# DRINKING WATER SOURCE PROTECTION

ACT FOR CLEAN WATER

**Thames-Sydenham and Region Source Protection Committee**

*Lower Thames Valley Source Protection Area*

Proposed

# Assessment Report

March 5, 2010

## *5.0 Issues Evaluation*

Made possible through the support of the Government of Ontario

Thames – Sydenham and Region
c/o Upper Thames River Conservation Authority
1424 Clarke Road, London, ON, N5V 5B9

March 15, 2010

Dear reader

Re: **Lower Thames Valley Proposed Assessment Report posted for comments**

The Thames-Sydenham and Region Source Protection Committee has posted the enclosed report for review and comment by stakeholders. This report is the second draft of the Proposed Assessment Report for the Lower Thames Valley Source Protection Authority. Comments received through the first posting have been considered by the Source Protection Committee and the report has been revised. Comments received in response to this posting will be forwarded with the Proposed Assessment Report to the Ministry of the Environment.

The Proposed Assessment Report for the Lower Thames Valley Source Protection Area represents a significant milestone in the Source Protection Committee's progress in the completion of the first Source Protection Plans for the Thames-Sydenham and Region. While this Assessment Report contains most of the required information, it is not complete. As a result this Assessment Report identifies the work remaining to complete the Assessment Report for this Source Protection Authority. The Source Protection Committee realizes that this report is a "living document" which will need to be updated and amended. This Assessment Report identifies a number of items which will need to be undertaken before the first Source Protection Plan can be completed. As a result an amended Assessment Report is anticipated prior to completion of the Source Protection Plan for the Lower Thames Valley Source Protection Area.

The Thames-Sydenham and Region Source Protection Committee is also preparing drafts of Assessment Reports for the St. Clair Region and Upper Thames River Source Protection Authorities. These documents will be posted as they reach a point where they can be posted.

We hope that you will take advantage of the open houses being held throughout the region to learn more about this Assessment Report and Source Protection planning. More information on these open houses is available on the web site on the bottom of this letter.

Yours truly,
THAMES-SYDENHAM and REGION

Robert Bedggood, Chair
Source Protection Committee

# Table of Contents

## List of Figures



## List of Maps

## *List of Tables*

# 5.0 Issues Evaluation

Under the Clean Water Act (2006), drinking water quality *issues* must be identified for *drinking water systems* included in the Assessment Report. In the Lower Thames Valley Source Protection Area, there are surface and groundwater municipal *drinking water systems*, shown in Map 1-3. A drinking water quality *issue* is a *parameter* (substance) or *pathogen* (disease-causing microorganism) shown to deteriorate, or trend towards a deterioration of raw (untreated) water quality. This Section of the Assessment Report describes what substances in source (untreated) water may be considered *issues* as well as the methodology used to identify *issues*. A list of drinking water quality *issues* identified in the Lower Thames Valley Source Protection Area is also provided.

## *5.1 What is a Drinking Water Quality Issue?*

The *Technical Rules: Assessment Report* indicates which substances can be considered in the identification of drinking water quality *issues* in raw (untreated) source water. They are the Schedule 1, 2 and 3 *parameters* of the Ontario Drinking Water Quality Standards (Reg. 169/03 of the Safe Drinking Water Act, 2002) and Table 4 *parameters* of the Technical Support Document for the Ontario Drinking Water Standards, Objectives and Guidelines (an MOE publication, PIBS4449e01, June 2006). *Pathogens*, which are disease-causing organisms, can also be considered in the identification of drinking water quality *issues*.

The *Schedule 1 parameters* are the two indicator microorganisms, total coliform and *Escherichia coli (E. coli)*. These *parameters* are routinely tested in raw source and treated water, and also in distribution systems, under the Safe Drinking Water Act (2002). The testing of *Schedule 1 parameters* in raw water helps indicate possible pathogenic contamination in the raw water prior to treatment.

The *Schedule 2 parameters* are chemical substances such as lead, nitrate and atrazine. The *Schedule 3 parameters* are radio-active material such as uranium-235. The Schedule 1, 2 and 3 *parameters* have human-health based treated drinking water standards called *Maximum Acceptable Concentrations (MAC)*. The Schedule 1, 2 and 3 *parameters* and their safe levels (in treated drinking water) are listed in Tables 5-1, 5-2 and 5-3.

