

Oak Ridges Moraine Conservation Plan

WATERSHED PLANS

Technical Paper # 9

Ministry of the Environment

June 2005

DRAFT

Acknowledgements

This technical paper is one in a series of technical papers that provides guidance for implementing the water-related provisions of the Oak Ridges Moraine Conservation Plan. This technical paper was prepared by Scott Duff of the Ministry of the Environment. The technical paper includes contributions from Dr. Andrea Bradford and Stephen Maude of the Ministry of the Environment. Stephen Maude and Diane Blachford of the Ministry of the Environment coordinated the preparation of this series of technical papers.

TABLE OF CONTENTS

1	PURPOSE AND OVERVIEW	1
2	WATERSHED PLAN REQUIREMENTS OF THE OAK RIDGES MORaine CONSERVATION PLAN.....	1
3	RATIONALE FOR THE REQUIREMENTS	3
4	OUTPUTS OF THE WATERSHED PLAN PROCESS.....	5
5	IMPLEMENTING THE REQUIREMENTS	5
	1) Scoping.....	9
	2) Characterize the Watershed System.....	10
	3) Set Goals, Objectives and Working Targets	12
	4) Develop Management Alternatives.....	15
	5) Evaluate Management Alternatives	15
	6) Select a Preferred Management Alternative	16
	7) Finalize Targets.....	16
	8) Develop Implementation and Monitoring Plan.....	16
6	REQUIREMENTS FOR MAJOR DEVELOPMENT PRIOR TO COMPLETION OF A WATERSHED PLAN.....	20
7	REVIEWING AND EVALUATING WATERSHED PLANS	20
	APPENDIX A: SOURCES OF ADDITIONAL INFORMATION.....	22

LIST OF FIGURES

Figure 1:	Framework for the Water Provisions of the ORMCP.....	4
Figure 2:	Watershed Management Process and Watershed Planning Steps	8
Figure 3:	Subwatershed Boundaries.....	10
Figure 4:	Interrelationships between Components	11

LIST OF TABLES

Table 1:	Key Elements of Success in Watershed Management.....	6
Table 2:	Steps for formulating management objectives.....	13
Table 3:	Summary of the strategic directions which should govern the final number, form and content of management objectives	14
Table 4:	Optional Approaches to Defining Targets for the Protection or Restoration of Water Quality	15
Table 5:	Hierarchy of Types of Monitoring	18

Watershed Plans

1 PURPOSE AND OVERVIEW

This technical paper provides guidance to assist municipalities in developing watershed plans to implement the water provisions of the Oak Ridges Moraine Conservation Plan (ORMCP), Sections 24 to 29, 38, and 42 to 47. It promotes an ecosystem-based approach to integrated watershed management and the process of adaptive environmental management for the implementation of the ORMCP water provisions. Subsection 24(3)(a) of the ORMCP states that a watershed plan must include a *Water Budget* and a *Water Conservation Plan* as set out in Section 25. Separate guidance is available for water budgets and water conservation plans.

There is significant history and active practice of watershed management in southern Ontario. As a result, much guidance and experience is already available on many aspects of watershed management. It is not the intent of this technical paper to provide comprehensive guidance on all aspects of watershed management. Where appropriate, the reader will be directed to existing guidance and references.

2 WATERSHED PLAN REQUIREMENTS OF THE OAK RIDGES MORAINÉ CONSERVATION PLAN

The direction for preparing watershed plans stems from Part III of the ORMCP, “Protecting Ecological and Hydrological Integrity”. The ORMCP contains a number of requirements aimed at protecting hydrological integrity. However, the preparation of a watershed plan is core to all the water provisions of the ORMCP.

The following provisions from the ORMCP must be identified and implemented through the watershed plan process:

- 24(1)** *Every upper-tier and single-tier municipality shall, on or before April 22, 2003, begin preparing a watershed plan in accordance with subsection (3), for every watershed whose streams originate within the municipality’s area of jurisdiction.*
- 24(2)** *The objectives and requirements of each watershed plan shall be incorporated into the municipality’s official plan.*
- 24(3)** *A watershed plan shall include, as a minimum,*
 - (a) a water budget and conservation plan as set out in section 25;*
 - (b) land and water use and management strategies;*
 - (c) a framework for implementation, which may include more detailed implementation plans for smaller geographic areas, such as subwatershed plans, or for specific subject matter, such as environmental management plans;*
 - (d) an environmental monitoring plan;*

- (e) provisions requiring the use of environmental management practices and programs, such as programs to prevent pollution, reduce the use of pesticides and manage the use of road salt, and*
 - (f) criteria for evaluating the protection of water quality and quantity, hydrological features and hydrological functions.*
- 24(4)** *Major development is prohibited unless,*
- (a) the watershed plan for the relevant watershed, prepared in accordance with subsection (3), has been completed;*
 - (b) the major development conforms with the watershed plan; and*
 - (c) a water budget and conservation plan, prepared in accordance with section 25 and demonstrating that the water supply required for the major development is sustainable, has been completed.*
- 24(5)** *Subsection (4) applies to every application commenced on or after April 23, 2007.*
- 24(6)** *Subsection (8) applies to every application commenced before the date mentioned in subsection (5), except an application described in subsection (7).*
- 24(7)** *Clause (4) (c) applies to every application that is commenced on or after April 22, 2004 and relates to the part of The Regional Municipality of York that is served by the Yonge Street Aquifer.*

This technical paper deals with Section 24 (1-7) of the ORMCP explicitly, but also recognizes the integrating nature of watershed management within the broader framework of an ecosystem approach.

Sections 24 and 25 of the ORMCP require that every upper-tier and single-tier municipality in the plan area shall, on or before April 22, 2003, begin preparing a watershed plan for every watershed whose streams originate within the municipality's area of jurisdiction.

With the exception of the part of the Regional Municipality of York that is served by the Yonge Street Aquifer, watershed plans are to be completed by April 23, 2007 or major development will be prohibited in that area until such time as the applicable watershed plan has been completed. For that part of the Regional Municipality of York that is served by the Yonge Street Aquifer, a water budget and water conservation plan must be completed by April 22, 2004 or major development will be prohibited in that area until such time as the applicable watershed plan has been completed.

