INNOVATIONS IN WATERSHED STEWARDSHIP SERIES

Conservation ONTARIO
Natural Champions

Watershed Management in Ontario: LESSONS LEARNED and Best Practices

THE CONSERVATION AUTHORITIES OF ONTARIO

AUSABLE BAYFIELD • CATARAQUI REGION • CATFISH CREEK • CENTRAL LAKE ONTARIO • CREDIT VALLEY
CROWE VALLEY • ESSEX REGION • GANARASK REGION • GRAND RIVER • GREY SAUBLE • HALTON REGION
HAMILTON REGION • KAWARTHA REGION • KETTLE CREEK • LAKEHEAD REGION • LAKE SIMCOE
LONG POINT REGION • LOWER THAMES VALLEY • LOWER TRENT VALLEY • MAITLAND VALLEY • MATTAGAMI REGION
MISSISSIPPI VALLEY • NIAGARA PENINSULA • NICKEL DISTRICT • NORTH BAY MATTAWA • NOTTAWASAGA VALLEY
OTONABEE REGION • QUINTE CONSERVATION • RAISIN RIVER • RIDEAU VALLEY • SAUGEEN VALLEY
SAULT STE. MARIE REGION • SOUTH NATION • ST. CLAIR REGION • TORONTO REGION • UPPER THAMES RIVER

PROJECT PARTNERS

Grand River Conservation Authority · CVC Credit Valley Conservation · Toronto and Region Conservation for The Living City · Ontario

This guide was made possible by the **Government of Ontario** and **Conservation Ontario** in partnership with the **Credit Valley Conservation Authority, Grand River Conservation Authority** and the **Toronto and Region Conservation Authority**.

Watershed Management in Ontario: LESSONS LEARNED and Best Practices

EXECUTIVE SUMMARY

Ontario has long been recognized as a world leader in watershed management. The purpose of this report is to examine the lessons that have been learned in the last ten years and to identify the best practices currently being used in watershed management. Watershed management is defined to include the development of watershed plans, the implementation of those plans, monitoring of progress, and periodic review of plans. The lessons learned and best practices were identified by examining the experiences of three of Ontario's thirty-six conservation authorities - Credit Valley Conservation (CVC), the Grand River Conservation Authority (GRCA) and the Toronto and Region Conservation Authority (TRCA). These three conservation authorities are among those that have had the most experience in watershed management. The forerunner of the GRCA was, in fact, Ontario's first watershed-based management organization and it completed its first Basin Study twenty years ago.

It was beyond the scope of this project to look comprehensively at watershed management across the province of Ontario. There is a great variation in the province in the size and nature of its watersheds, in the issues that are important, and in the tools and approaches used. Nevertheless, we hope that the findings of this report - the lessons learned and the best practices in watershed management - will be useful to and transferable to other conservation authorities in the province, as well as to municipalities, interest groups and others working to maintain and restore the health of Ontario's watersheds. We must emphasize that the report is not intended to be a "how to" manual. Effective watershed management is "place-based" and must reflect the distinct local environmental and social context of a place.

Acknowledgement:

Conservation Ontario thanks the Ontario Government for providing the initial funding for our watershed management projects. We'd 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.

Watershed Management in Ontario: LESSONS LEARNED and Best Practices

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 BACKGROUND TO THE REPORT

The Beginnings of Watershed Management

The origins of watershed management in Ontario date back at least seventy years. In 1932, the province passed legislation to create the Grand River Conservation Commission, a partnership of eight municipalities that was established to address flooding, drought and degraded water quality in the Grand River Basin. It soon became apparent, however, that these problems were not restricted solely to the Grand River. Across the province, rapid changes in land use -- including deforestation and urban development - were causing flooding, soil erosion, silting of streams, degraded water quality and destruction of fisheries.

Growing concern about these widespread environmental problems led to the passage in 1946 of the *Conservation Authorities Act*. The *Act* allowed for the creation of a new kind of agency, watershed-based conservation authorities, which were given a mandate to protect and manage natural resources, including water. For the first time in Ontario, the watershed - an ecosystem-based unit rather than a politically derived unit - was to be used as a boundary for managing human activities. This was to be accomplished by making municipalities partners in conservation authorities, and therefore partners in conservation. In the wake of the passage of the *Conservation Authorities Act*, conservation authorities sprang up across the southern part of the province, and began the challenging task of managing natural resources on a watershed basis.

The Watershed as a Management Unit

The watershed has been recognized as an appropriate unit for managing water resources for at least 70 years. A recent review of international watershed management experience[1] identified a number of reasons why structuring policy, planning, management and implementation on the basis of watersheds makes good sense. These include:

- 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 in Ontario: LESSONS LEARNED and Best Practices

In its submission to the 2001 O'Connor Inquiry into the Walkerton contaminated water tragedy, Conservation Ontario made the argument in this way. "Watershed management is not so much about managing natural resources, but about managing human activity as it affects those resources. The drainage area of the river provides the natural boundary for managing and mitigating human and environmental interactions. Because human activity includes actions by governments, municipalities, industries and landowners, watershed management must be a cooperative effort. Effective watershed management can prevent community water shortages, poor water quality, flooding and erosion. The expense of undertaking watershed management is far less than the cost of future remediation."[2]

The use of watersheds as a management unit has been endorsed widely in many jurisdictions including England, Wales, Australia, and in many states in the US. Recently, the watershed management approach received support in Ontario's "Managing the Environment" report. The "Managing the Environment" report identified best practices for managing the environment and recommended a number of fundamental shifts that are needed to establish the province as a leading environmental jurisdiction. These shifts, (see box below) are not only consistent with a watershed management approach, but in fact are consistent with how watershed planning and management is carried out in Ontario right now.

FUNDAMENTAL SHIFTS NEEDED

- A shift to a broader strategic approach to managing the environment (as compared to the more traditional regulated and reactive approach) where implementation is shared across jurisdictional agencies.

- A shift towards continuous improvement in environmental performance.

- A shift to a "place-based" approach using boundaries that make environmental sense and which facilitate a cross-media, cumulative approach.

- A shift towards a comprehensive, more flexible set of regulatory and non-regulatory tools and incentives (e.g., best management practices) instead of a more traditional "command and control" approach.

- A shift to an approach based on shared responsibility with the regulated community, NGOs, the public and the scientific/technical community, and transparent sharing of information with the public.

Taken from: Executive Resource Group, 2001. Managing the Environment: A review of best practices. Prepared for the Secretary of Cabinet.

More recently still, in the Part Two Report of the Walkerton Inquiry, Justice O'Connor argued that the province needed to use a multiple-barrier system for the protection of drinking water safety. The first barrier in such a system, he argued, is source protection. Accordingly, the first recommendation made by O'Connor was that drinking water sources should be protected by developing watershed-based source protection plans, and these should be required for all watersheds in Ontario. He further argued that:

- watershed-based source protection plans should ideally form part of a broader watershed management plan;
- where they exist, conservation authorities should coordinate development of the plans;
- where conservation authorities do not exist, the Ministry of the Environment (MOE) should coordinate development of source protection plans; and
- draft source protection plans should be prepared through an inclusive process of local consultation[3] .

#3 Source: O'Connor Report 2002

The provincial government has recently announced the creation of an Advisory Committee to develop a framework for source protection planning. Conservation authorities will be represented on the committee.

The Framework for Watershed Management

The scope and thrust of watershed management has evolved significantly since Ontario's first conservation authorities were created in the late 1940s. In the 1950s, "watershed management" usually meant single-issue flood management programs. In the 1980s and 1990s, these had evolved to more complex Master Drainage Plans. Today, "watershed management" means integrated, ecosystem-based watershed management initiatives that include consideration of stream morphology, groundwater, terrestrial habitat, wetlands, woodlots, and environmentally significant or sensitive areas (see Figure 1-1). "State-of-the-art" watershed management today not only addresses a broader range of resource and environmental protection issues than previous initiatives, but also considers and evaluates the interrelationships among these issues. For example, managers might consider the interrelationships among groundwater recharge areas, wetlands and fish communities.

Walkerton Inquiry Recommendations on Drinking Water Source Protection

1. Drinking water sources should be protected by developing watershed-based source protection plans. Source protection plans should be required for all watersheds in Ontario.

2. The MOE should ensure that draft source protection plans are prepared through an inclusive process of local consultation. Where appropriate, this process should be managed by conservation authorities.

3. Draft source protection plans should be reviewed by the MOE and subject to ministry approval.

4. Provincial government decisions that affect the quality of drinking water sources must be consistent with approved source protection plans.

5. Where the potential exists for a significant direct threat to drinking water sources, municipal plans and decisions must be consistent with the applicable source protection plan. Otherwise, municipal official plans and decisions should have regard to the source protection plan. The plans should designate areas where consistency is required.

6. The provincial government should provide for limited rights of appeal to challenge source protection plans, and provincial and municipal decisions that are inconsistent with the plan.

7. The provincial government should ensure that sufficient funds are available to complete the planning and adoption of source protection plans.

8. Conservation authorities (or in their absence, the MOE) should be responsible for implementing local initiatives to educate landowners, industry, and the public about the requirements and importance of drinking water source protection.

9. Septic systems should be inspected as a condition for the transfer of a deed.

10. The MOE should not issue Certificates of Approval for the spreading of waste materials unless they are compatible with the applicable source protection plan.

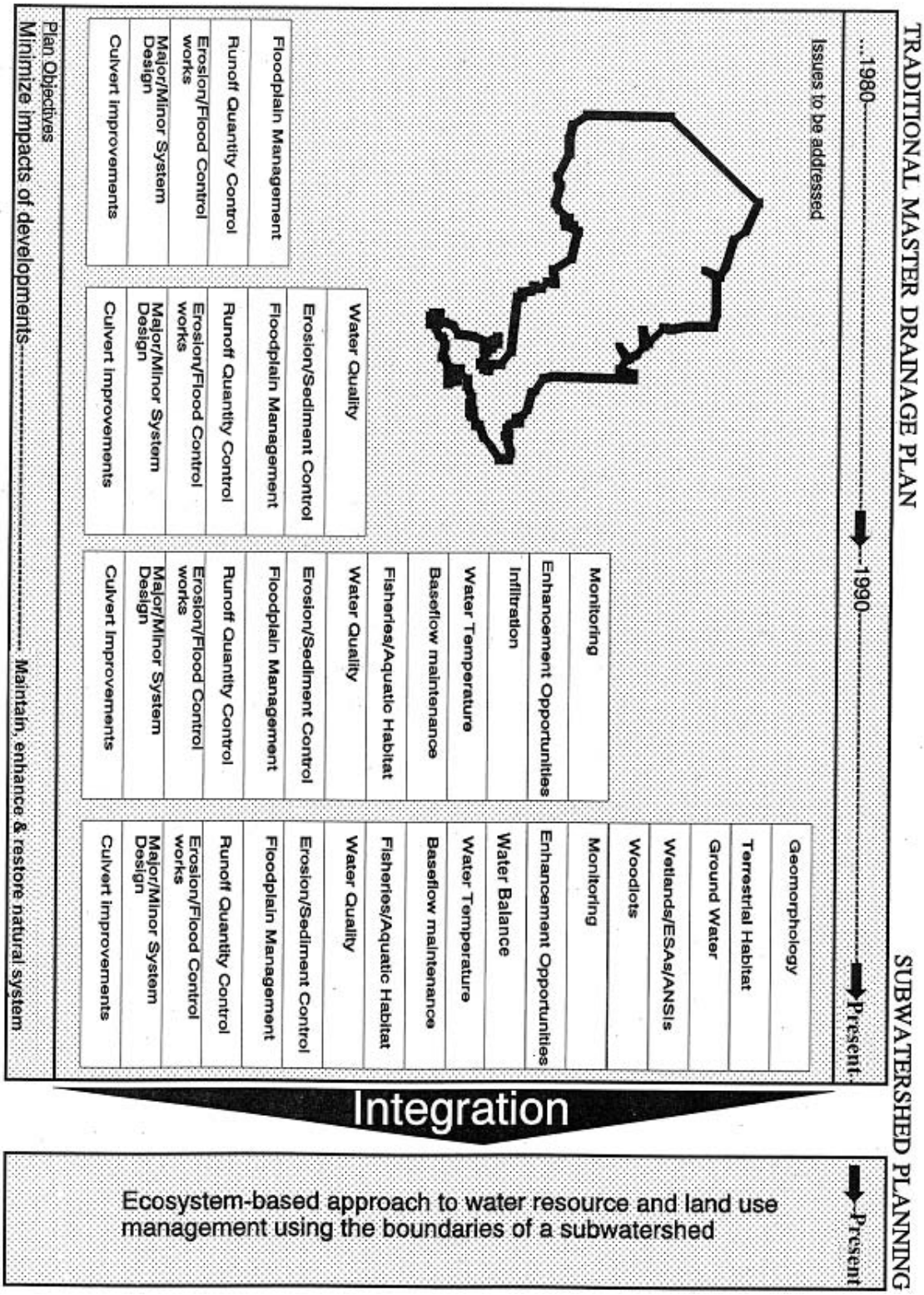
11. The MOE should take the lead role in regulating the potential impacts of farm activities on drinking water sources. OMAFRA should provide technical support to the MOE and should continue to advise farmers about the protection of drinking water sources.

12. Where necessary, the MOE should establish minimum regulatory requirements for agricultural activities that generate impacts on drinking water sources.

13. All large or intensive farms, and all farms in areas designated as sensitive or high-risk by the applicable source protection plan, should be required to develop binding individual water protection plans consistent with the source protection plan.