The *Table 4 parameters* are physical (such as taste, colour and turbidity) and chemical (such as sodium, iron and chloride) substances. Some of these affect the aesthetic quality of the water (taste, odour), and hence their treated water criteria are called *Aesthetic Objectives (AO).* Yet other Table 4 substances may interfere with the efficient and effective treatment, disinfection and distribution of the water (alkalinity, hardness), and their treated water criteria are called *Operational Guidelines (OG).* The Table 4 *parameters* and their objectives and guidelines (in treated drinking water) are listed in Table 5-4.

*Pathogens* are disease-causing protozoa, bacteria or viruses. Protozoa and bacteria are single-celled microscopic living organisms, while viruses are smaller than, and can live in, a single cell. *Pathogens* can cause severe or fatal waterborne illness in humans. Some are resistant to commonly used disinfectants at water treatment plants. Examples of *pathogens* include *Salmonella, Campylobacter, E. coli* strain O157:H7, *Legionella* and *Helicobacter pylori* (waterborne bacteria), noroviruses, hepatitis A and rotaviruses (intestinal viruses), and *Giardia* and *Cryptosporidium* (protozoa). In the *Technical Rules: Assessment Report*, unlike *parameters* listed in Schedule 1, 2 and 3, and Table 4, *pathogens* are not limited to a specific list. The *Schedule 1 parameters* (total coliform and *E. coli*) are routinely monitored, as described earlier, to indicate possible pathogenic contamination of raw water sources. However, specific *pathogens* are not monitored routinely in raw water sources unless there is an indication that monitoring of a specific *pathogen* is warranted.

**Table 5-1: Schedule 1 Parameters (from O. Reg. 169/03 of the Safe Drinking Water Act, 2002) and their Treated Drinking Water Quality Standards**

| Item | Microbiological Parameter | Standard (MAC, counts/100 mL) |
|---|---|---|
| 1. | *Escherichia coli* (E. coli) | Non detectable |
| 2. | Total coliforms | Non detectable |

**Table 5-2 Schedule 2 Parameters (O. Reg. 169/03 of the Safe Drinking Water Act, 2002) and their Treated Drinking Water Quality Standards**

| Item | Chemical Parameter | Standard (MAC, mg/L) | Item | Chemical Parameter | Standard (MAC, mg/L) |
|---|---|---|---|---|---|
| 1. | Alachlor | 0.005 | 40. | Diuron | 0.15 |
| 2. | Aldicarb | 0.009 | 41. | Fluoride | 1.5 [b] |
| 3. | Aldrin + Dieldrin | 0.0007 | 42. | Glyphosate | 0.28 |
| 4. | Antimony | 0.006 | 43. | Heptachlor + Heptachlor Epoxide | 0.003 |
| 5. | Arsenic | 0.025 | 44. | Lead | 0.010 [c] |
| 6. | Atrazine + N-dealkylated metabolites | 0.005 | 45. | Lindane (Total) | 0.004 |
| 7. | Azinphos-methyl | 0.02 | 46. | Malathion | 0.19 |
| 8. | Barium | 1.0 | 47. | Mercury | 0.001 |
| 9. | Bendiocarb | 0.04 | 48. | Methoxychlor | 0.9 |
| 10. | Benzene | 0.005 | 49. | Metolachlor | 0.05 |
| 11. | Benzo(a)pyrene | 0.00001 | 50. | Metribuzin | 0.08 |
| 12. | Boron | 5.0 | 51. | Microcystin LR | 0.0015 |
| 13. | Bromate | 0.01 | 52. | Monochlorobenzene | 0.08 |
| 14. | Bromoxynil | 0.005 | 53. | Nitrate (as nitrogen) | 10.0 [d] |
| 15. | Cadmium | 0.005 | 54. | Nitrite (as nitrogen) | 1.0 [d] |
| 16. | Carbaryl | 0.09 | 55. | Nitrate + Nitrite (as nitrogen) | 10.0 [d] |
| 17. | Carbofuran | 0.09 | 56. | Nitrilotriacetic Acid (NTA) | 0.4 |
| 18. | Carbon Tetrachloride | 0.005 | 57. | N-Nitrosodimethylamine (NDMA) | 0.000009 |
| 19. | Chloramines | 3.0 | 58. | Paraquat | 0.01 |
| 20. | Chlordane (Total) | 0.007 | 59. | Parathion | 0.05 |
| 21. | Chlorpyrifos | 0.09 | 60. | Pentachlorophenol | 0.06 |
| 22. | Chromium | 0.05 | 61. | Phorate | 0.002 |
| 23. | Cyanazine | 0.01 | 62. | Picloram | 0.19 |
| 24. | Cyanide | 0.2 | 63. | Polychlorinated Biphenyls (PCB) | 0.003 |
| 25. | Diazinon | 0.02 | 64. | Prometryne | 0.001 |
| 26. | Dicamba | 0.12 | 65. | Selenium | 0.01 |
| 27. | 1,2-Dichlorobenzene | 0.2 | 66. | Simazine | 0.01 |
| 28. | 1,4-Dichlorobenzene | 0.005 | 67. | Temephos | 0.28 |
| 29. | Dichlorodiphenyltrichloroethane (DDT) + metabolites | 0.03 | 68. | Terbufos | 0.001 |
| 30. | 1,2-Dichloroethane | 0.005 | 69. | Tetrachloroethylene (perchloroethylene) | 0.03 |
| 31. | 1,1-Dichloroethylene (vinylidene chloride) | 0.014 | 70. | 2,3,4,6-Tetrachlorophenol | 0.1 |
| 32. | Dichloromethane | 0.05 | 71. | Triallate | 0.23 |
| 33. | 2,4-Dichlorophenol | 0.9 | 72. | Trichloroethylene | 0.005 |
| 34. | 2,4-Dichlorophenoxy acetic acid (2,4-D) | 0.1 | 73. | 2,4,6-Trichlorophenol | 0.005 |
| 35. | Diclofop-methyl | 0.009 | 74. | 2,4,5-Trichlorophenoxy acetic acid (2,4,5-T) | 0.28 |
| 36. | Dimethoate | 0.02 | 75. | Trifluralin | 0.045 |
| 37. | Dinoseb | 0.01 | 76. | Trihalomethanes (THMs) | 0.100 [e] |
| 38. | Dioxin and Furan | 0.000000015 [a] | 77. | Uranium | 0.02 |
| 39. | Diquat | 0.07 | 78. | Vinyl Chloride | 0.002 |