In drafting the ORMCP, the need to include provisions to address specific water issues, such as wellhead protection and stormwater management, was recognized. But the ORMCP takes a more comprehensive approach to water management, one that acknowledges the importance of water and the hydrological (water) cycle within an ecosystem approach.

3 RATIONALE FOR THE REQUIREMENTS

This section provides a brief overview of the rationale for using an integrated watershed management approach for implementing the water requirements of the ORMCP.

The Oak Ridges Moraine (ORM) is one of Ontario's most significant landforms. The Moraine has a unique concentration of environmental, geological, and hydrological features that makes its ecosystem vital to south-central Ontario, including: clean and abundant water resources, and healthy and diverse plant and animal habitat.

An ecosystem approach to land use planning requires that boundaries for land use planning be based on biophysical units as the context for examining the relationships between the natural environment and human activities. The watershed is an ecologically relevant boundary for considering hydrological features and functions and related attributes. Within a watershed, the hydrological cycle provides a pathway that integrates physical, chemical, and biological processes. It connects hydrological features – streams, wetlands, kettle lakes, and groundwater – to each other and to human activities and constructed features.

Watershed management is a process of managing human activities within an area defined by watershed boundaries. Watershed management makes sense for a number of reasons (Conservation Ontario, 2003. *Watershed Management in Ontario: Lessons Learned and Best Practices*):

- because of its unique properties, water integrates and catalyzes other biophysical processes in air, land, and water environments;
- watersheds define distinct biophysical units;
- watersheds are an easily-understood ecosystem unit;
- the health of rivers and streams is both influenced by and illustrative of the health of the lands through which they flow;
- water systems demonstrate the cumulative effects of environmental stresses;
- quality of life is directly linked to water quality in watersheds;
- most management actions can be integrated using watersheds, at some scale, as a common planning unit; and
- there is strong and growing public support for implementation at the local watershed level.

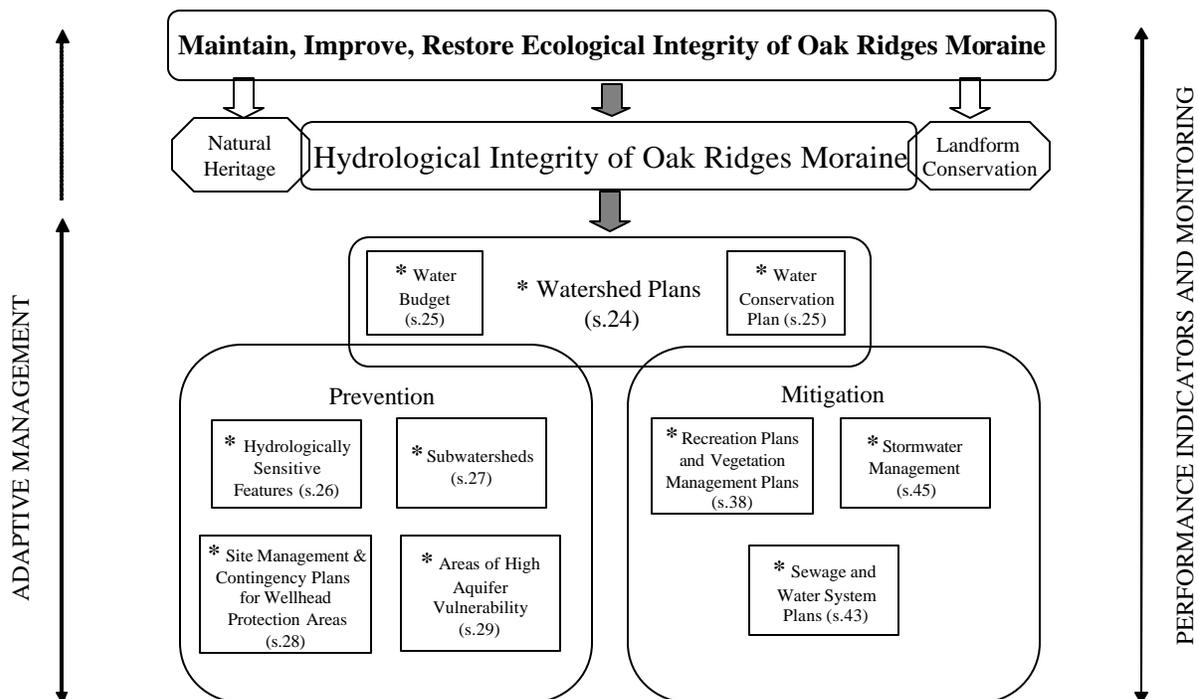
Watershed management generally includes the following components: the identification of issues and scoping, the development of watershed plans, implementation of those plans, monitoring and reporting of progress, and periodic review and evaluation.

A *watershed study* is the process of compiling the information needed to prepare a watershed plan. A study involves collecting available information, and filling in data gaps in order to understand the functions, conditions, and issues of the watershed. A *watershed plan* document is a key product of a watershed study.

The requirement for upper-tier and single-tier municipalities to prepare watershed plans is a cornerstone of the ORMCP water provisions. It provides a holistic framework for the other feature-focused and issue-based water provisions of the ORMCP (Figure 1). Specific strategies

and activities to maintain, improve, or restore ecological and hydrological integrity should be developed through the ORM watershed plans. By providing a broad understanding of ecosystem function and status, and recommending actions for appropriate land and water management in the watershed, the watershed plan can help incorporate relevant ecosystem considerations into land use planning decisions. Watershed plans incorporated into municipal official plans and zoning by-laws, will collectively contribute to maintaining, improving or restoring the hydrological, and hence ecological, integrity across the Oak Ridges Moraine.

Figure 1: Framework for the Water Provisions of the ORMCP



Framework for water provisions of the Oak Ridges Moraine Conservation Plan
 (* = Technical Paper; s. = ORMCP Section)

Within this framework the ORMCP takes a multi-faceted approach to hydrological integrity. The water provisions involve prevention (e.g. protection of hydrologically sensitive features, subwatershed limits to impervious surfaces, groundwater source protection), mitigation (e.g. recreation and vegetation management plans, stormwater management, sewage and water system plans), and adaptive management.