14. Once a farm has in place an individual water protection plan that is consistent with the applicable source protection plan, municipalities should not have the authority to require that farm to meet a higher standard of protection of drinking water sources than that which is laid out in the farm's water protection plan.

Figure 1-1: The Evolution of Watershed Planning
Adapted from: MOE and MNR, 1993. Subwatershed Planning



Watershed Management in Ontario: LESSONS LEARNED and Best Practices

As practiced in Ontario, watershed management can be defined as follows:

Watershed management:

- is the process of managing human activities and natural resources in an area defined by watershed boundaries;
- aims to protect and manage natural resources (including their functions and linkages) for this and future generations;
- reflects the local environmental and social context;
- uses an integrated, interdisciplinary approach;
- considers the environment, the economy and communities;
- uses a partnership approach to plan and manage;
- uses adaptive environmental management approaches that aim for continuous improvement.

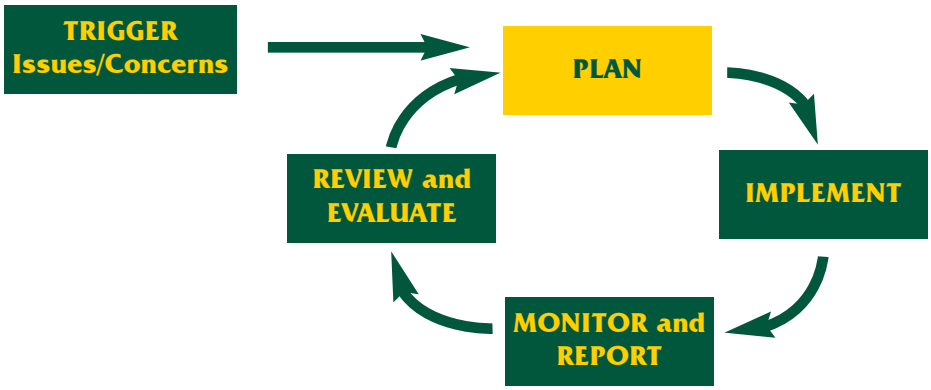
A consistent, provincial approach to watershed management and watershed planning was articulated in the trilogy of watershed management guidelines prepared by the Ontario Ministries of Environment and Energy and Natural Resources in June 1993[4]. These guidelines provided resource managers, planners and stakeholders with information on why and how to carry out watershed and subwatershed planning, and how these plans should be integrated into the conventional municipal land use planning process.

An evaluation of watershed planning and management in Ontario was done in 1996 to examine how projects were being carried out, the evolving practice of watershed management, and the experience of participants in pilot watershed and subwatershed planning projects. One of the conclusions of this evaluation was that watershed management was needed for the protection of Ontario's natural resources and environmental health. Stakeholders who were consulted during the evaluation endorsed the concept of watershed management as a comprehensive tool for planning for water and land uses in relation to the environmental, social and economic well-being of the communities within the watershed[5].

The basic thrust of watershed management in Ontario today has not changed since 1993. As illustrated in Figure 1-2, the process of watershed management has four main stages, and usually is carried out because of an external trigger, such as public concern about environmental conditions. The four stages of watershed management are: planning; implementation; monitoring and reporting; and reviewing and evaluating. These are described at length in Chapter 3.

There are two other fundamental elements of watershed management. One, is that it is by definition a **partnership process** involving conservation authorities, municipalities and other key stakeholders. The second fundamental element is **public involvement.** Consultation with and involvement of the public occurs at every stage of watershed management (i.e., during the development of watershed plans, during implementation of projects and programs, during monitoring and reporting on conditions in the watershed, and reviewing watershed plans. These important aspects of the watershed management process are addressed in section 3.4 of this report.

Figure 1-2: The Watershed Management Process



1.2 PURPOSE OF THE REPORT

Conservation Authorities and municipalities have been using the most recent (1993) provincial guidelines for watershed management for almost a decade now. Over this period, conservation authorities and municipalities have gained valuable experience in all aspects of watershed management. This has included how best to develop and implement watershed and subwatershed plans. To a lesser degree, experience has been gained in the other two elements of watershed management -- monitoring and reporting on progress made and periodic review of watershed plans.

The purpose of this report is to examine the lessons that have been learned in the last ten years and to identify the best practices used in watershed planning, implementation and monitoring. This is done by examining the experiences of three of Ontario's 36 conservation authorities - Credit Valley Conservation (CVC), the Grand River Conservation Authority (GRCA) and the Toronto and Region Conservation Authority (TRCA).

Specifically, the report addresses five issues:

1. It examines the status of watershed and subwatershed planning in Ontario, including the extent of planning done, and the purposes for which it was undertaken, (Chapter 2). A closer examination of the status of watershed and subwatershed planning is carried out for CVC, GRCA and TRCA.

2. It updates the generic framework for watershed management and watershed/subwatershed planning, reflecting the changes in emphasis and practice that have taken place since 1993. This includes the importance aspects of partnership approaches and public involvement (Chapter 3).

3. Through the use of case studies from CVC, GRCA and TRCA, it assesses the generic framework for watershed management and watershed and subwatershed planning to identify factors for success, barriers and trends (Chapter 4)

4. It examines the process of implementing watershed and subwatershed plans and discusses implementation mechanisms that have been used in the CVC, GRCA and TRCA (Chapter 5).

5. It provides an evaluation framework for measuring progress in watershed management (Chapter 6).

Conclusions and recommendations are presented in Chapter 7. We hope that the lessons learned by the CVC, GRCA and TRCA will be useful to and transferable to other conservation authorities in Ontario, as well as to municipalities, interest groups and others working to maintain and restore the health of Ontario's watersheds. We should emphasize, however, that this report is not intended to be a "how to" manual. Effective watershed management is "place-based" and must reflect the distinct local environmental and social context of a place.

1.3 HOW THE REPORT WAS DEVELOPED

Steering Committee

Hazel Breton (Chair)	**CVC**
Leslie Demal	**MNR**
Bonnie Fox	**Conservation Ontario**
Adele Freeman	**TRCA**
Joanna Kidd	**Lura Consulting**
Dave Maunder	**Aquafor Beech Limited**
Sonya Meek	**TRCA**
Julie O'Brien	**MNR**
Tony Smith	**GRCA**
Ray Tufgar	**Totten Sims Hubicki Associates**

The report was developed by a Steering Committee with representation from MNR, Conservation Ontario, CVC, GRCA, TRCA and practitioners working in the field of watershed and subwatershed planning.

In developing the report, Steering Committee members drew extensively on their own experiences and on relevant reports on watershed planning and management. A telephone survey was carried out to update the status of watershed and subwatershed planning in the province (Chapter 2) and this information was added to that previously collected by MNR and Conservation Ontario. Conservation authority representatives developed case studies of watershed and subwatershed plans (included as Appendices B to G), selecting a range of studies for which implementation was underway.

These case studies were used to guide the assessment of the generic framework for watershed planning and management (Chapter 4). Implementation (Chapter 5) is examined by looking at the process and mechanisms used by the CVC, GRCA and TRCA. The evaluation framework for assessing progress in watershed management (Chapter 6) was developed based on experience in the three conservation authorities.

In draft form, the report was circulated to peers working in the field of watershed planning and management for review. Where the comments received fell within the scope of the report and were deemed to be relevant, they have been incorporated into the final report.

2.0 THE STATUS OF WATERSHED PLANNING IN ONTARIO

2.1 WATERSHED AND SUBWATERSHED PLANNING IN ONTARIO

Status of Planning

In 1995, MNR and MOE carried out a survey to identify the extent of watershed and subwatershed planning being carried out in the province. Conservation authorities were contacted and asked to fill out a detailed database template (see Appendix A) for all watershed management projects initiated within their watersheds between 1990 and 1995. Twenty-three of 36 conservation authorities responded to the survey and the number of projects initiated are presented in Table 2-1. This number reported includes watershed and subwatershed plans, plans and projects of varying, size but clear definitions were not provided. In some cases, the lead agencies for these projects were municipalities, or developers, but there was a local conservation authority involved in 81 of 87 projects reported. Two of the six projects reporting no CA involvement were MNR-led projects that were outside CA jurisdiction. The information gathered from this survey was published in 1997 by the Ministries of Environment and Natural Resources as "Inventory of Watershed Management Projects in Ontario, 1990-1995".

In 2000, using funding from MNR and MOE, Conservation Ontario redeveloped the 1990-1995 report as a map-referenced database on the internet and repeated the survey. Conservation authorities were again asked to fill out a detailed database template for all "watershed management projects" initiated between 1996 and 2000 and to update the database template for projects initiated between 1990 and 1995. It was beyond the scope of this update project to more clearly define "watershed management projects". However, the rule of thumb used was that a "watershed management project" could not be a single resource issue study (e.g. fisheries, forestry, groundwater) but had to integrate multiple resource issues with a water resource emphasis/component (i.e., watershed-based analysis). Full survey responses of new projects and status updates to the 1990-1995 projects were received from 11 of 36 conservation authorities. This information was included in the map-referenced database at http://www.conservation-ontario.on.ca/projects/iwmpo/index.htm. The geographic extent of watershed and subwatershed planning activities is presented in map form on this Conservation Ontario Web site. It is important to note that there is great variability in the size and scope of the projects reported -- one project may represent a full watershed plan for thousands of square kilometers while another may only be a small subwatershed plan for a proposed development site. The total area of each reported project is not additive because, in some cases, the projects are nested within each other.

As part of this demonstration project and because of a concern that the low response rate would misrepresent the level of activity in Ontario, MNR staff conducted a brief telephone survey of those conservation authorities that did not respond to the detailed 1996-2000 survey. All conservation authorities that had not responded to the request for updated information in 2000 were contacted and given the opportunity to indicate at least the number of projects initiated. The results are shown in Table 2-1.

Table 2-1 shows that there were fewer projects initiated between 1996 and 2000 than were initiated between 1990 and 1995. It is possible that this drop in activity may be related to decreased funding to Conservation Authorities.

Analysis of the Conservation Ontario inventory database indicates that most watershed management projects appear to have been driven by urban development pressures. Some were initiated to address general watershed management issues, rehabilitation or regeneration needs and/or agricultural pressures.

The development of watershed and subwatershed plans is a voluntary activity, and there is no requirement for them to be carried out, and no requirement for conservation authorities to report on plan development. Given the importance of watershed planning in the protection and restoration of water-related resources. In the Part Two Report of the Walkerton Inquiry, Justice O'Connor recommended that watershed-based source protection plans be a legislated requirement under *the Environmental Protection Act*.

In the interim, to aid the province in improving information on the status of watershed and subwatershed planning, we have developed a survey instrument (see Appendix A) which builds on the survey previously used for the inventory. We believe that use of it will help improve the response rate by conservation authorities and improve the quality of information returned. Specifically, it more clearly defines watershed and subwatershed plans and tributary plans, environmental site plans and other types of projects carried out on a "watershed" basis, such as fishery or forestry plans.

Table 2-1 Reported Number of Watershed Management Projects Initiated

CONSERVATION AUTHORITY INVOLVED	PERIOD	
	1990-1995	1996-2000
Ausable-Bayfield	1	0
Cataraqui Region	1	0
Central Lake Ontario	3	5
Credit Valley	6	13
Ganaraska	0	1
Grand River (2)	29	7
Halton	10	4
Hamilton	1	2
Kettle Creek	4	2
Lake Simcoe Region	7	3
Lakehead Region	2	0
Long Point Region	0	2
Lower Thames Valley	0	1
Lower Trent	1	1
Maitland Valley	1	3
Mattagami Region	1	1
Mississippi Valley	1	3
MNR	2	1
Niagara Pennisula	2	2
North Bay-Mattawa	2	1
Nottawasaga Valley	1	1
Otonabee Region	4	5
Quinte (3)	2	1
Raisin Region	0	5
Rideau Valley	3	0
St. Clair Region	0	4
South Nation River	1	0
Toronto Region (2)	12	11
Upper Thames Region	6	4
Number of projects initiated	**103**	**83**

Total Number of Projects Initiated and Reported for 1990 to 2000 = 186

1. Table has been updated with information collected during this study.
2. Total number of projects for Grand River and Toronto Region for 1990-1995 have been updated since the original survey results (i.e. from 15 to 29 and from 10 to 12 respectively).
3. Quinte Conservation was formerly Moira, Napanee, and Prince Edward Conservation Authorities in the 1990-1995 survey.

2.2 WATERSHED AND SUBWATERSHED PLANNING IN GRCA, CVC AND TRCA

The objective of this section is to summarize the extent of watershed and subwatershed plans that have been undertaken within each of the three conservation authorities' jurisdictions, the timeframe in which they were conducted, and the approach used.

One of the conclusions that can be drawn is that, while the three conservation authorities follow a similar overall approach, the details vary. The reasons for the differences are due to a number of factors including the triggers for undertaking the study, funding availability, willingness of municipalities to participate, degree of land use change (urban and rural), rehabilitation and regeneration needs, and the number of watersheds to be addressed. The accompanying figures illustrate where watershed and subwatershed plans have been undertaken within the three conservation authorities' jurisdictions.

