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**TO:** Chair and members of the Board of Health

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**PREPARED BY:** Bo Cheyne, Environmental Health Specialist, Health Protection  
Blair Hodgson, Health Promotion Specialist, Health Analytics  
Wendy Briggs, Public Health Inspector, Health Protection

**APPROVED BY:** Christopher Beveridge, Director, Health Protection

*Original signed document on file*

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**SUBMITTED BY:** Dr. Nicola J. Mercer, MD, MBA, MPH, FRCPC  
Medical Officer of Health & CEO

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## Recommendations

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It is recommended that the Board of Health:

1. **Receive this report for information.**

## Key Points

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- Private well owners in Ontario are able to have the bacteriological quality of their water tested for free through Public Health.
- WDGPH is analyzing the regional and temporal patterns of well water samples submitted for testing over a 10 year period from 2006-2015.
- Objectives of this study include:
  - identifying regions where testing rates are low
  - identifying regions where there are clusters of adverse testing results.
- The goal of this initiative is to increase the number of well water sample submissions among private well owners. Some examples of how this may be achieved include:
  - identifying regions to target promotional efforts to improve testing rates and sampling frequency
  - identifying regions where additional water sample drop-off locations may be needed.
- Preliminary analysis has been conducted for 2011 to 2015:
  - 31,452 samples were included in the analysis
  - On average, 19% of samples showed evidence of bacterial contamination and 2.9% were positive for *E. coli*

- Over the 5 year period, only 21% to 25% of wells tested in a given year met the recommended testing frequency (at least three times a year)
- In 2015, well testing rates across municipalities ranged from 10-47%.

## Discussion

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### Private well water and health

The residents of Wellington County, Dufferin County, and the City of Guelph receive 100% of their drinking water from groundwater well sources. A major study of private drinking water wells on farm properties in Ontario found that 34% of tested wells had significant evidence of bacterial contamination.<sup>1</sup> In a Canadian study, results demonstrated that individuals with private wells were at 5.2 times higher risk of enteric disease.<sup>2</sup> In a survey of a neighbouring jurisdiction, only about a quarter of the well owner population submit water samples for bacteriological testing.<sup>3</sup> This suggests that well owners could be better informed about risks associated with private well water and the importance of testing their water.

### Free private well water testing program in Ontario

In Ontario, owners of private domestic drinking water wells can have the bacteriological quality of their water tested for free. The testing is funded by the province and samples are tested for two indicators of bacteriological contamination: coliform bacteria and *E. coli* (see table 1).

Table 1: Water samples are tested for indicators of bacteriological contamination

Indicator	Possible sources	What does the test indicate?	What actions should the well owner take?
<b>Coliform bacteria</b>	<ul style="list-style-type: none"> <li>• Often found in animal waste, sewage, soil and vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• Indicator of potential surface water contamination</li> </ul>	<ul style="list-style-type: none"> <li>• Water <i>may be</i> unsafe to drink. Advised to use alternative source and contact Public Health for further information</li> </ul>
<b><i>E. coli</i></b>	<ul style="list-style-type: none"> <li>• Normally only found in digestive systems of humans and animals</li> </ul>	<ul style="list-style-type: none"> <li>• Indicator of faecal contamination</li> </ul>	<ul style="list-style-type: none"> <li>• Water <i>is</i> unsafe to drink. Advised to use alternative source and contact Public Health for further information</li> </ul>

To have a private well tested, an empty sampling bottle can be picked up from most Public Health offices as well as some local municipal offices. Instructions are provided with the sampling bottle outlining how to collect, store and transport a water sample. Water samples can be dropped off at designated locations in Guelph, Orangeville, Fergus, Shelburne, Mount Forest, and Palmerston to be couriered to the Public Health Ontario Laboratory for testing. (<https://www.wdgpulichealth.ca/your-home/well-water-testing>).

Test results are available two to three business days after the sample is received at the laboratory. Well owners can access their results by phone (or wait for results to arrive by mail if request was made on the submission form). Results are also provided to the local Public Health unit.

