWIMS	Drinking Water Information Management System
DWQ	Drinking Water Quality
ENVC	Department of Environment and Conservation
GCDWQ	*Guidelines for Canadian Drinking Water Quality*
GIS	Geographic Information System
GS	Department of Government Services
HAA	Haloacetic Acid
HCS	Department of Health and Community Services
ILUC	Interdepartmental Land Use Committee
IMAC	Interim Maximum Acceptable Concentration
LTD	Less Than Detection Limit
MA	Department of Municipal Affairs
MAC	Maximum Acceptable Limit
MBSAP	Multi-Barrier Strategic Action Plan
MTU	Mobile Training Unit
OETC	Operator Education Training and Certification
PWDU	Potable Water Dispensing Units
QA/QC	Quality Assurance/Quality Control
SDW-TWG	Safe Drinking Water Technical Working Group
UV	Ultraviolet

1 Introduction

1.1 Overview

The *Drinking-water Safety Annual Report* continues to provide information about progress and accomplishments to ensure drinking-water safety in Newfoundland and Labrador. This is the sixth annual report, which applies to the fiscal year of 2006/7 as defined by the reporting period from April 1, 2006, to March 31, 2007.

The Government of Newfoundland and Labrador provides the public with clean and safe drinking water by applying the Multi-barrier Strategic Action Plan (MBSAP). The multi-barrier approach is considered to be the most effective way to manage drinking-water systems. It recognizes that health and environmental issues are inter-related, and thus helps integrate efforts to improve public health and to protect the natural environment. This year's report highlights various aspects of drinking-water safety achieved through proper operation and maintenance.

Simply put, the MBSAP uses three multi-component levels of protection to safeguard the quality of drinking water. The Departments of Environment and Conservation (ENVC), Health and Community Services (HCS), Government Services (GS), and Municipal Affairs (MA) all work together to implement the components of the MBSAP.

Proactive operation and maintenance activities are an integral part of the MBSAP. Examples of these activities range from the proper operation and maintenance of the drinking-water distribution system (in Level 1 of the MBSAP) and the education and training of operators in the proper operation and maintenance of drinking-water systems (in Level 2) to the research and development of operation and maintenance activities (in Level 3).

The levels and components of the MBSAP (shown in Figure 1) include:

Level 1
- Source-water protection
- Drinking-water treatment
- Drinking-water distribution system

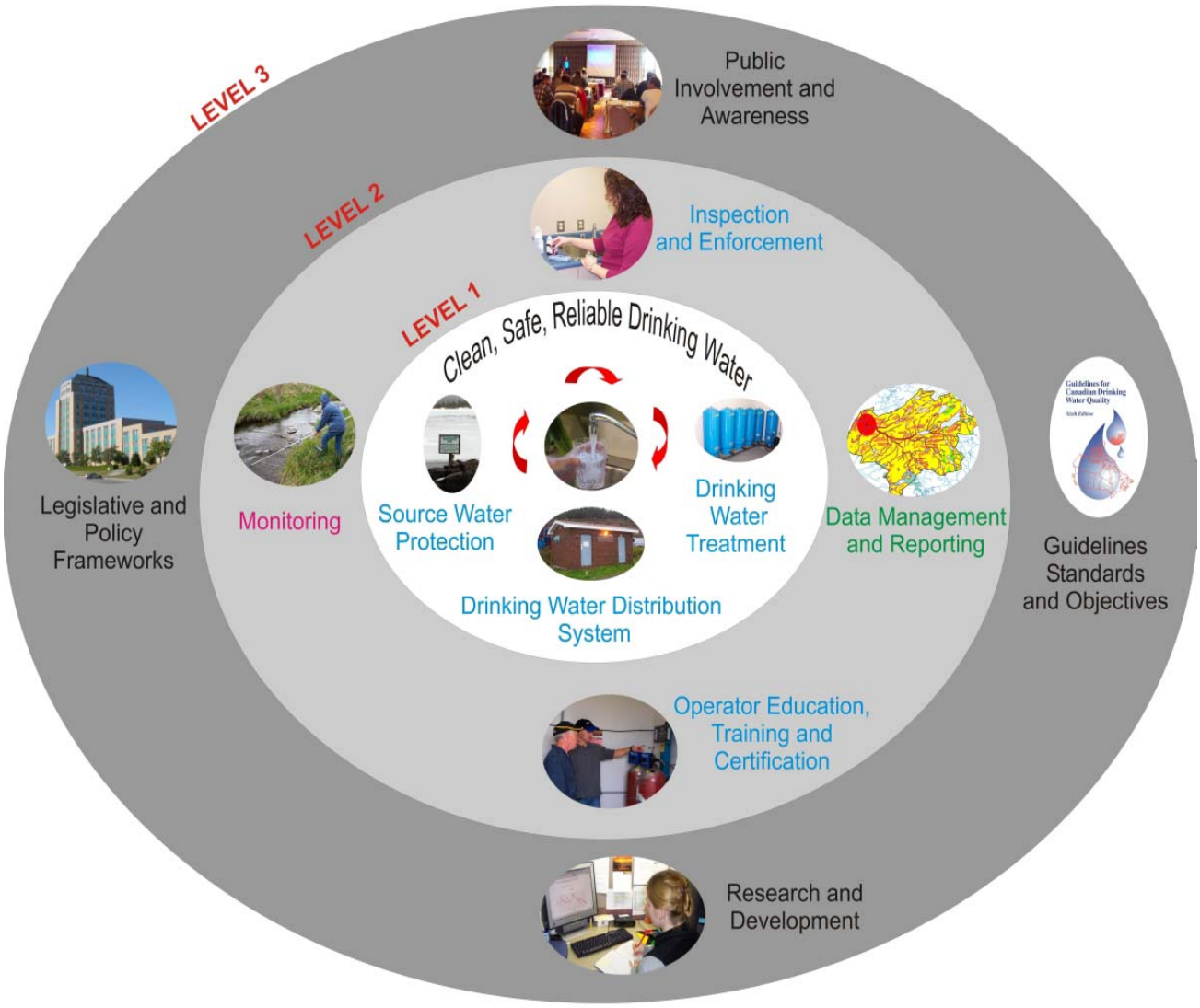
Level 2
- Monitoring
- Inspection and enforcement
- Data management and reporting
- Operator education, training, and certification

Level 3
- Legislative and policy frameworks
- Public involvement and awareness
- Guidelines, standards, and objectives
- Research and development

A committee of Deputy Ministers deals with drinking-water safety on a proactive basis. The committee is chaired by the Deputy Minister of ENVC and includes the Deputy Ministers of HCS, GS, and MA. The Deputy Ministers' committee is supported by the inter-departmental Safe Drinking Water–Technical Working Group (SDW–TWG) which has members drawn from the same four departments. In addition, representatives from the Public Health Laboratory plus the Medical Officers of Health from each of the province's regional Health Authorities belong to the Working Group. The SDW–TWG is also chaired by ENVC. Led by the Deputy Ministers' committee, progress in implementing the MBSAP for drinking-water safety continues to be made.

This annual report is part of regular efforts to inform the public of the status of drinking-water quality in the province. As in previous years, its structure reflects the key components of the MBSAP during the fiscal year from April 1, 2006, to March 31, 2007. The theme of this year's report is "Drinking Water Safety through Proper Operation and Maintenance." The focus is on this theme in relation to the various components of the MBSAP.

Figure 1 : The Components of the Multi-Barrier Strategic Action Plan (MBSAP)



PARTICIPATING AGENCIES

Agencies in four provincial government departments oversee the implementation of the MBSAP. Their participation in the various components is denoted by the following colour coding:

Department of Environment and Conservation

Departments of Environment and Conservation / Health and Community Services / Government Services / Municipal Affairs / Federal Government

Departments of Environment and Conservation / Government Services

Departments of Environment and Conservation / Municipal Affairs

1.2 Objectives

The objective of this report is to provide the reader with an overview of activities undertaken to advance the MBSAP and outline the progress made towards ensuring drinking-water safety in the province. Highlights that illustrate how the Province met these objectives during the 2006/7 fiscal year include:

- The opening of new water treatment plants in Gander and St. John's
- The opening of Potable Water Disinfection Units in Howley and St. Lawrence
- Introducing alternative disinfection techniques such as chlorine demand management, MIOX, ozone, and UV
- Adapting to new standards in the *Guidelines for Canadian Drinking-water Quality* (GCDWQ) for bromodichloromethane (BDCM) and revised guidelines for arsenic
- Implementing a Real-time Water-quality Monitoring program for Conne River's source water

Discussion of these and other highlights is provided in the chapters that follow and summarized below:

Chapter 2: Progress and accomplishments made through activities in Level 1 of the MBSAP—source-water protection, water treatment, and the water distribution system.

Chapter 3: Progress and accomplishments made through activities in Level 2 of the MBSAP—monitoring, inspection and enforcement, data management and reporting, and operator education, training, and certification.

Chapter 4: Progress and accomplishments made through activities in Level 3 of the MBSAP—legislative and policy frameworks, public involvement and awareness, research and development, and guidelines, standards, and objectives.

Chapter 5: Progress and accomplishments made through activities in all levels of the MBSAP.

Chapter 6: Proposed activities of the path forward for fiscal year 2007/8 that will provide clean, safe, and secure drinking water in the province.

2 Level 1 of the MBSAP

2.1 Source-water Protection

Protecting drinking water starts at the source. Drinking-water sources can be either surface water or groundwater. Surface-water sources include, for example, rivers, brooks, lakes, ponds, and reservoirs. Groundwater sources include both dug and drilled wells.

The protection of source water is an important factor in protecting public health and also reduces the challenges involved in water treatment. The costs associated with treating a water-contamination event are much greater than the costs associated with running a source-protection program. The *Water Resources Act, 2002* is used to designate and protect public drinking-water sources as either Protected Public Water Supply Areas (surface-water supply) or Protected Wellheads (groundwater supply).

The province of Newfoundland and Labrador has one of the most widely adopted and well-established source-water protection programs in the country. Currently, approximately 91% of the population of the province that receives drinking water from public water supplies receives it from protected water supplies. At the close of fiscal year 2006/7, there were 319 Protected Public Water Supplies in the province (see Figure 2).

ENVC's source-water protection program is considered highly successful because most major water-supply areas in Newfoundland and Labrador have been designated as Protected Public Water Supply Areas. As requests to protect a water-supply area must come from a community, ENVC encourages communities that have not already done so to initiate the protection process.

All water supplies considered for designation as a Protected Public Water Supply Area go through a designation process. First, information about ownership, drainage patterns, watershed area, nearby land-use activities, and surrounding topography is submitted to the Interdepartmental Land Use Committee (ILUC). After ILUC reviews and releases the information, the water supply is ready to be legally designated a Protected Public Water Supply Area. Following designation, all activities within the protected area are controlled, and high-risk activities that could impair water quality are restricted.

During fiscal year 2006/7, nine water supplies were protected, six were amended, two remained pending, and one was repealed. The processes of amending or protecting a water supply took, on average, about five months. In the case of the repeal, it was determined that the water supplies for the communities of Gillams and Meadows had a common drainage area; both are now covered under the same regulation (see Table 1).

At the end of March 31, 2007, there were 599 communities listed in the province's public water-supply database. This number represents 376 communities with public water supplies and 223 communities without public water supplies. Of the 376 communities with public water supplies there were 535 public water-supply systems (see Figure 2), which were supplied by 308 surface-water sources (servicing the majority of the province's population) and 199 groundwater sources.

A Watershed Management Committee brings various stakeholders together to deal with land-management and development issues in a Public Water Supply Area. A watershed management committee may form as a proactive measure for a protected area, or as a result of conflict over development activity within the protected area. Primary stakeholders on a Watershed Management Committee typically include town council members, town residents, industry involved with development activities, ENVC staff, environmental groups, and other concerned parties.