2.2.1 Grand River Conservation Authority

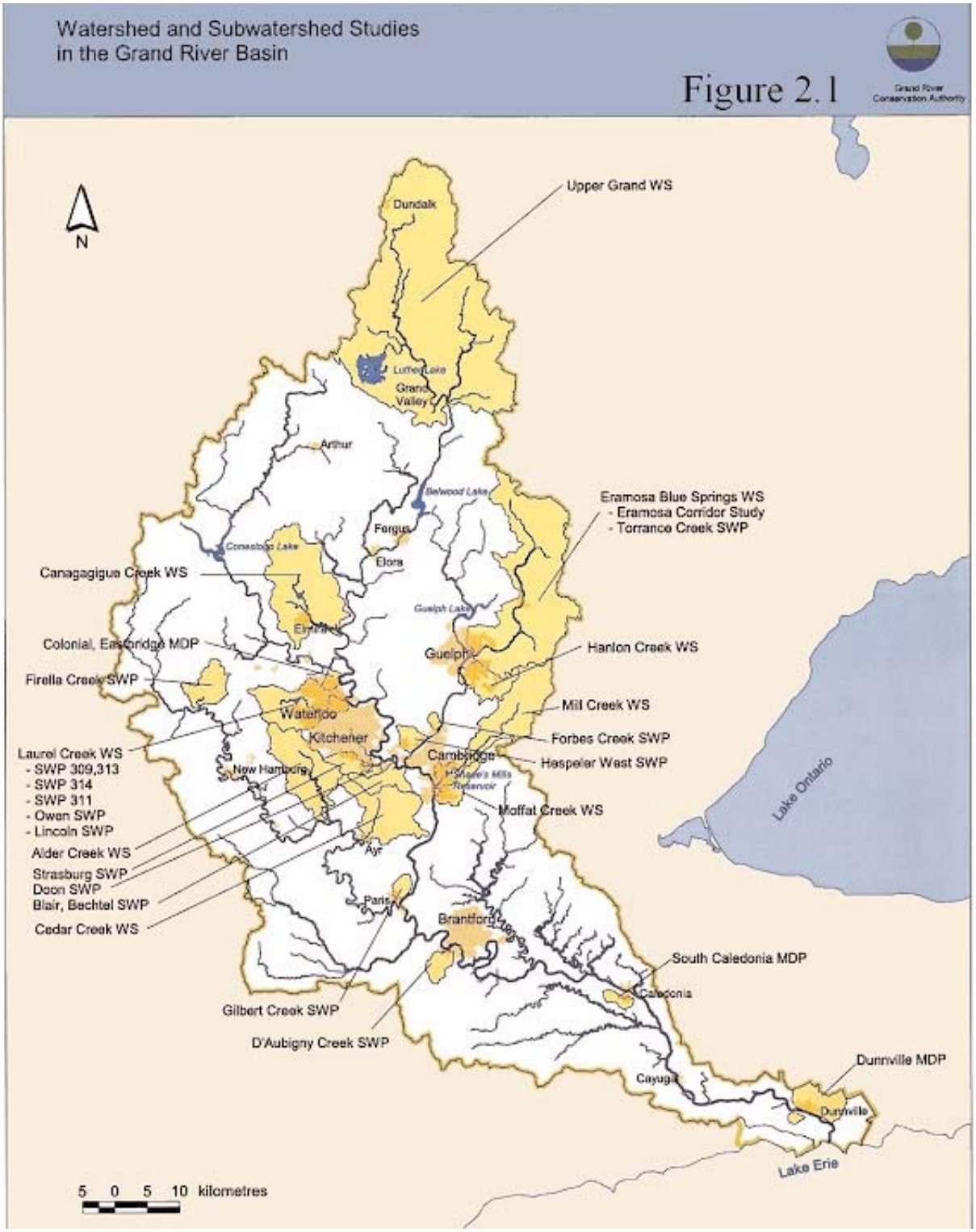
The GRCA initiated its watershed plan (the Grand River Basin Water Management Study) in 1977 and completed it 1982. The major water management problems which were addressed in the plan included flood damage, degraded water quality and water supply shortages. (Details of the planning process are included as Case Study #3 in Appendix D).

In the late 1980s and throughout the 1990s, a number of subwatershed studies were initiated and to date, about 20 subwatershed plans have been completed (see Figure 2-1). Most of these were undertaken in urbanizing areas because of development pressures. These include the Laurel Creek (included in Appendix E as Case Study #4), Stratsburg Creek and Hanlon Creek studies. A few studies (Eramosa Blue Springs and Upper Grand Subwatershed) dealt primarily with rural land use and water supply issues.

Upon completion of several of the subwatershed plans, a number of Environmental Management Plans (EMPs) were carried out. EMPs typically deal with a portion of the subwatershed area and define, in further detail, the environmental resources and the appropriate management alternatives to be undertaken within the study area. For example, five EMPs have been undertaken within the Laurel Creek Subwatershed.

Presently, GRCA are focusing on updating its watershed plan, and are currently undertaking or have recently completed a number of component studies including a water budget analysis and assimilative capacity study.

Figure 2-1: GRCA Subwatershed Studies



2.2.2 Credit Valley Conservation

The CVC initiated its watershed study, the Credit River Water Management Strategy (presented in Appendix B as Case Study #1) because of pending land use changes and associated concerns relating to flooding, water quality degradation, impairment of the fishery and loss of wetlands. The study was undertaken in two phases: the first phase (1988-1990) focused on flooding and erosion, while the second phase (1990-1992) addressed water quality, aquatic, groundwater and terrestrial issues.

One of the recommendations of the watershed study was to further assess the watershed by addressing issues occurring in each of the 20 subwatersheds. The subwatershed plans were to be undertaken in three phases:

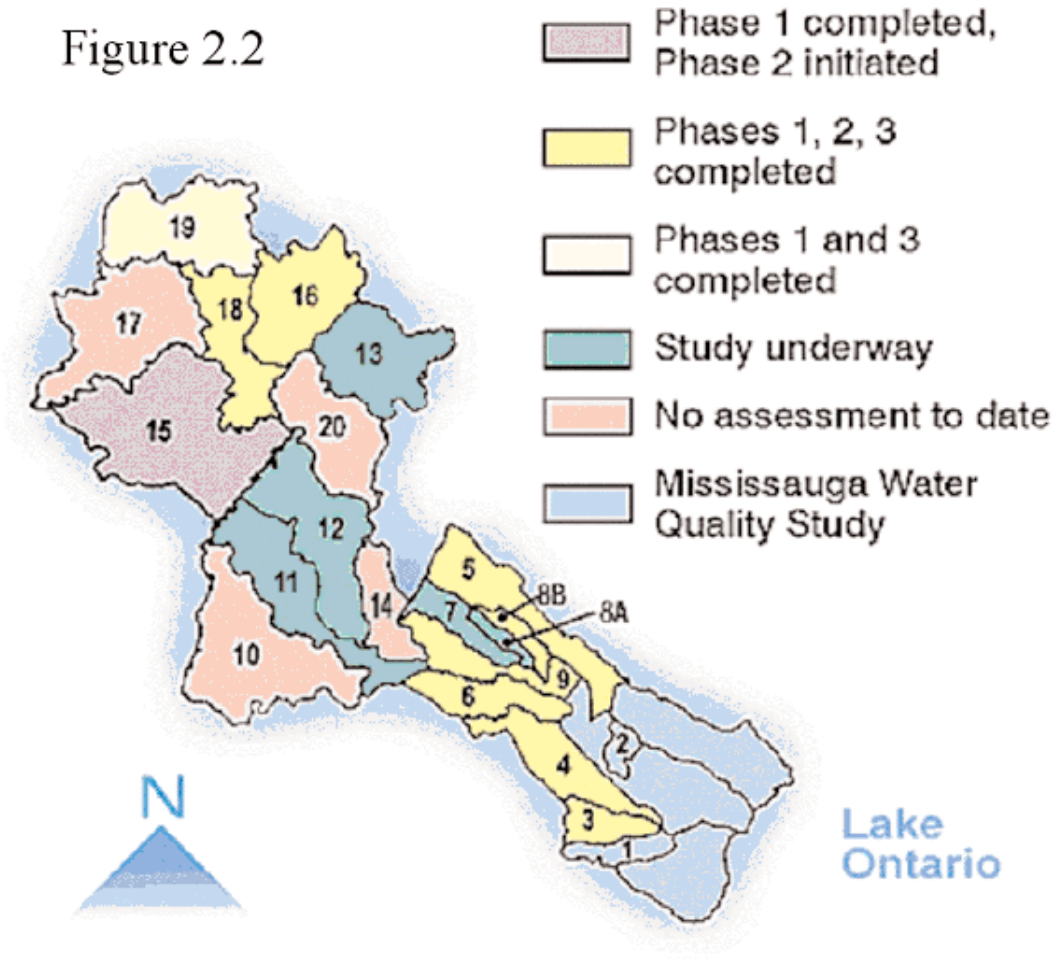
- **Phase I**: Subwatershed Characterization;
- **Phase II**: Impact Assessment; and
- **Phase III**: Implementation.

As illustrated in Figure 2-2, eight subwatershed plans have been completed, eight have been partially completed and four have yet to be initiated. The subwatershed plans have been undertaken as a result of a number of factors including development pressures, aggregate extraction and restoration and regeneration of rural areas.

Tributary plans have been initiated as part of the implementation of the subwatershed plans that have been completed.

CVC is presently in the process of augmenting its original watershed work. Work has started on a watershed water budget and a water quality strategy. The aim of these is to assess the surface and groundwater quality and availability with a view to understanding how future growth may or may not affect watershed conditions. To establish current conditions, CVC has initiated a watershed-wide integrated monitoring program. These three major initiatives, in conjunction with the results of the subwatershed plans will feed into the update of the watershed plan.

Figure 2-2: CVC Subwatershed Plans



2.2.3 Toronto and Region Conservation Authority

As illustrated in Figure 2-3, TRCA has nine watersheds under its jurisdiction. Land uses within the nine watersheds vary considerably from the relatively undeveloped (Duffins Creek) to the highly urbanized (the Don River which is 80% urbanized).

TRCA's initial watershed studies involved the Don River and Rouge River. The Strategy to Improve Don River Water Quality was completed in 1989, and addressed the impact of existing and proposed land uses on water quality, recreation, aesthetics and aquatic resources. The Rouge River Comprehensive Basin Management Study was completed in 1990. It addressed issues related to water quality, flooding, erosion, public health (related to use of natural resources), and aquatic and terrestrial resources. Watershed-wide strategies to address these issues were presented.

In 1989, TRCA committed to developing a watershed management strategy for each of its nine watersheds. A two-year timeframe was set for each study to provide some level of watershed-scale direction and to help address the widespread development pressures and regeneration needs within the TRCA jurisdiction. Within timeframe and budget constraints related to the recession in the 1990s, some components of the watershed studies were completed in a greater level of detail than others. For this reason, TRCA has distinguished between watershed "strategies" and "plans".

Watershed management strategies and plans both provide strategic direction for protection and regeneration activities for a broad range of issues (i.e. flood hydrology, water quality, aquatic and terrestrial resources, recreational use, and heritage). TRCA's strategies differ from plans in that the strategies include detailed modeling and analysis of only a few selected components (principally hydrology and aquatic resources). The strategies also rely on a more qualitative approach, using professional judgment and community input to develop management strategies for the remaining issues. Completion of the remaining technical studies become recommendations of the strategies. TRCA's watershed plans involve a more quantitative assessment of alternative land use and management scenarios for a broad range of study components. Both the strategies and plans contain planning maps, targets and recommended management directions, at a level of detail commensurate with the supporting studies.

Since 1990, TRCA has completed watershed management strategies for the Don River (1994), Humber River (1997), and Etobicoke and Mimico Creek watersheds (2002) and a watershed plan for the Duffins and Carruthers Creek Watersheds (2002). The Don Watershed Regeneration Strategy (included as Appendix F, Case Study #5) focused on regeneration/enhancement efforts within already urbanized areas.

It was initiated, in part, because the Don River is one of the major contributors of pollutants to Toronto Bay, and the Toronto waterfront was designated in 1985 as one of 44 Areas of Concern in the Great Lakes Basin.

After completion of its watershed strategies and plans, TRCA establishes the regular preparation of a watershed report card to report on watershed health and progress at implementing the watershed strategy. To date, Report Cards have been published for the Don Watershed (1997 and 2000) and Humber Watershed (2000). TRCA has recently established a Regional Watershed Monitoring Program to fulfill its monitoring and reporting needs at both watershed and subwatershed scales.

Another recent, related initiative within TRCA's jurisdiction is the City of Toronto Wet Weather Flow Master Management Plan, which will provide a comprehensive approach for restoring water quality, hydrology, and aquatic habitat conditions within the City, in the context of the entire watersheds.

