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Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY



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EXECUTIVE SUMMARY

The "Phosphorus Trading and Water Quality: Economic Incentives and Multistakeholder Watershed Management in the Lake Simcoe and South Nation River Watersheds" Report was prepared for the Ministry of Environment and Ministry of Natural Resources as part of the "Watershed Management Place-Based Demonstration Projects". This is one of six demonstration projects designed to explore innovative approaches to watershed place-based management. This report was prepared by South Nation Conservation Authority and Lake Simcoe Region Conservation Authority based on their water quality trading program experiences and proposals.

MOE is interested in working with conservation authorities and municipalities on a watershed or subwatershed basis to examine the feasibility of developing a phosphorus trading management system in appropriate circumstances.

The use of a phosphorus trading management system is recognized as only one component of a watershed plan with the objective of offsetting phosphorus loading. A phosphorus trading system does not replace but rather complements other important water quality management practices and strong land use planning controls.

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Conservation Ontario thanks the Ontario Government for providing the initial funding for our watershed management projects. We'd also like to thank the Ministry of Natural Resources and the Ministry of the Environment for their assistance in making these projects a success.

The partners of the watershed-based demonstration projects have been working collaboratively since April 2002 to produce the results contained in this final report, released in May 2003.

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1.0 INTRODUCTION

The “Phosphorus Management and Water Quality: Economic Incentives and Multi-stakeholder Watershed Management In the Lake Simcoe and South Nation River Watersheds” Report describes a leading edge initiative for applying economic incentives for surface water management on a watershed basis in Ontario. This involves water quality trading for phosphorus credits. It is called “Total Phosphorus Management” (TPM) and is currently being applied in the South Nation River watershed. The Ministry of Environment was instrumental in developing a framework for TPM and allowing local stakeholders to develop an approach adapted to their watershed conditions. Water quality trading is an emerging trend in several jurisdictions around the world. The Province and stakeholders must be proactive to expand the application of TPM in order to remain competitive and achieve the environmental gains and economic benefits.

The use of a phosphorus trading management system is recognized as a small component of a watershed plan. Its objective is to offset phosphorus loading. A phosphorus trading system does not replace but rather complements other important water quality management practices and strong land use planning controls.

TPM allows municipal and industrial wastewater or stormwater facilities to offset phosphorus from their discharges by investing in non-point source or point source control projects. This provides grants for water quality improvement projects such as upgrades of stormwater control retrofits and agricultural best management practices. Often there is an economic advantage to implementing TPM for new or expanding wastewater and stormwater management. Another significant objective of TPM is to create a net environmental benefit since a

greater load of phosphorus must be removed from offset sources than is discharged by the wastewater or stormwater facility.

TPM requires the involvement of many stakeholders including the Ministry of Environment, Conservation Authority, wastewater discharger, municipality and other affected Provincial ministries and stakeholders (e.g. agriculture).

This report is based on the experience of the TPM programs in the South Nation and proposals in the Lake Simcoe watersheds. Given early developing experiences to date, this report, is not the definitive guide for implementing TPM in other parts of Ontario. Application of TPM elsewhere will require site-specific considerations and provincial support. This document does, however, provide important information to consider before establishing new TPM programs.

This report is presented in 3 parts. First, the (Background summary of Economic Trading concepts section) describes economic incentive programs in other jurisdictions as well as Ontario as well as the analysis of water quality trading compatibility with current water management recommendations from Walkerton and the “Managing the Environment” Report. The (Generic Framework to implement Phosphorus Management using Economic Incentive Programs) outlines a generic framework for TPM with supporting South Nation and Lake Simcoe Region experiences. The (Two Case Studies of Economic Incentive Programs Used to Implement Surface Water Phosphorus Management) is a case study describing specific examples which apply the overall TPM program as outlined in the generic framework.



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2.0 BACKGROUND SUMMARY OF ECONOMIC TRADING CONCEPTS

2.1 INTRODUCTION

This paper reviews a new method of using economic instruments to improve water quality in Ontario, called Total Phosphorus Management (TPM). TPM allows municipal and industrial wastewater dischargers to invest in the control of non-point sources of pollution as an option to employing more costly point source phosphorus treatment to reduce nutrient loadings. There are several advantages to this method, when compared with traditional wastewater treatment, including more cost effective control of nutrient loading to watersheds and improved water quality.

Currently in Ontario, the TPM approach has been successfully applied in the South Nation River watershed and work is currently underway to develop a similar model for application in the Lake Simcoe watershed. The following discussion provides a brief explanation of how economic incentives are used in Ontario.

Economic instruments, or market-based instruments, allow the market to drive pollution reduction initiatives. The majority of economic instruments for pollution control are based on the idea of the Polluter Pay Principle (PPP), and aim to internalize environmental costs that are otherwise borne by the ecosystem and society, rather than by the producer and consumer of the good or service in question.

However, unlike normal commodities, the market is not able to determine the price of emission. This is primarily due to the nature of the environment as a public good and the practical impossibility of assigning individual property rights to the environmental commodity. A public good is a good that even if one person is consuming it is still available for consumption by others. In other words, private property rights cannot be assigned to it. The lack of a price determining mechanism within the market means that there is a market failure that can be corrected by public policy instruments.

2.2 BACKGROUND

Phosphorus loading is a problem primarily in southern Ontario watercourses. For example, annual mean phosphorus concentrations for the main South Nation River are 3 - 5 times greater than Provincial Water Quality Objectives. In the Lake Simcoe Watershed, a 25% reduction in phosphorus loading is required to restore the health of the Lake. Studies have shown that over 50% of the phosphorus load in both watersheds comes from non-point sources (NPS). Other studies in the Great Lakes have reached similar conclusions.

While the impact of non-point source pollution is well understood, non-point source pollution is typically more difficult to identify and control than traditional point source pollution. Consequently, controlling non-point sources has only recently become a focus in environmental regulations and policies.

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To control non-point source pollution of phosphorus, the Ministry of the Environment (MOE) created an economic incentive pilot approach in the South Nation River watershed called Total Phosphorus Management (TPM). This approach provides municipal and industrial dischargers with the option of employing higher levels of treatment to control increases in phosphorus loading or offsetting their increased phosphorus load through investing in less costly non-point sources (NPS). Offsetting of phosphorus loads in this manner is only allowed if a net load reduction to a watershed is achieved.

The economic advantage of TPM is clear. The cost of controlling phosphorus from point sources is several times more expensive than the cost of controlling phosphorus from non-point sources. Since the costs for controlling non-point source phosphorus loads is 7 – 10 times cheaper than controlling point source pollution, there is a natural economic incentive for controlling phosphorus loadings to a watershed through investments in non-point source controls.

2.3 ECONOMIC INSTRUMENTS AND ONTARIO

As part of the “Managing the Environment” report, Research Paper #2¹ entitled “Economic Instruments for Environmental Policy Making in Ontario” reviews some of the conditions and approaches that will be important for successful implementation of economic instruments in Ontario.

It also reviews the reasons why Ontario should implement economic instruments. This section highlights the key components of this research paper.

Ontario needs to examine an economic incentive program to control phosphorus because it can offer greater efficient in environmental protection, compared to traditional wastewater treatment. (Point source pollution control is still extremely important. It is only through the practice of effectively treating point sources that we are now able to consider the offsetting of non-toxic, pathogen parameters such as phosphorus.) This efficiency is necessary to:

- achieve environment protection in the most economically manner;
- control the climbing costs of meeting increasingly strong environmental conservation and protection legislation and regulations; and
- encourage innovative and co-operative approaches amongst the regulated community, the government and other stakeholders.

Economic incentive programs can help Ontario implement its environmental agenda in ways that are consistent with many of the Provincial Government’s key economic objectives:

- Reducing the deficit. Economic instruments follow the polluter pays principle, allowing the Province to fund environmental improvement during tight fiscal times

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- Ensuring environmental infrastructure and services have a sound financial footing. Economic instruments allow for financially sustainable environmental infrastructure and services without large government subsidization.
- Encouraging innovation. Economic instruments do not lock polluters into adopting specific technologies. Instead, they provide incentives for ongoing innovation and technology development to reduce pollution.
- Enhancing competitiveness. Economic instruments can achieve environmental goals at lower cost than traditional approaches, thereby reducing the economic burden associated with environmental protection initiatives. This makes it more attractive for industry to locate in Ontario.
- Redeploying funds to other sectors of the economy. Economic instruments can transfer funds from large economic or urban centers to smaller, rural economies that are in need of new sources of revenue. Funds can also be used to help farmers improve their economic stability.

There are several other points to consider when using economic incentives.

1. First, economic instruments are practical. From large nation-wide applications to small applications, economic instruments exist in various jurisdictions around the world. They no longer belong only to the realm of theoretical economic modeling exercises.