Figure 2: Map Showing Diversity of Public Water Supplies

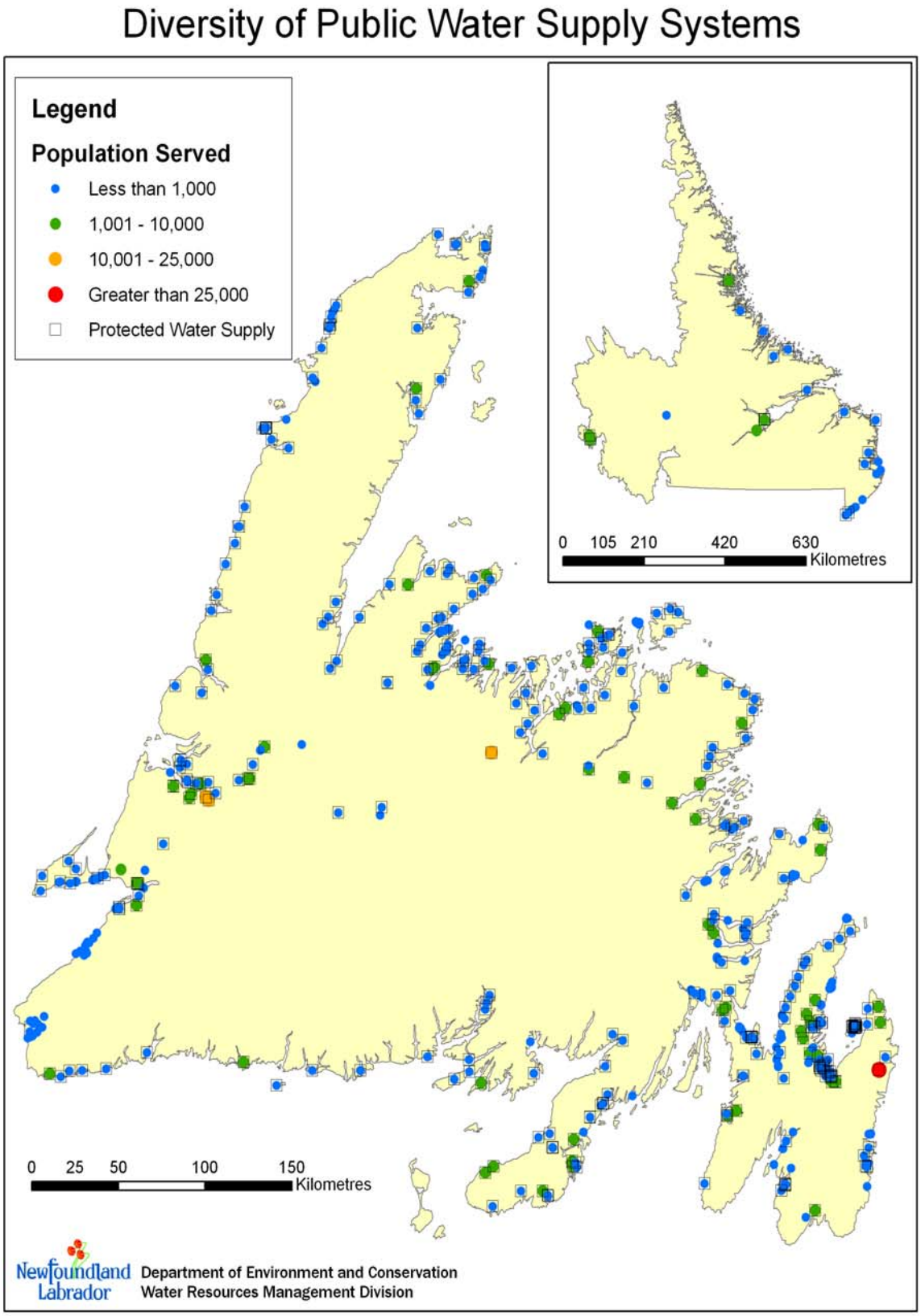


Table 1: Water Supplies Protected in Fiscal Year 2006/7

Community	Supply Name	Notice Type	ILUC Start	ILUC Complete	Days in Process
Whitbourne	Hodges River	Amendment	Jan 19, 2006	Jul 21, 2006	183
Lumsden	Gull Pond	Amendment	Jan 20, 2006	May 1, 2006	101
Bryant's Cove	Bryant's Cove Wellfield	New	Feb 21, 2006	Jun 15, 2006	114
Harbour Grace	#1 Thicket Susie Galway Well	New	Jun 8, 2006	Dec 6, 2006	181
Harbour Grace	#2 Thicket Well	New	Jun 8, 2006	Dec 6, 2006	181
Harbour Grace	Mercer's Road Well	New	Jun 8, 2006	Dec 6, 2006	181
Harbour Grace	Southside Well	New	Jun 8, 2006	Dec 6, 2006	181
Lushes Bight - Beaumont - Beaumont North	Beaumont North Handpump Well	New	Jun 8, 2006	Dec 6, 2006	181
Red Harbour	Wellfield	New	Jun 8, 2006	Dec 6, 2006	181
St. Joseph's	Wellfield	New	Jul 18, 2006	Dec 6, 2006	141
Winterland	Wellfield	New	Jul 18, 2006	Dec 6, 2006	141
Gillams	Jackie Tapps Brook	Repeal	-	Sep 12, 2006	-
Meadows	Meaters Brook	Amendment	-	Sep 12, 2006	-
Burgoyne's Cove	Lower Rocky Pond	Amendment	Jan 2, 2007	Mar 7, 2007	64
Embree	Troke's Cove Pond	Amendment	Jan 2, 2007	Mar 7, 2007	64
				Average	**140**

Currently, there are five active Watershed Management Committees in the province:

- Clarenville Watershed Management Committee
- Steady Brook Watershed Management Committee
- Corner Brook Watershed Management Committee
- Gander Watershed Management Committee
- Northern Arm Lake Watershed Management Committee

2.2 Drinking-water Treatment

Ensuring drinking-water safety requires source-water treatment. Water-treatment activities include all the processes, techniques, and systems used to clean, disinfect, and protect water before it is distributed for use.

When source-water quality problems are identified, the Department of Environment and Conservation, in consultation with the Department of Municipal Affairs, assesses the water-treatment needs of the affected communities. It then provides recommendations for funding and for the type of treatment plant that is required. The recommendations are based on a review of water-quality data, the extent and nature of the water-quality problems, and the economic viability of various treatment options.

In drinking-water treatment, disinfection refers to the process by which microbial agents are destroyed or rendered harmless in the drinking water. The most popular method of disinfection is chlorination. Chlorine of any form (solid, liquid, or gas) is able to disinfect the drinking-water as well as help minimize microbial growth in the distribution system. In fiscal year 2006/7, there were 437 chlorine disinfection systems in use. They comprised 297 liquid-chlorine systems, eight chlorine-powder systems, and 132 chlorine-gas systems.

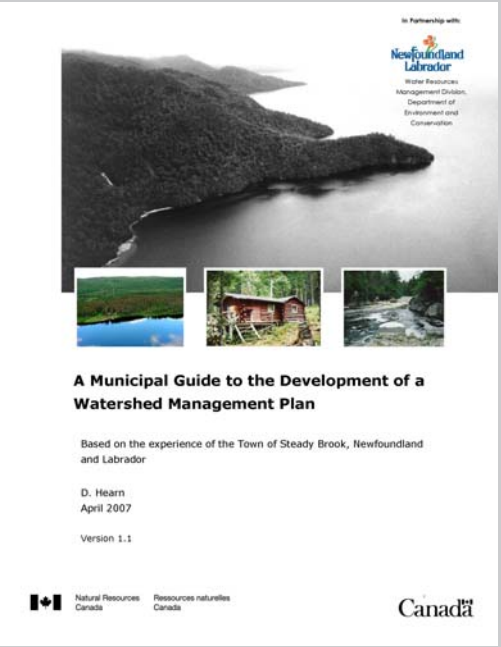
Although chlorine is an effective disinfectant, its presence in the distribution system can stimulate the presence of disinfection by-products (DBPs). It is essential to maintain a sufficient level of chlorine for disinfection, but it

A Municipal Guide to the Development of a Watershed Management Plan

The protection of drinking-water sources is one of the cornerstones of the province of Newfoundland and Labrador's multi-barrier strategic action plan for drinking-water safety. The most cost-effective way to ensure a safe water supply is to prevent drinking-water problems from developing in the first place. Fiscal year 2006/7 saw the completion of the *Municipal Guide to the Development of a Watershed Management Plan*. Developed in partnership with the Western Newfoundland Model Forest, the *Guide* outlines the process of creating a user-friendly Watershed Management/Source Protection Plan for the Town of Steady Brook. The *Guide* is intended for use by communities that have development and/or resource-use pressures (forestry, recreation, agriculture, mineral extraction, roads, communication corridors) in their protected public water-supply area. It outlines the five main steps in the development of a watershed management/source protection plan:

1. Establishing a Watershed Management Advisory Committee
    - Involving relevant stakeholders on committee
    - Developing terms of reference for committee
2. Characterizing the watershed
    - Delineating watershed
    - Identifying natural features
    - Identifying land and water uses
3. Identifying potential contaminants and conducting risk assessment
    - Identifying potential contaminants from identified uses
    - Undertaking risk assessment and sensitivity analysis
4. Developing a Watershed Management Plan
    - Developing management strategies
5. Implementing, reviewing, and amending a Watershed Management Plan

The *Guide* provides many useful examples and references for users to develop their own Watershed Management/Source Protection Plan in order to manage land- and water-use activity in a more holistic and sustainable manner. Protecting source water makes good public-health sense, good economic sense, and good environmental sense. The guide leads communities gradually through the process of developing a usable and technically sound protection plan for their drinking-water source.



Risk Assessment in the Preparation of Watershed Management Plans

Risk assessment is a way of estimating the likelihood of negative effects occurring as a result of exposure to certain health hazards, especially pollutants in the environment. Estimating the negative effects of identified potential contaminants makes it possible to determine the activities that require higher levels of control or regulation, or even prohibition.

Three methods of risk assessment have been identified for use in the preparation of Watershed Management/Source Protection Plans:

- Risk matrix analysis
- Numerical risk index
- Vulnerability index

Risk matrix analysis is the simplest method. It looks at the likelihood that a particular contaminant will occur because of an identified cause (measured from low to high) and the severity of the effects of that contaminant's presence (from minor to catastrophic). All possible causes of contamination in the watershed are given a priority ranking based on where they fall in the matrix.

The numerical risk index involves both subjective and quantitative analyses and requires significant knowledge about the watershed, regulatory programs, and the effects of contaminants on water quality. Each factor of interest is evaluated for each potential pollution source and scored using the index formula. Pollution sources with the highest score are given priority in terms of management of the potentially contaminating activity.

The vulnerability index provides a decision-making tool box for water-resource professionals, planners, and those in authority, so that they can determine the most appropriate vulnerability assessment method for their source water based on available data, the type of water source, and the scale and characteristics of their watersheds. The pollution potential of source water is its intrinsic vulnerability (that is, the risk factors that exist by virtue of the hydrogeologic conditions and physical settings of the source water, independent of existing chemical threats). Vulnerability will also be affected by management practices within the watershed.

Based on the risk of potential water contamination from certain activities, the watershed can be mapped to indicate sensitive areas and areas where different levels of development activity might be suitable. The use of risk analysis in the preparation of watershed management plans is outlined in the *Steady Brook Watershed Management Plan* and the *Municipal Guide to the Development of a Watershed Management Plan*.

is also important not to have an over-abundance of chlorine, which could lead to the formation of DBPs.

Optimal levels of chlorine for disinfection may be obtained through chlorine demand management (CDM). CDM is a useful tool for managing the potential formation of DBPs and can also reduce the costs of operating a chlorination system for a community.

Alternatives to chlorine disinfection include ultraviolet radiation (UV), ozone, and mixed oxidants (MIOX), all of which are currently in use in the province.

In the UV disinfection process, water flows through an ultraviolet irradiation chamber; any microbial agents in the water are de-activated when the water absorbs the UV. The UV process can be used as a primary disinfectant and is most effective in treating water with low turbidity and colour. As UV leaves

Chlorine Demand Management (CDM)

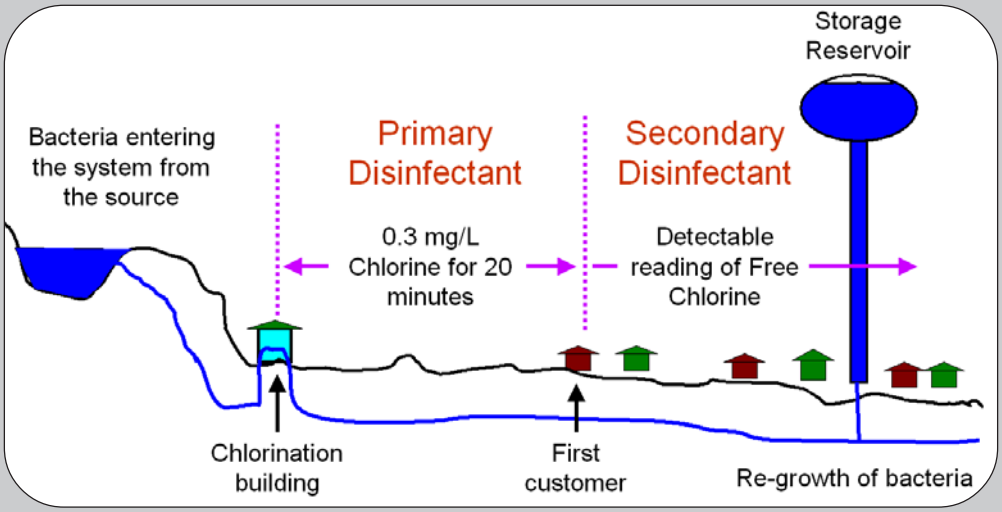
Most communities in Newfoundland and Labrador rely on adding chlorine to their drinking water as their only form of water treatment. Typical chlorine dosages in most community drinking-water systems range from 5 to 15 mg/L. Chlorine is added to destroy microbiological organisms that could cause acute health effects.

Guidelines for the required level of primary and secondary disinfectant determine the chlorine dosage. The requirement for primary disinfection is a free chorine level of 0.3 mg/L at the first user on the distribution system with a chlorine contact time in the water of 20 minutes. The requirement for secondary disinfection is a detectable level of free chlorine throughout all parts of the water-distribution system. Over time, chlorine will decay in the distribution system through chemical reactions (with microorganisms, metals, and organic material) within the bulk water and with pipe walls.

Excess chlorine use can cause problems for communities with respect to cost, taste, staining of fixtures and laundry (where water pH is naturally low), and the formation of disinfection by-products (DBPs) such as THMs and HAAs. Water system operators must try to balance the disinfectant level against guideline requirements and the risk posed by microbial contamination and DBP formation, which is not always an easy task.

Chlorine demand management (CDM) looks at ways of reducing the overall chlorine use while still meeting guideline requirements for microbial destruction, and reducing the formation potential of DBPs. Some CDM options now being recommended to communities are:

- Reducing the chlorine disinfectant dosage
- Moving the point of chlorine application closer to the first user
- Locating the chlorination system down-pipe of the water storage tank
- Installing a chlorine booster to reduce the overall chlorine dosage from a single point of application
- Using flow or residual-based chlorine dosage control systems



Above: Chlorine levels at different points in a distribution network.

no residual disinfection, a secondary disinfectant such as chlorine is required to provide disinfection throughout the water distribution system.

Ozone is a powerful oxidant over a wide pH and temperature range; it is formed by passing prepared dry clean air between two high voltage electrodes. Using ozone as a drinking-water disinfectant can remove colour, taste, and odour and de-activate microbial agents including *Giardia* and *Cryptosporidium*. As with UV, ozone does not leave residual disinfection; secondary disinfection is thus required in the water-distribution system.

MIOX uses salt, water and electricity to produce a concentrated solution of oxidants that disinfect the source water and provide a general improvement in the taste and odour of the final product.

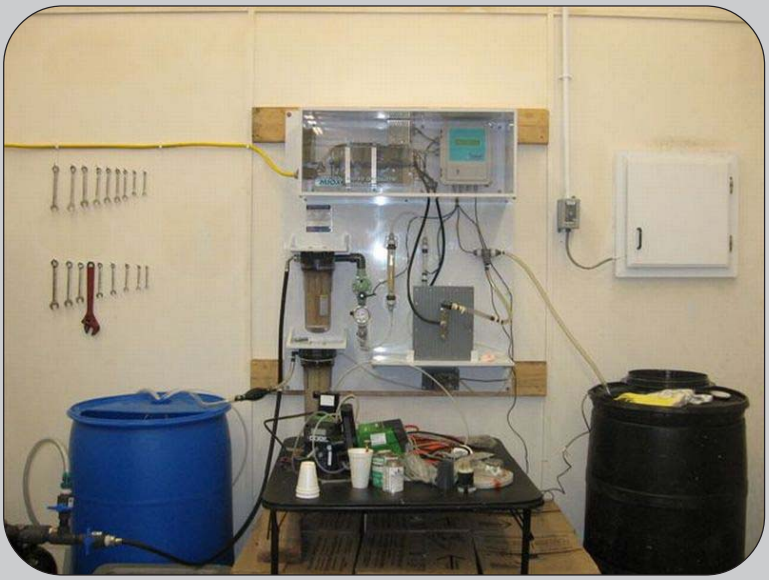
There are 14 conventional water-treatment plants operating in the province. In addition to disinfection, conventional water-treatment plants use coagulation, flocculation, sedimentation and filtration—or a combination of these processes—to improve the quality of raw source water. Site-specific water-quality problems may require additional treatment; there is a number of communities using infiltration

MIOX: Heart's Delight–Islington Water Treatment Plant

A pilot MIOX system was installed in the Heart's Delight-–Islington water treatment plant to replace a hypochlorination system. MIOX (short for mixed oxidants) is generated on-site by using salt, water, and electricity to produce a drinking-water disinfectant.