On a trial basis starting in early 2017, when WDGPH receives an adverse water testing result (*E. coli*, high total coliform, or overgrown results) a public health inspector will call the submitter to advise them that the water may be or is unsafe to drink, discuss possible causes of the adverse result, and provide guidance on follow-up actions such as disinfecting the well. Well owners can also continue to call Public Health when they have questions about their well water or sample results as they did prior to starting this new initiative in 2017.

## Examining well water sample submission patterns and rates

Wellington-Dufferin-Guelph Public Health (WDGPH) has the mandate under the Ontario Public Health Standards (Safe Water standard) to prevent or reduce the burden of waterborne illness related to drinking water. Specifically, WDGPH is to conduct surveillance of drinking water systems and of drinking water illnesses, their associated risk factors, and emerging trends. In addition, WDGPH has requirements to inform private citizens who operate their own wells how to safely manage their own drinking water systems. Given the elevated risk of illness with drinking untested well water, a goal of the program is to have all well owners test their well water at least three times a year (recommended testing frequency).

In order to achieve this goal, it is essential to understand current testing behaviours and barriers amongst well owners. Consequently, WDGPH will be analyzing the regional patterns of well water samples submitted for testing over a 10 year period from 2006-2015. The total number of private wells will be estimated by using the Well Water Information System (WWIS) database maintained by the Ministry of Environment and Climate Change (MOECC) ([www.ontario.ca/environment-and-energy/map-well-records](http://www.ontario.ca/environment-and-energy/map-well-records)).

Examining sample submission patterns and testing rates will identify regions where there is a need to target education and awareness efforts along with removal of any identified testing barriers to increase the number of private well owners meeting the recommendations.

## Examining spatial trends in tested water quality

Longer-term objectives include analyzing results for spatial patterns to identify potential clusters of adverse water results. An adverse water result includes samples that test positive for *E.coli* (evidence of faecal contamination) and/or above a set threshold for coliform bacteria (significant evidence of bacterial contamination).

Spatial patterns can be compared to maps that identify vulnerable groundwater regions. These vulnerability maps were generated in recent years through Ontario's Source Water Protection Program ([www.applications.ene.gov.on.ca/swp/en/](http://www.applications.ene.gov.on.ca/swp/en/)).

## Preliminary Data Preparation and Analysis

Initial efforts have focused on preparing and cleaning data collected from 2011-2015. A total number of 36,485 samples were submitted for the Wellington-Dufferin-Guelph jurisdiction during this time period. Of those samples, 3,167 (8.7%) were not tested because they did not meet one of the multiple criteria required to conduct testing (for example, the sample arrived at the lab more than 48 hours after collection). The remaining 33,318 sample results were reviewed and cleaned resulting in 31,452 sampling results that could be analyzed (samples excluded included those with missing information, for example, incomplete address information). A final review of the cleaned 2011-2015 data is required prior to finalizing the dataset and conducting a detailed analysis. A preliminary analysis, however, was completed to provide an initial snapshot of this sampling period.

The analyzed results are presented in Table 2. Of the 31,452 samples tested, 19% had evidence of bacterial contamination.

**Table 2: Summary of testing results for 2011-2015 showing evidence of bacterial contamination**

Year	Samples tested	% with evidence of bacterial contamination* (water <i>may be</i> unsafe to drink)	% positive for <i>E. coli</i> (at $\geq 1$ CFU/100mL) (water <i>is</i> unsafe to drink)
2011	6,855	23%	3.0%
2012	6,515	18%	1.9%
2013	5,978	19%	3.5%
2014	5,997	19%	3.2%
2015	6,107	16%	2.7%
<b>2011-2015</b>	<b>31,452</b>	<b>19%</b>	<b>2.9%</b>

\* Sample had coliform present at  $>5$  CFU/100mL or the testing plate was overgrown with other bacteria. Note these samples could have *also* contained *E. coli*, in which case they would be deemed unsafe to drink.

Samples submitted with matching addresses were assumed to have been collected from the same well. It is recommended that well owners test their well at least three times per year. Table 3 shows the total number of private wells that were sampled (tested) in a given year, and the percentage of those sampled wells that were tested at least three times. The total number of wells being sampled in a given year remains constant, however, the percentage of those wells being tested at the recommended frequency in a given year may be decreasing, see Figure 1.

