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Data Sources and Methods for the Reducing Phosphorus Loads to Lake Simcoe Indicator

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1 Introduction

The Reducing Phosphorus Loads to Lake Simcoe indicator is part of the Canadian Environmental Sustainability Indicators (CESI) program (<http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=47F48106-1>), which provides data and information to track Canada's performance on key environmental sustainability issues.

2 Description and rationale of the Reducing Phosphorus Loads to Lake Simcoe indicator

2.1 Description

The Reducing Phosphorus Loads to Lake Simcoe indicator summarizes estimates of the amount of phosphorus per year no longer reaching Lake Simcoe as a result of completed beneficial management projects funded by Environment Canada's Lake Simcoe Clean-Up Fund. The contribution of each project to phosphorus reduction in the lake was estimated using equations drawn from the scientific literature specific to the project type.

2.2 Rationale

Rapid population growth, urban development and agricultural intensification have had an impact on water quality in Lake Simcoe. Phosphorus pollution in the lake and its tributaries from this human development is causing excessive growth of aquatic plants and algae and low oxygen conditions. These changes are causing the lake's coldwater fish community, wildlife and overall water quality to deteriorate.

The Reducing Phosphorus Loads to Lake Simcoe indicator was created to measure the contribution that the Lake Simcoe Clean-Up Fund projects are making toward reducing the amount of phosphorus reaching Lake Simcoe from its watershed. The fund's goals were to accelerate the adoption of beneficial management practices in the Lake Simcoe watershed that are intended to reduce phosphorus loads from urban and rural sources, thereby allowing for the restoration of the lake's ecological integrity and restoration of a self-sustaining coldwater fishery.

3 Data

3.1 Data source

Performance measurement data, which were provided to the fund in the final reports of all projects receiving funding, were used to calculate this indicator.

3.2 Spatial coverage

This indicator focuses on estimated phosphorus reductions due to beneficial management projects completed in the Lake Simcoe watershed.

3.3 Temporal coverage

This indicator reports on the results of beneficial management projects implemented from December 2008 to March 2012.

3.4 Data completeness

The data for this indicator rely on information provided by project partners. This indicator includes data for all projects that completed and submitted their final reports by March 2012. The year associated with a project reflects the year that the final report was submitted to the program, not the year that the work was done.

The Lake Simcoe Clean-Up Fund supported 150 beneficial management projects and 16 large scale stewardship programs that involved the implementation of over 350 beneficial management projects. Of the projects funded, 49% had a direct impact on phosphorus loading and 43% had an indirect impact. The other 8% have not produced reports. This indicator only reports on those projects that resulted in direct phosphorus reductions to Lake Simcoe.

3.5 Data timeliness

This indicator reports data up to March 2012, the most recent data available. There is less than a six-month lag between the latest data and publication.

4 Methods

The details about how the Reducing Phosphorus Loads to Lake Simcoe Indicator was calculated can be found in the Lake Simcoe Clean-Up Fund: Phosphorous Reduction Calculation Report.¹

Estimates of phosphorus loading reductions to Lake Simcoe resulting from the implementation of beneficial management practices were calculated by the Lake Simcoe Clean-Up Fund program. These estimates were generated using performance measurement data provided in the final reports of all projects receiving funding and phosphorus-loading equations taken from the scientific literature. These equations are used by other water management agencies in Ontario to estimate the amount of phosphorus removed through managerial practices. The amount of phosphorus reaching a watercourse is based on the form and chemical nature of the phosphorus compounds and the degree of contact with the soil, soil pH, soil texture, soil type and aerobic conditions. The efficacy of each beneficial management practice varies, and often a range of estimated values was calculated.

Projects were grouped into three source types: agricultural, rural and urban. Beneficial management practices to reduce phosphorus inputs from agriculture include projects acting directly on a farming practice such as disposing of milk-house washwater and limiting livestock access to streams. Rural projects include those that could reduce phosphorus loading coming from rural non-farm properties. Urban projects include, for example, such as constructing wetlands that directly remove phosphorus from wastewater.

Ranges in the estimated phosphorus reductions occurred when several options were tested. For example, controlling livestock access to a stream can result in either a 2% or 3% reduction in the amount of phosphorus reaching the water body per year. Because there is no pre- and post-project monitoring to verify how well the practice is performing, estimates for both the 2% and 3% options were run producing a range in phosphorus reduction. To calculate the indicator, the mid-point of the estimated range of values calculated in the phosphorus reduction calculation was used (Table 1). To include the 2012 data in this indicator, phosphorus reduction estimates

¹ Sealock L (2011) Lake Simcoe Clean-Up Fund: Phosphorous Reduction Calculation Report. Great Lakes Management and Reporting Section, Environment Canada.

were calculated using the most conservative estimate (Table 1). Data for the indicator were calculated as the sum of the 2008-2011 midpoint estimated load and the 2012 estimated load.

Given that the results are estimates, the figures for the total of each project type were rounded to the nearest 100 kilograms of phosphorus per year and these rounded figures were summed to give the final total.

Table 1: Estimated phosphorus reductions for completed Lake Simcoe Clean-Up Fund beneficial management projects from December 2008 to March 2012 as reported in Sealock (2011).

Beneficial management practice	2008-2011 Estimated phosphorus reduction (kg/yr)	2008-2011 Mid-point phosphorus reduction (kg/yr)	2012 Estimated phosphorus reduction (kg/yr)	2008-2012 Estimated phosphorus reduction (kg/yr) ¹
Agricultural sources				
Livestock access	167-251	209.2	18	227.2
Dairy pile manure	87-688	387.5	35.6	423.2
Milk-house washwater	478	478.4	105.8	584.3
Clean water diversion	14	14.3	14.3	28.5
Rural sources				
Vegetated buffer strips	0.0042-0.0044	0.0043	3.9	3.9
Streambank erosion	15.7-16.4	16	14.3	30.3
Septic replacement			356.6	356.6
Tree planting			0.96	0.96
Urban runoff and stormwater sources				
Stormwater retrofits	35	35	0	35
Constructed wetlands	60	60	0.127	60.1
Innovative technology	1000			1000
On-site sewage	67	67	0	67
Total	1924-2610	1267	550	2817

¹Totals may not add up due to rounding.

5 Caveats and limitations

As the results of these projects were not monitored for phosphorus loadings and concentrations, the Lake Simcoe Clean-Up Fund program relied on the most appropriate, current and accepted equations to predict phosphorus loading reductions resulting from the implementation of beneficial management practices. In spite of the rigour behind them, uncertainty exists when using these formulae.

The indicator does not compare results to data on measured annual releases of phosphorus. The estimates of phosphorus reduction assume that each management project completed through the Lake Simcoe Clean-Up Fund results in a permanent reduction in phosphorus flows to surface waters.

The Lake Simcoe Protection Plan to reduce phosphorus loads to Lake Simcoe is being lead by the Province of Ontario, working with partners such as the Lake Simcoe Region Conservation Authority, local stakeholders, municipalities and other partners, such as Environment Canada. Environment Canada's Lake Simcoe Clean-Up Fund (http://www.ec.gc.ca/doc/eau-water/simcoe_e.html) contributes to Ontario's overall goals for the lake by providing funding for priority clean-up projects at the community, lake-wide or watershed-wide level.

6 References and further reading

Ontario Ministry of the Environment (2010) Lake Simcoe Phosphorus Reduction Strategy. Retrieved on 13 July, 2012. Available from: http://www.ene.gov.on.ca/environment/en/local/lake_simcoe_protection/STDPROD_075796#strategy.

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