**Notes: (a)** Total toxic equivalents when compared with 2,3,7,8-TCDD. **(b)** When added to drinking water, it is recommended to adjust the fluoride concentration to be 0.5 to 0.8 mg/L for optimal level of tooth decay control. Where supplies contain naturally occurring levels higher than 1.5 mg/L but less than 2.4 mg/L, the Ministry of Health and Long Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources. **(c)** This standard applies to water at the point of consumption. **(d)** Where both nitrate and nitrite exist, the total of both should not exceed 10 mg/L. **(e)** This standard is expressed as the running annual average of quarterly samples measured at point reflecting the maximum residence time in the distribution system.

**Table 5-3 Schedule 3 Parameters (O. Reg. 169/03 of the Safe Drinking Water Act, 2002) and their Treated Drinking Water Quality Standards**

| Item | Radiological Parameter | Standard (MAC, in becquerels per litre) | Item | Radiological Parameter | Standard (MAC, in becquerels per litre) |
|---|---|---|---|---|---|
| **Natural Radionuclides** | | | Artificial Radionuclides Continued | | |
| 1. | Beryllium-7 | 4000.0 | 40. | Iron-55 | 300.0 |
| 2. | Bismuth -210 | 70.0 | 41. | Iron-59 | 40.0 |
| 3. | Lead-210 | 0.1 | 42. | Manganese-54 | 200.0 |
| 4. | Polonium-210 | 0.2 | 43. | Mercury-197 | 400.0 |
| 5. | Radium-224 | 2.0 | 44. | Mercury-203 | 80.0 |
| 6. | Radium-226 | 0.6 | 45. | Molybdenum-99 | 70.0 |
| 7. | Radium-228 | 0.5 | 46. | Neptunium-239 | 100.0 |
| 8. | Thorium-228 | 2.0 | 47. | Niobium-95 | 200.0 |
| 9. | Thorium-230 | 0.4 | 48. | Phosphorus-32 | 50.0 |
| 10. | Thorium-232 | 0.1 | 49. | Plutonium-238 | 0.3 |
| 11. | Thorium-234 | 20.0 | 50. | Plutonium-239 | 0.2 |
| 12. | Uranium-234 | 4.0 | 51. | Plutonium-240 | 0.2 |
| 13. | Uranium-235 | 4.0 | 52. | Plutonium-241 | 10.0 |
| 14. | Uranium-238 | 4.0 | 53. | Rhodium-105 | 300.0 |
| **Artificial Radionuclides** | | | 54. | Rubidium-81 | 3000.0 |
| 15. | Americium-241 | 0.2 | 55. | Rubidium-86 | 50.0 |
| 16. | Antimony-122 | 50.0 | 56. | Ruthenium-103 | 100.0 |
| 17. | Antimony-124 | 40.0 | 57. | Ruthenium-106 | 10.0 |
| 18. | Antimony-125 | 100.0 | 58. | Selenium-75 | 70.0 |
| 19. | Barium-140 | 40.0 | 59. | Silver-108m | 70.0 |
| 20. | Bromine-82 | 300.0 | 60. | Silver-110m | 50.0 |
| 21. | Calcium-45 | 200.0 | 61. | Silver-111 | 70.0 |
| 22. | Calcium-47 | 60.0 | 62. | Sodium-22 | 50.0 |
| 23. | Carbon-14 | 200.0 | 63. | Strontium-85 | 300.0 |
| 24. | Cerium-141 | 100.0 | 64. | Strontium-89 | 40.0 |
| 25. | Cerium-144 | 20.0 | 65. | Strontium-90 | 5.0 |
| 26. | Cesium-131 | 2000.0 | 66. | Sulphur-35 | 500.0 |