The preventative provisions, found in Part III of the ORMCP, will be implemented primarily at regional or watershed and subwatershed scales. The mitigative provisions apply primarily to activities at the major development site scale; they are contained in Part IV of the ORMCP.

While focused on the site-scale, ideally the mitigative provisions should also be implemented within the larger context of a watershed plan.

4 OUTPUTS OF THE WATERSHED PLAN PROCESS

The watershed plan must meet the requirements of the ORMCP, including:

- A Water Budget that meets the intent of the ORMCP, as per the Technical Papers;
- A Water Conservation Plan that meets the intent of the ORMCP, as per the Technical Papers;
- Environmental management plans and strategies for land and water use which reduce watershed or subwatershed threats to water quality and quantity;
- Plans to meet impervious surface targets identified in the ORMCP;
- Plans to meet self-sustaining vegetation targets identified in the ORMCP;
- A monitoring plan prepared and implemented that includes performance indicators that effectively track changes in water quality and quantity, including the protection of hydrological features and functions; and
- An implementation plan that ensures effective actions and strategies are undertaken, including incorporating recommendations of the watershed plans into both upper-tier and lower-tier municipal official plans and zoning by-laws.

5 IMPLEMENTING THE REQUIREMENTS

Table 1 shows the key elements of success in watershed management experienced by various watershed management projects in Ontario.

Table 1: Key Elements of Success in Watershed Management

ASPECTS	FACTORS FOR SUCCESS
Watershed /Subwatershed Planning	<ul style="list-style-type: none"> Tailor planning process to particular watershed Develop clear Terms of Reference that define process, roles and responsibilities Build understanding and support of Steering Committee Collect baseline data up front Effectively characterize the system by integrating information from each discipline Use GIS to communicate data, information and recommendations Set clear, understandable goals, objectives and targets Consider a range of alternatives Have expertise and decision support tools for evaluating alternatives
Implementing Watershed Plans	<ul style="list-style-type: none"> Identify clear, discrete actions and responsibilities Ensure clear accountability of deliverables Ensure "buy in" from key partners from the beginning Gain support of municipal politicians and staff Include actions at different scales (i.e., watershed, subwatershed, site and individual actions) Set "do-able" short term milestones as well as longer-term targets
Monitoring and Reporting	<ul style="list-style-type: none"> Celebrate success Report on a regular basis Involve the public in developing monitoring plans, monitoring and reporting Link monitoring to watershed goals, objectives and targets.
Periodic Review of Plans	<ul style="list-style-type: none"> Update at 10 year intervals to reflect changes in environmental conditions, stressors, and public preferences
Partnership Approaches	<ul style="list-style-type: none"> Involve key partners from the beginning of the process in Steering Committee and others (i.e., Technical Committees) Seek strong leadership at the political and staff level from key partners Forge strong links to other programs and processes to maximize the use of information Use consensus-based approaches to develop a shared vision Adopt a philosophy of collaboration in planning and implementation
Public Involvement	<ul style="list-style-type: none"> Involve the public in determining the study objectives, goals and selection of the preferred plan Be inclusive, open and unbiased Aim to create "local ambassadors" – public participants in the process who can educate, motivate and serve as watchdogs in their own neighbourhoods Find a strong, enthusiastic and respected citizen to chair the project Steering Committee
Communication	<ul style="list-style-type: none"> Use effective visual tools such as GIS mapping and photos Develop reports that are engaging, easy to read and appealing Consider the needs of users (e.g., make Implementation Plans stand-alone documents) Celebrate successes
Institutional Aspects	<ul style="list-style-type: none"> Have strong coordination at the local level Have watershed managers develop watershed/subwatershed plans Set an ambitious schedule and keep to it Find dedicated staff to develop the watershed/subwatershed plan

From: Conservation Ontario, 2003. "Watershed Management in Ontario: Lessons Learned and Best Practices", page 44.

Effective partnership approaches have been central to the success of watershed planning and management in Ontario. This means the involvement of key stakeholders, such as municipalities, provincial ministries and community representatives, in a focused and targeted manner from the earliest stages. Effective partnership approaches lead to successful completion of watershed plans, encourage buy-in for implementation, and create a climate for effective monitoring and reporting (Conservation Ontario, 2003, *Watershed Management in Ontario: Lessons Learned and Best Practices*).

As part of the watershed planning process, municipalities may wish to address issues beyond those required by the ORMCP. Without limiting the range of issues that municipalities may wish to consider in preparing watershed plans, the following section outlines the requirements to meet the intent of the ORMCP. Municipalities may wish to complete watershed plans at different levels of detail in order to fulfill the goals of the ORMCP requirements. Issues considered that are not part of the ORMCP requirements would not need to be part of conformity requirements associated with the completion of the watershed plans.

In addressing the requirements, municipalities have two options:

Option 1: Develop watershed plans for those watersheds located wholly or partially within the ORMCP area that specifically address the requirements of the ORMCP.

Option 2: Incorporate the requirements of the ORMCP into a larger watershed planning exercise developed for a broader range of management objectives than just conformity with the ORMCP.

Municipalities may wish to review existing watershed plans prepared by municipalities or conservation authorities to determine the extent to which these plans fulfill the requirements of the ORMCP. Any gaps or further analyses required could be identified and addressed at that time.

