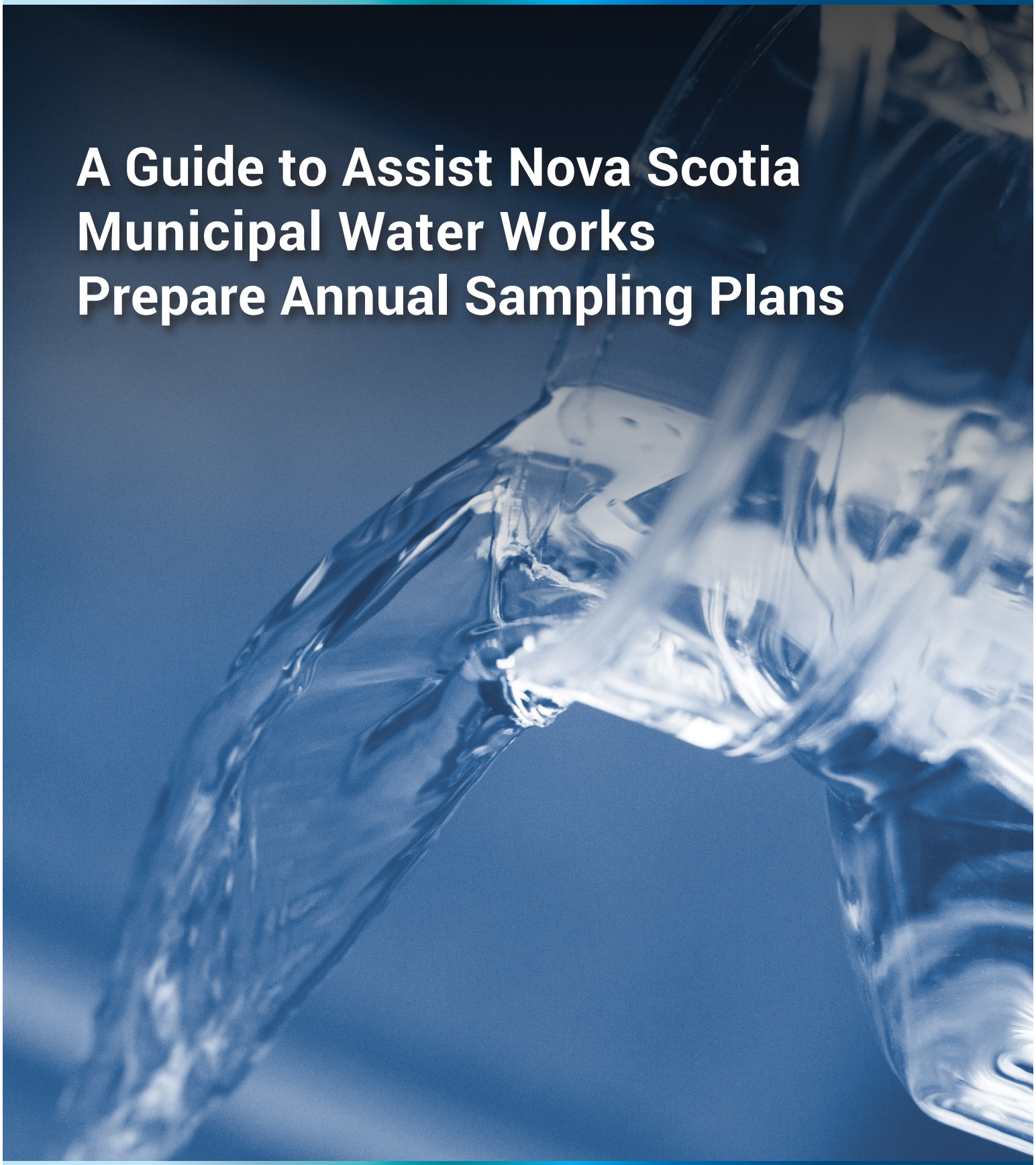
A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans



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A Guide to Assist Nova Scotia Municipal Water Works Prepare Annual Sampling Plans
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Introduction

The main purpose of this document is to provide guidance to municipal water treatment and distribution facilities in Nova Scotia to develop an annual sampling plan.

Why is an Annual Sampling Plan Required?

Recognizing that ensuring access to safe drinking water is a core public health initiative, the Nova Scotia government adopted the health-related *Guidelines for Canadian Drinking Water Quality* (GCDWQ) as legally binding standards in October 2000. The GCDWQ set out the basic parameters that every municipal water system should strive to achieve in order to provide the cleanest, safest and most reliable drinking water possible. By developing an annual sampling plan, the municipal water utility demonstrates that they are meeting regulatory requirements.