Some of the benefits of a MIOX disinfection system include:

- Reducing the amount of transporting, handling, and storage of chemicals
- Inactivating microbial agents
- Reducing the potential for DBP formation
- Improving residual disinfection rates
- Improving water's taste and odour
- Making system operation and maintenance easier
- Lowering costs (less expensive than traditional chlorine disinfection)



Above: The MIOX Disinfection System in Heart's Delight–Islington.

galleries and filtration units to deal with high colour or the presence of iron, manganese, and arsenic. A recently reduced guideline (as per the *Guidelines for Canadian Drinking Water Quality*, or GCDWQ) shows that arsenic is becoming a more serious concern; some communities have begun to install arsenic removal systems.

In fiscal year 2006/7, several communities evaluated, installed, or commissioned new water-treatment plants. In St. John's, the Windsor Lake water-treatment plant became operational. A treatment plant in Gander was completed and became operational, and the Town of Burgeo applied for funding to complete the commissioning of a water-treatment plant. Construction of a new treatment plant for Clarenville continued, and the first phase in preparation for a new treatment plant for Baie Verte—including the installation of the transmission main and storage tank—was completed. The next phase was expected to begin in the fall of 2007.

Windsor Lake Water Treatment Plant

In June, 2007, the City of St. John's Windsor Lake water treatment plant was officially commissioned. This treatment plant produces approximately 78 million litres a day of treated water to service 60,000 residents in the east end of the city. The design incorporates a multi-barrier approach to water treatment centered on micro-filtration using membrane technology. The plant cost approximately $35 million.

The treatment facility includes primary and secondary membrane units that physically separate contaminants from water. The units are able to remove particles and pathogens as small as 0.1 microns. The design of the primary and secondary membrane system allows for treatment of 99% of all water supplied to the plant.

In addition to membrane treatment, the water is disinfected using UV and chlorine prior to its release into the distribution system. The UV process acts as a primary disinfectant and the chlorine as a secondary disinfectant (providing a disinfectant residual throughout the distribution system). To adjust pH and alkalinity levels in the treated water, lime and CO_2 are added.

The Windsor Lake facility is also equipped with an engineered wetland to handle the waste stream from the water treatment plant processes. The waste stream is discharged to the wetland and slowly makes its way back to the source water.

Above: City of St. John's and ENVC staff overlook the Windsor Lake Water Treatment Plant, shown are Haseen Khan, Lynnann Stapleton, Martin Goebel, Art Cheeseman.

Gander Water Treatment Plant

In March, 2007, the first water was produced from a new ozone-filtration treatment plant in Gander (pictured at left). The improved quality of the tap water quickly became evident and the reaction of Gander's residents was very positive.

The opening realized a long-term objective for the Town: water treatment was first contemplated in 1984 after the town's water supply had been under a boil-water advisory for 199 days. Gander has also wrestled with elevated disinfection by-products and sediment problems over the years, which were the main reasons for additional treatment.

The plant is designed for a treatment capacity of 12 million litres a day through four parallel pressurized treatment streams. The process includes pre-filtration, ozonation, post-ozone dual-media filtration, granular activated-carbon filtration, pH adjustment, and chlorine disinfection.

The total capital cost of the treatment plant and related improvements at the intake and pumphouse was $8.9 million. The operational cost is expected to be an additional $200,000 per year.

Above: Improved appearance of tap water in Gander.

In small communities where water-quality issues persist and conventional water-treatment plants are not economically or technically feasible, Potable Water Dispensing Units (PWDUs) are an option for improving drinking-water quality. These small-scale treatment units are provided by the province to treat poor-quality source water and provide drinking water of high quality to residents at a centralized location. To date, several pilot projects using these units have been carried out successfully; during fiscal year 2006/7, units were installed in Howley and St. Lawrence.

2.3 Drinking-water Distribution System

The water-distribution system is the final physical barrier for water treatment and the final component in Level 1 of the MBSAP. As well, the water-distribution network is the largest component of a water supply's physical infrastructure, consisting of a network of pipes, valves, service lines, pumping stations, fire hydrants, and storage facilities that all work together to deliver drinking water to homes, businesses, and industries. The classification system for water-distribution systems was developed by the Association of Boards of Certification. It classifies systems according to the size of the serviced population (Table 2).

Very small distribution systems are the most common type of system in the province. Very small systems face two major challenges. The first is operation and maintenance, along with employing and retaining qualified and trained operators. The second is administering the system. Many communities have relatively small populations spread over a large geographical area, which makes administering public water-distribution systems and providing safe drinking water a challenging task. To address both these challenges Government continues to encourage the concept of regional water systems and regional water operators.

Problems associated with the infrastructure of the water-distribution system include leaks and breaks, which may result in reduced hydraulic capacity and degraded water quality. Proper infrastructure maintenance and repair require that best management practices and operational procedures be followed. Government addresses this need through its Operator Education, Training, and Certification program (discussed in more detail in Section 3.4). The financial cost of repairing and replacing infrastructure is substantial; in 2006/7 the Department of Municipal Affairs spent $13.4 million on water-supply infrastructure.

Table 2: Classification of Water-distribution Systems in Fiscal Year 2006/7

Water Distribution System Classification	Population Size	Number of Systems
Systems with an unknown serviced population	n/a	19
Very small systems	500 or less	378
Small systems	501 to 1,000	70
Medium systems	1,001 to 10,000	63
Large systems	10,001 to 25,000	4
Very large system	More than 25,000	1
Total number of systems	-	**535**

Potable Water Dispensing Units (PWDUs)

Potable Water Dispensing Units, or PWDUs, provide a solution to persistent drinking-water quality issues for small communities. A PWDU receives chlorine-treated source water and further treats the water (through a combination of filters, ozone, ultraviolet irradiation, and reverse osmosis) to produce drinking water of high quality. The PWDU is conveniently located within the community and consumers use it as a filling station to obtain water for consumption. Currently, the communities of Black Tickle-Domino, Buchans, Burnt Islands, Howley, and St. Lawrence are using PWDUs to produce clean, safe drinking water for their residents. These communities not only have all expressed satisfaction with their PWDU but they have also reported a significant improvement in drinking-water quality.

Newfoundland & Labrador Potable Water Dispensing Units

Community	Pop.	Year Installed	Capital Cost + Annual Operation & Maintenance Costs	Capacity (Litres per day)	System Processes
Black Tickle-Domino	220	2003/4	$100,000 + $25,000	1,200	Liquid chlorine (source), activated carbon, RO, multimedia filters
Buchans	750	2004	$70,000 + $1,500	4,000	Chlorine gas (source), ozone, activated carbon, UV, two screening filters
Burnt Islands	703	2005	$26,048 + $600	4,000	Chlorine gas (source), activated carbon, UV, RO, multimedia filters
Howley	271	2007	$30,000	4,000	Liquid chlorine (source), activated carbon, UV, RO, multimedia filters
St. Lawrence	1,500	2006	$53,561	4,000	Chlorine gas (source), ozone, activated carbon, UV

Above: The St. Lawrence PWDU Building (left) and its PWDU.

3 Level 2 of the MBSAP

3.1 Monitoring

Level 2 of the MBSAP involves drinking-water quality monitoring. The Departments of Environment and Conservation and Government Services together monitor the drinking-water quality of all public water supplies in the province. ENVC is responsible for monitoring chemical and physical components of source- and tap-water quality; GS is responsible for monitoring bacteriological tap-water quality and residual chlorine concentrations. Communities can monitor water-quality parameters themselves; some also monitor specific parameters for operational purposes.

Ensuring safe drinking water involves measuring water quality by collecting samples that can then be analyzed and compared to the GCDWQ. Sampling is conducted regularly on water-supply sources (surface water or groundwater) and on tap water. The samples are tested for a variety of physical, chemical, and biological parameters. When required, ENVC will design special monitoring programs in which the goals of the program are specific to site characteristics and/or emerging issues. ENVC uses the monitoring information to determine if substances found in water samples are at safe levels according to the GCDWQ, and also for operational purposes.

ENVC uses the Province's "Standards for Chemical and Physical Monitoring of Drinking Water" which outlines the minimal parameters that should be monitored as part of the drinking-water-quality program. As well, the Standards provide information about required sampling frequency and the locations at which samples are taken. These standards can be found on the Internet at:

www.env.gov.nl.ca/env/Env/waterres/Policies/WQ-Standard-PhysicalChemical.asp

Monitoring conducted over months or years can indicate water-quality stability and identify if water quality is improving or deteriorating. This assists the government to determine if source protection or corrective measures need to be reviewed.

3.1.1 Sample Collection

It is important that ENVC staff follow a consistent approach when collecting samples. The departmental sampling protocol is outlined in *Drinking Water Quality Monitoring Manual: Physical and Chemical Parameters,* which is available online at:

www.env.gov.nl.ca/Env/Env/waterres/Surfacewater/DWQ%20Manual/DWQMonitoringManual.asp

3.1.1.1 Chemical and Physical Water Quality

ENVC is responsible for collecting samples to analyze chemical and physical parameters in drinking water. These parameters include:

- Inorganics
- Trihalomethanes (THMs)
- Haloacetic acids (HAAs)
- Emerging or special parameters

The annual drinking-water-quality sampling schedule design is based on monitoring guidelines and issue analysis conducted on previous sampling data. Source- and tap-water samples for inorganic parameters are collected semi-annually (and in some circumstances quarterly). In most cases, HAA sampling is semi-annual with the exception of communities with a population greater than 5,000, where collection is quarterly. THM samples are collected quarterly because the guideline is based on annual running averages.

During the 2006/7 fiscal year there were 3,375 inorganic source, inorganic tap, THM, and HAA samples scheduled for collection; 2,845 samples were actually collected, as shown in Table 3. The missed samples resulted from a range of circumstances that included site inaccessibility, lack of chlorination, sample spoilage, and staff vacancies.

For fiscal year 2007/8, 2,896 samples are scheduled to be collected. The lower number of scheduled samples is a result of reduced surface-water-source sampling during the winter and a smaller groundwater-source sampling program.

3.1.1.2 Bacteriological Water Quality

Through the Department of Government Services, Environmental Health Officers (EHO) collects samples from public drinking-water supplies for analysis of bacteriological parameters. As of March 31, 2007 32 of 36 EHO positions were filled along with three certified public health inspectors working in either managerial or coordinator positions with Government Services, operating out of 14 offices. The frequency of bacteriological sample collection is based on the population serviced by the water supply (see Table 4). During fiscal year 2006/7, 19,149

Table 3: Overview of Chemical/Physical Sampling Activity in Fiscal Year 2006/7

Parameter	Number of Source Samples			Number of Tap Samples		
	Surface	Ground	Total	Surface	Ground	Total
Inorganic Parameters	188	339	527	594	363	**957**
THMs	THMs are a result of chlorination, thus are not found in source water samples			942	91	**1033**
HAAs	HAAs are a result of chlorination, thus are not found in source water samples			316	12	**328**
Special or Emerging Parameters	--	--	--	38	85	**123**

Notes: Some communities were removed from public water-supply status during the fiscal year; 25 samples for these communities are not included in this table, including four source, 17 tap, two THM, and two HAA.

Table 4: Frequency of Bacteriological Sampling

Population Serviced (number of people)	Sampling Frequency (per month)
Fewer than 100 or no distribution system	One sample
Fewer than 5,000	Four samples
5,001 to 90,000	One sample per 1,000 population
More than 90,000	90 samples plus one sample per additional 10,000 population

bacteriological samples were collected from public drinking-water supplies across Newfoundland and Labrador.

3.1.2 Sample Analysis

3.1.2.1 Analysis for Chemical and Physical Water-quality Parameters

ENVC submits all drinking-water samples to external laboratories for analysis. The department requires that the laboratory be accredited to ensure that it is competent to perform sample analysis. Table 5 lists the accredited laboratories that performed analysis on samples collected for chemical and physical water-quality parameters during the 2006/7 fiscal year. In addition to the regular drinking-water sampling program, special sampling was done for chlorate and chlorite, and radiological parameters.

In 2001, the province of Newfoundland and Labrador adopted the chemical and physical guidelines for safe drinking water that are outlined in the sixth edition of the *Guidelines for Canadian Drinking Water Quality* (GCDWQ). The GCDWQ is published by Health Canada and is updated when necessary. A summary of the guidelines can be found online at:

www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/doc-sup-appui/sum_guide-res_recom/summary-sommaire_e.pdf

3.1.2.2 Analysis for Bacteriological Water-quality Parameters

Analysis of bacteriological samples was conducted by the provincial Public Health Laboratory (PHL) and regional testing sites operating under its direction. Testing was done for the presence of total coliforms and *E. coli* (see section 3.1.3.2). Provincial bacteriological parameters (as outlined in *Standards for Bacteriological Quality of Drinking Water*) are based on the GCDWQ, and can be found online at:

www.env.gov.nl.ca/Env/env/waterres/Policies/WQ-Standards-Microbiological.asp

3.1.3 Water-quality Monitoring Results

3.1.3.1 Chemical and Physical Parameters

Exceedances of the guideline values in the GCDWQ were noted in the tap-water-quality data for the 2006/7 fiscal year (see Table 6). Each of these exceedances will be discussed in the following sub-sections.

3.1.3.1.1 Aesthetic Parameters

Aesthetic parameters do not pose a direct health or safety concern, but they can negatively affect consumers' opinions of the drinking water that are based on taste, colour, and odour. Aesthetic parameters can also be used to determine the operational efficiency of the water system and, although no health impacts are involved, may indicate a need to make operational changes to the disinfection, treatment, or distribution systems.

Parameters that were in exceedance of the GCDWQ aesthetic objectives (AO) during the 2006/7 fiscal year include pH, chloride, colour, copper, iron, manganese, TDS, sodium, and sulfate. Table 7, which outlines these exceedances, shows that pH and colour exceedances were the most common and widespread. The distribution of colour and pH exceedances throughout the province is shown in Figure 3.