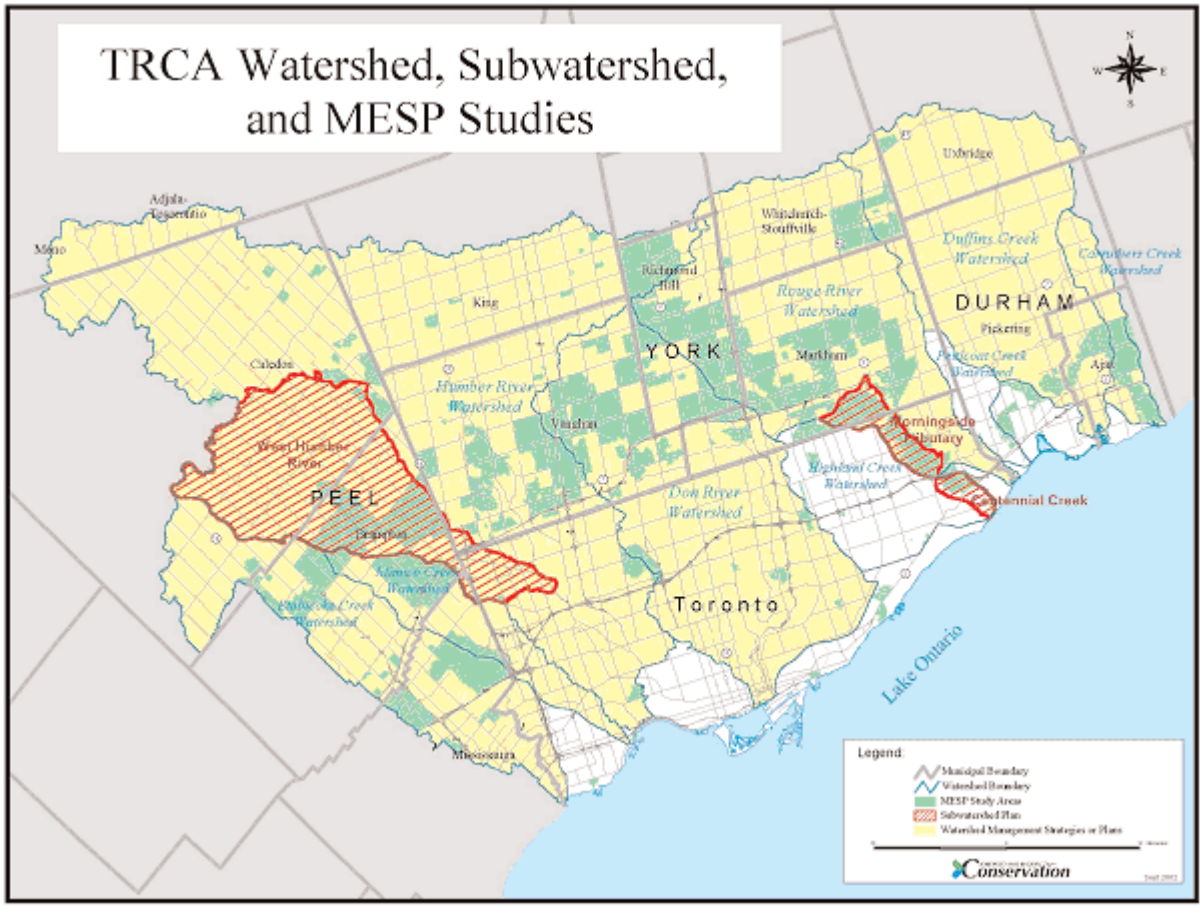
TRCA's level of effort to complete watershed strategies, plans, and report cards and cost have increased over time, reflecting the adoption of community-based approaches, expanded technical complexity, and increased efforts to coordinate with municipal planning initiatives. A limited number of subwatershed plans have been completed within TRCA. Those that have been completed include the West Humber Subwatershed Study (Appendix G,Case Study #6), Morningside Tributary Study and the Centennial Creek Subwatershed Study. The focus within TRCA has been on undertaking tributary plans (referred to by TRCA as Master Environmental Servicing Plans). Generally, these plans have been funded by the private sector with TRCA acting primarily as an approval agency. Furthermore, the geographic area covered is more limited as compared to a subwatershed plan (approximately 40 have been completed). The watershed-scale Component Studies and Watershed Plans that have been completed are being used to provide direction (e.g., flow targets, restoration initiatives, habitat targets, target aquatic species, natural heritage targets) for subsequent EMPs.

The MESP approach is a less preferred alternative to the preparation of full subwatershed plans, because of the limited ability to understand cumulative effects of land use proposals throughout a subwatershed. However, TRCA has found this approach to be the most practical means of providing environmental direction for urban development planning. The late 1980s and early 1990s represented a period of rapid urban growth in the municipalities surrounding Toronto. Due to the sheer volume of development proposals, timing issues among neighbouring landowners, a political climate that promoted development, and the expected development delays associated with coordination activities, the preparation of subwatershed plans was not widely supported by area municipalities or the development community.

Development-related environmental planning was practiced primarily at the large development block plan stage (i.e. encompassing several phases of a plan of subdivision) through "MESPs". Although earlier MESPS focused on water quantity concerns, by the early 1990s, their scope had typically been broadened to include water quality, erosion, aquatic and terrestrial habitat concerns as well.

The boundaries of the water-related component studies were required to be extended to the full subwatershed boundary, although all other components were limited to the landowners'property. Watershed scale guidance was provided by TRCA's watershed studies and plans.

Figure 2-3: TRCA Watershed, Subwatershed and MESP Studies



3.0 A GENERIC FRAMEWORK FOR WATERSHED MANAGEMENT

This chapter of the report discusses the generic framework for watershed management and watershed planning that is currently being used by the CVC, GRCA and TRCA.

The framework is considered by the three conservation authorities to be "best practice". It both represents current practice and reflects the experience gained over the last ten years.

A clear distinction is made between watershed planning, which is one component of watershed management, and watershed management itself.

3.1 THE WATERSHED MANAGEMENT PROCESS

A consistent, provincial approach to watershed management and watershed planning was articulated in the trilogy of watershed management guidelines published by the MOEE and MNR in June 1993. The basic thrust of watershed management remains the same today. As illustrated in Figure 1-2, the process of watershed management has four main stages. These are:

- **Planning:** developing watershed, subwatershed or other watershed-based environmental plans;
- **Implementation:** implementing the programs, policies or projects that arise from watershed, subwatershed or other watershed-based environmental plans;
- **Monitoring and Reporting:** assessing whether plan goals, objectives and targets are being met and periodically communicating the results to decision-makers and the public; and
- **Reviewing, Evaluating and Updating:** periodically reviewing watershed management plans themselves to see if changes are needed and then altering targets, plans or actions as required.

This sequence of events is usually initiated because of a **trigger**. The watershed management process is illustrated in a more detailed way in Figures 3-1 and 3-2 and described below. Figure 3-2 illustrates the importance and integrated nature of **stakeholder and public involvement** in watershed management.

Watershed management is not just a technical process of monitoring and modeling and measuring, it is also a social process. To be relevant, watershed management must not only be based on solid science, but must also acknowledge and reflect the preferences of the people living in the watershed. The preferences may be expressed as desired end uses, desired states (goals, objectives and targets), and desired strategies for achieving goals. Stakeholder and public involvement is discussed at length in section 3.4.

3.1.1 Watershed Management Stages

Triggers:
As noted in the figures 3-1 and 3-2, the development of watershed management plans is usually spurred on by one or more triggers. These can include proposals that can have significant environmental effects, such as proposals for large-scale urban development, gravel extraction or large water takings. Triggers can also include updates of official plans or broad environmental concerns such as loss of fish species or degraded water quality in rivers.

Planning:
As noted in Chapter 2.0 of this report, Ontario municipalities and conservation authorities have amassed considerable experience in the last decade in the development of Watershed and Subwatershed Plans. The generic steps in the Watershed or Subwatershed Planning process - how it is carried out -- are described in section 3.2. The relationship between Watershed and Subwatershed Plans (and the more detailed Tributary Plans and Environmental Site Plans) is addressed in section 3.3. In general, there has been more focus and attention placed on the planning part of the management cycle in the province than on the implementation, monitoring, and review parts of the cycle[6].

Implementation:
Watersheds are complex systems, and watershed management plans are necessarily multi-faceted. The implementation of plans, therefore, usually takes place on many fronts and can involve dozens of agencies and organizations and thousands of individuals. Time spans for implementation vary widely, with small projects such as building a fish ladder at a weir, which might take a few weeks, to retrofitting stormwater management ponds, which could take decades. Some projects (such as remediating contaminated soil or sediments) require expert engineering, while others (such as planting riparian vegetation) can be carried out with volunteer labour. Some items (such as expansion of sewage treatment plants) can cost millions of dollars, while others (such as community stewardship programs) can be carried out relatively cheaply. Most watershed plans involve both regulatory approaches (municipal sewer use bylaws, for example with fines for those who don't comply), incentives (such as recognition of good corporate citizens), and education and awareness programs to involve the public.

To be effective, implementation plans need to clearly identify the actions, the targets to be reached, the implementing body or bodies, the schedule and the costs. A closer look at implementation plans and mechanisms is provided in Chapter 5.0.

Monitoring and Reporting:
Monitoring progress in terms of meeting goals, objectives or targets and reporting to the public and decision-makers are fundamental elements of sound resource management. Simply put, monitoring allows us to see if we are achieving what we have set out to do. Given the complex nature of watersheds, comprehensive monitoring plans can be quite extensive. Typically, monitoring programs look at stresses on the watershed (such as the number of combined sewer overflows), environmental conditions (such as phosphorus levels in rivers and streams) and institutional responses (such as the number of rain barrels installed in a neighbourhood). Monitoring frameworks are examined at length in chapter 6.0.

Reviewing, Evaluating and Updating:
The fourth stage of watershed management is to periodically - say once every five or ten years - review watershed plans to see if they need to be updated in light of changing environmental conditions, changing land use pressures, or changing public attitudes. We make watershed plans using the best knowledge available at the time, but these should not be static documents. "Effective watershed management is an iterative process, [which should take] full advantage of both the successes and mistakes of implementation"[7].

This reiteration - also called **adaptive environmental management** (AEM) - is characterized by the following:

- It recognizes that there is uncertainty in our ability to understand watersheds and predict future changes in them.

- It also acknowledges that we learn through experimentation, and encourages us to change in the light of experience gained.

- It reflects the need for and use of continuous and deliberate learning and improvement.

- It encourages us to expect "surprise" or natural variability in an ecosystem.

- It requires a system approach to planning, managing and monitoring our activities.

- It requires a partnership approach involving researchers, managers and other stakeholders.

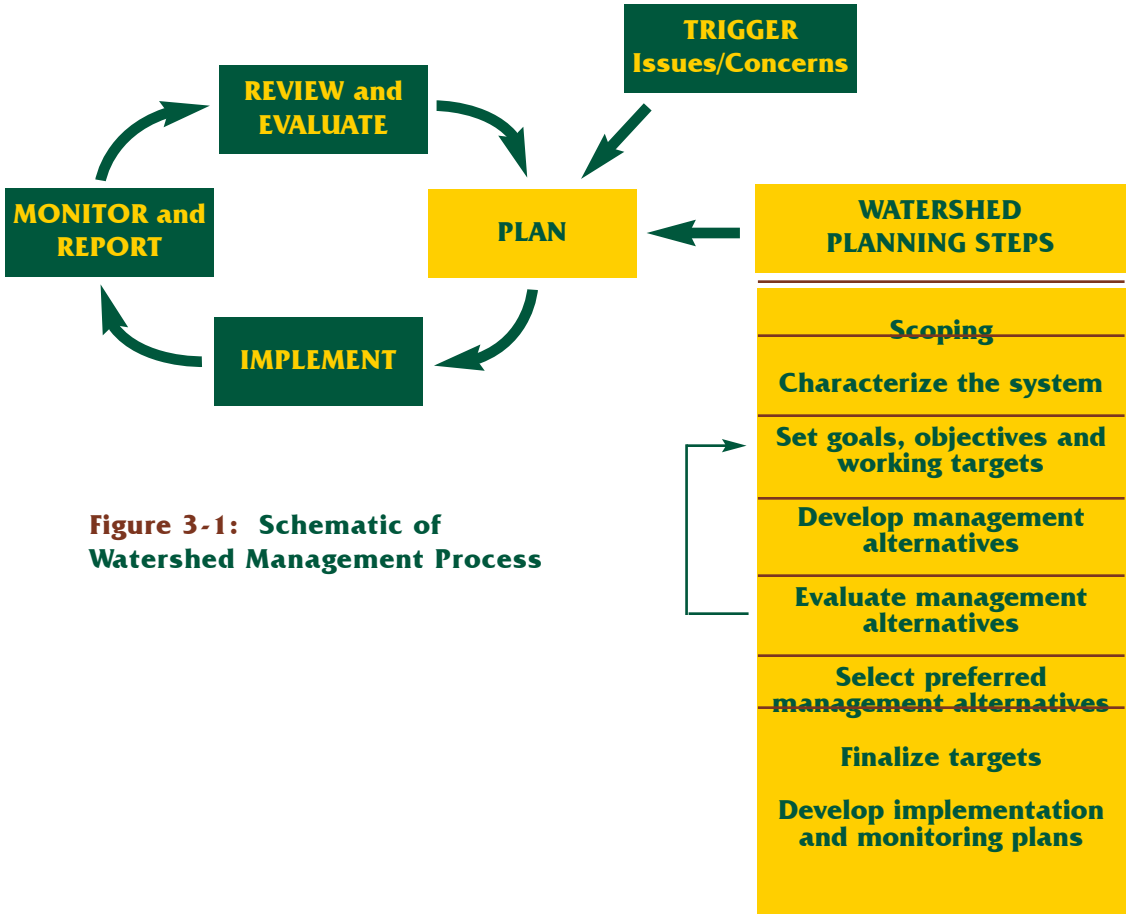


Figure 3-1: Schematic of Watershed Management Process

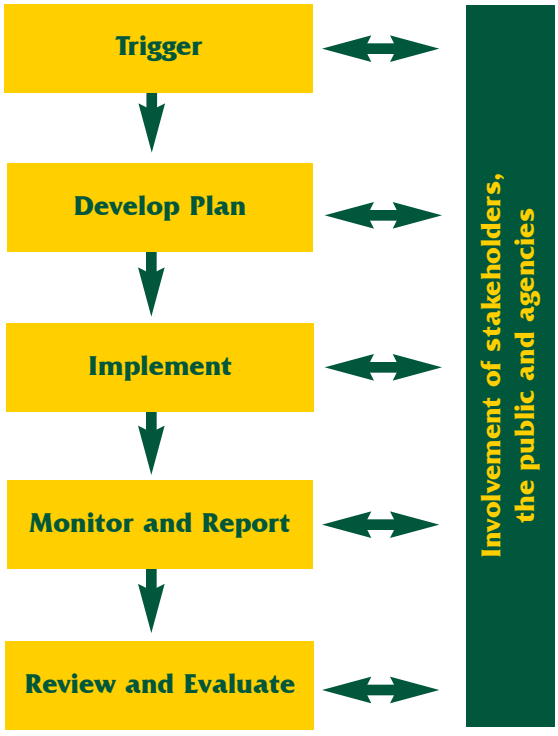


Figure 3-2: Stakeholder, Public and Agency Involvement in the Watershed Management Process

3.2 THE WATERSHED PLANNING PROCESS

This section of the report addresses the planning process used for both Watershed and Subwatershed Plans. The steps involved in developing a Subwatershed Plan are the same as those used for developing a Watershed Plan, although as described in section 3.3, the level of detail and the scale of analysis may be quite different between the two. The generic steps used to develop both types of plans are illustrated in Figure 3-3 and the questions to be answered within these planning steps are listed in Figure 3-4. Individual municipalities or conservation authorities may use different names for the various planning steps involved.