| 27. | Cesium-134 | 7.0 | 67. | Technetium-99 | 200.0 |
| 28. | Cesium-136 | 50.0 | 68. | Technetium-99m | 7000.0 |
| 29. | Cesium-137 | 10.0 | 69. | Tellurium-129m | 40.0 |
| 30. | Chromium-51 | 3000.0 | 70. | Tellurium-131m | 40.0 |
| 31. | Cobalt-57 | 40.0 | 71. | Tellurium-132 | 40.0 |
| 32. | Cobalt-58 | 20.0 | 72. | Thallium-201 | 2000.0 |
| 33. | Cobalt-60 | 2.0 | 73. | Tritium | 7000.0 |
| 34. | Gallium-67 | 500.0 | 74. | Ytterbium-169 | 100.0 |
| 35. | Gold-198 | 90.0 | 75. | Yttrium-90 | 30.0 |
| 36. | Indium-111 | 400.0 | 76. | Yttrium-91 | 30.0 |
| 37. | Iodine-125 | 10.0 | 77. | Zinc-65 | 40.0 |
| 38. | Iodine-129 | 1.0 | 78. | Zirconium-95 | 100.0 |
| 39. | Iodine-131 | 6.0 | | | |

**Table 5-4 Table 4 Parameters (from the Technical Support Document for the Ontario Drinking Water Standards, Objectives and Guidelines, MOE 2006) with their Treated Drinking Water Aesthetic Objectives and Operational Guidelines**

| Table 4 Parameter | AO | OG |
|---|---|---|
| 1,2-Dichlorobenzene | 0.003[a] mg/L | |
| 1,4-Dichlorobenzene | 0.001[a] mg/L | |
| 2,4-Dichlorophenol | 0.0003[a] mg/L | |
| 2,3,4,6-Tetrachlorophenol | 0.001[a] mg/L | |
| 2,4,6-Trichlorophenol | 0.002[a] mg/L | |
| 2,4,5-Trichlorophenoxy acetic acid (2,4,5-T) | 0.02[a] mg/L | |
| Alkalinity (as $CaCO_3$) | | 30-500 mg/L |
| Aluminum | | 0.1 mg/L |
| Chloride | 250 mg/L | |
| Colour | 5 TCU | |
| Copper | 1 mg/L | |
| Dissolved Organic Carbon | 5 mg/L | |
| Ethylbenzene | 0.0024 mg/L | |
| Hardness (as $CaCO_3$) | | 80-100 mg/L |
| Heterotrophic Plate Count (HPC)-General bacteria population expressed as colony counts on a heterotrophic plate count | | f |
| Iron | 0.3 mg/L | |
| Manganese | 0.05 mg/L | |
| Methane | 3L/ $m^3$ | |
| Monochlorobenzene | 0.03[a] mg/L | |
| Odour | Inoffensive | |
| Organic Nitrogen | | 0.15 mg/L |
| pH | | 6.5-8.5 (no units) |
| Pentachlorophenol | 0.03[a] mg/L | |
| Sodium | b | |
| Sulphate | 500[c] mg/L | |
| Sulphide | 0.05 mg/L | |
| Taste | Inoffensive | |
| Temperature | $15^0C$ | |
| Toluene | 0.024 mg/L | |
| Total Dissolved Solids | 500 mg/L | |
| Turbidity | 5 NTU[d] | e |
| Xylenes | 0.3 mg/L | |
| Zinc | 5 mg/L | |

**Notes: (a)** Refer to Table 5-2 (Schedule 2 parameters) for MAC standard. **(b)** The AO for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets. **(c)** When sulphate levels exceed 500 mg/L, water may have a laxative effect on some people. **(d)** Applicable for all waters at the point of consumption. **(e)** The OGs for filtration processes are provided as performance criteria in the Procedure for Disinfection of Drinking Water in Ontario. **(f)** Increases in HPC concentrations above baseline levels are considered undesirable.