Many utilities, however, voluntarily choose to collect more than the required minimum number of samples. The benefits are:

- High customer confidence and satisfaction
- Strong working relationships and trust between the utility and the regulatory agencies
- Timely identification and response to water quality issues
- Cost savings on treatment chemicals and process maintenance

In addition to regular water quality monitoring, public drinking water supplies are required to report water quality exceedances and take immediate action to ensure the protection of public health as outlined in the *Guidelines for Monitoring Public Drinking Water Supplies, Part I* and required per section 34 of the Water and Wastewater Facilities and Public Drinking Water Supplies Regulations.

What Should Be Included in The Annual Sampling Plan?

Annual sampling plans will be unique for every facility in Nova Scotia. The number and type of water quality parameters analysed at a water treatment facility and in a water distribution system will be based on the type of treatment provided, the size of the facility, source water characteristics and requirements of the facility's Approval to Operate. An effective sampling plan should, **at a minimum**, include the following elements:

- Parameters to be analysed and the frequency at which they are sampled
- Sampling site locations
- Schematic of the distribution systems with sampling locations

What Should Be Considered When Developing Your Sampling Plan?

Your sampling plan should outline any **routine sampling** activities that are part of:

- Source Water Characterization and Protection Monitoring
- Compliance Monitoring
- Process Control Monitoring

Sampling in response to an upset in the source water, treatment plant or distribution system is encouraged, however this information should be captured in Contingency Plans and Standing Operating Procedures as it is not considered routine sampling.

Source Water Characterization & Protection Monitoring

Parameters that are recommended in the source water protection plan must be included in the annual sampling plan. The source water protection plan should be reviewed and assessed annually, or whenever significant changes to the municipal water system or risks to its source water occur. Changes to sampling requirements should be reflected in the annual sampling plan.

Compliance Monitoring

Compliance monitoring requirements are outlined in the latest versions of the:

- Approval to Operate
- Guidelines for Monitoring Public Drinking Water Supplies, Part I
- Guidelines for Canadian Drinking Water Quality

Approval to Operate

Parameters outlined in Schedule A as well as any site-specific requirements outlined in the Approval to Operate shall be sampled at the frequency indicated. This should be reflected in the Annual Sampling Plan.

Guidelines for Monitoring Public Drinking Water Supplies, Part I

Section 33 of the Water and Wastewater Facilities and Public Drinking Water Supplies Regulations requires owners of a public drinking water supply to sample for parameters in the manner and frequency set out in the Guidelines or as otherwise required by the Minister or an administrator.

Guidelines for Canadian Drinking Water Quality

Section 33 of the Water and Wastewater Facilities and Public Drinking Water Supplies Regulations requires owners of a public drinking water supply to ensure that the microbiological, physical and chemical characteristics of a supply do no exceed maximum acceptable concentrations (MAC). As such, the health-related parameters are legally enforceable standards that must be measured every 5 years from both untreated and treated water samples. It is the responsibility of the approval holder to ensure that all parameters outlined in the latest version of the GCDWQ are analysed.

Aesthetic objectives (AO) or operational guidelines (OG) are generally not legally enforceable unless they are identified in your operating approval or they compromise disinfection or other treatment processes.

Maximum acceptable concentration (MAC) — is a level that has been established for certain substances in the GCDWQ that are known or suspected to cause adverse health effects.

Aesthetic objective (AO) — is a level that has been established for certain substances in the GCDWQ that may impair the taste, odour or colour of water or which may interfere with good water quality control practices.

Operational guideline (OG) — is a level that has been established for certain substances in the GCDWQ that may negatively affect the efficient and effective treatment, disinfection, and distribution of water.

Process Control Monitoring

There are a number of critical water quality parameters that are adjusted or monitored throughout the treatment process to ensure efficacy of treatment such as pH, temperature etc. These parameters should also be included in the annual sampling plan.

Verification of In-Plant Sample Results

Any parameters that are permitted to be analysed at the facility or a laboratory that is not accredited, per the conditions of the Approval to Operate, must be verified quarterly by an accredited laboratory. These parameters should be clearly identified in the annual sampling plan and documented in the QA/QC program.

Annual Sampling Plan Templates

To facilitate the development of your annual sampling plan, templates specific to your source water type are available for download on our website.

Note: Due to the site specific variability of requirements these templates may not include all required parameters. It is the responsibility of the utility to ensure that their annual sampling plan is complete and captures all required sampling as outlined in this Guide and your operating approval.

Sampling Program Standard Operating Procedure

While the annual sampling plan should include the parameters, location and frequency, a separate document "Sampling Program SOP" shall be developed to include practical information for staff to ensure consistency in the collection of water quality samples. This SOP shall be made available upon request by the Department or during facility inspections and audits. The SOP should contain, **at a minimum**, the following:

- Methods for collecting samples including any collection devices, containers to be used, sample preservation, hold times, field measurements and notes, labs to be used for analysis, etc.
- Reference to the methods used for measuring water quality parameters in-house. These methods should be based on recognized and established methods (e.g. HACH, manufacturer's methods, Standard Methods, etc.)
- Calibration and maintenance protocols and schedules for all in-plant instrumentation per the manufacturer's recommendation
- Quality assurance and quality controls (QA/QC) protocols

What is a Quality Assurance/Quality Control Program?