Stakeholder and Public Involvement:

It is important to engage the public and stakeholders when developing Watershed and Subwatershed Plans. As discussed in Chapter 4 (Lessons Learned), effective involvement of the public and stakeholders is key to the development of a good plan, and is absolutely vital for implementation to succeed. How public and stakeholder involvement is carried out varies widely, but the principles are consistent with those used in the Environmental Assessment process. That is, the public and stakeholders should be involved early on, before any key decisions are made, and throughout the process at key milestones. Stakeholder and public involvement is discussed at length in section 3.4 of this report.

Scoping:

Scoping is carried out in the very early stages of the watershed planning process. Information and data from existing sources are pulled together. These may come in the form of base resource maps, drainage plans, land use and planning studies, fish and wildlife inventories and other materials. Historical documents may also be useful in terms of describing historical conditions and changes that have occurred over time in the watershed or subwatershed. Initial issue identification and information gap analysis then allows for development of a workplan and allocation of resources (expertise, costs, schedule etc.) to complete the process.

Characterizing the System:

Planning for the future requires starting with a good understanding of the present. Characterizing a watershed typically begins with filling data and information gaps that were identified in the scoping exercise. The next step is usually to gain a good understanding of the existing conditions in the watershed or subwatershed. This typically includes collecting information on:

- **surface water resources** (including water budget, baseflows, peak flows and flood lines);
- **surface water quality** (including nutrients, contaminants, temperature and other key parameters in both wet and dry weather conditions);

- **groundwater resources**
(including the identification of recharge/discharge areas, geological conditions, the location and capacity of aquifers, flow direction and gradient, and existing wells);

- **stream morphology**
(including the classification of streams with respect to stability and sensitivity to land use changes);

- **terrestrial resources**
(including wetlands, woodlots, landforms, environmentally sensitive areas and wildlife);

- **aquatic resources**
(including fish, amphibians, and aquatic reptiles, mammals, birds and insects);

- **land use**
(existing and proposed); and

- **demographics**
(population and other relevant social factors).

The next step is to *integrate*, to look at the overall form, function and linkages of the natural system. The integration step examines the interrelationships among the above constituents. The use of GIS overlays can identify important areas for protection: e.g., areas in which there is not only good water quality, but also a thriving fishery, significant baseflow from groundwater and extensive riparian cover.

Setting Goals:

Once there is a good understanding of the natural system, goals, objectives and working targets are set with stakeholders and the public. These goals, objectives and working targets reflect community values and sound science and will vary widely to reflect environmental conditions, issues and public preferences. Targets are generally very specific and measurable - for example, restoring riparian cover on a certain percentage of the stream length of a subwatershed.

Developing Management Alternatives:

Once a good understanding of the natural systems is obtained, and goals, objectives and working targets are defined, managers can develop alternative management strategies for various future scenarios. (These might reflect, for example, high growth, medium growth and low growth scenarios). For these scenarios, the alternative management strategies might reflect differing levels of stormwater control, habitat and stream restoration, protection of natural areas, and other actions that are already expressed in the goals and objectives that have been set.

Evaluating Management Alternatives:

Once alternative management strategies are identified, they are evaluated against a common set of criteria. These typically include such factors as: the ability to meet targets, public acceptability, cost, technical feasibility, the potential to enhance the environment, and the impact on future land uses.

Selecting a Preferred Management Alternative:

With input from the public and stakeholders, a preferred management alternative is selected. Generally, this will be the management alternative that best meets the objectives set by the public and stakeholders.

Finalizing Targets:

Targets are amended if needed and finalized for inclusion in the Watershed or Subwatershed Plan and other relevant municipal planning documents.

Developing Implementation and Monitoring Plans:

An Implementation Plan is developed for the Watershed or Subwatershed Plan. This lists actions to be undertaken, the agency or organization responsible, timelines for completion, and funding sources. The Monitoring Plan describes the extent of monitoring, timing, agencies or organizations responsible, and reporting frequency.

Figure 3-3: Steps in Watershed/Subwatershed Planning

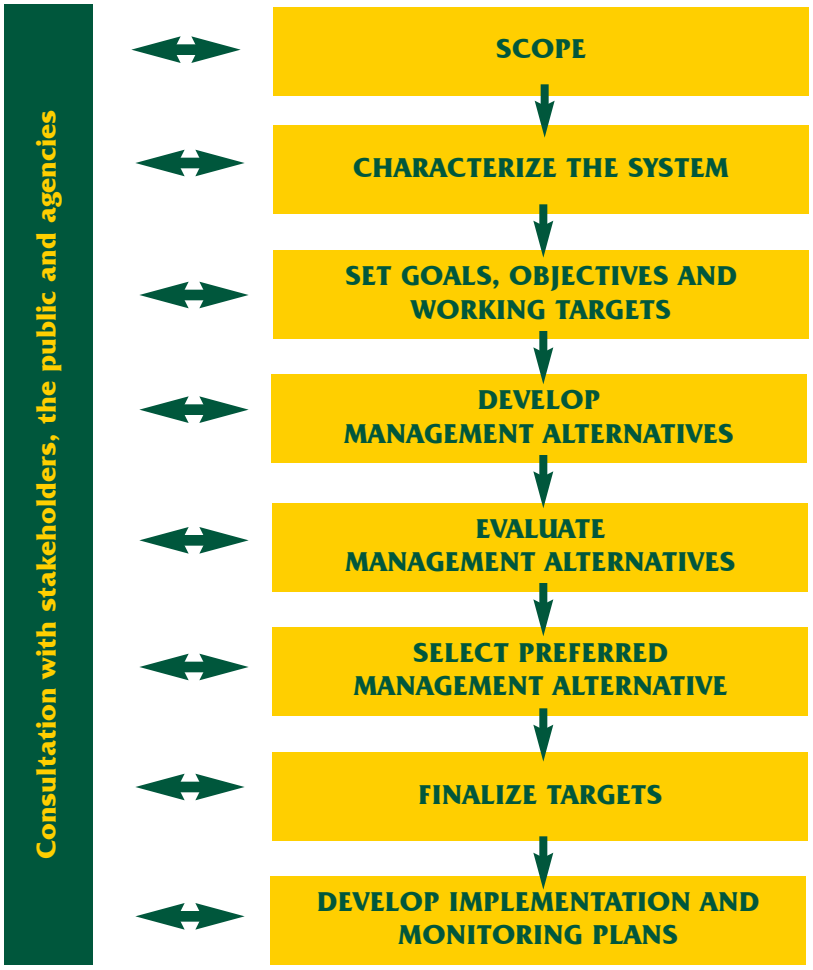
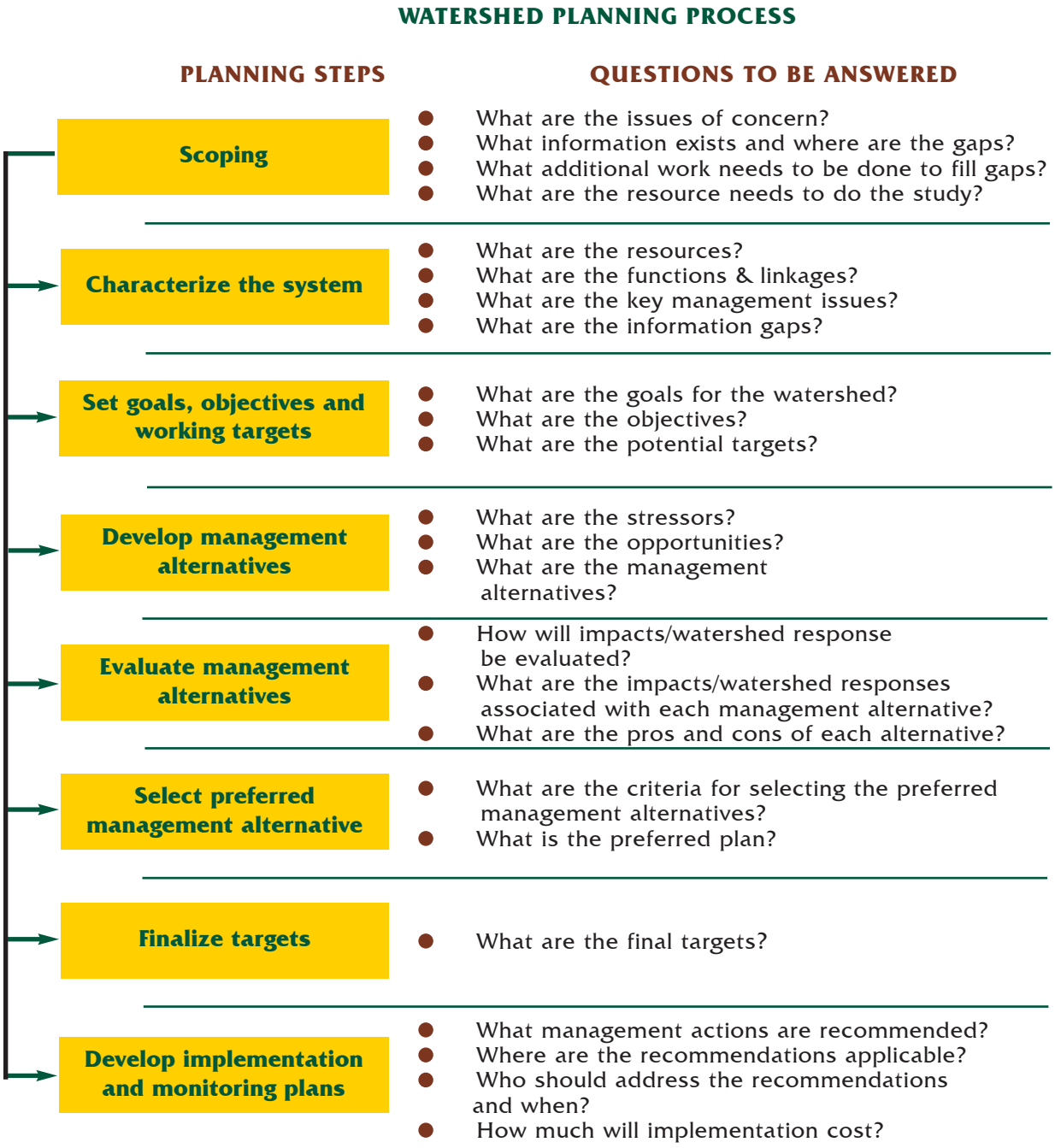


Figure 3-4: Questions to be answered in the planning process



3.3 WATERSHED PLANNING AT DIFFERENT SCALES

As practiced in Ontario, watershed planning is carried out at four different scales, with the level of detail increasing as the size of the planning area decreases. The nested nature of these plans is illustrated in Figures 3-5 and 3-6.

The most logical and efficient way to carry out watershed planning is to begin with the watershed plan, then develop subwatershed plans on a priority basis, and then carry on with tributary plans and finally environmental site plans as needed. This is the most effective way of planning, as each stage provides direction and information for the following stage. This approach also avoids the potential for duplication of effort (for example, avoiding duplicating the development of hydrologic models for a subwatershed).

In practice, however, because of financial constraints many municipalities and conservation authorities develop subwatershed plans first, and later integrate them into an overall watershed plan[8]. Likewise, tributary plans may be developed before subwatershed plans are created. This is indicated in Figure 3-5 by the double-ended arrows. (As noted below, if tributary plans are developed before subwatershed plans, some components such as hydrology must still be studied at the subwatershed scale).

Watershed Plans:

Watershed plans typically cover large areas (1,000 km^2 or more) and correspond to the drainage basins of major rivers such as the Thames, Credit, Grand or Humber. They contain goals, objectives and targets for the entire watershed and document both environmental resources and environmental problems. They also provide watershed-wide policy and direction for protecting surface and groundwater, natural features, fisheries, open space systems, terrestrial and aquatic habitats and other factors. Where resources are degraded, watershed plans address restoration needs. Watershed plans typically include both implementation plans (specifying who will do what by when) and monitoring plans (describing how monitoring of the watershed and reporting is to take place).

Recommendations arising from watershed plans, such as the delineation of natural areas or recharge zones to be protected from development, are typically included in official plans. Typical current costs for a watershed plan range from $300,000 to $1 million.