2. Second, real world applications of economic instruments show that their theoretical benefits (cost effectiveness, encouraging innovation and better use of information) can be realized. For example, a US study concluded that incentive-based approaches can save between 10% to 90% of the cost of controlling pollution compared to traditional command and control approaches² which dictate the exact procedures or construction techniques that must be used.

3. It is not easy to design successful economic instruments. They require the same attention to goal/standard-setting and compliance and enforcement as traditional command-and-control policies. Analytical skills and information different from those traditionally used in environmental policy design are often needed for economic instruments.

4. Different processes for stakeholder consultation may be needed to develop and implement economic instruments. Economic instruments may be more complicated, or unfamiliar to stakeholders. A strong understanding of what the economic instrument is designed to achieve is required to get the best results from stakeholders.

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5. Economic instruments more often complement traditional command-and-control approaches than replace. A clear line cannot be drawn between economic instruments and command-and-control approaches, since many economic instruments incorporate elements of command-and-control. Despite these advantages, there are several major barriers delaying the wide-scale application of economic incentives:

Lack of specific environmental targets and allocation of responsibilities for meeting targets is one barrier. When targets and responsibilities are clear, as opposed to dictating the use of certain technologies, then stakeholder discussion and analytical efforts can focus on what is the best way to meet the targets. Only in these circumstances are the advantages of economic instruments likely to emerge.

the fact that practical design options are poorly understood is another barrier. Nearly everyone has a basic familiarity with economic instruments, but very few have the deep understanding needed to work around design and implementation hurdles. Too often economic instruments are eliminated from consideration after superficial scans reveal challenges and before the true benefits of market-based approaches become apparent.

Yet another is the perception that it is an additional tax. In today's climate, environmental charges and fees are difficult to implement because of public/corporate opposition to new taxes. Often this is assumed even before serious consideration is given

to design options that might mitigate opposition, (e.g. channeling revenues back to polluters who take further steps to reduce pollution, revenue neutrality and stakeholder education about the inherent fairness of polluter pays).

Also, decision makers are reluctant to try new policy tools. Policy development is led by people with substantial experience in traditional technologies, but less experience with economic instruments. Consequently, decisions are based on what is most familiar.

Other barriers to economic instruments exist, but careful consultation and design can overcome these barriers. These barriers include:

- some stakeholders believe that economic instruments will negatively affect competitiveness;
- some stakeholders believe economic instruments are "licenses to pollute;"
- economic instruments are not perceived to be for environmental purposes;
- allocating environmental charges for environmental purposes faces opposition, often by finance departments;
- little statutory authority exists to implement economic instruments;
- political opposition to tax incentives;
- pollution revenues received from one municipality, are spent in another, even if it is within the same watershed.

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2.3.1 Relevance of Economic Incentives “to Managing the Environment”, Walkerton Report

Ontario has recently released two major reports that deal with pollution. The Walkerton Inquiry³ and Managing the Environment⁴ reports documented many issues including the need to address non-point source pollution. Both reports recognized the potential for using economic incentives to control non-point source pollution and to clean up Ontario’s water.

The “Managing the Environment” report recommended 5 strategic shifts if the Province is to improve environmental quality, establish itself as a leading environmental jurisdiction, and act as a model for other jurisdictions to emulate. The following are the 5 shifts, with examples of how the TPM program can help achieve them.

Strategic Shift # 1: high level government-wide vision with shared implementation

- the MOE, MNR, MMAH, OMAF, SNC consulted before TPM was implemented
- MOE/OMAF on SNC’s Clean Water Committee that implements program
- Provincial *Water Resources Act* adhered to via Certificate of Approvals issued to dischargers
- Implemented by multi-stakeholder watershed committee, not just the MOE

Strategic Shift # 2: continuous improvement in environmental performance

- Under the TPM approach, NPS controls are aimed at reducing phosphorus loading. However these controls do provide the added benefit of also minimizing pathogen, sediment and sediment-associated pollutants from entering watercourses
- TPM acts as income redistribution from largely rich point source dischargers to usually smaller, non-point sources thereby allowing more pollution reduction
- As more money is diverted to non-point source controls, greater water quality benefits will accrue
- Economic incentives encourage techniques that are proven to reduce phosphorus (e.g. flocculator, constructed wetland)

Strategic Shift # 3: place based approach using boundaries that make environmental sense

- Managing the Environment stated that water quality improvements must be done using watersheds, and TPM is implemented on watersheds
- Since pollution is cumulative, NPS controls are necessary even where tributaries within a watershed meet Provincial water quality guidelines

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- If a watershed is used as the management unit, both land and water-based NPS projects that reduce phosphorus are eligible for TPM grants

- Conservation Authorities already have the legislative power to deal with some of the legal, organizational, jurisdictional accountability issues of TPM in watersheds

Strategic Shift # 4: increased use of flexible, non-regulatory tools, incentives

- TPM is performance and outcome based: it sets targets to achieve phosphorus reduction, not how to get there

- Multi-stakeholder committees decide how to meet phosphorus reduction targets and the Province sets the loading target as part of the sewage works approval

- This approach ensures cooperation amongst stakeholders and the Province

- Ultimately, TPM changes behavior (and improves water quality) through incentive grants, not a command and control structure

- TPM is a result of cooperative agreements and strong partnerships, not regulation and enforcement

- Economic incentives enhance environmental protection by making it easier to participate: landowners apply voluntarily for grants

- The local clean water committees are flexible and act according to the local situation, while still achieving Provincial targets

Strategic Shift # 5: shared responsibility with regulatory community

- Water quality improvement is now a shared responsibility between local people and the province

- Clean Water Committees set their own direction to achieve provincial water quality targets

- All meetings on TPM are open to the public

- Multi-stakeholder Committees allow peer to peer networking and decision-making The Walkerton Report supported managing the environment on a number of points, including:

- a need for government-wide environmental strategy
- within this strategy, assigning clear roles
- the need for adequate resources to do the work
- the need for a watershed approach
- local stakeholder decision making
- open process for public involvement

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The key recommendations from the Walkerton Report require protection of drinking water sources. An economic incentive model achieves this because it targets NPS pollution, such as manure runoff, stream bank erosion, and stormwater runoff which often threatens ground and surface water sources of drinking water. The TPM program as it is now structured cannot achieve drinking water source protection. However a targeted approach using economic incentives could achieve this.

2.4 ECONOMIC INCENTIVES ELSEWHERE

In Australia, a new government policy was recently announced that allows farmers to trade credits if they practice good water and soil conservation.⁵

In the United States, the concept of trading is well established. Managing the Environment also has a good discussion of economic incentives through examination of a number of case studies. These case studies provide good examples and best practices from Canada, the US, and Europe. The case studies include water pollution, air pollution and energy efficiency.

The reference page contains some relevant examples that are important reading when trying to understand the concept of economic incentives. A search of the World Wide Web will also reveal many more examples, discussions and explanations of economic incentives (e.g.

www.epa.gov/owow/watershed/trading.htm).

2.4.1 United States

The United States Environmental Protection Agency (EPA) has a proposed Water Quality Trading Policy⁶. The EPA wrote this policy as an update to its previous watershed trading policies in order to provide guidance in implementing watershed trading. It is intended to facilitate and encourage trading. The policy outlines the main elements required to implement a successful trading program.

These include:

- clear authority for trading
- clearly defined unit of trade
- standardized protocols
- mechanisms for compliance and enforcement
- public participation and open access to information
- program evaluations
- compliance with existing statutes
- appeal mechanisms

In the US, 40% of the water bodies do not meet Federal water quality standards. The majority of the pollutants come from non-point sources and 218 million people live within 15 km of impaired waters. States have to do water quality assessments and develop action plans if the surface water does not meet the Federal *Clean Water Act* standards for water quality. The EPA allows water quality trading to achieve water quality goals on a watershed basis. This approach will save \$1.4 billion (Cdn) annually in the United States.

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An additional valuable reference is “A New Tool For Water Quality: Making Watershed-based Trading Work For You”⁷. This publication, prepared by the National Wildlife Federation in the US, is an introductory text to the concept of economic incentives. It explains many of the concepts in plain language and answers the most common questions associated with trading programs. Many of these same questions were raised during the development of the TPM program in Ontario.

The major sources of non-point source pollution are listed (agricultural land, logging, road construction, lawns, smokestacks/car exhaust, dams and levies). This paper also discusses the different types of trades that are possible (point to point; intra-plant; pre-treatment; point source to non-point source; non-point source to non-point source).

It lists the benefits (costs savings; greater reduction in pollution; innovation; emphasis on water quality and not technology; public involvement) and problems (enforceability; monitoring; equity; hot spots) with trading.