Table 5: Summary of Analytical Laboratories Used in Fiscal Year 2006/7

Parameter		Laboratory
Regular sampling	Inorganic	Accutest Laboratories Ltd.
	THM	Accutest Laboratories Ltd.
	HAA	Accutest Laboratories Ltd.
Special sampling	Chlorate and chlorite	Maxxam Analytics Inc.
	Radiological	Accutest Laboratories Ltd.

Table 6: Parameters that Exceeded the GCDWQ in Fiscal Year 2006/7

Aesthetic Parameter	Contaminant Parameter
pH	Arsenic
Chloride	Fluoride
Colour	Lead
Copper	Turbidity
Iron	Trihalomethanes (THMs)
Manganese	Bromodichloromethane (BDCM)
Sodium	
Sulphate	
Total dissolved solids (TDS)	

Table 7: Summary of Chemical and Physical Parameter Exceedances in Tap Samples in Fiscal Year 2006/7

Aesthetic Parameter	GCDWQ Aesthetic Objective (AO)		Number of Exceedances (number of tap samples)
pH	6.5 to 8.5	≤ 6.5	339
		≥ 8.5	22
Chloride	≤ 250 mg/L		2
Colour	≤ 15 TCU		438
Copper	≤ 1.0 mg/L		6
Iron	≤ 0.3 mg/L		117
Manganese	≤ 0.05 mg/L		90
Sodium	≤ 200 mg/L		3
Sulfate	≤ 500 mg/L		4
TDS	≤ 500 mg/L		14

Notes: pH levels do not have a unit measure; TCU refers to True Colour Units.

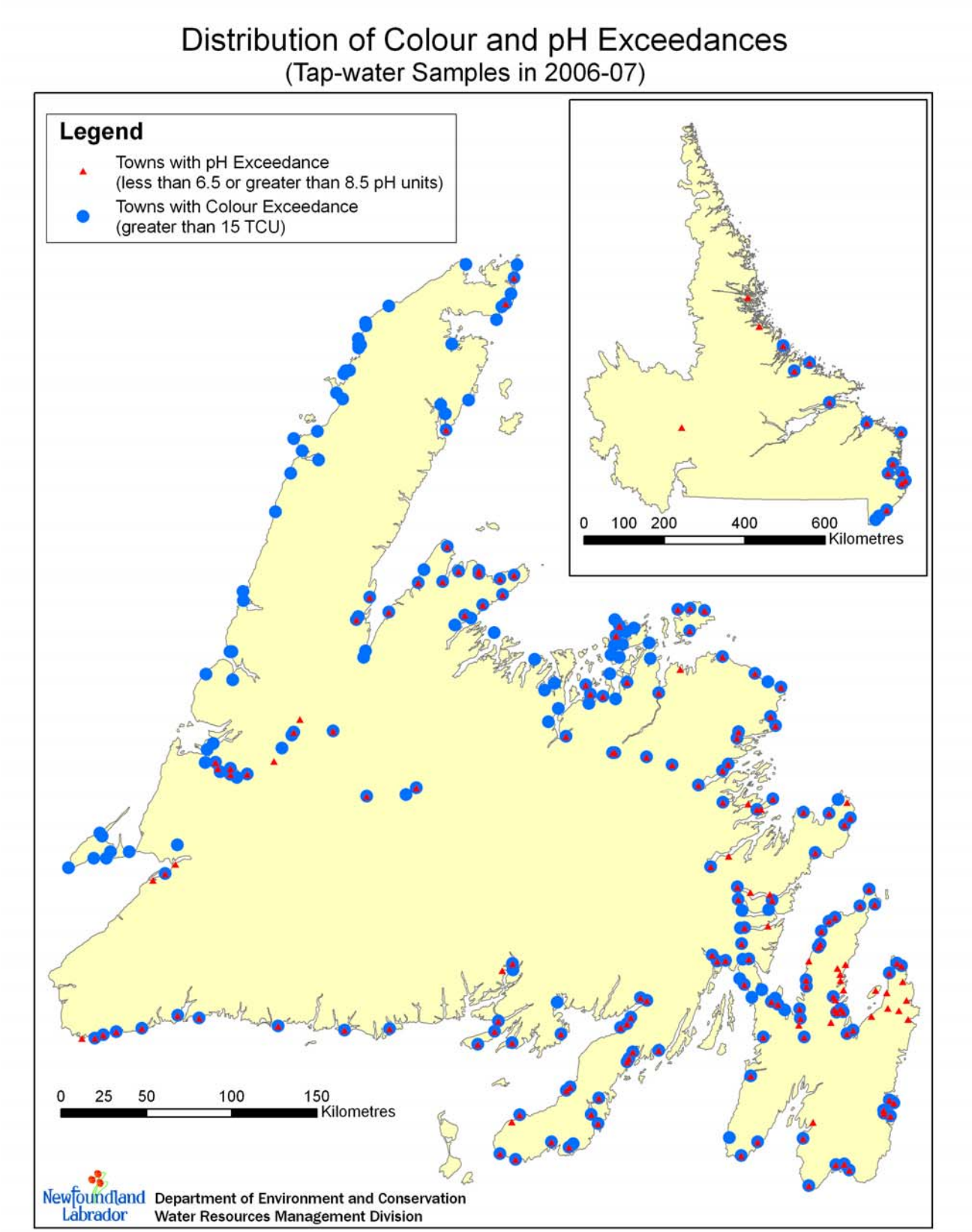
The following paragraphs discuss the aesthetic exceedances that were identified in fiscal year 2006/7:

pH – The pH value measures the acidity of water. A low pH accelerates the corrosion of pipes and fittings and a high pH encourages scaling in the distribution system. Low pH levels are common in many areas of the province, mostly where source water originates in watersheds that have a high percentage of bogs. Water in a bog environment typically has a pH value between three and four.

Chloride – The presence of chloride in drinking-water sources can be attributed to the dissolution of salt deposits, salting of highways to control ice and snow, effluents from chemical industries, oil-well operations, sewage, irrigation drainage, landfill leachates, sea spray, and seawater intrusion in coastal areas. Each of these sources may result in local contamination of surface water and groundwater.

Colour – Colour in drinking water is generally due to the presence of coloured organic substances or metals (such as organic debris, leaves, iron, manganese, copper, etc.). In addition, drinking-water supplies that are fed by water from bogs or peatlands may have increased colour because of the presence of humic acids, tannins, and lignins. Activities that take place in the watershed of the water supply and watershed land-cover characteristics can both influence the level of

Figure 3: Location of Colour and pH Exceedances



colour in source water. Although colour is an aesthetic parameter, elevated levels of colour in source water can be a concern because the substances causing the colour have the potential to contribute to THM formation.

Copper – The presence of copper in drinking water is generally a result of corrosion in copper piping systems. Elevated levels of copper can result in blue-green staining on fixtures and may cause a bad taste.

Iron – Iron is a naturally occurring element that is often found in drinking-water source supplies. Elevated iron levels may also be caused by the dissolution of iron piping in the distribution system. The presence of high levels of iron in drinking water may cause brown staining on plumbing fixtures and other household items. It can also adversely affect the taste of the water.

Manganese – Manganese is a naturally occurring element that is common to both surface and groundwater. Elevated levels of manganese can stain plumbing fixtures and other household items, and can adversely affect the taste of drinking water.

Total Dissolved Solids (TDS) – TDS are mainly inorganic substances that are dissolved in water. They can affect the taste of drinking water. As well, high levels of TDS may cause excessively hard water, mineral deposits, and corrosion.

Sodium – The taste of drinking water is generally considered offensive at sodium concentrations above the AO. Sodium is not considered a toxic element; adults normally consume up to 5 grams per day of sodium. Although the average intake of sodium from drinking water is only a small fraction of a normal diet's daily amount, the intake from this source could be significant for individuals with hypertension or congestive heart failure, who may require a sodium-restricted diet.

Sulphate – Sulphates reach the aquatic environment in wastes discharged by industries that use sulphates and sulphuric acid, such as mining and smelting operations. It has frequently been observed that levels of sulphate in surface water correlate with levels of sulphur dioxide in emissions from industrial or other human sources. Sulphates are listed as an aesthetic parameter because they affect taste.

3.1.3.1.2 Contaminants

Contaminants are substances that are known or suspected to cause adverse health effects when they occur in concentrations greater than the established maximum acceptable concentration (MAC) or the interim maximum acceptable concentration (IMAC) as set by the GCDWQ. In the 2006/07 fiscal year, contaminant exceedances in tap samples were detected for arsenic, bromodichloromethane (BDCM), lead, turbidity, and trihalomethanes (THMs), as outlined in Table 8.

Table 8: Number of Tap Samples with Contaminant Exceedances in Fiscal Year 2006/7

Contaminant Parameter	GCDWQ Health-based Guideline	Number of Exceedances (number of tap samples)
Lead	≤ 10 µg /L	6
Turbidity	≤ 1.0 NTU	140
THMs	≤ 100 µg/L	115
BDCM	≤ 16 µg/L	43
Arsenic	≤ 10 µg/L	30

Notes: NTU refers to Nephelometric Unit; the THM guideline is based on quarterly averages for communities and not on individual samples.

The following paragraphs discuss the contaminant exceedances identified in fiscal year 2006/7:

Arsenic – Arsenic is a natural element that is widely distributed throughout the Earth's crust. It is often found naturally in groundwater, through erosion and weathering of soils, minerals, and ores. Arsenic compounds are used commercially and industrially in the manufacture of a variety of products and may enter drinking water sources directly from industrial effluents and indirectly from atmospheric deposition.

Bromodichloromethane (BDCM) – BDCM is one of the most commonly found trihalomethanes in drinking water. The GCDWQ includes concentrations of BDCM in the concentration parameters for trihalomethanes, but a separate guideline for BDCM is also deemed necessary.

Lead – The corrosion of plumbing fixtures that contain lead (in pipes, solder, or service connections) usually accounts for elevated levels of lead in drinking water. Naturally occurring sources may also contribute to its presence.

Turbidity – Turbidity is a measure of water's inability to transmit light—or of the "cloudiness" of water. Turbidity in source waters is generally a result of suspended solids and materials such as clay, silt, or micro-organisms. When found in a tap-water sample, turbidity can reflect source-water characteristics or conditions in the distribution system. High turbidity alone is not considered a harmful condition, but its presence can reduce the effectiveness of disinfection treatments. Incorporating source-protection methods and treatment alternatives may help reduce turbidity levels. Elevated turbidity levels are very common in surface-based public water supplies throughout the province.

Trihalomethanes (THMs) – THMs are disinfection by-products that form when chlorine is added to water that contains elevated levels of natural organic matter. Elevated THM levels are very common for surface-based public water supplies in Newfoundland and Labrador because so many of them contain high levels of natural organic matter.

3.1.3.1.3 Special Sampling

In conjunction with the regular drinking-water sampling program, a special sampling program was also conducted during fiscal year 2006/7. Sampling was conducted for emerging areas of concern, including:

- Chlorate and chlorite
- Radiological parameters (gross alpha, gross beta, lead-210, radium-226, radium-228)

Tables 9 and 10 summarize the 2006/7 fiscal year special sampling results.

3.1.3.1.3.1 Chlorate and Chlorite

Both chlorate and chlorite are disinfection by-products found in drinking water that has been disinfected with chlorine dioxide. Chlorate may also form as a disinfection by-product of hypochlorite or calcium hypochlorite, types of liquid and powder chlorine. In Newfoundland and Labrador, chlorine dioxide is not used as a disinfectant for public drinking-water systems. However, almost 300 public drinking-water systems use hypo-chlorination for disinfection purposes.

The special sampling program for chlorate and chlorite was expanded for fiscal year 2006/7 to include sampling sites in Labrador, as well as additional sites in the western region of Newfoundland. Communities chosen for chlorate and chlorite sampling were communities that used hypochlorite as a disinfectant and had a history of high THM and HAA levels.

During the summer quarter of 2006, 23 samples were taken for chlorate and chlorite analysis between August 21 and October 18. Details and results of the study include:

- 21 of the sampled systems used liquid chlorine and the two remaining systems used powdered chlorine
- Seven of the sampled systems had chlorate levels that were less than the detection limit of 0.1 mg/L

- 15 systems had chlorate levels ranging from 0.1 mg/L to 1.0 mg/L
- One system had a chlorate level of 1.0 mg/L
- All 21 sampled systems had chlorite levels that were less than the detection limit of 0.1 mg/L

Follow-up special sampling was undertaken during the winter quarter of 2007. Fifteen of the summer 2006 sampling locations were re-sampled between January 16, 2007, and March 13, 2007. This data will help determine if there are seasonal variations. Details and results of this study include:

- 14 of the re-sampled systems used liquid chlorine and one system used chlorine powder
- 13 of the re-sampled systems had chlorate levels that were less than the detection limit of 0.1 mg/L
- Two re-sampled systems had chlorate levels of 0.1 mg/L and 0.7 mg/L
- All of the 15 re-sampled systems had chlorite levels that were less than the detection limit of 0.1 mg/L

Table 9: Chlorate and Chlorite Sampling Results in Fiscal Year 2006/7

Community	Water Supply	Type of Disinfection	Summer 2006		Winter 2007	
			Dissolved Chlorate (mg/L)	Dissolved Chlorite (mg/L)	Dissolved Chlorate (mg/L)	Dissolved Chlorite (mg/L)
George's Brook – Milton	Lilly Pond	Liquid	0.1	LTD	LTD	LTD
Elliston	Big Pond	Liquid	0.1	LTD	LTD	LTD
Keels	Boland's Pond	Liquid	0.2	LTD	LTD	LTD
Newman's Cove	Heale Pond Brook	Liquid	0.1	LTD	LTD	LTD
Burgoyne's Cove	Lower Rocky Pond	Liquid	0.1	LTD	LTD	LTD
Bauline	Bauline Brook	Liquid	0.8	LTD	LTD	LTD
St. Shott's	Unnamed Pond	Liquid	0.4	LTD	LTD	LTD
Cape Freels North	Long Pond	Liquid	0.1	LTD	-	-
Carmanville	Grandfathers Pond	Liquid	0.2	LTD	-	-
Little Bay Islands	Jones' Pond & Gull Pond	Liquid	0.7	LTD	-	-
Pleasantview	Little Arm Pond	Liquid	LTD	LTD	-	-
Tilting	Sandy Cove Pond	Liquid	0.9	LTD	-	-
Burlington	Eastern Island Pond	Liquid	0.4	LTD	0.7	LTD
Fleur de Lys	First Pond, Narrow Pond	Liquid	LTD	LTD	-	-
Irishtown-Summerside	Pynn's Pond	Liquid	0.5	LTD	LTD	LTD
Plum Point	Grand Pond	Liquid	0.6	LTD	LTD	LTD
Reidville	Humber Canal, Grand Lake	Liquid	LTD	LTD	LTD	LTD
St. Lunaire-Griquet	Lookout Brook	Liquid	1	LTD	LTD	LTD
Straitsview	Saddle Hill Pond	Liquid	LTD	LTD	LTD	LTD
Mary's Harbour	St. Mary's River	Powder	LTD	LTD	LTD	LTD
Port Hope-Simpson	Arnold's Brook and Pond	Liquid	LTD	LTD	LTD	LTD
Rigolet	Rigolet Pond	Liquid	LTD	LTD	-	-
St. Lewis	Tub Harbour Pond	Powder	0.2	LTD	-	-

Notes: LTD indicates the parameter tested was less than the detection limit of the analysis; "-" indicates that a sample was not taken for analysis.