## 5.2 Impact of Identifying an Issue

Should an *issue* be identified, activities that contribute to the *issue* within a *vulnerable area* are deemed to be a *significant risk* to the source of drinking water. *Significant risks* must be mitigated through the *source protection plan*.

The area and the activity contributing to a drinking water quality *issue* must also be identified. Further, a third intake protection zone (*IPZ-3*) for surface water intakes may be delineated to include the activity and area known to contribute to the drinking water quality *issue*. These tasks are yet to be completed and will be part of an amended Assessment Report.

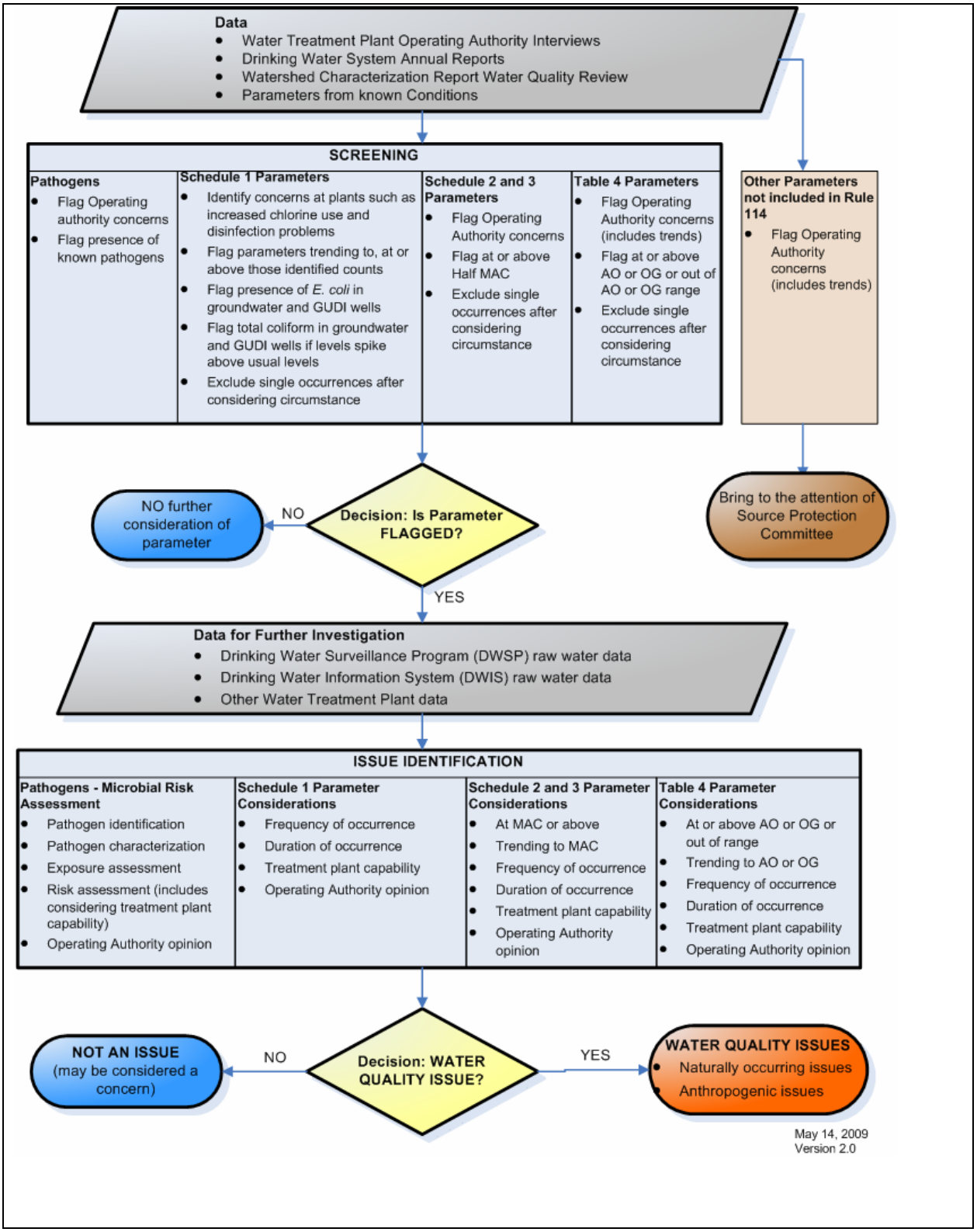
## 5.3 Issue Evaluation Methodology

Identifying *issues* is a key step in the overall process of protecting drinking water quality. *Issues* were identified in the Lower Thames Valley Source Protection Area by following the Thames-Sydenham and Region Issues Evaluation Methodology (May 14, 2009), depicted in Figure 5-1. The methodology is provided in Appendix 8. The evaluation is a two step process. Firstly, in the screening step, raw (untreated) water quality data is compared to a benchmark and *parameters* may be flagged if they meet the screening criteria. The benchmarks for chemical, physical and radioactive *parameters* are generally half the applicable human health based Ontario drinking water standards (*Maximum Acceptable Concentrations,* or *MAC*), and the full levels of the *Aesthetic Objectives (AO) and Operational Guidelines (OG)*, and any plant operating authority concerns. Secondly, in the identification step, an investigation of the *parameters* flagged through the first step is undertaken. This includes a review of trends and spikes, frequency and duration of occurrence, presence at or trending towards the applicable *MAC*, *AO* or *OG* benchmark, consideration of existing water treatment plant capabilities and discussions with the water treatment plant operating authority.

*Pathogens* are also evaluated in a two step process that differs from the evaluation of the Schedule 1, 2, 3 and Table 4 *parameters*. In the first step (screening), *pathogens* are flagged if they are a concern to the operating authority, known to occur in raw water, persist in treated water, or have caused a waterborne outbreak in the past. A *pathogen* that is flagged through

the screening process must be subject to a microbial risk assessment to identify whether it is an *issue*. This assessment involves *pathogen* characterization, exposure assessment and risk characterization. Some of the elements considered in a microbial risk assessment are: pathological characteristics, infection mechanisms, resistance to control or treatment, survival, persistence, seasonality, reliability of treatment processes and route of human exposure.