Finally, it gives a checklist of requirements for a trading program:

- targets
- good compliance records from the discharger
- enforcement
- proper trading ratio
- avoidance of hot spots
- bans on certain types of trades (e.g. toxins)
- legal oversight
- public participation

Another American program which is similar in form to the TPM program and could serve as a model to achieve real water quality benefits in Ontario, is the Total Maximum Daily Load (TMDL)⁸ program.

The US has a legislated TMDL program that implements the US’s *Clean Water Act*. Rather than looking at each individual polluter or wastewater discharger, and setting water quality objectives for each individual in isolation of the ecosystem, TMDL set the maximum pollutant that a water body can receive and still meet water quality standards. It is then up to the polluters collectively in the watershed to decide how to reduce pollutants and who will reduce them.

Finally, the Chesapeake Bay program produced the fact sheet, “What are the Six Elements To Nutrient Trading?” It reinforces the material in the other appendices, and shows the widespread adoption of economic incentive concepts. The elements are:

- identifying nutrient reduction goals
- determining types, number of credits that may be traded
- performing trade administration
- ensuring accountability
- assessing progress in nutrient reduction goals
- involving stakeholders

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2.5 ECONOMIC INSTRUMENTS IN ONTARIO

Economic instruments have been discussed and analyzed for many years in Ontario. For example, the government created the Ontario Round Table on the Environment and Economy, that existed from 1988 to 1994. It was established to provoke discussion and, ideally, bring forth solutions in search of a provincial strategy for sustainable development. Many of the members were stakeholders in the sustainability debate, public and private sector alike. The Round Table undertook research that resulted in the publication of *Opportunities and Economic Instruments*⁹ in 1992. This report made specific recommendations regarding instruments that could be implemented with respect to, among other aspects, tradable permits for water pollution emissions in a watershed.

A more recent discussion concerning the use of market-based instruments in Ontario can be found in the 1998 report of the Environmental Commissioner of Ontario¹⁰. Part 2 of the Report includes discussion on emissions trading and carbon taxes. The discussion encompasses the theory behind economic instruments, current use outside of the Province, progress within Ontario, contentious issues embedded in the use of such an instrument, as well as a list of relevant sources for further reading about instruments.

An economic incentive program is already in place in Ontario. Under the Ontario Emissions Trading Code that was established in January, 2002, the Province set targets for clean air by setting caps for emissions from power generating stations. If a power plant cannot meet its emission targets, it can buy emission reduction credits from another organization or company. Trading can occur within 12 US states or Ontario.

Ontario started this system because trading has the potential to provide clean air benefits far beyond those of caps alone. It encourages all companies and organizations to sell emission reduction credits to those who may need them to offset excess emissions. To ensure environmental integrity, Ontario requires:

- lower caps in future years than those that exist today
- rigorous monitoring
- real, quantifiable, verifiable credits
- a system that is transparent and accountable
- incentives for new techniques of conservation and renewable energy

An emissions trading code, or policy, was developed to facilitate air emissions trading. It sets out the procedures and requirements for creation and transfer of credits. It also describes the Ontario Emission Trading Registry which is used to notify the public of the air pollution credit distribution or retirement and to provide public access to all documentation related to trading.

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This policy on emissions trading could shape the structure of a similar policy on water pollution credits. One major difference, compared to emissions trading, is that water trading must be done within watersheds. The delineation of watersheds and subwatersheds would have to be dealt with through policy. The current policy on water trading is not as developed as the air emissions trading policy, and this type of rigorous policy is required for provincial application.

The Province currently has a policy that allows water pollutants trading. This is done through the application of Policy 2 of Provincial water quality objectives.¹¹ This policy allowed economic incentive-based trading programs to be established at the two Conservation Authorities, South Nation Conservation and Lake Simcoe Region Conservation Authority.

If we look at the 5 points listed on previous page as requirements of a water trading policy, then both the South Nation and Lake Simcoe approaches follow the policies of the air emissions trading policy. Both are setting, or attempting to set, lower caps on the amount of phosphorus that can enter a lake or river than currently exist in the Province today. Lake Simcoe is seeking to reduce the amount of phosphorus, whereas the South Nation watershed has a Provincial policy of zero discharge from new wastewater facilities. The South Nation program is attempting to reduce phosphorus loadings through the application of the offsetting ratio of point source and non-point source loads.

Both programs are doing water quality monitoring, either alone or in conjunction with similar programs by other agencies. The phosphorus credits will be real and quantifiable since both organizations will use scientific formulae to calculate phosphorus removal. All decisions that are made are done in open sessions of committees, with minutes and records that are open to the public. Finally, since the province is setting policy and the implementation framework, and not the means to achieve this policy, new techniques of phosphorus reduction can be developed and implemented.

In order to move forward on environmental issues, the key is to have political leadership, adequate resources and creative thinking to ensure that all options in the environmental policy toolbox are considered. The compelling evidence to date on economic instruments and the urgency to find better solutions to environmental problems justify efforts to ensure economic instruments are fully considered.

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3.0 GENERIC FRAMEWORK TO IMPLEMENT PHOSPHORUS MANAGEMENT USING ECONOMIC INCENTIVE PROGRAMS

3.1 INTRODUCTION

This section outlines a generic “Total Phosphorus Management” (TPM) framework for applying economic incentives to reduce phosphorus levels within a watershed. It has been written in a "how to" format for wastewater managers, environmental consultants, conservation authorities, provincial and municipal government staff and others interested in phosphorus trading. It describes the steps required to establish a successful TPM program.

This guide has been compiled using experience from existing water quality trading programs in the South Nation River and the development approaches for Lake Simcoe Region watershed. These programs involve many stakeholders including the Ministry of Environment (MOE), South Nation Conservation and Lake Simcoe Region Conservation Authority, wastewater/stormwater dischargers, and other stakeholders such as those implementing the water quality offset projects.

Excess phosphorus loading is a problem in many of Ontario's watercourses. As a tool to control non-point source pollution, MOE is encouraging an economic incentive program called Total Phosphorus Management (TPM). TPM allows wastewater or stormwater dischargers to reduce overall phosphorus loadings by giving grants for other water quality improvement measures such as upgrades of stormwater control facilities and agricultural best management practices.

It allows wastewater dischargers to offset phosphorus from their treatment plants to a watercourse by investing in non-point source (NPS) phosphorus control projects.

TPM has been successfully applied by MOE Eastern Region on a pilot basis within the South Nation River for the past 4 years. As a result of the South Nation pilot, the MOE, Lake Simcoe Region Conservation Authority and other stakeholders have been working together since 2000 to develop a framework for applying the TPM approach in the Lake Simcoe watershed.

Under a TPM program, the discharger has the option of either controlling phosphorus at their sewage plant or stormwater treatment facility through improved phosphorus removal or paying to offset phosphorus from non-point or point sources.

There are many potential advantages to TPM are as follows:

- lower costs of discharge treatment
- net water quality and environmental benefit
- funding to other water quality improvement projects

There are a number of requirements and responsibilities which accompany the successful administration of a TPM program.

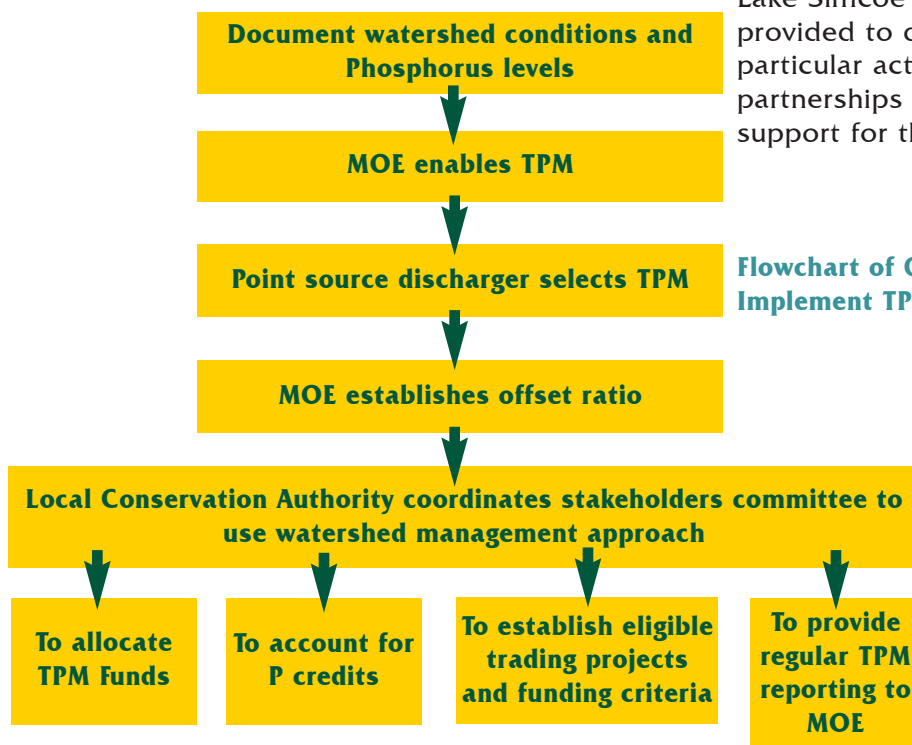
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3.2 PARTNERSHIP REQUIREMENTS FOR ESTABLISHING A TOTAL PHOSPHORUS MANAGEMENT PROGRAM