Table 3: Summary of private wells that met the recommended testing guideline of three times per year in any given year (2011-2015)

Year	No. of sampled wells (tested at least once)	% of sampled wells that were tested at least 3 times*
2011	3273	25%
2012	3161	24%
2013	3054	22%
2014	3095	22%
2015	3172	21%

\*It is recommended to test a private drinking water well at least three times per year.

A key study objective is to understand local testing rates for private wells (*i.e.* the number of private wells being tested relative to the total number of wells estimated from the WWIS database). Figure 2 shows approximate testing rates for each municipality in 2015. Due to the structure of the WWIS database, the data for Centre Wellington and Guelph/Eramosa is currently combined for this preliminary review of the data (these municipalities will be separated for the detailed analysis). Also, the WWIS data for the City of Guelph and Shelburne needs significant review and cleaning. Consequently, preliminary estimates for these communities are not provided here. Results showed that testing rates at the municipal level varied between 10-47%.

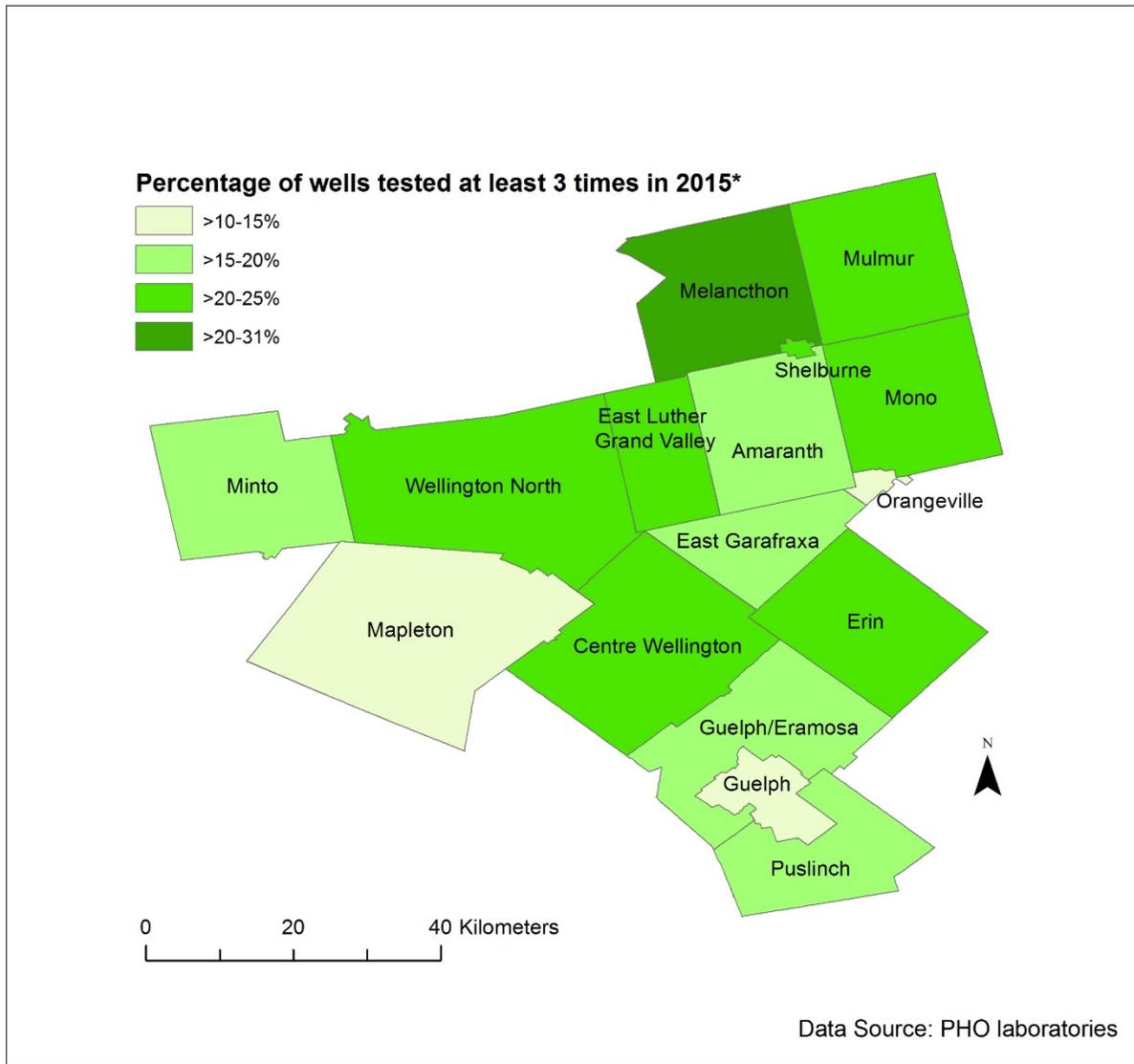


Figure 1: Map showing percentage of wells sampled in 2015 that were tested at least three times. \*Percentage was determined by dividing the number of wells tested at least three times by the total number of wells that were sampled (at least once) in 2015.