Subwatershed Plans:

The area covered by a subwatershed is typically in the range of 50 to 200 km^2. At this smaller scale, there is enhanced detail that allows local environmental issues to be addressed. Subwatershed Plans contain goals, objectives and targets for management of the subwatershed. They also:

- identify the form, function and linkages of the natural system (including surface and groundwater, aquatic and terrestrial habitats, fisheries and wildlife communities, soils and stream morphology);

- identify environmentally sensitive or hazard lands;

- identify existing and proposed land uses;

- identify areas where development may be permitted;

- provide direction for Best Management Practices (e.g., for agriculture, aggregate extraction, development servicing, woodlots, etc.);

- provide direction and consistency for approval of development for municipalities;

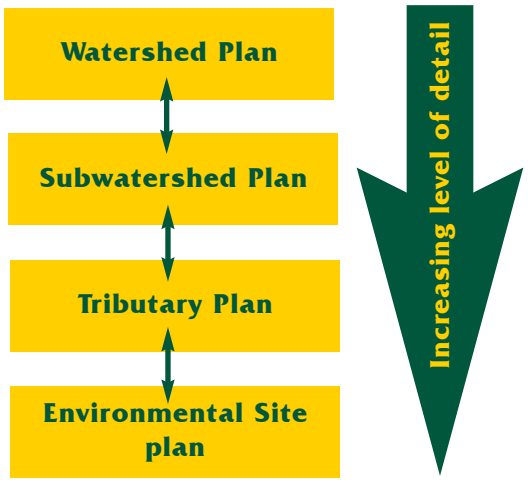
- address cumulative impacts of changes on the natural environment; and

- include both implementation and monitoring plans.

Subwatershed plans are tailored to address specific subwatershed issues and local municipal concerns. The plan for a highly urbanized subwatershed may differ markedly from that for a rural area, reflecting the different environmental condition and stresses between the two.

Recommendations contained in subwatershed plans may be included in official plans, secondary plans, growth management strategies, or other municipal planning mechanisms. Typical current costs for a subwatershed plan range from $200,000 to $500,000.

Figure 3-5: Nested Watershed Planning



Tributary Plans:

Proposals for significant land use changes (such as proposals for subdivisions, large-scale water taking, gravel extraction or intensive agriculture) may require the development of a tributary plan. (In various places, these are called Environmental Management Plans, Environmental Impact Reports, Environmental Area Plans, or Master Environmental Servicing Plans). Tributary plans are carried out on a portion of a subwatershed, and usually address an area of between 2 to 10 km^2 in size. Although it is not always the current practice, the boundaries of a tributary plan should match the drainage basin of a tributary.

Tributary plans may be prepared before or after a subwatershed plan. If carried out after the subwatershed plan has been developed, a tributary plan will benefit from the data collected and directions set out in the subwatershed plan. If a subwatershed plan has not been developed, the tributary plan should be done at a level of detail equivalent to that which would be contained in the subwatershed plan. Tributary plans typically:

- document the environmental resources in a tributary with supporting detailed studies;
- set environmental protection targets for ground and surface water, aquatic and terrestrial communities and stream morphology;
- identify Best Management Practices to be used including stormwater management;
- refine/define areas to be protected and/or restored;
- identify locations for future stormwater management facilities; and
- identify future site-specific studies and monitoring needs.

Recommendations arising from a Tributary Plan are generally reflected in secondary plans, official plan amendments, conditions for draft plan approval or conditions for site plan approval. Typical current costs for a tributary plan range from $75,000 to $100,000.

Environmental Site Plans:

At a still finer level of detail is the environmental site plan, sometimes referred to as an Environmental / Stormwater Management Report (ESWM). These are usually prepared to meet conditions set out in a Draft Plan of Approval. An environmental site plan provides details on proposed environmental and stormwater management measures, and is usually submitted with plans for grading, erosion/sediment control and site servicing.

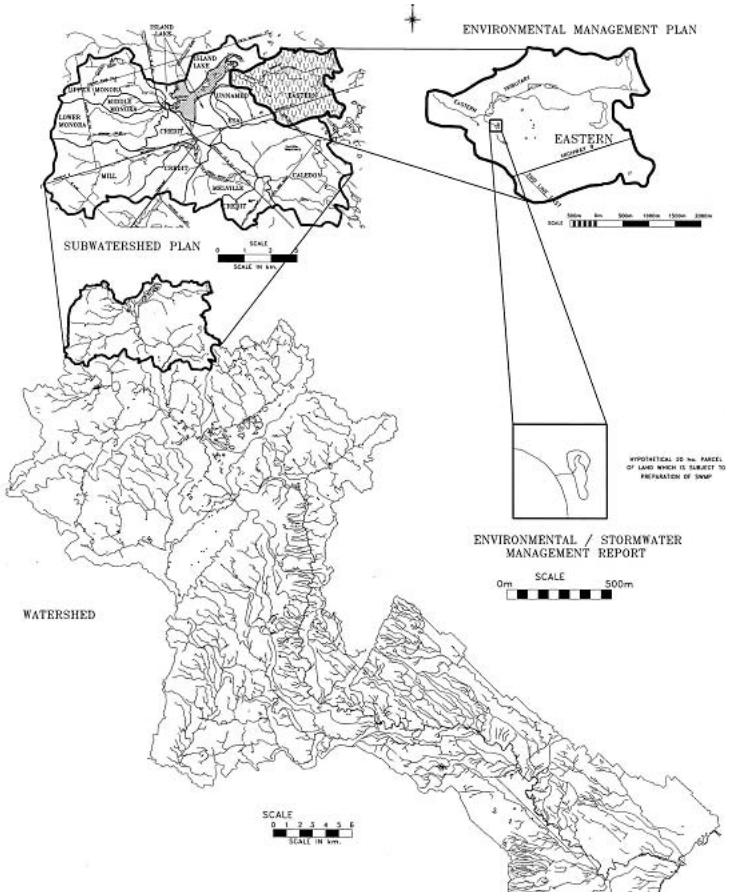
The specific requirements for an environmental site plan tend to vary. Some of the typical key deliverables include:

- detailed designs of stormwater management facilities;

- detailed designs of environmental restoration works (e.g., stream protection works);
- delineation of constraints (e.g., significant woodlots, wetlands or hazard lands);
- sediment and erosion control plans;
- detailed geotechnical and water resource reports;
- delineation of grading limits and tree preservation plans;
- revegetation and lands caping plans;
- access routes and disposal areas for operation and maintenance; and
- landscape features including trails, parkland and other recreational amenities.

The recommendations arising from an environmental site plan are usually included in the engineering design drawings for the draft approved plans of subdivision. Typical current costs for a site plan range from $25,000 to $50,000.

Figure 3-6: Nested Watershed Planning in the Credit River



Taken from: Stormwater Planning and Design Manual (unpublished)

3.4 PARTNERSHIP APPROACHES AND PUBLIC INVOLVEMENT

3.4.1 Partnership Approaches

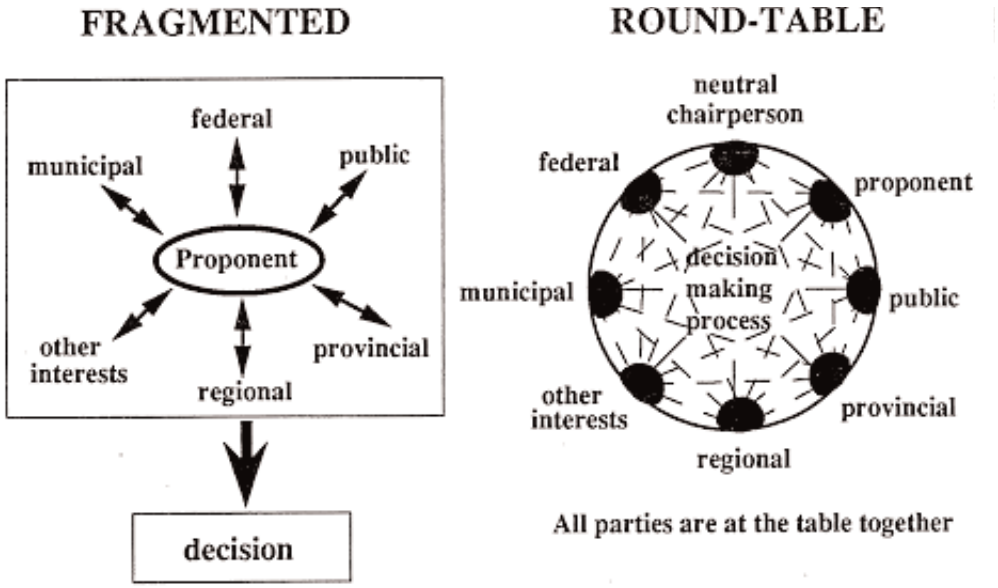
The use of partnership approaches is embedded in the idea and practice of watershed planning and management. There are at least four reasons why this is so. First, watershed boundaries often cross municipal, regional and sometimes provincial and national boundaries. Where this is the case, different agencies need to work together in order to effectively conserve and protect the watershed's resources. Second, watershed management is the responsibility of conservation authorities and watershed planning is most often carried out by conservation authorities. Conservation authorities are by definition partnership agencies, formed from their constituent municipalities. Third, watershed management is an integrated approach to management that considers all aspects of the environment. Accordingly, it requires different agencies with different interests to work together in order for integration to take place. Municipal planners work alongside water managers, fisheries biologists, water quality experts and others. Fourth, there is widespread acceptance that partnership approaches (also called "roundtable" or "stakeholder" approaches) are the most effective ways to manage resources and make decisions.

The jurisdictional framework for protecting the environment and managing natural resources has evolved over decades and is characterized by fragmentation, overlap in some areas and gaps in others. Partnership approaches aim to break through this fragmentation by bringing key decision-makers together to address issues cooperatively (see figure 3-7). Roundtable decision-making replaces sequential, one-on-one interaction. With all parties at the table, representatives gain an understanding of different points of view and needs. Experience has shown that partnership approaches lead to more flexibility, increased cooperation, creative problem-solving and faster decision-making than is found in linear approaches.

As noted in Chapter 4 of this report, effective partnership approaches have been central to the success of watershed planning and management in the province. Successful watershed plans have been those in which key stakeholders (member municipalities, agencies such as MOE, MNR and OMAFRA and the community representatives) have been involved in a focused and targeted manner from the earliest stages. This includes representation on steering, technical and implementation committees. The experience in GRCA, CVC and TRCA is that effective partnership approaches lead to successful completion of watershed plans, encourage "buy in" for implementation, and create a climate for effective monitoring and reporting.

Forging strong links to municipal staff and gaining the active participation and leadership of municipal politicians and citizens help create a constituency that cares about the watershed and which becomes a champion for it.

Figure 3-7 Contrasting Decision-Making Processes



taken from: Barrett, S. and J. Kidd. 1991. Pathways: *Towards an ecosystem approach*. Royal Commission on the Future of the Toronto Waterfront.

3.4.2 Stakeholder and Public Involvement

Public involvement in watershed planning and management is an integral part of both processes. The public - or rather, publics, because there are a great many of them - play a number of important roles in watersheds. The "public" includes taxpayers, landowners, workers, users of recreational resources, school children, churchgoers and others. The public includes all sectors: business, institutional, environmental, recreational and agricultural. Stakeholders are a sub-set of the general public and include anyone with a "stake" in the process. They may be directly affected by a particular issue, or may represent the interests of a particular sector or organization. Stakeholders are self-defined and can include businesses, developers, recreational users groups, residents and others. Because of their greater stake in an issue, stakeholders tend to be willing to invest more time and energy in processes such as watershed planning, and more likely to volunteer for committees or tasks which require a significant investment of time.

The experience of GRCA, CVC and TRCA in watershed planning and management is that effective public involvement is a key factor for success (see Chapter 4). In watershed planning, public involvement:

- starts early in the process and continues throughout;
- is focused at key milestones in the process;
- captures the public's preferences in terms of watershed goals, objectives and targets (helping to answer the question, "Where do we want to be?");
- provides direction for identification, evaluation and selection of management options;
- creates local "ambassadors" who act as watchdogs, advocates, educators and catalysts for action; and
- encourages citizens to act as stewards - to get involved in protection, restoration, cleanup and monitoring projects in the watershed.

In practice, the scale of a public involvement program and the techniques and tools used differ depending on the scale of a watershed planning study, the level of interest, and the issues involved. For a relatively small, rural watershed, public involvement may be limited to two meetings, one to develop goals and one to select a preferred management alternative.

For a larger, more complex study, like the Don Watershed Strategy, public involvement might include dozens of public meetings and the formation of a multi-stakeholder group like the Don Watershed Task Force to guide the process along.

Some of the elements that contribute to effective public involvement in watershed planning are:

- clear Terms of Reference for the study that describe roles, responsibilities, deliverables, time lines and opportunities for public involvement;
- effective facilitation;
- clear, understandable and timely study reports and documents
- clear, accessible and attractive newsletters and other tools that provide updates on the planning process;
- the use of graphic ways to depicting information such as GIS and air photos;
- accessible and timely opportunities for involvement;
- the provision of a variety of ways for people to participate in the process, according to their level of interest;
- openness and transparency; and
- clear documentation of the input received and how it affected the planning process.

4.0 LESSONS LEARNED: ASSESSING THE GENERIC

This section of the report examines the lessons learned by CVC, GRCA and TRCA. In a decade of watershed planning (twenty five years in the case of GRCA), much has been learned about the factors that contribute to success in watershed planning and management, the challenges and barriers, and trends in planning and management. These are examined through the six case studies contained in Appendices C to H. The case studies were selected to provide a spectrum of scales and type of area (e.g., the heavily urban Don Watershed and the Grand River, which still contains large areas devoted to agriculture). The reader is encouraged to read these case studies which provide a wealth of detail about how these complex plans were developed.