Figure 5-1: Thames-Sydenham and Region Issues Evaluation Methodology



## 5.4 Issues Evaluation Technical Studies

As described in Section 4 – Vulnerability Assessment, a large project, led by the Essex Region Conservation Authority (*ERCA*) was initiated through a partnership between *ERCA* and the Conservation Authorities in the Thames-Sydenham and Region and the plant operators. This project included 7 intakes in the Essex Region and 3 Chatham-Kent intakes in the Thames-Sydenham and Region. Stantec Consulting Limited was the primary consultant. The Municipality of Chatham-Kent Public Utilities Commission (*PUC*) was an active partner in the project and participated in the technical steering of the project.

Another project was led by the Municipality of West Elgin with the Ontario Clean Water Agency (*OCWA*) providing technical and project management services for the municipality. The West Elgin water treatment plant is owned by the Municipality of West Elgin and is managed by the Tri-County Water Management Committee.

The technical studies are listed below In Table 5-5.

**Table 5-5 Technical Studies on Drinking Water Quality Issues Evaluation**

| Drinking Water Systems | Technical Study on Issues Evaluation |
|---|---|
| Wheatley, Chatham and South Chatham-Kent | Technical Memorandum: Issues Technical Memorandum: Issues Identification for the Thames Sydenham Region Water Treatment Plants. Essex Chatham-Kent Source Protection Planning Technical Study. Stantec Consulting Ltd. February 2010. |
| West Elgin | Issues Evaluation Technical Memorandum: Issues Evaluation for the West Elgin Water Plant Treatment. Munciapltiy of West Elgin Source Protection Planning Technical Study. Stantec Consulting Ltd.. March 2010. |

## 5.5 Identified Issues

Certain *parameters* that met the screening criteria, in the first step of *issues* evaluation, were flagged. In the second step of *issues* evaluation, flagged *parameters* were further investigated to identify drinking water quality *issues* in the Lower Thames Valley SPA. The identified *issues* are listed and described in Table 5-6. Certain *parameters* may be due to *anthropogenic* (man-made) sources, i.e. due to the activities on land, or naturally occurring, or both. No *pathogens* are identified as *issues* in the raw (untreated) source water in the Lower Thames Valley SPA. It is important to note that the drinking water quality *issues* identified in Table 5-6 are based on raw (untreated) water quality and do not represent the quality of water after treatment. The operation of a water treatment plant including treatment and distribution are governed separately by the Safe Drinking Water Act (2002).