Experience in the Lake Simcoe Region and South Nation River Watersheds demonstrate that there are a number of steps that should be followed when implementing a TPM program. Depending on whether TPM provides for a point to point or point to non-point source water quality trade, each step described below has varying degrees of applicability. These steps are not in order of importance. They are all considered prerequisites to implementing TPM. In order to provide a generic framework for successful administration of a TPM approach the following points should be considered:

1. Document watershed conditions and phosphorus levels.
2. Enable TPM as an option for point source discharges.
3. Point source discharger selects TPM as treatment option.
4. Require watershed management approach.
5. Establish offset ratios.
6. Develop procedures to allocate TPM funds.
7. Establish eligible trading projects and funding criteria.
8. Account for phosphorus credits.
9. Provide regular TPM reporting.

It is important to note that TPM requires many stakeholders to work together on a watershed basis to coordinate a successful program. The following discussion deals with each of these points more fully. References to the South Nation and Lake Simcoe TPM programs are also provided to demonstrate the particular action, as well as the partnerships involved through local support for the programs.



Flowchart of Generic Framework to Implement TPM

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3.2.1 Document Watershed Conditions and Phosphorus Levels

There must be scientific research to document the extent and sources of water quality contamination within the watershed. This includes the watershed characteristics (e.g. area, soils, hydrology), fish and wildlife habitat, land use patterns, water quality conditions and allocation of water quality loadings from point and non-point sources. Studies are necessary to provide the environmental basis for implementing a TPM program.

South Nation

The South Nation River watershed drains 3900 square kilometres in Eastern Ontario into the Ottawa River. It is comprised of approximately 60% agricultural land that focuses predominantly on dairy production. The River is 180 kilometres long with an average flow of 200 cubic meters per second during spring flood to a low of 7 cubic meters per second in the summer period. The watershed includes 15 municipalities, 17 lagoons (14 municipal, 1 landfill, 2 industrial) and a population of 100,000. Some villages within the watershed have experienced growth in both residential and commercial developments due to their proximity to Ottawa and the construction and upgrading of highways (e.g. Highway 417). Some villages' water supplies have been contaminated water supplies from faulty septic systems. These factors have resulted in new or expanding sewage treatment plants within the South Nation River watershed. Annual mean phosphorus concentrations for the South Nation

River outlet are approximately 5 times greater than Provincial Water Quality Objectives. The 1993 *Wastewater Assimilation Study*¹² on the South Nation River documented that phosphorus levels in the South Nation River were above Provincial Water Quality Objectives throughout the watershed. It was also found that over 90% of the pollutants came from non-point sources. In the South Nation watershed, non-point sources must be managed to realize water quality improvements.

The impact of non-point source pollution is well understood. Non-point source pollution is more difficult to identify and control than traditional point sources. Controlling non-point sources has increasingly become a focus in environmental regulations and policies. In many of Ontario's waterways non-point sources have a significant impact on water quality; water quality improvement will only occur if non-point source pollutants are controlled.

Lake Simcoe

Located 50 kilometres north of Toronto, Lake Simcoe is less than one hour drive from half the population in Ontario. The watershed has a total land and water surface area of 3580 square kilometres, of which the lake occupies about 20 percent or 722 square kilometres. Lake Simcoe is part of the Trent-Severn Waterway connecting Lake Ontario to Georgian Bay and is southern Ontario's largest body of water (excluding the Great Lakes).

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

The land portion of the watershed is approximately 2858 square kilometres and is drained by 35 tributary rivers, with five major tributaries accounting for over 60 percent of the total area. Most of these rivers originate along the southern boundary of the watershed in the prominent physiographic feature known as the Oak Ridges Moraine. These rivers then drain in a northerly direction before discharging to Lake Simcoe.

Lake Simcoe provides a source of drinking water for 5 communities with an average of 9,500 cubic meters being used each day. There are 14 water pollution control facilities within the watershed: seven that discharge their treated effluent directly into Lake Simcoe and seven that discharge to streams which eventually drain to the lake. Lake Simcoe has the distinction of being the most heavily fished lake in Ontario and generates more than \$200 million dollars per year for the local economy through associated recreational activities. Rapid urbanization is occurring and is projected throughout the south and western portion of the watershed.

Declining cold water fish population in Lake Simcoe during the early 1980's led to a *Lake Simcoe Environmental Management Study*³ which found annual loading of phosphorus at 104 tonnes per year, 50% of which was originating from non-point sources. This study determined that fish populations could be sustained in the lake if annual phosphorus loading was 75 tonnes/year. Thus in the Lake Simcoe watershed, a 25% reduction

in the current phosphorus loading while allowing no further net increase is required to restore the health of the Lake.

The total phosphorus loading entering Lake Simcoe in 1998 is displayed in Figure 1.0 and was estimated at 102 tonnes/year¹⁴. The largest loading contributor is atmospheric deposition, followed by tributary loadings, urban stormwater runoff, effluent from the 14 sewage treatment plants, and pump-off water from the marsh polders (e.g. Holland Marsh). A marsh polder is defined as describes a wetland which is dyked, then drained to be used as farmland. Urban loading sources are of significant concern due to the large amount of urban growth, which will occur in the watershed over the next twenty years. Urban stormwater runoff combined with the discharge from sewage treatment plants are the only two phosphorus loading sources projected to increase into the future.

Estimated Phosphorus Loadings to Lake Simcoe for 1998 (Tonnes/year)

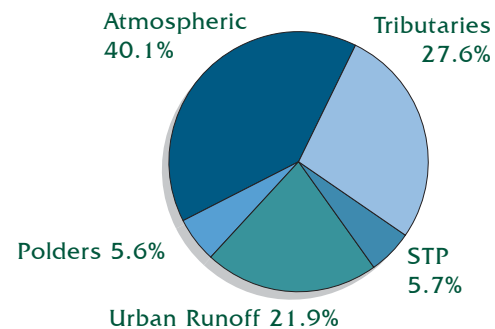


Figure 1: Estimated Phosphorus Loading to Lake Simcoe for 1998

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

In both the South Nation and the Lake Simcoe watersheds, scientific research documented watershed characteristics and escalating phosphorus levels in the watershed. The South Nation Study documented that Provincial Water Quality Objectives for phosphorus were exceeded, and the Lake Simcoe Study showed that phosphorus needed to be reduced in order to restore the health of the Lake. Studies such as these are necessary to provide the environmental basis for implementing a TPM program.

3.2.2 Enable TPM as an Option For Point Source Discharges

TPM cannot proceed unless the regional Ministry of Environment adopts the application of TPM as an eligible option for point source phosphorus management. To assist with TPM implementation, it is helpful to establish a stakeholder Committee to determine the roles and responsibilities for all parties involved.

The Ministry of Environment is responsible for water quality management in Ontario including the approval of sewage and stormwater facilities. All point source discharges must conform to established provincial regulatory standards for all parameters including phosphorus.

Provincial Water Management Policy 2 applies to areas where water quality does not meet the water quality objectives. The policy states:

“Water quality which presently does not meet Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives.”

In 1998, the MOE’s Eastern Region decided that a broader interpretation of “all practical measures shall be taken” would include phosphorus offsetting or credit trading instead of the previous interpretation which only considered enhanced treatment. Through the broader interpretation of this policy, municipal and industrial dischargers were provided a less costly alternative for phosphorus control. The “MOE – Eastern Region Position Total Phosphorus Management in the South Nation River Watershed ” is included in Appendix A.

Wastewater treatment plants are still required to have a high level of treatment and control their biochemical oxygen demand (BOD), suspended solids, ammonia and phosphorus in order to ensure local water quality was protected. The normal level of treatment required for municipal and private sewage works discharging to surface waters is secondary treatment or equivalent. Higher levels of treatment than secondary, up to and including no discharge to surface waters, may be imposed and justified by site specific assessments of the receiving water. For example, different standards would apply for a trout stream versus a large river.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

The discharger must then implement treatment technology to meet MOE requirements. However, there is still a new loading to the receiver watercourse after meeting treatment standards. That is, if the treatment standard is 1.0 mg/l phosphorus limit and there is a volume of discharge being released, this constitutes a new loading.