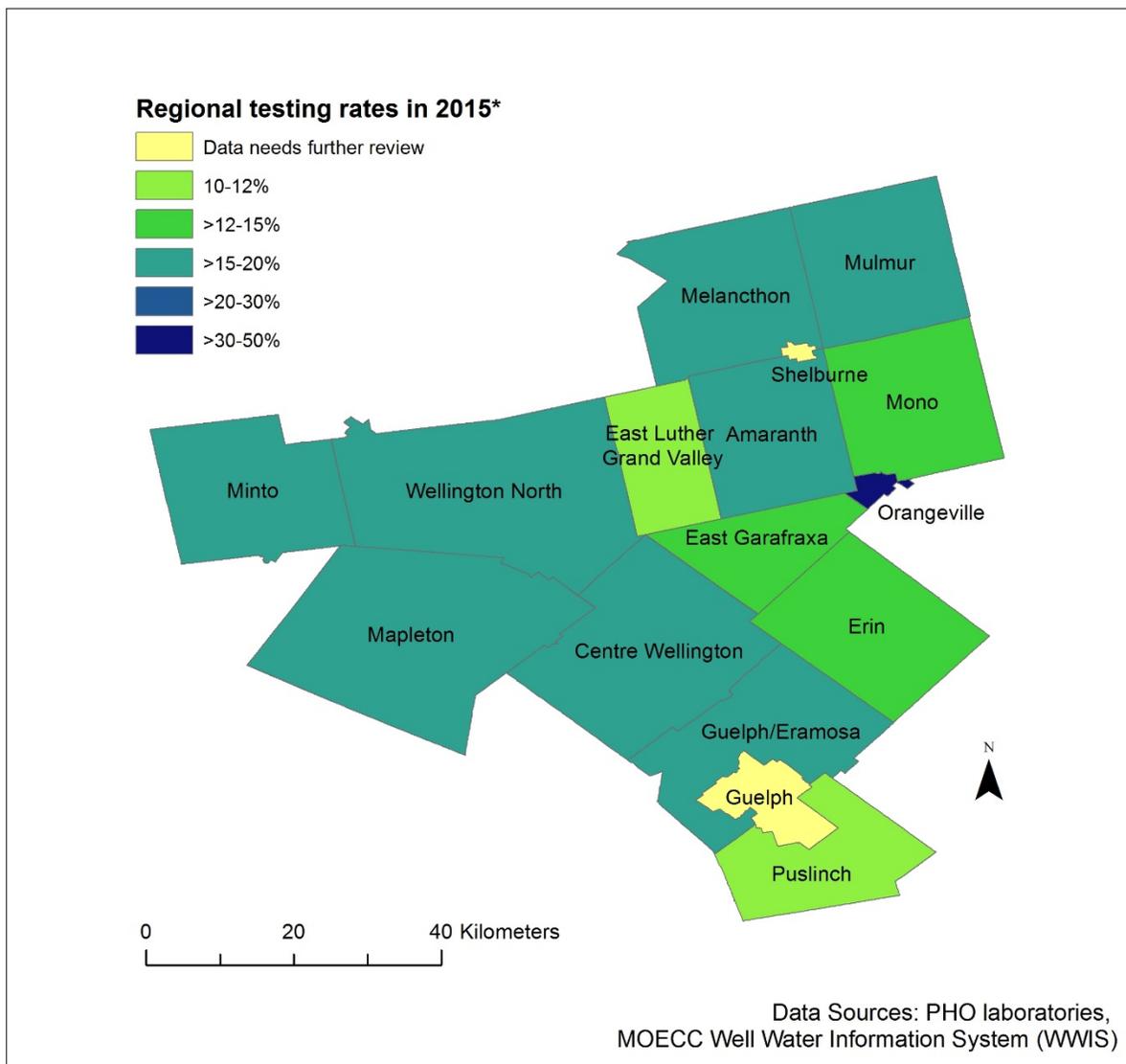


Figure 2: Testing rates for each municipality for 2015. Data for Centre Wellington and Guelph/Eramosa are combined. \*Testing rate is estimated using the total number of wells that were tested at least once in 2015 compared with the total number of domestic wells identified in the WWIS database. (No municipalities fell in the 20-30% range).

## Conclusion

The Ontario Public Health Standards indicate that boards of health shall be guided by a set of four principles, the first of which is need. The Standard states that “The principle of need acknowledges the importance of using data and information to inform decision-making at the local level regarding program assessment, planning, delivery, management, and evaluation. In order to be successful in achieving outcomes, boards of health shall continuously tailor their programs and services to address needs that are influenced by differences in the context of their local communities.”

In order to better understand differences in need across our jurisdiction, WDGPH will be analyzing the results of well water samples submitted for testing over a 10 year period from 2006-2015. A preliminary analysis of samples submitted between 2011 and 2015 resulted in 31,452 samples that could be analyzed. Of those, 19% of samples showed evidence of bacterial contamination and 2.9% were positive for *E. coli*. Between 21% and 25% of wells tested in a given year met the recommended testing frequency (at least three times a year). When 2015 data were examined at the municipal level and compared with the WWIS database of domestic wells, testing rates across municipalities were estimated to range between 10-47%.

Results from this work will inform the development of programs to increase the number of well water sample submissions among private well owners. WDGPH will be able to increase awareness for testing in regions where sample submission rates are lower than average or where rates are declining. If spatial analysis reveals clusters of adverse water testing results, education efforts could also be focused in those areas. Increased promotional efforts could be accompanied by additional water sample drop-off depots in an effort to increase sample submission rates. Furthermore, private well owners in these areas could be surveyed to learn more about their perceptions of risks from drinking untreated well water, and gain insights into reasons owners may or may not test. Results from surveys targeting specific areas may identify additional ways to increase testing rates in these regions.