The flagged *parameters* that were not identified as drinking water quality *issues* include those of aesthetic concern, treated water disinfection by-products, microbial indicators and naturally occurring substances. More information on flagged *parameters* is provided in Appendix 9 of the Assessment Report. The identified *issues* and flagged *parameters* will be subject to a re-evaluation in subsequent assessment reports.

**Table 5-6 Drinking Water Quality Issues Identified in the Lower Thames Valley Source Protection Area**

| System | *Issue* | Brief Description of Evaluation | Natural or *Anthropogenic* Source |
|---|---|---|---|
| **Wheatley** (Lake Erie intakes) | Turbidity | Over 3 years, 44 raw (untreated) water samples were collected and tested for turbidity. About 86% of the sampling results measure above the treated water AO of 5 NTU, with a highest value of 59 NTU. Prolonged elevated levels of turbidity are a cause of concern to the plant operator. | Possibly both natural and *anthropogenic* causes, further investigation required |
| **Chatham/ South Kent** (Lake Erie intake) | Aluminum | About 43% of the raw (untreated) water sample points were above the treated water OG benchmark of 0.1 mg/L, and 70% measured above 50% of the OG benchmark, highest measured value being 0.55 mg/L. | Possibly both natural and *anthropogenic* causes, further investigation required |
| | Organic nitrogen | All (100%) of the available raw water data measured above the treated water OG of 0.15 mg/L, with the highest measured value being 0.48 mg/L. The trend line implies that the organic nitrogen levels have been slightly increasing over time. | Possibly both natural and *anthropogenic* causes, further investigation required |
| | Turbidity | About 47% of the raw water sampling results measured above the treated water AO benchmark of 5 NTU with the highest measured value being 75 NTU. | Possibly both natural and *anthropogenic* causes, further investigation required |
| | Hardness | All (100%) of the raw water samples collected and analyzed for hardness exceeded the treated water OG benchmark range of 80 to 100 mg/L, with the highest measured value being 143 mg/L. | Naturally occurring |
| **West Elgin** (Lake Erie intakes) | Turbidity | From review of raw (untreated) water sample turbidity data, 74% of the sampling results measured above the treated water benchmark AO of 5 NTU, with a highest turbidity level of 1408 NTU. | Possibly both natural and *anthropogenic* causes, further investigation required |
| **Ridgetown** (ground-water wells) | Fluoride | Since 2000, there have been 21 instances of fluoride concentrations in the raw water being above the treated water MAC of 1.5 mg/L, with a highest level of 2.05 mg/L. | Naturally occurring |
| | Methane | Dillon (2008) found methane levels to be regularly above the treated water AO of 3 $L/m^3$. A cascade aeration system is in place to address high methane levels. | Naturally occurring |
| **Highgate** (ground-water wells) | Fluoride | Since 2003, there were 14 instances of fluoride concentrations in the raw water being above the treated water MAC benchmark of 1.5 mg/L and a further 6 instances where concentrations were above 50% of the MAC benchmark. The highest fluoride level was 2.0 mg/L, and average value was 1.65 mg/L. | Naturally occurring |
| | Methane | Between 2004 and 2008, raw water methane levels were typically 17 to 55 $L/m^3$, regularly above the treated water AO of 3 $L/m^3$. | Naturally occurring |
| | Organic nitrogen | Since 2004, the available raw water data levels of organic nitrogen measured above the treated water OG of 0.15 mg/L, with a highest level of 0.5 mg/L. The source of the organic nitrogen was assessed by Dillon and finding summarized in the study: Highgate Municipal Water Supply System, Hydrogeological Information Review, May 30, 2008, Dillon. The study concluded that the observed organic nitrogen is likely from the aquifer which contains a high concentration of organic rich shale material from the underlying Kettle Point Formation. | Naturally occurring. |

## 5.6 Work Plan

If a drinking water quality *issue* is identified, the area and the activity contributing to a drinking water quality *issue* must also be identified. This work has yet to be completed and will be part of an amended Assessment Report. However, a work plan to complete this work must be submitted with this Assessment Report. The Table 5-7 lays out the work plan to identify the area and the activity contributing to the *issue*. Since it is yet to be determined whether most *issues* are naturally occurring, or caused by *anthropogenic* (man-made activities), or both, it may be necessary to first determine how the *issue* is caused.