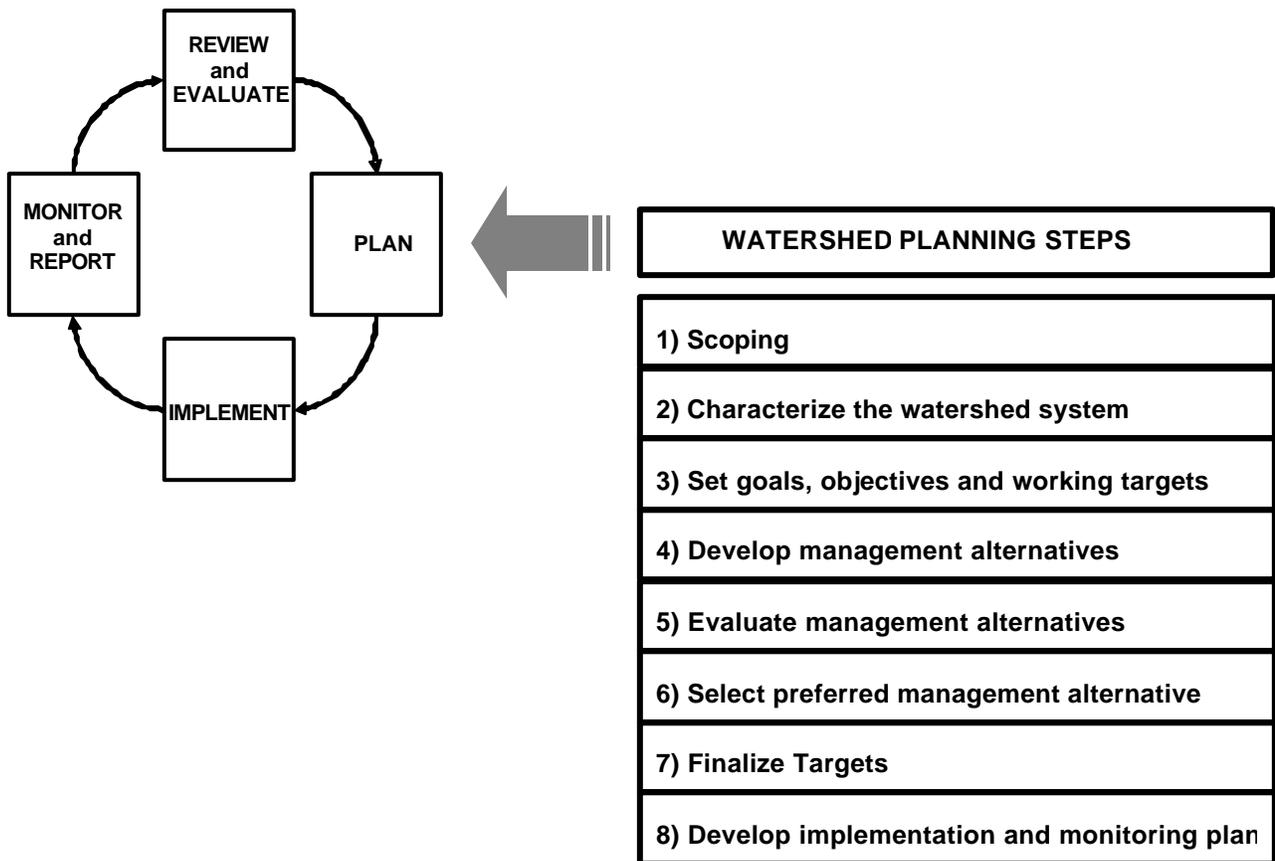
In consultation with stakeholders, a municipality may wish to determine priority watersheds within the municipality, in recognition of the fact that it may not be possible to study all watersheds at the same time. Priorities may be based upon an assessment of pressures and stresses, or the amount of available information

Figure 2 shows the watershed management process – plan, implement, monitor and report, review and evaluate – and the recommended steps to follow in preparing a watershed plan. It is recommended that municipalities follow the basic process and steps illustrated in Figure 2 when formulating ORM watershed plans. Individual component studies will need to scope their process to fit the context of their watershed and management issues within the context of the ORM and the ORMCP.

The remainder of this section describes each of the watershed planning steps, with a focus on fulfilling the watershed plan requirements of the ORMCP.

Figure 2: Watershed Management Process and Watershed Planning Steps

Adapted from: “Watershed Management in Ontario: Lessons Learned and Best Practices”.
 Conservation Ontario, 2003



1) Scoping

Watershed partners and stakeholders will need to work cooperatively to ensure that the watershed plans meet the intent of the ORMCP. Municipalities may choose to prepare a workplan, as a guide to the planning process, to share with all partners. Municipalities should be aware of the requirements of new and pending legislation, regulations and plans as they may affect or assist in the development of watershed plans. The province will endeavor to ensure that the municipalities have access to timely information, training and advice regarding new policies that affect them.

Data and Information

Significant amounts of data and information from provincial ministries, federal departments, conservation authorities, municipalities, universities and colleges, and non-governmental organizations are available to support preparation of watershed plans. To assist in preparing watershed plans, and in implementing other components of the ORMCP, these data and information need to be accessible to those that need them.

Through Land Information Ontario (LIO)¹, the Province is establishing an Oak Ridges Moraine data warehouse of available information that will be useful to support watershed planning. These data are accessible to members of the Ontario Geospatial Data Exchange (OGDE)². Additionally, the Province and many partners are documenting their data assets in the Ontario Land Information Directory (OLID)³ – a freely-available tool to store metadata and allow internet searching.

The preparation and maintenance of watershed information in electronic, digital format is strongly encouraged. Existing data on the ORM, such as the Conservation Authorities Moraine Coalition Hydraulic Database, assembled for the York-Peel-Durham groundwater group and the Oak Ridges Moraine Coalition, should be used in the preparation of the watershed plan.

The scale standard for preparing watershed plans is 1:10,000 or larger. The analysis of geospatial related data should be at a level of detail appropriate to the scale. Where less accurate data are used this should be clearly documented and the limitations posed by these data explained. All assumptions related to data reliability, interpretability and up-dating should be similarly documented.

Defining the Study Area

The Moraine divides the watersheds draining south into western Lake Ontario from those draining north into Georgian Bay, Lake Simcoe, and the Trent River system.

Figure 3 shows municipal administrative boundaries in the context of watershed boundaries and

¹ <http://www.lio.mnr.gov.on.ca>

² <http://www.lio.mnr.gov.on.ca/ogdedescription.cfm>

³ <http://www.lio.mnr.gov.on.ca/oliddisclaimer.cfm>

the stream network on the Moraine as defined by the Province. Municipalities should use this figure to assist in delineating study areas (i.e. watershed areas) for preparing watershed plans. Digital files of these figures are available from the Province.

Figure 3: Subwatershed Boundaries

See associated PDF file.

Many watersheds defined for streams originating on the ORM are not located entirely within the ORM. The subwatershed boundaries presented in Figure 3 are suggested as the minimum study area units for preparing a watershed plan. Because aquifers situated and recharged beneath the ORM often discharge off the Moraine, it is strongly recommended that analyses consider entire watersheds. Watershed plans are to be prepared on a watershed basis, but the ORMCP only requires that the results be applied in the ORM portion of the watershed.