Quality assurance and quality control (QA/QC) refers to an approach that verifies that sampling and monitoring are being performed correctly. A robust municipal QA/QC program should include field blanks, field duplicates, verification of in-plant sampling by an accredited laboratory and calibration standards.

Field Blanks consists of deionized water which is treated as a sample. It is used to identify errors or contamination in sample collection and analysis.

Field Duplicates consist of a duplicate sample collected by the same person, at the same location and time. It is used to estimate sampling and laboratory analysis precision.

Calibration Standards consist of one or more "standard concentrations" including a blank. These are used to calibrate in-plant instrumentation.

It is recommended that the number of QA/QC samples represent a minimum of 10% of the total number of samples. Any QA/QC samples conducted by the lab can count towards this minimum.

If there is greater than 5% variation in the samples then efforts should be taken to improve analytical methods and/or sampling techniques, including sample preparation, so that there can be a high level of confidence in the water quality results. The QA/QC approach should be documented in the SOP.

Note: Accredited laboratories also have internal QA/QC procedures including blanks, spikes, duplicates etc. however these do not need to be documented as part of the utilities' SOP.

Acceptable Laboratories

When testing and analysing water samples for compliance purposes, public drinking water supply owners are required to follow the Policy on Acceptable Certification of Laboratories and ensure that the laboratory contracted for sample analysis is deemed acceptable to the Department.

Resources

Policy on Acceptable Certification of Laboratories:
novascotia.ca/nse/airlandwater/docs/Policy-AcceptableCertificationOfLabs.pdf

List of Authorized Laboratories:
novascotia.ca/nse/water/waterlabs.asp

Appendix A: Calculating the Locational Running Annual Average (LRAA) for THM and HAA

In order to determine compliance with the Guidelines for Canadian Water Quality for THM and HAA, the locational running annual average (LRAA) is compared against the maximum acceptable concentration (MAC).

The LRAA is calculated by adding the values of the previous 4 quarterly samples collected from the same location and dividing the total value by 4 (e.g. the number of samples).

Example #1 – THM Concentrations (µg/L)

	Jan 2018	Apr 2018	Jul 2018	Oct 2018	LRAA Oct 2018
Sample Location A	64	73	115	92	**86**
Sample Location B	79	81	132	98	**97.5**
Sample Location C	80	84	106	78	**87**

Sample A: (64 + 73 + 115 + 92) /4 = **86**

Sample B: (79 + 81 + 132 + 98) /4 = **97.5**

Sample C: (80 + 84 + 106 + 78) /4 = **87**

Each time you conduct sampling for THM and HAA, you must recalculate the LRAA using the last 4 sample results as shown in Example #2 below.

Example #2 – THM Concentrations (µg/L)

	Jan 2018	Apr 2018	Jul 2018	Oct 2018	Jan 2019	LRAA Jan 2019
Sample Location A	64	73	115	92	78	**89.5**
Sample Location B	79	81	132	98	97	**102**
Sample Location C	80	84	106	78	83	**87.7**

Sample A: (73 + 115 + 92 + 78) /4 = **89.5**

Sample B: (81 + 132 + 98 + 97) /4 = **102**

Sample C: (84 + 106 + 78 + 83) /4 = **87.7**

In this example, the LRAA for sample location B, as of Jan 2019, exceeds the MAC for THM. This exceedance requires immediate notification to the Department.

Appendix B: Calculating the 95th/99th Percentile for Turbidity

Turbidity must be measured at a minimum frequency of once every five minutes for surface water (individual filter effluent) and GUDI water sources (at the wellhead). Where turbidimeters are polled more frequently than every five minutes, the "five-minute value" should be the average of the set of data taken at the smaller intervals. Any measurements that exceed the maximum allowable value for the technology used must be reported to the Department.

The 95th/99th percentile is calculated as follows:

Number of turbidity readings in a month = MTT

Number of turbidity readings in a month below or equal to the turbidity limit = MTBL

Percentile = (MTBL/MTT) X 100

Example

The turbidity limit for a conventional treatment facility is 0.2 NTU, at least 95% of the time each calendar month.

In the month of January, the plant's inline turbidimeter recorded 8,923 turbidity readings (which is the MTT). Of those readings, 8,645 were below the turbidity limit value of 0.2 NTU (this is the MTBL).

Percentile is calculated as follows:

(8645/8923) X 100 = 96.8%

The plant's turbidity value is compliant with the requirements as measurements were below 0.2 NTU 96.8 percent of the time in January.