**Table 5-7 : Work Plan for Identification of an Area and Activity Contributing to an Issue**

| System | *Issue* | Brief Description of Work | Proposed Timeline |
|---|---|---|---|
| **Wheatley, Chatham, West Elgin** (Lake Erie intakes) | Turbidity | This *issue* is possibly due to both natural and *anthropogenic* causes. Natural causes of turbidity may be erosion, natural decay of plants and animals, and algal growth. Human activities that could contribute to turbidity include runoff from cultivated fields or construction sites, waste discharges and dredging. Other information on possible causes of turbidity, provided at the public open houses, would be reviewed.<br><br>A study of correlation between wind or runoff events and the intake turbidity levels may need to be conducted. Similarly, a correlation between the in-land drains (natural or man-made) turbidity just before the outlet, and the intake turbidity (after an event) may need to be done. Aerial photos showing plumes after an event may help or sampling along drains and at their outlets may be needed. An examination of the composition of the turbidity (organic, inorganic) and its occurrence with other naturally occurring substances may also help determine the cause of turbidity.<br><br>Turbidity at Lake Erie intakes was also discussed at a Lake Erie working group. Future efforts of the working group may include considering this as a lake-wide *issue*. | Winter 2010 |
| **Chatham/ South Kent** (Lake Erie intake) | Aluminum | This *issue* is possibly due to both natural and *anthropogenic* causes. This *issue* seems common to western Lake Erie intakes. Therefore, work will be undertaken with neighbouring regions. Further investigation of this *parameter* at other intakes may also be required to determine if Aluminum is an *issue* at those locations as well.<br><br>The amount of *anthropogenic* aluminum released nationally in Canada is small compared with estimated natural aluminum releases; however, *anthropogenic* releases can dominate near strong point sources (CEPA Environmental Registry Substance Lists. Environment Canada, 2008). The aluminum levels in water and sediments near the intake, and the current land use activities that may cause aluminum to be released into the surface water will need to be investigated to help determine the source(s) of aluminum. | Winter 2010 |

**Table 5-7 : Work Plan for Identification of an Area and Activity Contributing to an Issue**

| System | *Issue* | Brief Description of Work | Proposed Timeline |
|---|---|---|---|
| | Organic nitrogen | This *issue* is possibly due to both natural and *anthropogenic* causes. Organic nitrogen may be attributed to natural sources such as forests and atmospheric deposition (dry deposits or in the form of precipitation) or by *anthropogenic* sources such as animal pastures, agricultural systems, urban/suburban storm water runoff (Bioavailability of DON from natural and *anthropogenic* sources to estuarine plankton. Limnology and Oceanography 47(2):353-366.Seitzinger S.P., R.W. Sanders, and R. Styles. 2002) and wastewater treatment plant effluent (Dissolved organic nitrogen characterization and bioavailability in wastewater effluents. Water Environment Research Foundation Report 02-CTS-1a. Pagilla, K. May 31 2010).<br><br>Within the Chatham/South Kent intake vulnerable areas, there are seven main storm sewer outfalls with mainly residential parcels along the shoreline and agricultural systems or pastures occupying most of the upland vulnerable area. Sampling for organic nitrogen at the sewer outfalls, in the sediments, near shore and in the intake raw water would need to be conducted to help determine the cause of organic nitrogen. | Winter 2010 |
| | Hardness | Identified to be naturally occurring. No further action required for this *issue* according to MOE guidance. | |
| **Ridgetown and Highgate** (ground-water wells) | Fluoride | Identified to be naturally occurring. No further action required for this *issue* according to MOE guidance. | |
| | Methane | Identified to be naturally occurring. No further action required for this *issue* according to MOE guidance. | |
| **Highgate** (ground-water wells) | Organic nitrogen | The source of the organic nitrogen was assessed by Dillon and summarized in the study: Highgate Municipal Water Supply System, Hydrogeological Information Review, May 30, 2008, Dillon. The study concluded that the observed organic nitrogen is likely from the aquifer which contains a high concentration of organic rich shale material from the underlying Kettle Point Formation. An investigation of the ambient groundwater quality data may help further confirm the cause of the organic nitrogen. This may require additional sampling. | Fall 2010 |

## *5.7 Data Gaps*

Schedule 2 and 3 (chemical and radiological) data for the West Elgin and Wheatley intake raw water were not available. Additional data collection would facilitate future *issues* evaluation.

There is no long-term (more than ten years) groundwater quality data available for *parameters* that can be considered *issues* under the Clean Water Act. Continued data collection in the future would aid in determining trends and better facilitate future *issues* evaluation.

The area and activity contributing to an *issue* are yet to be identified. A work plan to accomplish this is provided in this Section, in Table 5-7. The work itself, upon completion, would be part of an amended assessment report.