Municipalities are expected to work cooperatively with each other in areas where watershed boundaries overlap two or more municipalities. The *Watershed Action Guide* (see Appendix A) provides excellent guidance on developing effective and cooperative teams for watershed management.

Conservation Authorities

Conservation authorities (CAs) are municipal and provincial partnerships formed on a watershed basis for conservation, restoration, development and management of natural resources, flood prevention and environmental protection. CAs are experienced in water and natural resource management across municipal boundaries, and provide watershed related technical resources and expertise. Nine CAs across the ORM have united as the Conservation Authorities Moraine Coalition to advocate for and protect the ORM. The Coalition was formed in response to the need for a comprehensive policy, planning and management approach geared to sustaining the health of the entire Moraine. The Coalition will be working closely with its municipalities as they work to develop a clear and consistent approach to planning across the Moraine.

2) Characterize the Watershed System

The purpose of this step in preparing the watershed plan is to identify, analyze and evaluate watershed-specific constraints and opportunities that stem from the ORMCP. This will require the watershed study team to assemble existing data and/or collect new data, perform spatial and temporal trend analysis, evaluate the data and, where appropriate, use models to characterize the various components. The various components include:

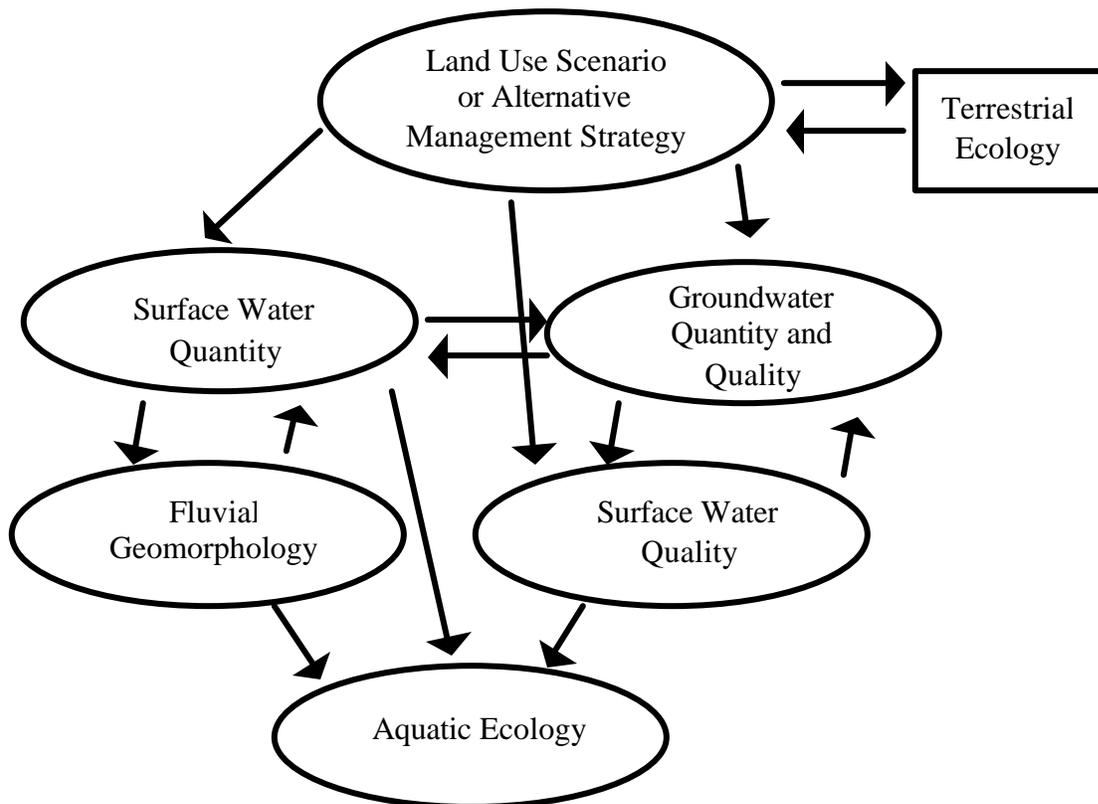
- aquatic ecology;
- terrestrial ecology;
- fluvial geomorphology;
- water quality;
- hydrology;

- hydrogeology;
- water budget;
- landform;
- soil types/geologic units;
- land use;
- impervious cover;
- socio-economic/recreational; and
- water resources issues and conflicts.

Wherever possible and appropriate, Geographical Information System (GIS) mapping should be used.

The functional linkages between the components should also be characterized. Although the watershed may be reduced to its constituent components for scientific study, the linkages must also be studied, and the system ultimately re-aggregated. Therefore the analysis should recognize the interrelationships between the components, as illustrated conceptually in Figure 4.

Figure 4: Interrelationships between Components



Adapted from: Toronto Region Conservation Authority Model

3) Set Goals, Objectives and Working Targets

Based on the scoping and watershed characterization exercise, the provisions of the ORMCP and the land use planning policies of the municipality, preliminary goals, objectives and working targets should be identified.

Goals are the qualitative descriptions of desired conditions. They are derived from the ORMCP and the watershed planning process, and provide direction for planning and management within the watershed. However, watershed managers require an operational definition of the goals – objectives of increasing focus, rigour, and achievability are developed to more specifically define the conditions required to meet the goals.

Section 24 of the ORMCP requires that the objectives and requirements of each watershed plan be incorporated into the municipality's official plan. The Section 24 requirement is important because management must begin with a clear image of the end in mind. Management objectives are used to:

- identify which aquatic effects of a proposed human activity are of importance;
- provide a preferred context for assessing the significance of impacts, managing the cause to prevent or mitigate the unwanted effects predicted; and
- identify restoration targets.

Management objectives also assign responsibility for preventing unwanted ecological change on people, groups or agencies that otherwise may unknowingly cause it. Table 2 outlines suggested steps involved in formulating management objectives. References offering additional guidance on developing and evaluating watershed goals and objectives are found in Appendix A.