The MOE has stated that permanent types of non-point source projects would qualify for phosphorus offsetting and these are explained further in Section 3.2.7.

TPM is regulated by the MOE by granting a Certificate of Approval for the sewage works on condition that TPM is implemented. The Certificate of Approval is the regulatory permit for the discharger to operate the wastewater treatment facility and it outlines the conditions of operations. The Certificate of Approval would identify that a deviation to Policy 2 requirements would be achieved through implementation of TPM as well as the target loadings removal required.

Another method of regulating TPM in the South Nation is that the MOE requires:

- a) a resolution of Council committing specific funds towards TPM (in cases where the proponent is a municipality)
- b) a copy of the signed agreement between the discharger and the South Nation Clean Water Program for delivery (in all cases, municipal, industrial or landfill)

An important part of this regulatory process is that the MOE has allowed local stakeholder committees to establish TPM criteria based on watershed conditions. For both the Lake Simcoe and South Nation watersheds, the local Conservation Authority was instrumental in coordinating these committees.

In the South Nation watershed, in order to identify and resolve concerns from all stakeholder groups, a Total Phosphorus Working Group made up of MOE, Ontario Ministry of Agriculture and Food (OMAF), SNC, farm organizations, municipal and industrial representatives was established. After 2 years of discussions, a set of guidelines which govern the program were developed and called "South Nation River Watershed Water Management Strategy: Statement of Roles and responsibilities". This document is included in Appendix B and describes the roles and responsibilities for each of the partners e.g. The MOE approves and regulates sewage treatment plants, SNC provides administration for Clean Water Program, Clean Water Committee approves grants, farmer/landowner completes and maintains project etc. Another important point addressed in the document is that the discharger has long-term responsibility for achieving phosphorus reduction targets and the landowner does not assume responsibility by participating in a TPM program.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

The stakeholder committee also has an important role in the on-going review and evaluation of the TPM program. The agreement of the terms and conditions for the TPM program on a watershed basis is critical to achieve “buy in” for a successful TPM program.

3.2.3 Point Source Discharger Selects TPM as Treatment Option

TPM is a voluntary option for stormwater or wastewater treatment phosphorus management. To assess whether it meets provincial approval requires, TPM is reviewed through an Environment Assessment Process. The Province provides the final approval for the option for phosphorus treatment, an option recommended by the Environmental Study Report.

New point source discharges must complete Environmental Assessments to be approved by the MOE before proceeding. Environmental Assessments generally include the following components:

- assessment of current and future conditions
- review of treatment options
- public consultation
- recommendation of preferred treatment option based on economic, environmental and social analysis.

In the South Nation and Lake Simcoe watersheds, TPM is one of several options that can be chosen to control point source discharges of phosphorus management. Other options for phosphorus control include different technological

methods at the site. Regardless of the methods chosen, the applicant must show under the Environmental Assessment policy that the level of phosphorus removal agreed to by the MOE policy is, in fact, met.

The Ministry of the Environment’s specific requirements for the Lake Simcoe TPM program are still under negotiation but the general conditions of approval are similar to the South Nation’s program. The TPM option is voluntary throughout the Lake Simcoe watershed and potential traders have the option of participating or proceeding with their projects under current legislation. Each project is required to complete a Municipal Class B Environmental Assessment for Sewage and Water Undertakings and obtain all necessary permits from the various approval agencies (Department of Fisheries and Oceans, Ministries of the Environment and Natural Resources, Conservation Authority). The MOE has imposed caps on the phosphorus loading allowed from municipal wastewater facilities discharging in the watershed.

The process in the South Nation River watershed is different than in Lake Simcoe. In this watershed, when a municipality expands an existing wastewater facility, or builds a new one, no additional phosphorus can be discharged from it. The Environmental Study Report documents that this will occur.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

If a TPM program is the preferred alternative recommended in the Environmental Assessment Report, the wastewater discharger must prove to the MOE that they have the expertise to implement a non-point source control program. They must also prove that they have a delivery mechanism to link point source phosphorus discharges to non-point source water quality improvement projects.

South Nation Conservation has an existing “Clean Water Program” with a proven track record offering water quality grants in the watershed. As a result, the discharger can approach SNC to discuss how a TPM program would work. In all cases an agreement with SNC’s Clean Water Program was presented to the regulators as the preferred TPM delivery strategy. This provided the necessary watershed approach, expertise and cost effective delivery. Each wastewater discharger would enter into an agreement with SNC, with MOE approval, for the terms for the TPM delivery including number of years to implement, payment terms, phosphorus reduction requirements and administrative requirements. The MOE establishes the offset ratio and approves the phosphorus loadings target to be offset; this information is applied to the delivery of the TPM program.

3.2.4 Require Watershed Management Approach

TPM programs must be run from the watershed management perspective to achieve environmental results. Phosphorus offsetting must occur within the same watershed. An administrative framework is required to achieve the offset. Watershed management can be coordinated by the local Conservation Authority with the involvement of a stakeholder committee. Phosphorus is a non-toxic pollutant. It is an essential nutrient and in excessive amounts it leads to eutrophication of a water system. Phosphorus accumulates along the entire length of a river from a variety of point and non-point sources. All sources must be controlled so that watershed loadings are reduced to acceptable levels. As a result, an offsetting of phosphorus loadings between point and non-point source pollution sources within the basin can realize net water quality benefit.

Before proceeding, the MOE must enable TPM as a treatment option for dischargers on a watershed basis. In the case of the South Nation TPM program, watershed implementation is accomplished through the South Nation Conservation and their respective multi-stakeholder committees. Decision-making to permit and then implement TPM requires a watershed management approach.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

The *Conservation Authorities Act, 1947*, gives the legislative authority for watershed implementation of a program. Conservation Authorities are organizations that meet the criteria of legislation, watershed jurisdiction, and accountability required for a TPM program. The Conservation Authority is managed by the local municipalities who are often the owners of stormwater or wastewater discharge operations. This familiarity gives a TPM program credibility. With a collective of municipalities sharing a watershed, water quality problems can be effectively administered by the Conservation Authorities.

TPM requires many stakeholders to work together on a watershed basis to coordinate a successful program. Depending on the offset program being point to point or point to non-point, the stakeholders will vary. Typical partners are the MOE, local conservation authority, stormwater or wastewater dischargers, receivers of offset credits (e.g. agriculture, municipal stormwater) and environmental representatives (also see Section 3.2.2). Even the decision on whether point or non-point source projects should be used for offsetting requires knowledge of watershed conditions and is best determined with stakeholder committee input.

In the Lake Simcoe watershed, it is proposed that TPM decisions be made by a Review Committee comprised of representatives from the Ministry of the Environment, upper and lower tier watershed municipalities and the development industry.

Due to the urban focus of the Lake Simcoe trading program only urban to urban trades are being considered at this time. The proposal to exclude trades involving agricultural best management practices was mutually agreed upon with the agricultural community during a series of consultative meetings held throughout the watershed by the Lake Simcoe Region Conservation Authority.

It is important to note that the decision by the agricultural community not to participate in the trading program was not due to any underlying concerns with the concept of phosphorus trading. Rather, it was in response to an already existing program entitled the Lake Simcoe Water Quality Improvement Program which was being delivered by the Authority in partnership with the Ontario Federation of Agriculture and the Ministry of Agriculture and Food. This program provides both technical and financial assistance to farmers and rural landowners within the watershed willing to undertake best management practices on their properties to improve water quality.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

All participants agreed that opportunities to improve water quality from urban areas should be a priority given that rural measures were already being implemented, and that all sources of phosphorus loading to Lake Simcoe need to be addressed to achieve the LSEMS phosphorus reduction target.

In the South Nation watershed, the TPM program applies to a large number of diverse non-point source projects and the delivery of grants is coordinated through a multi-stakeholder SNC Clean Water Committee. TPM offsetting of point source grants to non-point source projects is facilitated through the SNC Clean Water Program administered by the SNC Clean Water Committee. In place since 1994, the Clean Water Committee is comprised of representatives from SNC, local municipalities, farm groups, the MOE, the OMAF, community representatives and industry. The Clean Water Committee reports to the South Nation Conservation Board of Directors, however, in the eight years of operation the SNC has not reversed a decision of the Clean Water Committee.

Conservation Authority's role in managing TPM is a direct result of an established track record in watershed management programs. One example is water quality improvement programs. Starting early in the 1990's, the Clean Up Rural Beaches program¹⁵ was funded by the Ministry of Environment and delivered by Conservation Authorities including the Lake Simcoe and the South Nation. Groups comprised of conservation authority board members, provincial government agencies, the MOE, the OMAF, farm organizations, municipalities and industry were formed to oversee the review and approval of funding for non-point source projects. Through this involvement, the water committees became familiar with building consensus to manage and allocate resources for projects. Clean water projects increased as a result of new funding programs becoming available. Time is an important factor to build a working relationship within clean water groups. This example shows Conservation Authorities' experience coordinating watershed programs in partnership with stakeholder committees.