In this section of the report, where an element of success, a barrier or a trend references a particular conservation authority or a particular case study, it is denoted with square brackets (e.g., TRCA CS #6 refers to TRCA's Case Study #6 on the West Humber Subwatershed Study, which is presented as Appendix G). In practice, many of the points made in this section are applicable to all three conservation authorities. Compiled lists of elements of success, barriers and trends that are applicable to all three conservation authorities are found in Figures 4-1, 4-2 and 4-3 respectively.

4.1 ELEMENTS OF SUCCESS

4.1.1 Watershed Planning

Designing the Planning Process

- It is important to tailor the watershed/subwatershed planning process to the particular watershed (i.e., to respect the particular natural and social environment). [TRCA]

- There is a need for clear Terms of Reference to guide the development of watershed and subwatershed plans. This should clearly define the roles and responsibilities of the agencies and partners involved and describe the formal review and approval process [TRCA CS#6]

- Building understanding and commitment of the project Steering Committee is vital for success. [TRCA]

Characterizing the System

- Up front data collection is needed for effective watershed and subwatershed planning. [CVC CS #1)

- Effective characterization requires looking at rivers, tributaries, upland areas and how these are linked through the hydrologic cycle. [CVC CS #1)

- GIS mapping is an effective tool that can be used to depict data, information and recommendations. [CVC CS #1)

- To effectively characterize the system, analysis and findings from each discipline need to be integrated. [CVC CS #1)

Setting Goals, Objectives and Targets

- The development of clear and understandable goals and objectives was a key factor for success in the development of the Grand River Basin Water Management Study. Elaborate and rather unwieldy goals were reduced to three easily understood objectives for "public consumption". [GRCA CS #3]

Developing, Evaluating and Selecting Management Alternatives

- To effectively analyze the potential impacts of various management alternatives, the analysis and findings from each discipline need to be integrated. [CVC CS #1)

- Consideration of a wide range of alternative strategies - 26 in all -- was a key factor for success in the Grand. [GRCA CS #3]

- In the Grand, having adequate expertise and decision support tools to be able to do evaluate the relative economic, social and environmental costs and benefits of the different management alternatives was a key to success. [GRCA CS #3 and GRCA CS #4]]

4.1.2 Implementing Watershed Plans

- Effective implementation requires the identification of clear, discrete actions and responsibilities and clear accountability for deliverables. [CVC CS #1)
- A key contributor to effective implementation is the "buy in" of key partners, such as member municipalities, from the beginning. [CVC CS #1)

- In the Laurel Creek Subwatershed Study, the support of municipal politicians and staff (and their continuity with the planning stage) was a key factor for successful implementation. [GRCA CS #4]

- The ability of the GRCA to stitch together various programs to help improve rural water quality, in spite of shifting provincial priorities, illustrates how important it is to have a coordinating agency for implementation. [GRCA CS #3]

- In the Don, illustrating how the watershed management objectives apply at all scales helped promote public understanding and accelerated implementation. This was accomplished through the use of subwatershed scale Regeneration Plans, neighbourhood scale Concept Site Plans, and examples of "backyard" actions for residents, businesses, and schools. [TRCA CS #5]

- The use of Detailed Concept Site plans significantly accelerated the implementation of several large regeneration projects throughout the Don Watershed, which provided some "early successes", demonstration projects, and partnerships that could be used to motivate further action. Concept Site plans had already engaged a number of stakeholders in the process, so these working groups were already together. Having the plans already available provided a tangible focus for all partners in assembling the necessary financing/resources. [TRCA CS #5]

- A key factor for success in the Don was the setting of "do-able" short term milestones, as well as longer term challenging objectives in order to build momentum with small, immediate successes. [TRCA CS #5]

4.1.3 Monitoring and Reporting

- Celebrating success is considered a key factor for success in watershed management, in that it allows people to understand that progress is being made. Although not directly related to the Basin Study, the health of the Grand has been celebrated by being declared a Heritage River in 1994 and being awarded the Theiss River Prize for excellence in river management in 2000. Coverage of the Grand's trout fishery - one of the best in North America - has highlighted the improvements in the river's water quality. [GRCA CS #3]

4.1.4 Periodic Review of Plans

- Watershed plans need to be updated over time as follow-up monitoring takes place and watershed conditions change. [CVC CS #1]

- GRCA has initiated a continuous review of all components of the Basin Study, upgrading and maintaining its components on a continuous basis, rather than at a set interval. [GRCA CS #3]

4.1.5 Partnership Approaches

- Key partners (such as member municipalities and ministries such as MOEE, MNR and OMAFRA) were involved from the beginning in a very focused and targeted manner in the development of the Credit River Water Management Strategy. This was a key element of success in the process, leading to "buy in" for the implementation phase. [CVC CS #1]

- All parties affected by the Grand River Basin Water Management Study and its implementation were represented on key committees (the Grand River Implementation Committee and its Technical Committee). [GRCA CS #3] Similarly, all parties affected by the Laurel Creek Watershed Plan were involved in the Roundtable and Technical Committee. [GRCA CS #4]

- Having strong leadership at both the political and staff level at the City of Waterloo and GRCA was considered a key factor for success. [GRCA CS #4]

- Strong linkages to other programs (including monitoring programs and local and regional land use planning) optimized the use of available information and minimized duplication of effort. [GRCA CS #3]

- Involvement of municipal politicians on the Don Task Force helped expedite endorsement and implementation of the Strategy by municipal councils and supported the continued, active participation by municipal staff throughout the process. [TRCA CS #5]

- The use of a consensus based-based approach in the development of the Don Watershed Strategy was a key factor in its success. By creating an environment of consensus-building, the Task Force was able to describe a shared vision for a healthy urban watershed that was compellingly "practical" and therefore got the attention of a broader audience, including former skeptics. The Task Force vision deliberately states that "we do not wish to dismantle...the urban areas...to recreate a pristine Don River..." and the report deliberately coined the term "regenerate" to suggest some healthier new condition shaped by the resource potential and the urban fabric. [TRCA CS #5]

- The Don Watershed Task Force adopted a common philosophy of collaboration in planning and recognition of the need for multiple implementors rather than the "pointing fingers" approach of the past. This acceptance of shared responsibility was essential to effect implementation. [TRCA CS #5]

4.1.6 Public Involvement

- Public participation in determining the study objectives and in the formation, evaluation and selection of the final management plan was a key factor in the success of the Grand River Basin Water Management Study and the Laurel Creek Watershed Study. The process used by GRCA -- inclusive, open and unbiased - helped build trust in the planning process. [GRCA CS #3 and GRCA CS #4]

- In the Don, the involvement of citizens, NGOs, and politicians in the Task Force process, created a group of "local ambassadors" who have continued to educate, motivate and serve as watchdogs in their own neighbourhoods. This has helped multiply limited government resources many times over. [TRCA CS #5]

- Empowering a strong, enthusiastic, dedicated, and well respected citizen with the role of Chair in the Don Watershed Task Force helped to engage and empower other citizen members, gave the process more transparency, and made it clear that the product was a shared product and not just another agency report. [TRCA CS #5]

4.1.7 Communication

- Good visual products, such as GIS mapping and photos, are essential communication tools for communicating the plan and involving the public. [TRCA CS #5]

- In the Don, considerable effort was put into developing a "readable", interesting, and illustrated strategy document. This document (Forty Steps to a New Don) appealed to a broader audience and was widely read. Involvement of a professional (journalistic) writer was essential throughout the process, in order to be able to accurately communicate the Task Force discussions and convey the subtleties of the concepts they were trying to express.

- Even for technical users, watershed study reports can be imposing. Usability can be improved by separating out implementation and monitoring plans from process documentation on goals, background environmental conditions, and identification , analysis and evaluation of alternatives. [GRCA CS #4]

- It is important to celebrate successes. Celebration events, like Paddle the Don, attract media attention, and profile the work of the Task Force and their public, private, and political partners. [TRCA CS #5]

4.1.8 Institutional Aspects of Watershed Planning and Management

Coordination of Planning, Implementation and Monitoring

- Having a coordinator at the watershed level (i.e., in the conservation authority) was a key factor for success in the Grand River Basin Water Management Study. [GRCA CS #3]

- Similarly, for the Don Watershed Strategy, the existence of a coordinating agency (in this case, the CA) was necessary to bring everyone together during both the planning and implementation stages. In the Don, TRCA has been successful at bringing interested volunteers, groups, and agencies together with financial and technical resources to assist them in achieving their environmental objectives. Often this is an opportunity to pool resources and achieve larger common objectives than any one group could achieve on its own. [TRCA CS #5]

- Watershed managers should carry out watershed/subwatershed studies themselves in order to ensure that there is an institutional understanding and memory of the process and the findings. [CVC CS#1]

- Setting an ambitious schedule for the project and having a defined mandate for the Don Watershed Task Force, kept the participants engaged in the development of the Strategy. Clear lines of accountability within the process contributed to the adherence to deadlines. [TRCA CS #5]

Resources

- For both planning and implementation, the GRCA found that having adequate resources (time and money) was key to success. [GRCA CS #3 and GRCA CS #4]
- In the Don, TRCA found that having dedicated staff (both personal and corporate dedication of staff time) was essential to maintain enthusiasm, meet timelines, and fulfill expectations of volunteers. [TRCA CS #5]

Figure 4-1 Key Elements of Success in Watershed Management

ASPECT	FACTORS FOR SUCCESS
Watershed / Subwatershed Planning	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	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	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	Update at 10 year intervals to reflect changes in environmental conditions, stressors, and public preferences
Partnership Approaches	Involve key partners from the beginning of the process in Steering Committee and others (i.e., Technical Committees) Seek strong leadership fat 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	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	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	Have strong coordination at the local level (e.g., in the CA) Have watershed managers develop watershed/subwatershed plans Set an ambitious schedule and keep to it Find dedicated staff to develop the watershed/subwatershed plan

4.2 CHALLENGES AND BARRIERS

4.2.1 Watershed Planning

Characterizing the System

- To date, there has been only limited integration of economic and social aspects in watershed planning in the Credit River. These need to be better addressed in watershed and subwatershed planning. [CVC CS #1)

- The science of integration has improved tremendously in the last decade or so. However, there is still a lack of tools that allow watershed and subwatershed information to be integrated across disciplines. [CVC CS #1)

- Despite advances in development of surface and groundwater models, there is still a need for user-friendly holistic models that combine surface and groundwater). [CVC, CS #2]

- Quantitative models need to be developed that relate fish communities to water quality conditions. [CVC, CS #2

- Quantitative models need to be developed for the relationship between fish communities and flow regimes (upwellings, low flows, bankfull, overbank flows, etc.) [CVC, CS #2]

- Technical practitioners did not always understand the link between the Don Watershed Strategy document, which was written for a general audience, and the background technical studies that formed the basis for the Strategy's development and implementation. This could have been avoided with better coordination of the technical work into a clear compendium of linked background reports and implementation guidelines/criteria. [TRCA CS #5]

- Groundwater management was not addressed in a comprehensive way when the Don Watershed Strategy was being developed , due to financial and scheduling constraints together with the belief that adequate information was available relative to the concerns. [TRCA CS #5]

- Although a qualitative understanding of the linkages and issues between various scientific disciplines was provided in the Subwatershed Regeneration Management Plans, the practice of "integrated watershed management" was somewhat rudimentary in the Don Watershed Strategy. As the science has evolved considerably, this will be addressed during the periodic review of the Strategy. [TRCA CS #5]

4.2.2 Monitoring and Reporting

- The lack of integrated monitoring plans in some of CVC's older subwatershed plans made follow up evaluation difficult. Many of these early monitoring programs were one-dimensional (focusing only on water quality) and were very expensive to implement. [CVC CS #1]

4.2.3 Institutional Aspects of Watershed Planning and Management

- The high cost of watershed planning (both with respect to dollars and staff resources) is a major barrier. [GRCA CS #4]

- The lack of sustainable, multi-year funding for watershed planning and management hinders effective planning and action.

- The lack of political and public understanding of the importance of watershed management, and what it can achieve is a barrier that must be overcome.

- Watershed planning is not explicitly recognized in existing provincial legislation including the land use planning requirements of the *Planning Act*.

Figure 4-2 Challenges and Barriers in Watershed Management

Aspect	Challenges and Barriers
Watershed Planning	The social and economic environments need to be more fully addressed in watershed and subwatershed planning
Characterizing the System	Improved tools are need to better integrate information across disciplines User-friendly holistic models are needed that combine surface and groundwater More emphasis should be placed on groundwater studies Quantitative models are needed to relate fish communities to water quality conditions Quantitative models are needed to relate fish communities to flow regimes
Monitoring and Reporting	Lack of integrated monitoring programs in some older subwatershed plans makes follow up evaluation difficult
Institutional Aspects	High cost of watershed planning (both in terms of dollars and staff time) is a major barrier to the development of plans Lack of stable, multi-year funding for watershed planning and management hinders effective planning and action Lack of political and public understanding of the importance of watershed management must be overcome Watershed planning is not explicitly recognized in existing provincial legislation

4.3 TRENDS

4.3.1 Watershed Planning

- Many early studies were focused on urbanizing areas and were often driven by development pressures. Over the last ten years, there has been a gradual increase in emphasis on subwatershed planning in rural areas.

- There has been a clear trend towards doing more comprehensive technical analysis in watershed and subwatershed plans.

- There has been increasing use of GIS as an integration and communication tool.

- There has been increased use of water modelling and data management.

- The engineering approach traditionally used to manage water resources in urbanized areas is being replaced by an ecosystem approach.

- Many plans and programs are now being developed on a watershed scale. These include fisheries, forestry and terrestrial habitat plans, and rural water quality programs. In addition, there is a clear trend towards watershed-scale monitoring.