The special sampling program for chlorate and chlorite will continue into fiscal year 2007/8 and continue to provide background data that will be useful when the GCDWQ establishes maximum acceptable concentration levels for these by-products. The proposed MAC for both chlorate and chlorite is 1.0 mg/L.

3.1.3.1.3.2 Radionuclides

Radionuclides are naturally occurring radioactive elements that can sometimes be found in bedrock, soil, and water. They make their way into drinking water from groundwater-based sources if the groundwater moves through fractures in the bedrock that contain radionuclide elements. Over time, water can dissolve and absorb these elements.

A radionuclide-sampling program was initiated in May, 2005, to test selected public groundwater supplies in the province. This program was continued into the 2006/7 fiscal year. During the 2006/7 fiscal year, 21 groundwater systems were selected for sampling based on the previous radionuclide sampling, previous uranium-concentration sampling results, and on a uranium risk map produced in 2003 by the Department of Natural Resources and the Department of Environment and Conservation. Sampling was conducted for gross alpha, gross beta, lead-210, radium-226, and radium-228. Details and results of this study include:

- Four of the 13 sampled systems for gross alpha exceeded the World Health Organization (WHO) guideline of 0.1 Bq/L. These four samples were in a range of 0.1 to 0.2 Bq/L.
- Three of the 13 sampled systems for gross beta levels were above the detection limit; all three samples had a value of 0.1 Bq/L, which was below the WHO guideline of 1.0 Bq/L
- All of the 18 sampled systems for lead-210 were below the detection limit; GCDWQ radiological MAC was 0.1 Bq/L
- Three of the 21 sampled systems for radium-226 had levels that were above the detection limit, values were in the range of 0.01 to 0.11 Bq/L, all below the GCDWQ limit of 0.6 Bq/L
- All 21 sampled systems for radium-228 were below the detection limit, the GCDWQ was 0.5 Bq/L

In accordance with the screening guidelines, the groundwater systems that had exceedances will be re-sampled during fiscal year 2007/8.

3.1.3.2 Bacteriological Parameters

The Department of Government Services collected 19,149 bacteriological samples from public drinking-water systems throughout the province during the fiscal year. Of these samples, approximately five percent (879 samples) tested positive for the presence of total coliform levels and a fraction of one percent (144 samples) tested positive for the presence of *E. coli*. Table 11 provides details about these samples.

Total coliforms – Coliform bacteria are widely used as indicator organisms in water sampling because the analysis required is relatively simple and they can be detected in small numbers. If total coliforms are present in concentrations greater than the guidelines, it may indicate that the water treatment is inadequate or the bacteria is infiltrating or regrowing in the distribution system. Coliforms are generally found in the feces of warm-blooded animals but can also be found in aquatic environments, soil, and vegetation.

Escherichia coli (E. coli) – *E. coli* live naturally in the lower intestines of humans and animals. The presence of *E. coli* in a water sample is a definite indicator of fecal contamination. A positive result for E. coli indicates that there is a deficiency in the water-treatment process, or that there has been post-treatment contamination. ***This situation must be investigated immediately.*** Whether or not there is *E. coli*, the presence of coliform bacteria requires immediate investigation.

Table 10: Radionuclide Sampling Results in Fiscal Year 2006/7

Community	Water Supply Name	Gross Alpha (Bq/L)	Gross Beta (Bq/L)	Lead-210 (Bq/L)	Radium-226 (Bq/L)	Radium-228 (Bq/L)
Deep Bight	Well Field	-	-	LTD	LTD	LTD
Chance Cove	Eugene Smith Well	0.1	0.1	LTD	LTD	LTD
Chance Cove	Angus Brace Well	-	-	LTD	LTD	LTD
Chance Cove	Olive Smith Well	LTD	LTD	LTD	LTD	LTD
Chance Cove	New Housing Area Well	0.1	LTD	LTD	LTD	LTD
Chance Cove	Edgar Crann Well	-	-	LTD	0.03	LTD
Chance Cove	Albert Rowe Well	0.2	LTD	LTD	LTD	LTD
Winterland	Well Field	-	-	LTD	LTD	LTD
Harbour Grace	Thickett #1 - Susie Galway Well	0.1	0.1	LTD	LTD	LTD
Harbour Grace	Thickett #2 - New Well	-	-	LTD	LTD	LTD
Small Point	#8 Well - Effie Flight Well	-	-	LTD	LTD	LTD
McCallum	Drilled	-	-	LTD	0.01	LTD
St. Lunaire-Griquet	Drilled	-	-	-	0.11	-
Black Duck (Siding)	#2 Well	LTD	LTD	-	LTD	LTD
Black Duck (Siding)	#1 Well	LTD	LTD	-	LTD	LTD
Barachois Brook	Drilled	LTD	LTD	LTD	LTD	LTD
Mattis Point	Drilled	LTD	LTD	LTD	LTD	LTD
Flat Bay West	Federation of Indians - #3 Well	LTD	LTD	LTD	LTD	LTD
Birchy Brook	Federation of Indians - #1 Well	LTD	LTD	LTD	LTD	LTD
Tompkins	Greg Wall Well	LTD	LTD	LTD	LTD	LTD
O'Reagan's East	Drilled	LTD	LTD	LTD	LTD	LTD

Notes: LTD indicates the parameter tested was less than the detection limit of the analysis; "-" that a sample was not taken for analysis.

Table 11: Bacteriological Test Results from Public Water Supplies in Fiscal Year 2006/7

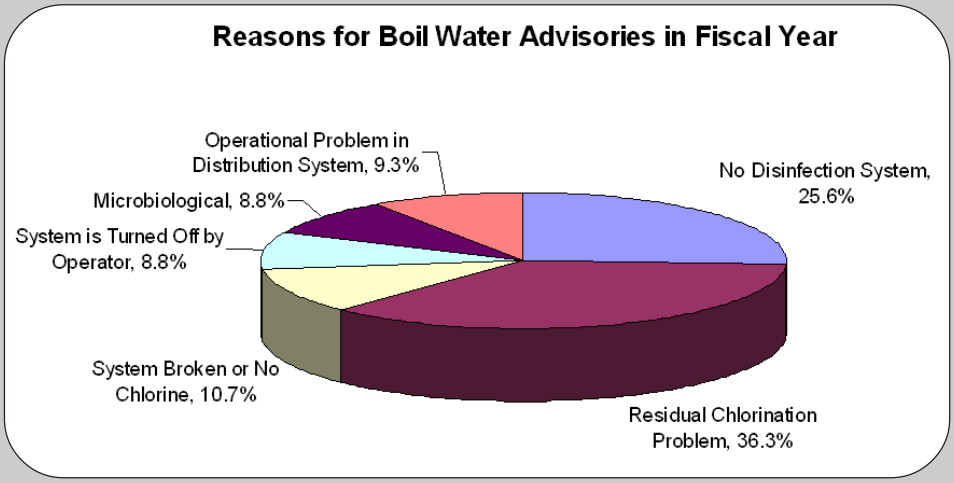
Samples	Department of Government Service Region					Totals
	Avalon	East	Central	West	Labrador	
Number of samples tested	7,061	2,061	4,817	3,575	1,635	19,149
Number of samples positive for total coliforms	115 (1.6%)	76 (3.7%)	345 (7.2%)	219 (6.1%)	124 (7.6%)	879 (4.6%)
Number of samples positive for *E. coli*	14 (0.2%)	22 (1.1%)	41 (0.9%)	42 (1.2%)	25 (1.5%)	144 (0.8%)

Boil-water Advisory Status: 2006/7

A Boil-water Advisory (BWA) is issued when there is reason to suspect pathogen contamination of a community's drinking water. BWAs are necessary to protect human health and are usually temporary. However, if BWAs are repeatedly issued to a community, the community may have to make modifications to its drinking-water system and/or to related operation and maintenance activities.

As of March 31, 2007, there were 215 BWAs in place in the province affecting 145 communities and 31,116 people. The BWAs were issued for the following situations:

- 36.3% – residual chlorination problem
- 25.6% – no disinfection system
- 10.7% – either a broken system or no chlorine
- 9.3% – an operational problem in the distribution system
- 8.8% – a disinfection system that was turned off by the operator
- 8.8% – failed microbiological tests



3.2 Inspection and Enforcement

Permits to Operate, as issued by ENVC under the *Water Resources Act, 2002* govern the operation of the province's drinking-water systems. The permits establish minimum standards that will ensure that clean and safe drinking water is delivered to consumers. Compliance with permit conditions is supported by inspections and enforcement by ENVC.

3.2.1 Inspection

ENVC requires that all public waterworks be maintained and operated in a sustainable manner. Informal inspections (site visits) are the first step to ensuring that this occurs. If problems are reported or observed, a formal inspection is undertaken. In fiscal year 2006/7, there were 87 water- and sewer-related inspections of public waterworks.

The *Water Resource Act, 2002*, also governs the construction and maintenance of public groundwater wells. In fiscal year 2006/7, ENVC conducted 275 inspections of public groundwater supplies. In addition, two inspections were carried out on protected public surface-water supplies in response to public concerns regarding development activities.

3.2.2 Enforcement

The *Water Resources Act, 2002* also regulates public water supply and sewer systems, and development activities within watersheds and governs the licensing of water-well drillers in the province.

Groundwater Inspections

During the fiscal year 2006/7, 97 communities in Newfoundland and Labrador used groundwater sources as a public water supply. To supply drinking water to the public, these communities operated 310 source wells, on average. Inspection of these public water supply wells showed that only 35 wells met all of the standards set by the Well Drilling Regulations under the *Water Resources Act*. While many of the deficiencies found are not critical, it is important to address them in order to prevent future problems.

The table below summarizes findings from groundwater well inspections to March 31, 2007. It covers 275 inspections carried out during the summer of 2006 and winter of 2007. The possible consequences of each problem and the likely impact on public drinking-water quality are also provided.

Problem / Consequence	**Number of Wells**
Problem: Ground/casing interface for well is not properly sealed. *Consequence:* Surface runoff and shallow groundwater may collect around the well casing and enter the well carrying pollutants into the water supply.	2
Problem: Area surrounding wellhead is not sloped properly. *Consequence:* Surface water passing over or near the well may seep around the well casing and into the well carrying pollutants into the water supply.	61
Problem: Wellhead is buried and not accessible. *Consequence:* Surface water and shallow groundwater passing over or near the well may pool over or around the well casing and eventually seep into the well carrying pollutants into the water supply. Also, difficulty may be experienced in locating and/or accessing the well for inspection, testing, and maintenance.	4
Problem: Well is located too near or inside a building. *Consequence:* The well's location may make proper cleaning, treatment, repair, testing, and inspection difficult.	76
Problem: Well is located too close to a source of contamination. *Consequence:* Soil conditions may not be adequate to filter impurities from percolating water before it enters the well. Well contamination may result, and in more serious situations the aquifer may become unfit for use.	2
Problem: Wellhead not sealed. *Consequence:* Contaminants may gain entrance to the well and aquifer(s), which may result in contamination. Foreign material, such as rocks, sticks, etc., can be dropped into the well making pump removal and well maintenance difficult.	133
Problem: Wellhead not vented properly. *Consequence*: The vacuum created inside the well during pumping may cause permanent damage to the bedrock-casing seal permitting contaminants from the surface and shallow groundwater to flow into the well.	226
Problem: Wellhead is too close to the ground or floor. *Consequence:* Foreign materials and various contaminants, such as surface water or floor drainage, can enter the well carrying pollutants directly into the water supply.	113
Problem: An unsealed abandoned public water supply well is nearby. *Consequences:* Vertical movement of contaminants in an unsealed well can pollute connected aquifers.	18
Problem: Poor hand-pump well construction. *Consequence:* Pollutants can gain direct entrance to the well and aquifer(s), resulting in contamination of the water supply.	8

Above: A poorly constructed, improperly sealed floor-level well (left), and a properly constructed well (right).

Regular inspections of water-supply systems are conducted to ensure that they comply with the terms and conditions of permits. During fiscal year 2006/7, 111 permits were issued that dealt with various components of water-supply and sewer systems (such as construction and operation).

ENVC issued 57 permits that regulated how activities in Protected Public Water Supply Areas should be conducted in order to ensure the integrity of drinking-water sources. The activities that these permits covered included cabins, forestry (domestic, commercial harvesting, silviculture), utility lines, quarries, roads, and trails.

The drilling or digging of non-domestic wells requires a permit from ENVC before construction begins. During fiscal year 2006/7, 19 non-domestic well permits were issued.

ENVC maintains a database of domestic wells. At the end of fiscal year 2006/7, there were 17,384 well records in the database; 493 of these records were added during the year. Also during this period, approximately 70 requests for information on well records were processed. These requests came from:

- Well owners
- Communities that were interested in drilling a well and needed information on groundwater resources
- Real estate agents needing information for real-estate transactions
- Well drillers
- Pump installers
- Other government departments

Workshop on Water Wells

The Department of Environment and Conservation held a workshop on water wells in January, 2007, for those directly involved in the water-well construction industry in the province. It was organized to discuss topics of interest and create an awareness of the importance of groundwater resources.

Guest speakers from Memorial University, private consultants, and government representatives discussed such topics as communications and customer relations, groundwater chemistry, and hydrofracturing of water wells. An open discussion at the end of the day provided a lively forum on the future of the water-well construction industry and government's role in protecting the groundwater resources of the province. An election of officers for the Newfoundland and Labrador Water Well Association was also held.

Above: Sterling Kean, Keith Abbott, Matt Hickman, Steve Osmond, and Francis Gale (left to right) listen as David Liverman of the Department of Natural Resources gives a presentation on rock and water chemistry at the water-well workshop.

3.3 Data Management and Reporting

3.3.1 Data Management

The ENVC drinking-water quality (DWQ) database and reporting system is a critical component in the management and reporting of drinking-water data. A single provincial database in ENVC stores the results from all chemical analyses from surface-water, groundwater, and tap-water samples (organic, inorganic, THMs, HAAs) that are taken as part of the provincial chemical monitoring program. The database also stores other essential information used in the management of the program.