3.2.5 Establish Offset Ratios

Prior to implementing a TPM program, the MOE must determine the offset ratio for the watershed offsetting program. This is a multiplier that reflects how much more phosphorus must be taken out from point or non-point sources of pollution versus what is contributed to watercourses by point source discharges.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

There is considerable background research on determining the most appropriate point to non-point source offset ratio. In the United States for example, 1:1 and 2:1 offset ratios are used in some jurisdictions. Obviously, the implementation of higher ratios results in greater net environmental improvement for the watershed and is desirable from both an environmental and public perspective.

The MOE has established the South Nation offset ratio at 4:1. That is, for every 1 kilogram of phosphorus that enters the watercourse from a point source discharge, 4 kilograms of phosphorus must be stopped from entering from non-point sources of pollution. The goal of TPM is to achieve a net environmental benefit as an actual reduction in the phosphorus load to the watershed. The MOE made a decision to use a 4 to 1 offset to provide adequate confidence that a net environmental benefit is achieved given actual conditions compared to predicted conditions (e.g. non-point source algorithms are estimations of loadings reduced and no in field water sampling is conducted).

In the South Nation watershed, the amount of phosphorus that a new or expanding wastewater treatment facility discharges is defined as the difference between the dischargers current maximum annual phosphorus load and the maximum annual phosphorus load that will result from the expansion of the sewage works. The maximum phosphorus load is derived by multiplying the phosphorus concentration limit by the annual hydraulic capacity of the sewage treatment facility.

These values are contained in the Certificates of Approval for the sewage works and the dischargers application/design.

The MOE directs the sewage works proponent, as part of their Policy 2 deviation request to provide and submit a plan to offset the increased phosphorus load to the South Nation watershed. As a result of the SNC's record in successfully administering the Clean Water Program, an agreement between the discharger and the SNC to administer TPM funds is accepted as the plan to offset the required phosphorus load. The SNC negotiates the TPM agreement directly with the discharger using the offset ratio and loadings figure approved by the MOE.

In the Lake Simcoe Region phosphorus removal ratios and costs continue to be developed. In this urban environment, capital costs ranging from \$1900 to \$4500/kg to remove phosphorus using traditional stormwater treatment facilities are common. As much as 50% of the non-point source phosphorus enters the watercourse as urban stormwater runoff. Phosphorus removal ratios in the 8:1 and 10:1 range are being considered for point source stormwater discharges to offset municipal stormwater retrofit projects.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

Two environmental conditions must be met before a trade can be considered.

the first condition is that the allowable discharge cannot in any way significantly impair the health of the local watercourse or reach to which it is being made (we would not allow a discharge which would exceed the assimilative capacity of a watercourse or would harm a local reach area even to achieve a reduction in the overall lake loading). Monitoring and reporting must be conducted to ensure that the proposed phosphorus reduction is being achieved.

In the Lake Simcoe watershed existing regulations imposed through the LSEMS by the Ministry of the Environment have required that municipalities continually upgrade their sewage treatment plants to maximize phosphorus abatement. Many sewage treatment plants have average phosphorus effluent concentrations that are below 0.1 mg/L. As a result, the cost associated with future upgrades for the purpose of phosphorus removal are extremely expensive and much higher than the cost quoted for the South Nation watershed. It is due to this high cost for further upgrades to sewage treatment plants that urban retrofits can be considered as cost effective alternatives for trading within the Lake Simcoe watershed.

The Lake Simcoe Region Conservation Authority is presently involved in the completion of stormwater management strategies for all of the towns and cities within the watershed to identify opportunities for the implementation of urban best management practices. The strategies involve identifying urban sewersheds including:

- stormwater runoff outfalls;
- a determination of the level of treatment (or lack of treatment) for each sewershed; and
- an assessment of opportunities to implement urban best management practices for water quality control.

Maps for the Town of Newmarket identifying controlled and uncontrolled sewer sheds have been completed. Upon identifying an opportunity for a retrofit a review of the potential phosphorus reduction is calculated along with a cost estimate for the preferred best management practices so that projects can be prioritized on a catchment, sub-watershed, and watershed basis. This information will provide the Conservation Authority as the administrator of the trading program with direction as to where generated revenue should be targeted for future trades to maximize the phosphorus loading reduction within the watershed.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

3.2.6 Develop Procedures to Allocate TPM Funds

After TPM approvals are complete, specific procedures must be in place to allocate TPM funds to point or non-point source projects. This would be most effectively administered by a stakeholder committee under the coordination of the Conservation Authority. The terms and conditions to link the discharge offset to the point or non-point source projects must be established and documented. The water quality trade may be direct with a specific project or indirect, such as through a non-point source water quality grant program, with no clear linkages to the landowner's water quality improvement project.

A stakeholder committee is required to coordinate the TPM funding allocation procedures. This may be the same group involved in establishing the overall TPM program or another committee more appropriate for the offsetting requirements. This committee would involve all relevant stakeholders such as government, Conservation Authority, dischargers and offset receivers. This committee should conduct an ongoing review and evaluation of program outcomes.

For the South Nation, the Clean Water Program has provided grants for water quality improvement projects since 1994. The Clean Water Committee administers the grant program and coordinated procedural considerations to add to TPM.

For Lake Simcoe, TPM is a new program for stormwater discharges and a new methodology was developed by the stakeholder committee coordinated by Lake Simcoe Region Conservation Authority.

The MOE was open to different delivery options. The SNC's record in administering the Clean Water Program provided the MOE with a high level of confidence that the Conservation Authority could effectively administer TPM funds on behalf of the wastewater discharger. The SNC Clean Water Program already had a proven non-point source water quality grant program and, as such, had a cost effective proven method to link point and non-point offset credits.

The procedures to approve non-point source projects for the SNC Clean Water Program are well documented in the "Clean Water Program Applicants Guide"¹⁶. The Program offers cost-share grants and technical assistance to landowners within the watershed to implement projects or adopt practices, which result in reductions of phosphorus and other pollutants to surface and ground water. With several years of public involvement and promotion of water issues, the SNC has established enough credibility, corporate responsibility and longevity within the community to become a phosphorus broker in the South Nation watershed.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

Decisions regarding approval of individual projects are made by the Clean Water Committee, which meets approximately 6 times per year. Priority is given to projects with the highest potential to improve water quality. The SNC Clean Water Program is also involved in educational initiatives and water quality monitoring.

The Clean Water Program has a high degree of landowner participation. One important feature enhancing participation by landowners is the use of local farmers to conduct field visits to discuss and review the applicants' project designs. SNC staff provide training and support for these field representatives. This has resulted in peer to peer project review which promotes the Clean Water Program and builds confidence in the community.

Today, the South Nation Clean Water Program is over subscribed by landowners seeking support for their non-point source water quality improvement projects.¹⁷ The Clean Water Committee oversees grant requests and makes decisions about resource allocations of the TPM program. Given the resources to implement projects and the power to make decisions, volunteer committees work effectively to allocate funding.

The South Nation Clean Water Committee uses a variety of program funding sources to help restore the health of the South Nation watershed. Current sources include: a municipal levy, a Parmalat Canada donation, TPM funding and Provincial and Federal funding.

The TPM component of the Clean Water Program is one source of a larger budget that is directed to the reduction of phosphorus and other pollutants to this watershed. Currently, TPM accounts for about 30% of the phosphorus reduction projects approved. Landowners receiving Clean Water Program funds do not know if their funding is from TPM or another source.

3.2.7 Establish Eligible Trading Projects and Funding Criteria

As part of TPM implementation, the eligible trading projects and funding criteria must be established. This can be accomplished by the stakeholder committee used to determine the procedures for TPM. Knowledge gained from watershed studies helps determine which projects are eligible for offsetting. The greatest environmental benefit may be gained by implementing point or non-point source project types. Conservation Authorities have the watershed management experience required to support decision making concerning the determination of eligible projects and funding level required to encourage participation.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

Non-point source contamination includes runoff from manure storage and barnyards, faulty septic systems, milkhouse wash water, livestock access to rivers, eroding shoreline and cropped fields, excess agricultural nutrients and urban stormwater runoff.

In South Nation's TPM program, the MOE required project types that were permanent in nature to ensure that the predicted annual phosphorus offset is achieved for the lifespan of the sewage treatment facility. Examples of permanent project types are manure storages, milkhouse washwater treatment, cattle fencing etc. The grant rates for these projects were generally a portion of capital cost with rates established by the Clean Water Committee. Financial assistance ranged from 50% to 75% depending on the project. Applicants who have completed an Environmental Farm Plan and had it deemed appropriate by a local peer review will receive a 10% bonus grant. All projects are evaluated by the Clean Water Committee before receiving funding.