Table 2: Steps for formulating management objectives

STEP 1 *Identify the boundaries of the ecosystem (e.g. a watershed).*

STEP 2

(a) Form the initial collaborative team. Determine the individuals, groups and agencies, whose management decisions or actions have the potential to most greatly affect the condition of the ecosystem and who wish to collaborate management.

(b) Collaboration requires negotiation: agree on a process for negotiating agreement among collaborators.

STEP 3 *Assess the past and present condition of the ecosystem.*

STEP 4

(a) Define causality: assess how human activities have likely changed the condition of the ecosystem.

(b) Determine if the initial collaborative team is sufficient to manage human activities given the apparent values and the type and direction of historical changes in the condition of the ecosystem. Identify and screen new candidates.

STEP 5 *Determine the desired condition of the ecosystem. Use a facilitated public forum to further refine the assessment by discussing interests and values, to identify a vision statement for each value, and to help identify valued ecosystem components.*

STEP 6 *Form a final collaborative team of implementers.*

STEP 7 *Use all previous information to formulate an initial set of objective statements. Organize them into ecological groupings so dependencies are made obvious.*

STEP 8 *Organize objectives into the three categories (i.e. maintenance, rehabilitation, and enhancement). Evaluate each objective, and ecologically co-dependent objectives, against the strategic directions, ideals and assessment criteria contained in Table 3. Objectives are complete and the process is finished if these are satisfied and when there is no possibility of misinterpretation – exit the steps.*

STEP 9 *Refine and tailor objective statements which do not satisfy step 8. Determine data or knowledge needed to refine objectives which do not satisfy the criteria and principles contained in Table 3. Prioritize these needs and decide what must be collected. Collect it.*

STEP 10 *Return to STEP 8.*

From: Gordon, Mark. 1998. "Formulating Objectives for Management on an Ecosystem Scale", page 7.

Table 3: Summary of the strategic directions which should govern the final number, form and content of management objectives

<p>UNDERPINNING MANAGEMENT PERSPECTIVE</p> <p>An ecosystem approach to management should be used to formulate management objectives, including:</p> <ol style="list-style-type: none"> (1) define the ecosystem boundaries (2) establish values first; then ecosystem realities (3) ensure that ecological knowledge and understanding exists and is used <ul style="list-style-type: none"> - "System thinking" is used to understand an ecosystem and how it works. - Causality is sufficiently understood - Perceptual and cognitive biases are recognised (4) transdisciplinary integration of knowledge and understanding occurs
<p>IDEALS</p> <ul style="list-style-type: none"> • Management ideals should be: <ol style="list-style-type: none"> (1) effective (2) efficient (3) fair • Human activities are managed to realize management objectives
<p>STRATEGIC DIRECTIONS OF MANAGEMENT</p> <ol style="list-style-type: none"> (1) maintenance and protection of ecosystem structures and functional processes thereby preventing unwanted ecological changes (2) rehabilitation of ecosystem structures and functional processes (3) enhancement of ecosystem structures and functional processes
<p>ASSESSMENT CRITERIA</p> <p><i>Management objectives</i> should be:</p> <ol style="list-style-type: none"> (1) clearly worded (2) achievable (3) verifiable (4) ecologically complete (5) accountable <p><i>Adapted from:</i> Gordon, Mark. 1998. "Formulating Objectives for Management on an Ecosystem Scale".</p>

Watershed goals and objectives set the stage for the development of specific indicators, measures, and targets. Targets are specific, quantitative benchmarks for a measure which may vary in time and space. For the Oak Ridges Moraine, targets could be developed for stream ecosystems, kettle lake ecosystems, wetland ecosystems, and aquifers. As an example, Table 4 gives optional approaches for setting water quality targets.

Table 4: Optional Approaches to Defining Targets for the Protection or Restoration of Water Quality

- 1) Set targets based on (tiered) water quality standards**
 - Provincial Water Quality Objectives (e.g. for total phosphorus, dissolved oxygen)
- 2) Set targets based on defined uses**
 - recreation (e.g. frequency of algal blooms)
 - fish habitat (e.g. temperature and dissolved oxygen)
- 3) Set targets based on comparison to other waters in the ecoregion**
 - establish regional reference conditions
- 4) Set targets based on the existing condition**
 - maintenance
 - proportional change
- 5) Set targets based on the historical condition**
 - restoration
 - proportional change
- 6) Set targets based on some combination of the above methods**

Adapted from: "Lake Wilcox Remediation Strategy". Gartner Lee Limited and Freshwater Research. 1996.

4) Develop Management Alternatives

At this step it is necessary to assess whether or not the existing or predicted conditions within the watershed satisfy the targets. The required management options may be classified as maintenance, improvement, or restoration. Models will be used in a predictive mode to assess the response of the watershed to alternative scenarios (e.g. land use, water withdrawals, restoration of natural areas, climate change). Alternative management options capable of meeting watershed targets are developed and the preferred strategy is selected using a decision-making framework and established criteria.

5) Evaluate Management Alternatives

The evaluation of alternative options and scenarios should include:

- an examination of the ability of the option to maintain, improve or restore water quality and quantity;
- an examination of the ability of the option to maintain, improve or restore the overall health

of aquatic ecosystems ;

- the cost and feasibility of the alternative; and
- the efficacy of implementation mechanisms (Official Plans, zoning by-laws, permits, guides, etc.).

6) Select a Preferred Management Alternative

The overall preferred strategy should describe more detailed component parts as they apply in the context of the watershed, such as:

- Water Budget;
- Water Conservation Plan;
- Water Allocation Strategy;
- Development of subwatershed plans;
- Groundwater Source Protection Plan;
- Wellhead Protection;
- Greenlands Strategy;
- Pollution Prevention Plan;
- Stormwater Management Strategy; and
- Restoration Plan.

The preferred management alternative must demonstrate:

- the requirements of Section 24 of the ORMCP have been met;
- the aquatic ecosystem will be maintained and where possible improved;
- groundwater and surface water quality and quantity will be maintained, and where possible improved and will not negatively impact future water users;
- a clear strategy for establishing a monitoring system to assess long-term trends in ecosystem health, water quality and quantity within the watershed;
- a clear strategy for implementing water conservation measures; and
- a clear strategy for addressing critical data gaps and deficiencies.