Prior to the start of each quarterly sampling period, the DWQ sampling schedule is reviewed and updated so that it can reflect the latest changes in the public water-supply list. Customized bottle labels, field sheets, and the new schedule are then printed and sent to staff. One month after the end of each season, the laboratory supplies ENVC with sample analysis reports in both electronic and printed formats. This data, along with information collected by staff on the field sheets, is imported into the DWQ databases.

The data then goes through a comprehensive Quality Assurance/Quality Control (QA/QC) procedure. This process usually takes about six weeks depending on the number of QA/QC issues that occur and the size of the dataset. When the QA/QC procedure is complete, reports are printed and mailed to each community, and summary reports are posted on the department's web site.

The enterprise-level Oracle database-management system is a critical component in the management of drinking-water-quality data. With this system, data can be used in both tabular and geographic information system (GIS) formats, and shared more effectively between software applications. It also allows links to be created between spatial data (such as public water-supply boundaries) and tabular-attribute data (such as water-quality sampling results).

To improve data sharing and program delivery further, ENVC has continued to migrate to new web-based applications that are tied into the enterprise-level Oracle database system. During the 2006/7 fiscal year, work continued on internal web applications to support the DWQ program. Web applications in development during 2006/7 include:

- Continuing work on Phase 2 of an enhanced version of the DWQ Sampling Schedule Application. When completed, it will add the ability to reconcile scheduled sampling against completed sampling. The work on Phase 2 that has been completed to date includes:
    - Implementation and testing of database structures and relations
    - Creation of a draft web application
- Implementation of the new date-based guideline values for arsenic and bromodichloromethane (BDCM). This implementation was performed on almost all of the applications used in the DWQ program.
- The start of development of a web application to implement the Newfoundland and Labrador Canadian Water Quality Index (CWQI) calculator. The existing calculator is a Microsoft Excel spreadsheet that has been extensively customized by ENVC. In order to add new functionality and integrate the use of the calculator with DWQ applications, it is necessary to move the application to a more flexible environment. The work that has been completed to date includes:
    - Implementation and testing of program structures and web services
    - Creation of a draft web application
- Continuing work with the staff of the Office of the Chief Information Officer (OCIO) to update the internal drinking-water-quality web-based GIS application. It is anticipated that this work will be completed early in 2007/8. Updated features will include:
    - Ability to query new tables such as WQI, THM averages, BDCM, Langlier Index, HAA averages
    - Updated land cover statistics for all water supplies with new categories based on LandSat satellite imagery circa 2000

- Access to additional maps services such as the Labrador Inuit Settlement Area (LISA), aquaculture sites, outfall and dam locations
- Revamped interface for entering and editing historical information for water supplies.
- Updated DWQ reports

In 2002, in order to make it easier for government departments to share water-supply and water-quality information, the Municipal Information Management System (MIMS) was created. Managed by the Department of Municipal Affairs, MIMS is a database with several modules that hold basic information on the province's municipalities and their waste-management facilities, capital works, financial details, municipal profiles, and water supplies. MIMS continues to be enhanced when needed improvements are identified.

An essential component in the designation of Protected Public Water Supply Areas is the ENVC data-management staff. They prepare much of the documentation required for the Interdepartmental Land Use Committee (ILUC) process, including creating the initial boundary map for the watershed or wellhead, the legal description of the area, and a digital file of the new boundary (this file is an ILUC GIS layer that ENVC maintains for the use of ILUC members).

During the ILUC review process, changes to a watershed or wellhead boundary may be made. After the protected-area designation process is completed, a notice is published in the *Newfoundland Gazette* and the digital file of the final boundary is moved from the ILUC GIS layer to the Protected Supplies GIS layer, which is available to all departments and agencies on the internal government network. Stand-alone shape files are made available to the public on the web page and are updated daily.

The drinking-water-quality web-based GIS application that was developed and deployed (for internal use) by the ENVC in the 2003/4 fiscal year continues to be used to analyze water-quality records and the spatial aspects of water supplies. Currently, the application is still only available to government users. During fiscal year 2006/7, substantial updates were made to the internal web-based GIS application. It was decided by the Office of the Chief Information Officer that these changes should be completed prior to developing the public version of the application. A budget request for the public version has been approved for the 2007/8 fiscal year and was given the go-ahead by the OCIO, subject to availability of personnel from ENVC and OCIO.

3.3.2 Reporting

Annual and quarterly reports are sent to communities in which drinking water has been sampled during the reporting period, a practice introduced in the 2001/2 fiscal year. Depending on the sampling performed, reports may contain results of source, tap, THM, and HAA analysis, and the summary tools—the Water Quality Index (WQI) and the Langelier Index (LI). The WQI simply describes the condition of the community's drinking water. The LI is a tool used by water operators for stabilizing water, to control both internal corrosion of the piping system and the deposition of scale. During fiscal year 2006/7, the reports generated and mailed include:

- 321 quarterly reports in the spring of 2006
- 343 quarterly reports in the summer of 2006
- 371 quarterly and annual reports in the fall of 2006
- 367 quarterly reports in the winter of 2007

The exceedance-reporting protocol implemented in 2001/2 continues to be used successfully. Its function is to inform communities of contaminant exceedances above maximum acceptable concentrations or interim maximum acceptable concentrations (as found in the GCDWQ) as soon as the exceedance is reported by the laboratory. Based on departmental protocol, re-sampling may be required; if the contaminant is lead, exceedance reporting will follow the lead protocol. In fiscal year 2006/7, the exceedance reporting protocol was

used to report the following to affected communities:

- 24 sample exceedances in the spring of 2006-: one source, 23 tap
- 41 sample exceedances in the summer of 2006-: 19 source, 22 tap
- 18 sample exceedances in the fall of 2006-: all tap
- 9 sample exceedances in the winter of 2007-: 4 source, 5 tap

ENVC's web site is an important tool for communicating with the public. It is updated regularly with new information on drinking-water quality and related topics. Information posted throughout the 2006/07 fiscal year included:

- Quarterly drinking-water-quality reports for source and tap water, THMs, HAAs, DWQ index, Langelier Index:
  - Winter 2006: posted May 24, 2006
  - Spring 2006: posted September 11, 2006
  - Summer 2006: posted December 8, 2006
  - Fall 2006: posted February 26, 2007
- Update to the Chemical Drinking Water Quality Monitoring Schedule - April 1, 2006, to March 31, 2007 – posted May 24, 2006
- *Drinking Water Safety Annual Report*
  - 2005: posted August 17, 2006
  - 2006: posted March 16, 2007
- Chemical Drinking Water Quality Monitoring Schedule - April 1, 2006, to March 31, 2007 – posted May 24, 2006
- Maps showing the location of public water supplies, and hydrometric and ambient water-quality stations using Google Earth: posted June 12, 2006
- Chlorination equipment selection guidelines (a guide for the selection of appropriate disinfection equipment for municipal applications): posted July 4, 2006
- A list of Protected Public Water Supplies and Wellheads: posted September 18, 2006
- Additional information on the voluntary Water and Wastewater Operator Certification Program: posted November 22, 2006
- A list of accredited laboratories for routine physical and chemical analysis of drinking water: posted December 11, 2006
- 2007 Clean and Safe Drinking Water Workshop, "Emergency Preparedness, Planning, and Procedures for Small Water Systems": posted January 23, 2007

3.4 Operator Education, Training, and Certification (OETC)

To ensure the safe and sustainable operation of municipal water-supply systems, ENVC is continuing its strong commitment to municipal water-system operators through the Operator Education, Training, and Certification (OETC) program. The department has created a unique approach that provides operators with ongoing education and hands-on training, with a focus on job competency, drinking-water safety, environmental protection, and infrastructure sustainability.

The need for the OETC program remains quite high because of staffing challenges faced by communities throughout the province. Many highly experienced operators have reached or are nearing retirement age. Another common occurrence throughout Newfoundland and Labrador is the loss of trained operators to opportunities outside the province. In both circumstances, personnel is generally replaced by new operators who will need to participate in the education and training curriculum offered by the OETC program.

Information pertaining to the OETC program is available on the ENVC web site. It includes seminar schedules, curriculum, certification application forms, common questions and answers, etc., and can be viewed online at:

www.env.gov.nl.ca/env/Env/waterres/Template_OTEC.asp#mark

During the year, the Department of Municipal Affairs contributed $26,200 to aid with the education, training, and certification of municipal operators.

3.4.1 Operator Education

The OETC program's education component provides water-system operators with operational knowledge and water-quality theory required to operate and maintain their systems. It is presented through classroom-style seminars designed to provide the knowledge relevant to specific circumstances experienced in water-distribution systems in Newfoundland and Labrador. Operators who attend these educational sessions are provided with the information they need to prepare for certification exams.

During fiscal year 2006/7, educational seminars on various aspects of water distribution were delivered to approximately 150 operators under the OETC program. These seminars were delivered to new operators as well as operators who requested a review of previously seen material. The seminars involved one-day classroom sessions in 12 locations throughout the province. Topics covered in these sessions included basic water distribution theory, best practices for operation and maintenance, drinking-water regulations and guidelines, chemical and bacteriological water quality, cross-connection control devices, operator math skills, and disinfection.

Education seminars are open to municipal water-system operators, municipal staff and officials, park and campground operators, commercial / industrial water-system operators, and any interested individuals. No registration fee is charged for attending the seminars. The only costs incurred by participants are those associated with travel to the seminar location. Seminars are held in various locations throughout Newfoundland and Labrador to ease the burden of travel on participants and municipalities. The Department of Municipal Affairs provides financial assistance for travel and meals to municipalities on the coast of Labrador.

3.4.1.1 Annual Clean and Safe Drinking Water Workshop

ENVC hosted the sixth annual Clean and Safe Drinking Water Workshop at Hotel Gander on March 20-22, 2007. The theme of this year's workshop was "Emergency Preparedness, Planning, and Procedures for Small Water Systems" and incorporated 10 presentations related to this theme. Topics covered during these presentations included:

- The Disaster Funding Assistance Arrangement
- Emergency response and recovery planning
- Acoustic methods for the condition-assessment of water pipes
- Health significance of bacterial indicators in drinking water
- Tools for emergency response
- Variability of chlorinated DBPs in distribution systems
- Chlorine and chemical safety
- Preventing emergencies through watershed protection
- InfraGuide best practices
- The Stephenville flood

Copies of these presentations are available online at:

www.env.gov.nl.ca/env/Env/waterres/OETC/Operator/Workshop2007/Clean&Safe.asp

Twelve exhibitors participated in the trade-show component of the workshop, which showcased equipment and technologies used in the supply and distribution of drinking water. The trade show provided municipal officials and staff with the opportunity to meet and to discuss issues unique to their own municipal drinking-water systems.

Attendance at the 2007 workshop was quite high: 232 delegates from across the province. Delegates included municipal operators, municipal officials and other staff, aboriginal community members, band council members, government employees, students, and consultants. To alleviate the costs associated

Permits to Operate: A Positive Approach to Operating and Maintaining Public Drinking-water Systems

Most municipalities in Newfoundland and Labrador that operate a public drinking-water system have been issued a Water Distribution Permit to Operate and, where appropriate, a Water Treatment Permit to Operate, by the Department of Environment and Conservation. The permits are regulatory tools that provide operators of municipal drinking water systems with a focus for mastering essential activities related to proper operation and maintenance of their facilities. The conditions outlined in the permits include activities associated with preventative maintenance, best industry practices, and ongoing maintenance, all of which lead to improved quality and extended life for their systems.

Generally, the majority of municipalities in the province strive to comply with the conditions of their Permit to Operate. In some cases, small communities are doing so under considerable resource restrictions and limitations. Municipal leaders and operators are showing good leadership in following best practices in the operation and maintenance of their systems. As a result of compliance with the permit requirements, some municipalities have reported positive impacts such as reduced chlorine consumption costs, reduced disinfection by-product formation, and improved water quality.

To ensure continued and improved drinking-water quality throughout the province, a minimum of Level I operator certification will be required for the principal operator and back-up operator of all systems. In addition, municipal water--treatment and water-distribution facilities will be required to be operated or supervised at all times by a Level I certified operator. Depending on the classification level of some systems, more stringent requirements regarding operator certification levels may apply. Systems that are currently overseen without a certified operator are encouraged to pursue education and training and achieve Level I certification.

The Department of Environment and Conservation provides assistance to municipalities to aid them in achieving compliance with the certification requirements. In addition, the ENVC will continue focusing on the operational conditions of the Permit to Operate and to monitor compliance through surveys and review meetings.

Above: An example of a properly maintained water-treatment room in Joe Batt's Arm.

with travelling to the workshop, the Department of Municipal Affairs reimbursed municipalities that attended. Communities from the Island portion of the province were reimbursed up to $300; municipalities from Labrador were reimbursed up to $600.

Planning has already begun for the 2008 Clean and Safe Drinking Water Workshop, which will take place on March 11-13, 2008, in Gander. It will again include presentations related to issues and opportunities experienced by local municipalities.

3.4.2 Operator Training

The on-site training component of the OETC program is a unique approach to operator training in Canada. This hands-on training continues to be very successful and is well received by municipalities throughout the province. During the 2006/7 fiscal year, 146 hands-on training sessions were conducted through the use of mobile training units (MTUs). These training sessions provided operators with an opportunity to learn about pressure reduction valves (PRVs), chlorination systems, leak-detection equipment, and hydrant maintenance and repair.

Three MTUs have been dispatched throughout the province for hands-on training purposes They are based in St. John's, Grand Falls-Windsor, and Corner Brook. The Corner Brook MTU is responsible for providing hands-on training to municipalities in Labrador. It travelled to communities located on the southern coast of Labrador during the 2006/7 fiscal year. In addition, training equipment was transported to Happy Valley-Goose Bay and operators from the surrounding area were invited to a group hands-on training session.

Each MTU is equipped with the specialty tools, meters, gauges, and test kits used in municipal water-system operation and maintenance. The equipment inventory is continually modernized and expanded to keep pace with industry development and program expansion. This practice ensures that training is conducted with current technology. In addition, the OETC program strives to supply the MTUs with equipment that is feasible for smaller communities to operate.

The hands-on training curriculum will be expanded in the upcoming year to provide instruction on pipe-tapping equipment and methods. Previous hands-on training topics will be repeated as required or requested. This component of the OETC program has been affected by the challenge of new operators entering the system because of retirement and other vacancies. The hands-on training program will evolve with the training demands of operators throughout Newfoundland and Labrador.