The following chart provides details on some of the project types that are eligible under a TPM program as approved by the SNC Clean Water Committee.

Within the Lake Simcoe watershed the TPM program will fund only urban to urban trades (also see Section 3.2.4). Eligible projects are presently under review and include the construction of almost any urban best management practices approved by the Ministry of the Environment. The exceptions are rapid infiltration basins and trenches, and other smaller water quality devices (oil grit separators, catch-basins) if not associated with a larger stormwater management facility. Grant rates are also under review but current grants for stormwater quality retrofits are being provided based on a 50% cost sharing arrangement with the landowner (municipality) to a ceiling of \$100,000. Projects are being considered both at a watershed and subwatershed scale and selected based on their cost effectiveness for phosphorus removal. All projects must have regard for existing federal and provincial legislation. Therefore, each project is required to complete a Municipal Class B Environmental Assessment for Sewage and Water Undertakings and obtain all necessary permits from the various approval agencies (Department of Fisheries and Oceans, Ministries of the Environment and Natural Resources, Conservation Authority).

Project Type	Grant Rate	Grant Maximum
Milkhouse Wash Water Treatment	50%	\$5,000
Manure Storage	50%	\$10,000
Stormwater Control	50%	\$5,000
Livestock Restriction to Watercourses	75%	\$5,000
Septic System Repair	50%	\$1,000
Erosion Control Structures	50%	\$5,000
Buffer Strip Establishment	50%	\$5,000

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

3.2.8 Account for Phosphorus Credits

Phosphorus credits allocated through TPM offsetting must be accounted for. This can be accomplished through different methods such as algorithm calculations, computer modeling, site inspections and water quality monitoring. This accounting should be conducted on a watershed basis to demonstrate the net environmental benefit achieved.

In the South Nation program, accountability for phosphorus credits is accomplished by calculating phosphorus loadings from projects using algorithms, applying computer models, conducting field checks and ongoing water quality monitoring. South Nation Conservation uses phosphorus loading algorithms to calculate the amount of phosphorus kept out of a watercourse by various agricultural and rural best management practices. These algorithms were adopted from the Grand River Conservation Authority (GRCA) and are included in Appendix C. They are based on extensive research throughout the province and have been accepted as reasonable estimates of the phosphorus reduction from individual projects.

The SNC is currently coordinating a review of phosphorus loading algorithms to update and incorporate any new research that is available. There is a peer review group to oversee the project consisting of the MOE, the OMAF, the GRCA, Ottawa University, Virginia State University and consultants. This review will be finalized by December 2002.

As another “check”, SNC Program Representatives visit completed non-point source projects during the length of the program to ensure that the projects are maintained as approved in the project proposal.

Also to support phosphorus accounting, the SNC's Clean Water Program is working with many partners to apply the Agricultural Non-Point Source (AGNPS) computer model in the South Nation watershed. This model is used throughout the United States and was developed by the US Department of Agriculture. The model can be used as a management tool to identify areas of high contribution of nutrients and solids. These areas can then be targeted for the promotion of non-point source projects. The model will also assist the Clean Water Committee in approving the most cost effective phosphorus reduction best management practices.

The model is currently being tested to assess its potential to calculate phosphorus loading reductions on an individual project basis. Details about this computer model are provided in Appendix D.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

In-site water quality monitoring is important within the watershed at the beginning of a TPM program and on going while the program is carried out to document trends in phosphorus reduction. Sampling is done in partnership with the MOE through the Provincial Water Quality Monitoring Network. It is recognized that definitive water sampling results from TPM will be long term and difficult to document in the short term due to the climactic variability affecting phosphorus levels in the watershed throughout the year. Measurable gains in water quality resulting directly from TPM will also be difficult to document, since TPM deals mostly with expanding sewage treatment facilities and these point sources account for less than 6% of the total load to the South Nation watershed. Nevertheless, long-term analysis must be conducted and any trends documented.

In the Lake Simcoe watershed the proponent of the trade (municipality) will be responsible for providing an estimation on the effectiveness of the proposed best management practice. Computer modeling and analysis will be required to assess the effectiveness of stormwater management techniques proposed. This will be done as part of the Environmental Assessment process and the Lake Simcoe Region Conservation Authority will be responsible as the administrator of the progra. It is also responsible for peer reviewing the results and granting final approval.

3.2.9 Provide Regular TPM Reporting

As part of the discharger's Certificate of Approval for operations, reports must be submitted to the MOE periodically. The report would include TPM results. Some items which may be required include the following:

- water quality monitoring results at the point of discharge
- water quality upstream and downstream of the point of discharge
- watershed water quality results and trends
- TPM offset credits achieved with supporting information on types and numbers of projects implemented to achieve offset, calculation of loadings removed from implementation of projects using most appropriate methodology such as algorithms or computer models, follow-up inspection results of projects etc.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

In the South Nation watershed, the SNC has annual reporting requirements specified in the TPM agreement for credits achieved in the delivery of TPM offset funds. The wastewater discharger then submits the SNC TPM Report along with their Certificate of Approval operations reporting requirements to the MOE.

TPM reporting is an integral part of TPM accountability.

The TPM progress report summarizes TPM credits allocated to the wastewater discharger in that year to date as well as the project types. The Clean Water Program Annual Report is also supporting documentation. Each year, all Clean Water Program TPM eligible projects credits are totalled. Then the number of credits purchased by the wastewater discharger is allocated from the collective credits achieved subject to availability.

The allocation of funds within the Lake Simcoe watershed will be the responsibility of the Review Committee and will be administered by the Conservation Authority. Revenues and expenditures will be published in an audited report for the end of each calendar year. The reports will be published and available for the general public upon request and the reports will also be accessible on the LSEMS Web site. Reports will also be required to document the predicted phosphorus reduction resulting from each project and monitoring results as they become available for a period of one year.

Watershed Economic Incentives Through PHOSPHORUS TRADING and WATER QUALITY

4.0 TWO CASE STUDIES OF ECONOMIC INCENTIVE PROGRAMS USED TO IMPLEMENT SURFACE WATER PHOSPHORUS MANAGEMENT

4.1 INTRODUCTION

Section 4.0 describes TPM case studies in the South Nation and Lake Simcoe watersheds where economic incentive programs are or could be used to implement surface water phosphorus management. Section 3.0 described the necessary steps required to set up a TPM framework. These case studies demonstrate the implementation of this TPM framework “on the ground”.

The Lake Simcoe example describes a hypothetical urban to urban trade between a sewage treatment plant expansion and an upgrade to an existing stormwater control facility.

The South Nation River watershed example is the Village of Winchester. TPM was approved by the Ministry of Environment in 1999 for Winchester as part of their new expanded sewage works approval. In the trade, phosphorus reductions from rural non-point sources are exchanged for new urban or industrial wastewater discharges. TPM is implemented through the South Nation Conservation Clean Water Program administered by the Clean Water Committee.

4.2 LAKE SIMCOE REGION TOTAL PHOSPHORUS MANAGEMENT PROGRAM- HYPOTHETICAL EXAMPLE

4.2.1 Sewage Treatment Plant Expansion Trade

A local municipality has proposed an increase, its urban area to accommodate a growing population in accordance with its Official Plan. The local sewage treatment plant (STP) which is already operating at maximum efficiency must maintain the existing phosphorus load entering the local watercourse to satisfy the Ministry of the Environment Certificate of Approval. It is calculated that the proposed new development will contribute an additional phosphorus load of 20 kilograms per year (kg/yr) from the increase in STP effluent associated with the proposed development area. Therefore, to accommodate the proposed urban expansion, the municipality must eliminate the subsequent 20 kg/yr of additional phosphorus from entering the watercourse.

The Trade: Traditionally, the municipality would only have one option: to accommodate the proposed growth, to upgrade the existing STP to maintain the present day phosphorus load. However, with the advent of the Lake Simcoe Total Phosphorus Management Program the municipality now has the added opportunity to trade to mitigate the problem. To determine which option it should select, the municipality first undertakes an engineering study to identify the cost-benefit of upgrading the existing STP.

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The study concludes that maintaining the present day loading will require additional treatment capacity at a total capital cost of approximately \$500,000 or \$25,000 kg/yr.

Given the high cost of treatment, the municipality approaches the Lake Simcoe Region Conservation Authority to assess if a trade is feasible. The first step is to ascertain whether there are sufficient opportunities for urban stormwater retrofit trades within the subwatershed to ensure that the water quality of the local watercourse is not further degraded. Provided that the capacity exists, the trading option is evaluated using a trading ratio of 8:1 based on a unit cost phosphorus reduction of \$2,500/kg for stormwater retrofits.