7) Finalize Targets

Municipalities are expected to review working targets and the preferred management strategies with landowners, water users and key stakeholder groups in the watershed. Targets will be finalized after the review and specific, implementable actions identified.

8) Develop Implementation and Monitoring Plan

In completing the watershed plan, municipalities should develop detailed recommendations that describe roles, responsibilities, and schedules for implementing various components of the watershed plan including:

- specific implementation schemes that outline roles and responsibilities to carry out the recommendations;
- how planning (Official Plans and zoning bylaws) and regulatory tools will be employed to achieve targets;

- additional data collection, including monitoring requirements and locations;
- remediation and restoration work to be completed;
- water conservation practices to be introduced;
- introduction of a decision making model to consider the impact of resource and development decisions on the water budget;
- research and stewardship activities to be undertaken; and
- a monitoring strategy.

The watershed plan should strive to keep the public involved in the implementation, monitoring, maintenance, and mitigation projects. It should also promote community-based monitoring programs with schools, special interest groups, and neighbourhood associations in order to encourage public/private sector monitoring responsibilities and stewardship.

Implementation Plan

The management strategy must be implemented by incorporation of objectives and requirements of watershed plans into both upper and lower tier municipal Official Plans (OPs) (ORMCP 24(2)). The upper tier plan must provide policy direction to the lower tier municipalities with respect to incorporating the recommendations of the watershed plan into their official plans and zoning by-laws. The lower tier OPs and zoning by-laws will provide more detail.

The policies included in the OPs should identify the importance of watershed planning to protect groundwater and surface water resources. There should be a statement by the municipality (or County) committing to the protection of the quality and quantity of water resources. There should be policies included that require any land use, development or resource allocation decision to have appropriate regard to the requirements of the watershed plan.

Monitoring Plan

The ORMCP requires that every single-tier and upper-tier municipality prepare an environmental monitoring plan (s.24(3)(d)).

An environmental monitoring plan is required to assess the validity of targets, assess the effectiveness of watershed plans, evaluate success vis-à-vis the targets, trigger additional management activities, and detect changes requiring target adjustments.

Monitoring is to be used to assess relative success in achieving management objectives, to learn from mistakes (adaptive management) and to trigger corrective management responses. Monitoring must be viewed as a tool to be used to meet objectives rather than an end in itself.

Monitoring may involve using existing data or designing and implementing a new data collection program. Depending on the intended use/s of the data, data collection may be undertaken only once or it may require commitment to ongoing data collection. The information needed will depend on the reason for monitoring, and on the valued ecosystem components and related management targets. To the extent that some required data are not available, the monitoring plan

should document the steps to be taken to ensure that data will be collected and incorporated into the monitoring plan.

Table 5 shows the monitoring hierarchy:

- compliance monitoring takes place at the site scale;
- effectiveness monitoring at the site environs scale ;
- watershed monitoring at the watershed scale; and
- monitoring for performance indicators at the ORM or multi-watershed scale.

The monitoring to be carried out regarding watershed plans is at the watershed scale. A monitoring program will enable decision-makers to gather information about the state of the watershed in order to determine compliance with ORMCP section 24.

Table 5: Hierarchy of Types of Monitoring

Type of Monitoring	Scale	Responsibility	Specification of Requirements
ORM Performance Indicators and Monitoring Framework	Oak Ridges Moraine	Province, Conservation Authorities Moraine Coalition	ORMCP commitment
Watershed Health Monitoring	Watershed	Municipalities, Conservation Authorities	ORMCP requirements s.24
Effectiveness	Site environs	Developer	ORMCP, condition of development approval
Compliance	Site of development/facility	Operator/Contractor	Municipalities – Condition of Approval Ministry of the Environment – Certificates of Approval, Permits to Take Water

A monitoring program include design, implementation, analysis, and adaptive management.

Design of Monitoring Program

The purposes of monitoring and the subsequent uses of the data affect the design of a monitoring program. The following are some considerations in the design of the monitoring program:

- The monitoring program should include a description of the information required for assessing whether the management objectives and targets are being achieved by all stakeholders;
- Design of the watershed monitoring plan will be largely completed during the target setting process, which must address not only what is to be monitored but also where, how, and how frequently;
- Selection of monitoring sites may be governed in part by vulnerability to stress, intensity of stress, or location of management activities – e.g. high-risk ecosystems/species may be monitored more intensively;
- Data quality objectives need to be tied to management needs;
- The baseline reference condition against which change will be assessed needs to be determined; and
- Triggers/thresholds should be established for pre-defined response and corrective actions which will be taken to ensure that management objectives continue to be achieved if/when monitoring shows undesired ecological consequences of previous decisions.

Implementation

The monitoring program should keep the public involved by using community-based monitoring programs with schools, special interest groups, and neighbourhood associations to augment the public and private sector monitoring responsibilities.

Municipalities may wish to consider working together to implement monitoring programs over a number of watersheds. As well, the ORMCP watershed plan requirements could be integrated with existing monitoring programs and practices.

Analysis

Relationships between the specific indicators that are monitored and overall watershed plan objectives should be validated to determine whether relationships hold for entire range of conditions encountered.

Trends should be analyzed with a view to providing recommended management actions, ultimately providing synthesis of monitoring results to policy makers and the public.

Adaptive Management

The principles and practice of adaptive environmental management should be employed – i.e. management strategies and actions should be adjusted as necessary based on the results of the monitoring.

6 REQUIREMENTS FOR MAJOR DEVELOPMENT PRIOR TO COMPLETION OF A WATERSHED PLAN

Prior to the completion of a watershed plan, the following provisions from the ORMCP apply to applications for major development:

- 24(8)** *An application for major development to which this subsection applies shall not be approved unless,*
- (a) the relevant municipality has complied with clause 4(c); or*
 - (b) the applicant*
 - (i) identifies any hydrologically sensitive features and related hydrological functions on the site and how they will be protected,*
 - (ii) demonstrates that an adequate water supply is available for the development without compromising the ecological integrity of the Plan Area, and*
 - (iii) provides, with respect to the site and such other land as the approval authority considers necessary, a water budget and water conservation plan that,*
 - (A) characterizes groundwater and surface water flow systems by means of modelling,*
 - (B) identifies availability, quantity and quality of water sources, and*
 - (C) identifies water conservation measures.*

Several of these requirements, such as the identification and protection of hydrologically sensitive features and related functions and the demonstration of a sustainable water supply, are the same as those that apply once a watershed plan is in place. Guidance to assist with meeting these requirements can be found in a series of technical papers for the ORMCP.