3.4.3 Operator Certification

Certification of water-system operators is currently voluntary in Newfoundland and Labrador, but ENVC is moving in the direction of Phased Mandatory Operator Certification. As part of this process, larger municipalities will be required to employ certified operators within a reasonable time frame. This requirement will eventually extend to smaller municipalities.

Certification demonstrates that operators have achieved a level of competence in the operation and maintenance of their water-supply systems. As demonstrated by the changing requirements for certification, the need for certified operators is growing in importance. Table 12 lists the certification exams administered through the OETC program duringfiscal year 2006/7.

Also during this fiscal year, 240 certified operators were employed as water and/or wastewater operators throughout the province. The number of communities employing certified operators declined (to 110 municipalities, down from 115) because of retirements. Certified operators are also employed by other organizations or agencies throughout the province, including:

- Parks Canada: 8 certified operators
- National Defence or other federal facilities: 6 certified operators
- First Nations communities: 5 certified operators
- Industrial or commercial facilities: 5 certified operators

Water-system operators who participate in education seminars and hands-on training offered through the OETC program have an increased success rate when writing certification exams. Data reported by the Association of Boards of Certification demonstrates that operators in Newfoundland and Labrador have higher success rates in passing certification exams compared to the rest of North America (see Table 13).

Operator Education: The Future of the Program

The operator-education component of the Operator Education, Training, and Certification program (OETC) was initiated in 2001. Since this time, the vision for the program has evolved and expanded. New curriculum initiatives are in the works for the upcoming year: courses on water treatment and wastewater treatment will be offered, and seminars in wastewater collection will be developed. The water and wastewater treatment sectors are becoming much more important, and the new curriculum will satisfy the demand from operators for education in these areas.

The OETC program also realizes the challenges municipalities face in terms of retaining water and wastewater system operators. Over the next few years, a large percentage of operators will be at or near retirement age. In addition, many municipalities have noted that they are losing their operators to opportunities in other provinces. These situations also present a challenge to the OETC program itself. Curriculum topics covered by the Operator Education Program will need to be offered repeatedly to ensure that new operators entering the system receive adequate education. The program is designed to evolve with the needs and challenges of municipalities and be accessible to all operators in the province.

Above: The OETC logo.

Cape St. George Success Story

For several years, the Town of Cape St. George could not maintain adequate water pressure in certain areas of the community, and their chlorination and pumping costs were high. In fiscal year 2006/7, the OETC program provided leak-detection training to Town staff. As a result, the Town was able to identify two areas with leak noise and other areas requiring further inspection. Maintenance staff confirmed and repaired leaks in three locations and pinpointed a leak in another area using noise detection.

The Town has now actively reduced their leakage run time and cut their daily usage from more than 200,000 US gallons per day to 90,000 US gallons per day. This has reduced pumping costs by a third and chlorination costs by a half. The Town now has more success in maintaining chlorine residuals, pump-house maintenance is simplified because a day's supply of water can be stored in the reservoir, and pressure can now be maintained throughout the distribution system.

Above: Wayne Rouzes of Cape St. George operates an excavator to fix leaks in the town's water-distribution system.

Table 12: Certification Exams Administered in Fiscal Year 2006/7

Certification Exam	Number of Exams Administered
Water Distribution Class I	1
Water Distribution Class II	2
Water Distribution Class III	0
Water Treatment Class I	4
Water Treatment Class II	4
Water Treatment Class III	3

Why Operator Certification?

Certification is defined as "documentation, official recognition, or endorsement of qualifications through a standardized testing procedure." A Certified Operator has achieved or exceeded a minimum acceptable level of knowledge, skills, and abilities, in the view of the certifying body.

Where certification is mandatory, government regulations authorize an individual to hold a position by virtue of his or her demonstrated knowledge and abilities. Voluntary certification does not have legal status, but does acknowledge the qualifications of the individual.

Certification serves two purposes: it demonstrates competence and professionalism, and at the same time provides a mechanism to restrict the responsibilities of those requiring more training or experience.

Where the well-being of consumers is directly at stake, evidence clearly demonstrates the value of certification. Advanced technology and regulatory standards will not by themselves deliver safe drinking water to the citizens of this province. In order to ensure the safe and sustainable operation of water-supply systems, certified operating personnel must be used.

Water and wastewater system operators are certified in accordance with a classification system that identifies the education and experience requirements for operators of each class, identifies the system operated by size and/or complexity, and sets standardized exams targeted to each specific class. This system helps to assure consumers that the operator is qualified.

Table 13: Operator Certification Exam Statistics for Newfoundland and Labrador and North American Data from the Association of Boards of Certification (ABC)

Exam	ABC 2004			NL 2004-2007		
	Number of Exam Participants	Number of Exam Participants with Passing Grade	Pass Rate	Number of Exam Participants	Number of Exam Participants with Passing Grade	Pass Rate
WD I	1,354	909	67%	120	104	87%
WD II	729	446	61%	34	24	71%
WD III	253	129	51%	1	1	100%
WT I	822	562	68%	1	1	100%
WT II	807	377	47%	7	4	57%
WT III	459	186	41%	4	4	100%

Notes: WD indicates Water Distribution; WT indicates Water Treatment.

4 Level 3 of the MBSAP

4.1 Legislative and Policy Frameworks

The Department of Environment and Conservation and the Department of Municipal Affairs enforce legislation and policy frameworks that relate to drinking-water safety. ENVC is responsible for enforcing pertinent sections of the *Water Resources Act, 2002,* including the Environmental Control Water and Sewage Regulations and the Well-drilling Regulations

The Department of Municipal Affairs enforces pertinent sections of the *Municipal Affairs Act* and the *Municipalities Act, 1999,* that concern municipal infrastructure funding and the administration of municipal infrastructure that relates to drinking-water safety.

4.2 Public Involvement and Awareness

The Department of Environment and Conservation is committed to public involvement and awareness. Readily available and easily accessible information helps support this commitment. For example, all drinking-water quality data is available on the ENVC web site, and exceedance reporting, quarterly reports, and annual reports are all publicly available.

In addition, the public can participate in the Watershed Management Committees that have formed in several areas. These committees provide a forum for various stakeholders regarding land-management and water-quality issues.

The OETC program's range of activities ensures the involvement of municipal operators and administrators. The annual Drinking Water Safety Workshop is a particularly good forum for encouraging groups such as municipalities, consultants, and government officials to learn about drinking-water safety. It provides an opportunity for the public to discuss issues not only with water-industry professionals and government officials, but also with other municipalities. In this way, municipalities can learn from each other—they see the issues other communities are facing and how they are dealing with them.

Each year, employees of the ENVC's Water Resources Management Division are asked to make presentations on a range of issues to technical working groups, conferences, post-secondary education classes, municipalities, and interest groups. The presentations provide an opportunity to discuss topics that affect drinking water in the province. These are some of the many presentations conducted by the Water Resources Management Division in fiscal year 2006/07:

- "Establishment and Functioning of Watershed Management Committees in Newfoundland and Labrador," Steady Brook Watershed Management Committee, June, 2006
- "Management of Water Resources and Environmental Impacts," College of the North Atlantic, March, 2007
- "Preventing Emergencies through Watershed Protection," Clean and Safe Drinking Water Workshop, March, 2007
- "Real-Time Water Quality Monitoring at Mining Operations in Newfoundland and Labrador," Aquatic Toxicity Workshop, October, 2006
- "Real-time Water-quality Monitoring in Newfoundland," Marine Institute, February, 2007
- "Source Water Protection in Newfoundland and Labrador," Environment Canada Source-water Protection Workshop for First Nations, March, 2007
- "Tools for Emergency Response from the Water Resources Management Division," Clean and Safe Drinking Water Workshop, March, 2007
- "Water Quality Index," Marine Institute, March, 2007

In order to assess the workload of implementing new legislation on semi-public water supplies, a survey of the regional GSC offices on the number of semi-public water

supplies without disinfection in their region, as defined by the TWG, was conducted. This was done to update data previously captured. Considering the broad scope of the request, there were virtually no differences in the total numbers. Provincially, there are approximately 600 semi-public water supplies without disinfection in place.

4.3 Guidelines, Standards, and Objectives

Documents relating to drinking-water safety, guidelines, standards, and objectives are constantly being developed or revised within ENVC to meet current and future issues and challenges. These documents are an integral part of ENVC's regulatory program, which is directed at ensuring public health and environmental protection.

For the fiscal year 2006/7, these activities and publications included:

- "Guidelines on the Use of Water Bombers in PWSA," a Policy Direction Public Water Supply Area
- *A Municipal Guide to the Development of a Watershed Management Plan,* which provides a template to help communities develop their own watershed management plan
- In 2006, the GCDWQ revised the guideline for arsenic, reducing the MAC from 0.025 mg/L to 0.010 mg/L and set a guideline for Bromodichloromethane, BDCM, of 0.016 mg/L
- "Chlorination Equipment Selection Guidelines: A Guide for the Selection of Appropriate Disinfection Equipment for Municipal Applications," which provides general design criteria for designers and owner/operators of water supply systems, to help them choose disinfection equipment appropriate to their needs. See:

  www.env.gov.nl.ca/env/Env/waterres/CWWS/Chlorination_equipment/Report.asp

- *Drinking Water Quality Monitoring Manual,* revised in May, 2006. The manual outlines the protocols for the components of the ENVC's drinking-water-quality monitoring activities. Its intention is to serve as a reference guide for staff, as well as to ensure a consistent approach to drinking-water-quality monitoring. See:

  www.env.gov.nl.ca/Env/Env/waterres/Surfacewater/DWQ%20Manual/DWQMonitoringManual.asp

- Further revisions were made to the *Guidelines for the Design, Construction, Operation and Maintenance of Water and Sewer Works.* See:

  www.env.gov.nl.ca/env/Env/waterres/CWWS/Guidelines_Water_Sewerage/Report.asp

Activities and publication accomplished in the fiscal year by Health and Community Services include:

- The policy document, *Sample Site Selection* and *Sampling Procedures*, is in the process of being revised. The revision will more clearly indicate the requirement to meet the provincial sampling frequency standard and provide direction on enhanced monitoring for supplies with a history of problems (e.g., boil water advisories, disinfection problems, etc.)
- Drafted a policy related to dairy farm water quality
- Production of the Arsenic fact sheet following the adoption of a new MAC for Arsenic in the Health Canada Guidelines for Canadian Drinking Water Quality
- Drafting of a pamphlet related to environmental factors (including water) and the health of newborns and new or expectant mothers
- Purchased copies of "Playing It Safe" brochure, which emphasizes children's need for clean drinking water, and distributed the brochure to the Regional Health Authorities for inclusion in information given to new parents
- Represented the province in the Pilot Project on Indicators of Microbiological Water Quality and Children's Health, in Ottawa on September 12, 2006
- Provided information to be posted on the Healthy Students Healthy Schools website regarding Environmental Health issues related to schools (including drinking water)

The Canadian Council of Ministers of the Environment Water Quality Index

December 2006

What is the CCME WQI?

The Canadian Council of Ministers of the Environment (CCME) Water Quality Index (WQI) was developed to simplify the reporting of water-quality data. The CCME WQI is a mathematical summary tool that classifies water on the basis of water-quality guidelines specific to the intended use of the water. It provides meaningful summaries of water-quality data that are useful to the general public, as well as to technical and policy workers who are interested in water-quality results.

How the CCME WQI Works

The CCME WQI model consists of three measures of variance from selected water-quality objectives: scope; frequency; and amplitude. These three measures of non-compliance combine to produce a value between 0 and 100 that represents the overall water quality.

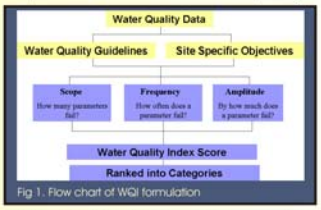


Fig 1. Flow chart of WQI formulation

The CCME WQI values are then converted into rankings by using the index categorization is shown (see table below).

Rank	WQI Value	Description
Excellent	95-100	Water quality is protected with a virtual absence of threat or impairment; conditions very close to natural or pristine levels; these index values can only be obtained if all measurements are within objectives virtually all of the time
Good	80-94	Water quality is protected with only a minor degree of threat or impairment; conditions rarely depart from natural or desirable levels
Fair	65-79	Water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels
Marginal	45-64	Water quality is frequently threatened or impaired; conditions often depart from natural or desirable levels
Poor	0-44	Water quality is almost always threatened or impaired; conditions usually depart from natural or desirable levels

Table 1. Categorization schema for WQI scores

Where to find the CCME WQI

www.ccme.ca/initiatives/water.html/category_id=102

www.gov.nl.ca/Env/env/waterres/Surfacewater/WQI/CanadianWQI.asp

Calculating the CCME WQI

Scope, frequency and amplitude, are used to calculate WQI values as shown in the table below.

$$F1 = \frac{\text{Number of failed variables}}{\text{Total Number of variables}} \times 100$$

$$F2 = \frac{\text{Number of failed variables}}{\text{Total number of tests}} \times 100$$

$$F3 = \frac{nse}{0.01nse + 0.01} \quad (nse = \text{normalized sum of excursions})$$

$$nse = \frac{\sum \text{excursions}}{\text{\# of tests}}$$

$$\text{excursion}_i = \frac{\text{FailedTestValue}}{\text{Objective}} - 1 \quad (\text{must not exceed})$$

$$\text{excursion}_i = \frac{\text{Objective}}{\text{FailedTestValue}} - 1 \quad (\text{must not fall below})$$

$$WQI = 100 - \frac{\sqrt{(F1^2 + F2^2 + F3^2)}}{1.732}$$

Fig 2. Calculation of the WQI

Applying the CCME WQI

The CCME WQI has been used in a number of applications in Newfoundland and Labrador.

For example, CCME WQI scores are used to report to communities, about how well the drinking-water-quality results of each quarter compared to drinking-water-quality guidelines. The scores also provide information about how well the community's drinking-water-quality ranked according to provincial expert opinion. The map below illustrates water supplies in the province and their CCME WQI scores.

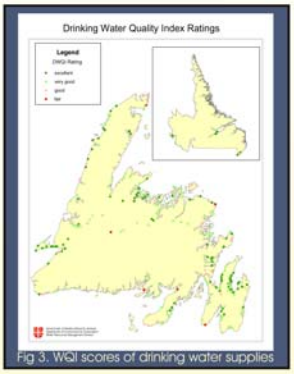
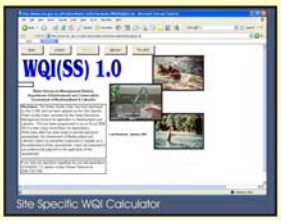


Fig 3. WQI scores of drinking water supplies

Other applications include using the CCME WQI to develop site-specific water-quality guidelines. For this, a Site-specific Water Quality Index Calculator, or WQI (SS), was developed. This calculator takes into account existing natural conditions (e.g. high pH) when calculating a WQI score. This results in a more accurate WQI score and rating.