This means that for every kilogram of phosphorus allowed to be discharged by the STP, eight kilograms must be reduced from urban runoff through stormwater control best management practices. The total cost to the municipality for the trade is as follows:

$$8 \text{ (trading ratio)} \times 20 \text{ (kgs of phosphorus to trade)} \times \$2,500 \text{ (cost per kg)} = \$400,000$$

The monies collected are used to install best management practices to control urban stormwater inputs. Under the trading scenario, the municipality saves approximately \$100,000 and reduces an additional 140 kg of phosphorus from entering the local watercourse and Lake Simcoe. Trading therefore maximizes the phosphorus load reduction while saving the municipal tax dollars.

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4.3 SOUTH NATION WATERSHED TOTAL PHOSPHORUS MANAGEMENT PROGRAM- VILLAGE OF WINCHESTER

The Village of Winchester in North Dundas Township was under a development freeze pending an increase in water supply and expansion of their wastewater treatment facilities. The new water supply was finalized and the Village then initiated expansion of their wastewater treatment facility and notified the Ministry of the Environment in 1999 (Annual Unit Area Loading provided by the MOE, the SWAMP, 2000).

The Village Council passed a resolution to conduct a Phosphorus Management and Water Quality (December 2002) Environmental Assessment for expanding the wastewater treatment facility. The Village contracted an engineering consultant to complete an Environmental Study Report (ESR) as part of the Environmental Assessment requirements. The ESR would ultimately recommend the preferred wastewater management options and would include the following items:

- assess current situation and future conditions
- determine options for treatment
- conduct public consultations
- recommend preferred options environmentally, economically and socially.

The Ministry of Environment advised the Village of Winchester that they must address Policy 2 requirements no new phosphorus discharges that in the South Nation River since phosphorus concentrations in the receiving River already exceed Provincial Water Quality Guidelines. They also advised that the Total Phosphorus Management program was an option to meet Policy 2 requirements and should be evaluated in the ESR.

The Village of Winchester contacted the SNC to discuss how a TPM program would work. The agreement, costs and procedures were reviewed. The TPM program would be delivered through the existing Clean Water Program as per the existing procedures developed and approved by the Clean Water Committee. The “South Nation River Watershed Water Management Strategy: Statement of Roles and Responsibilities” was the basis of TPM implementation in the South Nation watershed. The cost would be \$300 per kilogram of phosphorus to be removed through the Clean Water Program. This figure includes the cost of grants, delivery, promotion, and administration. The cost was calculated based on program experience. The total cost would be dependent on the amount of phosphorus to be removed as approved by MOE. The approved offset ratio and the amount of phosphorus load to be removed would be determined in the ESR and approved by the Ministry of Environment as part of the approval requirements.

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The Village of Winchester submitted the completed ESR to the Ministry of Environment. This included implementing a Total Phosphorus Management Program to address the Policy 2 requirements for the increased phosphorus loadings from the expanded wastewater discharges. The sewage works would be required to achieve a high level of treatment as per MOE standards for the South Nation River and not cause water quality degradation at the discharge point as determined by the river's assimilative capacity.

Winchester applied for a Certificate of Approval from the Ministry of Environment for expanding the wastewater treatment facility as per the ESR.

Winchester applied for Provincial Funding. Funding was approved for part of the sewage works with TPM as an eligible expense.

The Ministry of the Environment approved the calculation of the new phosphorus loadings from the expanded wastewater facility, the offset ratio required and the resulting TPM targets through the SNC Clean Water Program. The new phosphorus loading is 160 kg from the new treatment plant. The offset ratio is 4:1. Therefore the calculation for TPM removal target is as follows:

$$160 \text{ kg discharge} \times 4 \\ \text{offset ratio} = 640 \text{ kg}$$

640 kg phosphorus is to be removed from non-point source projects through the South Nation Clean Water Program.

SNC Board passed a resolution to enter into a TPM Agreement with the Village of Winchester. The SNC Clean Water Program TPM delivery cost

was calculated as follows:

$$640 \text{ kg (offset target)} \times \$300/\text{kg} \\ \text{(Clean Water Program delivery} \\ \text{cost for grants, monitoring and} \\ \text{administration)} = \$192,000.$$

This was negotiated with Winchester to be paid over 5 years to SNC.

As a result of MOE requirements, Winchester passed a resolution of Council committing \$192,000 to Total Phosphorus Management program funding to the SNC Clean Water Program. Winchester appointed a representative to the SNC Clean Water Committee. SNC and Village of Winchester finalized the TPM Agreement. A sample TPM Agreement is included in Appendix E.

The SNC Clean Water Program began TPM implementation after construction of the Winchester sewage works expansion was completed in 2001.

Through the Clean Water Program Committee and Clean Water Program, the TPM program phosphorus reduction credits were achieved through non-point source projects.

SNC reports phosphorus credits allocated through non-point source projects to Winchester in an Annual Report. Annual TPM reports will be completed until total monies are spent and the offset load is accounted for.

Winchester annually submits SNC TPM Annual Report to the MOE as part of the in Certificate of Approval reporting requirements.

The MOE reviews Winchester reports and approves compliance with Certificate of Approval requirements.

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5.0 CONCLUSION

Total Phosphorus Management (TPM) involves water quality trading for phosphorus credits on a watershed basis. It has been implemented in the South Nation River watershed through the lead of the Ministry of Environment and under development in the Lake Simcoe watershed as part of the Lake Simcoe Environment Management Strategy. It has been coordinated by Conservation Authorities in conjunction with stakeholder committees. Water quality trading is an emerging trend worldwide and must continue to be proactively developed in Ontario to remain competitive and achieve the significant environmental and economic benefits.

This report highlights the potential advantages of TPM as follows:

- net water quality and environmental benefit
- lower costs for wastewater or stormwater discharge treatment
- funding to other non-point or point source water quality improvement projects

TPM's success is through the involvement of many stakeholders including the Ministry of Environment, Conservation Authority, wastewater discharger, municipality and other affected provincial ministries and stakeholders (e.g. agriculture).

This report is based on the experience of the TPM programs in the South Nation and under development in the Lake Simcoe watersheds and provides important information to consider when establishing a new TPM program. Before proceeding, the MOE must enable TPM as a Treatment option for dischargers on a watershed basis. Decision-making to permit and then implement TPM requires a watershed management approach. Conservation Authorities and stakeholders must address local watershed considerations in the Program design.

TPM is a surface water quality trading program for phosphorus. Water quality trading opportunities also exist in Ontario for other parameters such as sediment and nitrogen. The information in this Report would also be applicable to other trading parameters.

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GLOSSARY

Biochemical Oxygen Demand: a measurement used to assess the rate at which water is deoxygenated. High BOD generally corresponds to waters containing high amounts of organic pollution.

Groundwater: water below the earth's surfaces that lies in the area of total saturation. Groundwater can exist in rock or granular material.

Non-Point Source: a source of pollutants from a wide geographic area, such as manure run-off, stream bank erosion, and stormwater run-off which often threatens the quality of ground and surface water sources of drinking water.

Nutrient: something that nourishes and promotes growth. It is possible to have too many nutrients in an ecosystem, which can result in an unhealthy imbalance or overgrowth of certain species.

Phosphorus: a non-toxic pollutant, that is an essential nutrient. In excessive amounts it leads to eutrophication of a water system. Phosphorus accumulates along the entire length of a river from a variety of point and non-point sources.

Point Source: a source of pollutants from a municipal treatment plant or an industrial facility, often by way of a pipe.

Riparian: relating to or located on the bank of a watercourse.

Subwatershed: a geographical area defining a single drainage zone within the watershed.

Watershed: a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.



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ACRONYMS

AGNPS MODEL: Agricultural Non-Point Source	OMAF: Ontario Ministry of Agriculture and Food
BMP: Best Management Practices	PWQMN: Provincial Water Quality Monitoring Network
BOD: Biochemical Oxygen Demand	PWQO: Provincial Water Quality Objective
CURB: Clean Up Rural Beaches	NPS: Non-Point Sources
CWC: Clean Water Committee	PPP: Polluter Pay Principle
EPA: United States Environmental Protection Agency	RAP: Remedial Action Plan
ESR: Environmental Study Report	SCS: Soil Conservation Service
GRCA: Grand River Conservation Authority	SNC: South Nation Conservation
LSEMS: Lake Simcoe Environmental Management Strategy	SNR: South Nation River
LSRCA: Lake Simcoe Region Conservation Authority	STP: Sewage Treatment Plant
MMAH: Ministry of Municipal Affairs and Housing	TMDL: Total Maximum Daily Load
MNR: Ministry of Natural Resources	TPM: Total Phosphorus Management
MOE: Ministry of the Environment	US: United States
	USDA: United States Department of Agriculture