## Ontario Public Health Standard

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As applicable.

## WDGPH Strategic Direction(s)

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Health Equity

We will provide programs and services that integrate health equity principles to reduce or eliminate health differences between population groups.

Organizational Capacity

We will improve our capacity to effectively deliver public health programs and services.

Service Centred Approach

We are committed to providing excellent service to anyone interacting with Public Health.

Building Healthy Communities

We will work with communities to support the health and well-being of everyone.

## Health Equity

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WDGPH will use the results of this study to reduce disparities in well water testing and promote safe drinking water for all residents. Identifying populations with low testing rates will allow WDGPH to explore barriers to well water testing in these areas. Although some studies have

identified well water testing barriers, such as inconvenience or lack of time, very little research has explored how social and economic factors can compound these barriers.<sup>3</sup> For example, although testing well water may be somewhat inconvenient or time consuming for most people, it will be much more inconvenient or time consuming for individuals who do not have access to transportation. Additional investigation into why testing rates in some areas are low or declining will provide insight into the best ways support and promote testing.

## References

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2. Uhlmann S, Galanis E, Takaro T, Mak S, Gustafson L, Embree G, et al. Where's the pump? Associating sporadic enteric disease with drinking water using a geographic information system in British Columbia, Canada. 1996-2005. *J Water Health*. 2009;7:692-98.
3. Hexemer AM, Pintar K, Bird TM, Zentner SE, Garcia HP, Pallari F. An investigation of bacteriological and chemical water quality and the barriers to private well water sampling in a southwestern Ontario community. *J Water Health*. 2008;6(4):521-25.