Site Specific WQI Calculator

WQI scores have been used to rank water-quality of lakes and rivers across the province relative to each other, as shown on the map below.


Fig 4. Relative ranking of water bodies

The CCME WQI was also used to evaluate best management practices for forestry, using a forestry specific WQI calculator.

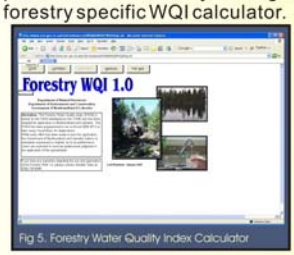


Fig 5. Forestry Water Quality Index Calculator

Additional applications that have been developed in NL include use as a screening tool to evaluate the suitability of waters for aquaculture, sensitivity studies, and evaluation of effectiveness of best management practices in a watershed. Further refinement and adaptation of the CCME WQI will lead to even more applications.

For More Information Contact:

Renée Paterson
Regional Water Quality Officer
(709)729-1159
ReneePaterson@gov.nl.ca

Water Resources Management Division
Department of Environment and Conservation
Government of Newfoundland and Labrador

Figure 4: ENVC staff have also created posters illustrating drinking-water program initiatives to assist with public awareness. Shown is the poster for the Canadian Council of Ministers of the Environment Water Quality Index.

- Coordinated an inventory of Environmental Health programs and services (including those related to drinking water) for the EH Working Group of the Provincial Wellness Advisory Council
- Developed content related to the Drinking Water program for inclusion on the revised HCS website.
- Assisted with the organization of the 2008 National Canadian Institute of Public Health Inspectors (CIPHI) Conference, which will include presentations related to drinking water quality
- Presented information related to Food Safety (including Drinking Water Quality) to high school teachers using the revised Nutrition course
- Participated in the adaptation and adoption of the HACCP Advantage program for food processors (includes components related to the provision of safe drinking water).

The Department of Municipal Affairs funded the compilation of a Maintenance Assurance Manual through the Town of Parson's Pond which was completed in November, 2006 under the direction of this Department in association with the Department of Environment and Conservation. The Maintenance Assurance Manual is intended to provide municipalities with a template such that water systems can be efficiently operated and maintained in a safe manner with greater reliability and potentially resulting in cost savings. This manual is presently under review by senior officials of both departments with consideration for pilot testing in the upcoming fiscal year.

4.4 Research and Development

ENVC constantly strives to improve all aspects of the MBSAP for drinking-water safety through research and the development of new tools and methodologies.

ENVC's Water Resources Management Division (WRMD) performs research that uses satellite imagery for water-resource management. This year satellite imagery was used in the development of a methodology to create an accurate wetlands inventory. Pilot projects involving the use of high-resolution optical and radar satellite imagery in conjunction with field verifications were conducted. The division also organized a customized wetlands identification and classification field course with provincial peatlands expert Dr. Doyle Wells to enhance staff skill in this area. The products that will result from this work will also contribute to a federal-provincial project for the development of a National Wetlands Inventory. Because watersheds are strongly influenced by the water budget and the type and quantity of wetlands they contain, this project can contribute to the effective management of water-supply sources and their associated watersheds.

Other related projects include:

- A web application for the Sewage Outfall Inventory database**.** This database contains information on municipal wastewater outfalls in the province. Application development tasks included:
    - Analysis, clean-up, and re-organization of existing data
    - Development of database structures and transfer of historical data
    - Application design with the addition of new tools for uploading and storing related photos, diagrams, and reports for each outfall
    - Linking this database to a GIS layer that displays outfall locations and documents

Real-time Water-quality Monitoring: Conne River

Many First Nations communities are located on or near the shorelines of rivers and lakes and these are often the only viable sources of community drinking water. These water bodies receive a variety of pollutants from nearby activities and land use, such as sewage and wastewater disposal, and run-off from solid waste disposal sites and industrial development. As a result of these growing stresses, natural processes alone can no longer be relied upon to purify drinking water. With this in mind, First Nations leaders, managers, and staff are developing proactive source-water protection plans to ensure the long-term availability of clean safe water for their communities.

The Miawpukek First Nations Community in Conne River, in partnership with the federal and provincial governments, has implemented a near-real-time water-quality monitoring program as a component of its source-water protection plan. In addition, a water-quality monitoring instrument has been installed in Southwest Brook below Southwest Pond (the water-supply source) that continually provides water-quality information to the community on a near-real-time basis. A number of physical characteristics are being monitored using data from the instrument, including temperature, pH, specific conductivity, total dissolved solids, dissolved oxygen, turbidity, and water level. While these characteristics themselves do not pose a direct human-health hazard, they can indicate the presence of other chemical or biological contaminants and provide early warning of potential threats to water quality and human health.

This real-time monitoring of the source-water supply enables the community to proactively identify changes in water quality and take necessary action to ensure the continued safety of their drinking water and the health of their people. It also provides the community with an opportunity to better understand and anticipate changes in water quality through the identification of seasonal and long-term trends.

Above: The water-quality monitoring instrument in operation in Southwest Brook, Conne River.

- Remote data collection
    - A new Automated Data Retrieval System (ADRS) database was developed. The ADRS collects, processes, and distributes hydrometric, climate, and real-time water-quality data. ADRS data is now stored in WRMD's enterprise-level database-management system (Oracle).
    - An improved version of ADRS management software was developed. This draft application is web-based and allows enhanced data management, data browsing/querying, and graphing capabilities
- Delineation and digitalization of the watersheds for 117 federal-provincial ambient water quality stations. Land-cover statistics based on recent satellite imagery were also calculated for each watershed. Having this data in GIS format improves analytical capacity and ENVC's ability to be more proactive in addressing-water quality issues.

5 Conclusions

The Multi-barrier Strategic Action Plan (MBSAP) continued to help strengthen the government's commitment to drinking water safety during fiscal year 2006/7. The objective of this report is to provide an overview of activities undertaken to advance the MBSAP and outline the progress made towards ensuring drinking-water safety in the province. Some of the developments in the three levels of the MBSAP that occurred in fiscal year 2006/7 are summarized below.

Source-water protection is an integral part of Level 1 of the MBSAP and during the fiscal year the source-water-protection program designated nine water supplies as Protected Public Water Supply Areas. As a result, 91% of people in the province who use public water are now receiving it from a protected source. Also, water treatment plants came on-line in Gander and St. John's, and Potable Water Dispensing Units became operational in Howley and St. Lawrence.

The Operator Education, Training, and Certification program continued to be a significant part of Level 2 of the MBSAP. During this fiscal year, 12 one-day classroom seminars were held in which 67 municipalities were represented. *In addition, 146 hands-on training sessions across Newfoundland and Labrador were held using mobile training units (MTUs).* The OETC program continues to contribute to the high success rate for operators writing certification exams. Another successful component of the OETC program was the annual Clean and Safe Drinking Water Workshop held in Gander March 20-22, 2007, with 232 delegates from across the province attending.

Level 3, the final component of the MBSAP, was supported by Government's continued interests in public involvement, development of guidelines, standards, and objectives, as well as through its research and development activities. During the fiscal year, all drinking-water-quality data was made available to the public on the ENVC web site and by regular reporting to the affected communities. Various guidelines were developed and revised during the fiscal year, including the maximum acceptable concentration for arsenic and bromodichloromethane as per the GCDWQ and the revision of the *Drinking-Water Quality Monitoring Manual*. An example of the continuing research and development activities was the development of an improved version of the Automated Data Retrieval System (ADRS), which is a data management tool for hydrometric, weather, and water-quality data.

The Government of Newfoundland and Labrador continued its commitment to the safety of drinking water in this province through ongoing use of the MBSAP. New ideas and new technologies will help resolve drinking-water issues and build on past accomplishments. The following section provides a look at MBSAP activities planned for the 2007/8 fiscal year.

5.1 Inter-department Cooperation

An inter-departmental committee was formed in June 2000 to ensure that the participating departments are always apprised of all current events pertaining to drinking water safety and to work together to deal with emerging drinking water safety issues. The committee is called the Safe Drinking Water - Technical Working Group (SDWTWG). It consists of representatives from the four government departments which are responsible for key aspects of providing clean and safe drinking water in accordance with the MBSAP. The departments are: Environment and Conservation, Health and Community Services, Municipal Affairs and Government Services. The committee includes representation from the Public Health Laboratory, the Medical Officers of Health and Executive Council.

The SDWTWG met ten times in 2006/07 and its activities were reported to the Chair of the Steering Committee of Senior Government Officials who is the Deputy Minister, Department of Environment and Conservation. The SDWTWG is an effective

networking mechanism and accomplished the following:

- Coordinate upgrades to the Municipal Information Management system (MIMs) in the area of data entry for water test results, recording of boil water advisories and maintaining a current record of water related infrastructure in the province as well as keeping the data current and up to date.
- Prepare and review the "Drinking Water Safety in Newfoundland and Labrador Annual Report 2006".
- Review proposed standards for drinking water safety for semi-public water supplies and develop a draft implementation plan.
- Review provincial boil water advisories and discuss ways to help communities to deal with the issues that bring about those advisories. Also coordinate with regional water committees.
- Keep committee members informed about the activities of the Federal, Provincial, Territorial Committee on Drinking Water and solicit comments on revised drinking water guidelines.
- Approval of private labs performing bacteriological testing.
- Communication of new "Guidelines for Canadian Drinking Water Quality" for arsenic to affected communities in Newfoundland and Labrador and assist with the implementation of the guidelines as it was changed from 25 µg/l to 10 µg/l.
- Review response to Sierra Legal Defense for their new water report.
- Discuss reporting of BDCM because of the new Health Canada guideline.
- Review the province's bacteriological water quality sampling frequency protocol.

6 Path Forward

6.1 Government Action Plans – 2007/8

6.1.1 Department of Environment and Conservation

ENVC will continue to develop and strengthen several areas of the MBSAP in the coming fiscal year. Traditional activities related to the MBSAP will continue and several new initiatives will be undertaken. A new element relating to "Issue Analysis and Corrective Measures" will be added to the MBSAP.

Because the protection of water supplies is an integral part of the MBSAP, communities will continue to be educated about its benefits and encouraged to pursue protection for their public drinking-water supplies. ENVC will designate water supplies as protected on an as-needed basis.

Monitoring in the 2007/8 fiscal year will be maintained at levels similar to previous years. Approximately 3,000 source, tap, THM, and HAA samples will be collected as part of the drinking-water-quality monitoring program. In addition, QA/QC sampling will be conducted in support of the monitoring program. Drinking-water-quality areas of priority concern for 2007/8 are expected to be:

- Aesthetic parameters – pH and colour
- Contaminant parameters – arsenic, lead, barium, and turbidity
- THMs
- Bacteriological parameters
- Monitoring requirements for HAAs and BDCMs will be streamlined in view of new guidelines for these DBPs.

The OETC program will continue to deliver education and training related to drinking-water matters throughout the province. It will consist of both classroom seminars and on-site training that uses the MTUs. The OETC web site will continue to be used to provide educational information and curriculum and seminar schedules for components of the OETC program. The annual Clean and Safe Drinking Water Workshop will be held in Gander on March 11-13, 2008. Its theme is "Small Town Solutions." The workshop will again include a tradeshow so that attendees can see and discuss equipment and technology with industry representatives.

6.1.2 Department of Municipal Affairs

The Department of Municipal Affairs will continue to financially support requests from communities for the provision of water related infrastructure. Appropriate water treatment technology to enable communities to meet the Canadian Drinking Water Guidelines continues to be a priority for capital funding assistance.

Cost effective approaches with regard to regionalization of operational and maintenance services will be encouraged in the way of both advisory and financial support. The Department will also continue to provide financial assistance to communities wishing to have representatives attend training, workshop and certification courses relating to drinking water safety.

6.1.3 Department of Health and Community Services

In 2007/8, the Department of Health and Community Services and the four Regional Health Authorities will continue to work collaboratively with our drinking water partners to enhance health promotion and protection efforts, and disease prevention initiatives related to drinking water. In 2007/8 the Department of Health and Community Services, and the Regional Health Authorities will continue to:

- Provide policy and technical support to the Department of Government Services who carry out bacteriological water quality monitoring and the interpretation of bacteriological water quality test results.

- Review and enhance drinking water safety promotional material.
- Provide health related advice to municipal leaders and residents where public water supplies are identified to have unsatisfactory water quality.
- Partner with the Department of Government Services and the Canadian Institute of Public Health Inspectors (NL Branch) to provide drinking water related continuing professional development to public health inspectors.
- Work at the national and inter-provincial levels on safe drinking water initiatives.

6.1.4 Department of Government Services

Through its bacteriological water monitoring program, the Department of Government Services helps ensure that public drinking water is protected from waterborne diseases and is safe for consumption. There were 19,149 public bacteriological water samples collected from 535 public water-supply systems in 2006/7. The continued high level of public water sample collection is an indication of the department's commitment to bacteriological water monitoring in compliance with the sampling levels currently recommended in the Provincial Standards and the *Guidelines for Canadian Drinking Water Quality*.

A review of the public water sampling program was undertaken as part of the department's workload analysis in the 2006/7 fiscal year with a view to determining whether additional improvements or efficiencies could be achieved. This review resulted in approval in the 2007/8 Budget to create six new Environmental Technician positions for GSC offices throughout the province. As part of their assigned duties, these personnel will assist the Environmental Health Officers (EHOs) in the collection of water samples, while EHOs will continue to provide interpretation of results and recommendations on the issuing of boil water advisories where necessary.

A country-wide shortage of qualified EHOs continues to present difficulty in recruitment and retention for those positions. To help address this problem, the department initiated a bursary program in 2006/7 to support three Environmental Health students in the two-year Environmental Health studies program at the University of Cape Breton, with a three year "return-of-service" agreement. This initiative continues in 2007/8 with a placement of two additional students. The purpose of this program is to secure graduates for employment in rural areas of the province starting in the fall of 2008.

The department is also interested in improving surveillance of drinking water that may be accessible to the public other than through municipal/public water supplies, such as semi-public and institutional supplies, and will continue discussions with the Department of Environment and Conservation on this issue in the coming months.

As in the past, the Department of Government Services will also continue to partner with the Department of Health and Community Services and the Regional Health Authorities. In order to ensure that Environmental Health Officers are provided the highest standard of professional development in their field, particularly in the area of bacteriological water monitoring, support for learning and development activities will continue to be provided in cooperation with the Canadian Institute of Public Health Inspectors (NL Branch).