The Technical Papers regarding Water Budgets and Water Conservation Plans have been prepared to assist with the preparation of water budgets and water conservation plans at a watershed scale. These technical papers should also be consulted when completing this requirement for a major development, and adapted to the appropriate scale for the proposed major development.

7 REVIEWING AND EVALUATING WATERSHED PLANS

There is wide and varied experience with watershed management planning in Ontario. However, the ORMCP is the first time a regulatory and prescriptive requirement has been applied to the preparation of a watershed plan. Therefore, it will be important to evaluate the implementation and effectiveness of this provision of the ORMCP.

The watershed plan is a living document. It must be updated on an on-going basis, as land and water use change, science evolves, and stakeholder priorities change in the watershed. The plan should be updated in time for any changes to be incorporated into Official Plans on a five-year basis, or at a very minimum in time for the ten year provincial review of the ORMCP. The province is committed to undertaking a formal review of the ORMCP every ten years. In part, this provincial review will be based on the monitoring of success in achieving the management objectives identified in the ORMCP and on an evaluation of watershed plans across the ORM.

The Province, in consultation with municipalities, conservation authorities, and others, intends to identify indicators for monitoring the performance of the ORMCP, and further intends to establish, in partnership with appropriate stakeholders, a monitoring network to collect, summarize, and evaluate performance indicator data.

APPENDIX A: SOURCES OF ADDITIONAL INFORMATION

Significant existing guidance is available on watershed and subwatershed management and planning. The following sources provide additional guidance and information to assist in preparing watershed plans.

Provincial Guidance

Ministry of Environment and Energy and Ministry of Natural Resources. 1993. Watershed Management on a Watershed Basis: Implementing an Ecosystem Approach. Publication 3109. <http://www.ene.gov.on.ca/programs/3109e.pdf>

Ministry of Environment and Energy and Ministry of Natural Resources. 1993. Subwatershed Planning. Publication 3111. <http://www.ene.gov.on.ca/programs/3111e.pdf>

Ministry of Environment and Energy and Ministry of Natural Resources. 1993. Integrating Water Management Objectives into Municipal Planning Documents. Publication 3110. <http://www.ene.gov.on.ca/programs/3110e.pdf>

Provincial Watershed Management Committee. 1998. Watershed Action Guide: A Practical Guide for Building Partnerships, Projects and Processes for a Sustainable Watershed, prepared by UMA Environmental Inc. http://www.trentu.ca/wsc/pub_wateractgd.shtml

Watershed Management Pilot Projects

Conservation Ontario. 2003. A Framework for Local Water-Use Decision-Making on a Watershed Basis, prepared by Credit Valley Conservation Authority, Grand River Conservation Authority, Toronto and Region Conservation Authority. <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Conservation Ontario. 2003. State of the Watershed Reporting: Improving Public Access to Information. Prepared by Rideau Valley Conservation Authority and Upper Thames River Conservation Authority. <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Conservation Ontario. 2003. Phosphorus Management and Water Quality: Economic Incentives and Multi-Stakeholder Watershed Management. Prepared by South Nation Conservation Authority and Lake Simcoe Region Conservation Authority <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Conservation Ontario. 2003. Enhancing Natural Water Storage on the Landscape. Prepared by Norfolk County Public Works and Environmental Services drainage superintendents, Norfolk Land Stewardship Council, Ministry of Natural Resources, Aylmer District and Ministry of Agriculture and Food. <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Conservation Ontario, 2003, Interactive Web-based Communication and Information Sharing. Lake Simcoe Region Conservation Authority. <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Conservation Ontario, December. 2003. Watershed Management in Ontario: Lesson Learned and Best Practices. Prepared by Credit Valley Conservation Authority, Grand River Conservation Authority, Toronto and Region Conservation Authority. <http://www.conservation-ontario.on.ca/projects/watershed.htm>

Additional Resources

Final Report of the Watershed Planning Initiative, Science and Technology Task Group. December 1997. ISBN 0-7778-6712-5

Gartner Lee Limited and Freshwater Research. 1996. Lake Wilcox remediation strategy.

Gordon, Mark. 1998. Formulating Objectives for Management on an Ecosystem Scale. Ontario Ministry of the Environment. ISBN 0-7778-7706-6
<http://www.ene.gov.on.ca/programs/3672e.pdf>

Jones, Chris, Mark Palmer, Susan Motkaluk and Mike Walters. 2002. Watershed Health Monitoring: Emerging Technologies. CRC Press, Boca Raton, FL.

Totten Sims Hubicki Associates, Donald G. Weatherbe Associates, and Elizabeth Leedham. 2001. Stormwater Pollution Prevention Handbook, Toronto and Region Conservation and Ministry of the Environment. Print ISBN 0-7794-2552-9 Internet ISBN 0-7794-2553-7
<http://www.ene.gov.on.ca/envision/water/stormwaterpph.htm>

Watershed Planning Implementation Project Management Committee. 1997. Inventory of Watershed Management Projects in Ontario, released by Ministry of Environment and Energy and Ministry of Natural Resources 1990-1995. Publication # 3546. ISBN 0-7778-6195-X
<http://www.ene.gov.on.ca/programs/35460.pdf>

Watershed Planning Implementation Project Management Committee. 1997. An Evaluation of Watershed Management in Ontario, released by Ministry of the Environment and Energy and Ministry of Natural Resources. Publication # 3513. ISBN 0-7778-5889-4
<http://www.ene.gov.on.ca/programs/3513e.pdf>

Wendy Leger, Rob Read and Amy Little, April 10-11, 2001, Water Use and Supply Project. Ecological Requirements Work Group. Indicators Workshop Proceedings. CCIW, Burlington, Ontario, Environment Canada, Ontario Region. <http://www.on.ec.gc.ca/water/water-use/summary-2002-e.html>