- There appears to be increased interest in inter-watershed planning where resources cross watershed boundaries. Examples of this include the Oak Ridges Moraine, where nine conservation authorities are collaborating, and the groundwater strategy being developed by York, Peel, Durham and Toronto, in which six conservation authorities are participating.

- There has been an increased emphasis in the last decade on understanding and protecting the natural environment system, rather than its component parts. This reflects the increased understanding of the interrelationships among system components, and an increased emphasis on linkages.

- There has been a philosophical shift with an increased emphasis on prevention rather than clean up. In watershed management, this has translated into an increased emphasis on drinking water source, reduction of pollutants at source and protection of headwater and recharge areas.

4.3.2 Implementing Watershed Plans

- Many mechanisms (tools) and approaches are being used to implement watershed and subwatershed plans in addition to the traditional mechanisms of the land use planning system. These include using the *Aggregate Resources Act* (commenting on applications), using *the Ontario Water Resources Act* (commenting on Permits to Take Water), and working through interest groups and organizations (such as the Aggregate Producers Association). [CVC, CS #2] Increasingly, stewardship approaches are being used that engage and involve neighbourhoods, businesses, organizations and institutions.

- In order to implement subwatershed plans, CVC has had to take a stronger role in commenting on source water protection within the land use planning process. [CVC, CS #2]

- Because of the clear link between environmental degradation and urbanization, CVC has had to provide upfront subwatershed data and information for the land use planning processes carried out by member municipalities. This includes providing input on land use changes as well as servicing for water, sanitary sewers and stormwater management. [CVC CS #1]

4.3.3 Monitoring and Reporting

- All of CVC's subwatershed plans now contain monitoring plans. Some early subwatershed plans did not have monitoring plans, which made evaluation difficult. [CVC CS#1]

- TRCA has embraced Watershed Report Cards as a tool for reporting on progress in watershed management. These provide easily understood "snapshots" of progress made and challenges yet to be attained.

4.3.4 Periodic Review of Plans

- CVC and TRCA have adopted the concept of adaptive environmental management which recognizes that environmental conditions evolve over time. Watershed and subwatershed plans represent the best understanding of environmental conditions at a particular time, and assumptions and models need to be verified over time with monitoring.

- GRCA's approach to reviewing the Basin Study has changed dramatically. Its first review was 12 years after completion of the Study, and this was understood to be too long. Five years was considered a more appropriate interval for review. However, GRCA recently has initiated a continuous review of all components of the Basin Study, upgrading and maintaining its components on a continuous basis, rather than at a set interval. [GRCA CS #3]

4.3.5 Partnership Approaches

- Close ties with the public works and planning departments of member municipalities has allowed CVC to provide advice on land use changes and infrastructure choices. Similarly, close ties with universities has allowed them to address emerging issues and keep pace with the evolving science of watershed management.

4.3.6 Public Involvement

- Conservation authorities are embracing new tools and approaches to involve the public in watershed planning and management. These include using workshops rather than town hall type meetings and Web-based ways of providing information to and interacting with people.

4.3.7 Institutional Aspects of Watershed Planning and Management

- There has been increased integration of watershed and subwatershed plans into the official plan process. As an example, the County of Wellington has included a characterization map of the Credit River as a schedule in its official plan.

- In order to have the capacity to carry out watershed and subwatershed plans, CVC, GRCA and TRCA have had to recruit and maintain technical staff in such fields as hydrology, hydrogeology, water quality, fluvial geomorphology, terrestrial biology and aquatic biology.

- CAs and municipalities are using policies and bylaws in new ways (e.g., such as topsoil and tree cutting bylaws.

- CAs have been able to reduce the high costs of watershed planning by adopting such measures as:

  - establishing watershed-wide resource databases and developing GIS expertise so that more Phase 1 data can be provided to users;
  - taking a stronger role in project management;
  - awarding the various components of a watershed plan to a number of specialists rather than hiring one consultant to manage all aspects of the study; and
  - carrying out some components of studies in-house (e.g., public participation, monitoring, etc.) [GRCA CS #4]

Figure 4-3 Trends in Watershed Management

ASPECT	FACTORS FOR SUCCESS
Watershed Planning	There has been an increase in subwatershed planning in rural areas More comprehensive technical analysis is being carried out in watershed and subwatershed plans GIS is increasingly being used as an integrative and communications tool The engineering approach to managing water resources in urban areas is being replaced with an ecosystem approach There has been increased use of modelling and data management Many plans and programs (such as fisheries, forestry and monitoring plans) are being developed on a watershed basis There is increased interest in inter-watershed planning There has been an increased emphasis on understanding and protecting the natural environment system, rather than its component parts There has been a philosophical shift with an emphasis on prevention rather than clean up
Implementation of Plans	Diverse mechanism are being used to implement watershed and subwatershed plans, including education Conservation authorities are playing a greater role in source protection of drinking water, by commenting in the land use planning process Conservation authorities are increasing providing upfront subwatershed data and information for use in municipal land use planning processes
Monitoring and Reporting	The trend is towards incorporating monitoring into all subwatershed plans The use of tools such as Watershed Report Cards allow the public to easily understand environmental conditions, progress made, and where effort still needs to be spent
Periodic Review of Plans	Many conservation authorities are beginning to focus on review of older watershed and subwatershed plans Many conservation authorities have adopted the concept of adaptive environmental management
Partnership Approaches	Developing close ties with staff at member municipalities has allowed CAs to provide advice on land use changes, infrastructure choices, etc. Developing ties with universities had allowed some CAs to address emerging issues and keep pace with the evolving science of watershed management
Public Involvement	Many CAs are embracing new tools and approaches to better involve the public in watershed planning and management
Institutional Aspects	There has been increased integration of watershed and subwatershed plans into the official plan process Many CAs have recruited technical experts is fields such as hydrology and hydrogeology in order to carry out watershed planning and management Many CAs have been able to reduce the high costs of watershed planning through: establishing watershed-wide databases, taking a stronger role in project management, using multiple specialists rather than a single consultant to carry out plans, and carrying out some components of studies in-house

5.0 IMPLEMENTATION

5.1 INTRODUCTION

The process used for implementing watershed and subwatershed plans is critical to ensure that the watershed management strategies are workable and effective. As watershed management has evolved, it has become widely recognized that a partnership, or cooperative approach is needed in order to implement management strategies. This typically includes relevant stakeholders such as municipalities, regulatory agencies, and sometimes non-governmental agencies (NGOs). The use of partnership approaches often requires changes to the operating structure and/or responsibilities of agencies as well as the adoption of processes that facilitate the involvement of stakeholder organizations.

This section of the report focuses on the process of implementation, and outlines the many different mechanisms that can be used for implementing watershed and subwatershed plans. It is based on the experiences of CVC, GRCA and TRCA.

The implementation process for watershed and subwatershed plans must clearly address the what, who, where, when and how of implementation:

- What actions are to be included in the implementation plan?
- Who will be responsible for leading the actions?
- Where will the actions take place?
- When will the actions be implemented? and
- How will the actions be carried out?

Implementation must be broad in scope, and must consider all of the recommendations in a watershed or subwatershed plan. The process that is followed by CVC, GRCA and TRCA is illustrated in Figure 5-1. It includes six steps:

1. Develop an Implementation Committee.

2. Identify the implementation requirements and consider the options available.

3. Develop a work plan for implementation.

4. Allocate resources to carry out the tasks included in the workplan.

5. Develop a schedule with milestone dates for various components of work plan.

6. Begin implementation.

These steps are explored in this chapter.

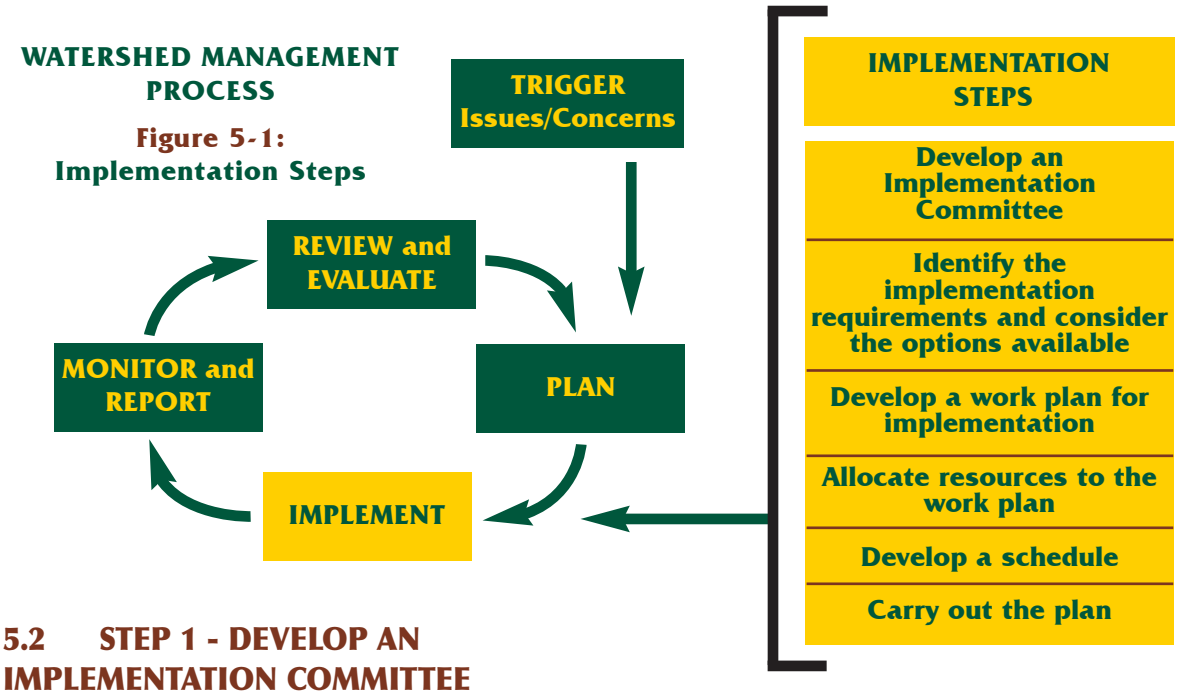


Figure 5-1: Implementation Steps

5.2 STEP 1 - DEVELOP AN IMPLEMENTATION COMMITTEE

A basic principle of watershed management is that it is based not on political boundaries but ecological ones - the watershed unit. Following from this principle, effective implementation is not rooted in one agency but many, including municipalities, agencies, and other stakeholders. To facilitate the coordination of implementation efforts, an implementation committee is often needed. This committee can either be established on a temporary basis to get the process started properly, or can be established as a long term group to ensure that all of the planned actions are carried out in accordance with the intended schedule and to later deal with review (see Chapter 6.2)

An implementation committee should include all of the conservation authorities, municipalities, agencies and other stakeholders that have a vested interest in seeing the plan's recommendations implemented and who could be affected by the implementation of the strategy. Often, community representatives are involved in the committee if stewardship or community involvement in rehabilitation projects is included in the plan.

In some cases, subcommittees are set up to address specific activities. For example, committees may be formed to integrate changes to engineering policies, facilitate community projects or develop stewardship programs. For the Implementation Committee itself, and any subcommittees, clear Terms of Reference should be developed so that mandates and the responsibilities of members are clear.

The reporting structure for committees and subcommittees is important, as is the chair. Both depend upon the purpose of the committee and the associated terms of reference. If the main purpose of a committee is policy setting, a senior staff manager may be best suited. If the focus of a committee is to develop programs for the community, then a councillor or community representative may be a better choice for chair. A staff resource person is typically required on the committee to provide the logistical support and continuity to that the implementation process can be carried out. Similarly, administrative funds are needed so that the committee can run effectively.

Key success factors for an Implementation Committee include:

- a clear purpose and terms of reference;
- a chair to suit the task;
- clear reporting responsibilities;.
- adequate staff resources; and
- adequate administrative funds.

5.3 STEP 2 - IDENTIFY THE IMPLEMENTATION REQUIREMENTS AND CONSIDER THE OPTIONS AVAILABLE

In order to address the multiplicity of issues addressed in watershed or subwatershed plan, an implementation plan typically includes a variety of implementation mechanisms. These can include everything from municipal by-laws to land acquisition to public education.

When developing the Implementation Plan, it is important to identify what needs to be accomplished, consider all of the options that are available and select the most appropriate mechanisms. The various implementation mechanisms that may be applicable include the following:

Land Use Planning Mechanisms

- Criteria to be used for land management
- Lands to be protected or managed (constraint lands)

Legislation, Regulations and Policies

- Criteria for stormwater (SWM) management
- Targets to be met (land, water, physical)
- Policies for protection / enhancement
- Changes to current policies, guidelines, regulations, standards and administrative roles

Funding Mechanisms

- Funding sources

Environmental Enhancement, Stewardship, Education

- Areas to be enhanced or rehabilitated
- Specific projects to be carried out
- Stewardship programs

Land Acquisition

- *Monitoring*
- *Future Studies*

These items discussed in sections 5.3.1 to 5.3.7.

5.3.1 Land Use Planning Mechanisms

Watershed and subwatershed plans are typically carried out because of specific needs or triggers. If urbanization is the trigger, watershed plans typically feed into the development of an Official Plan and Subwatershed Plans feed into the Secondary Planning process (see Figure 5-2). In other cases, such as water quality concerns in rural areas, watershed or subwatershed plans provide the means of developing policies or guidelines to manage the pollution sources and/or resource use.

Regardless of the initial trigger, the management strategy developed often has land use planning implications. Developing appropriate mechanisms for land use planning can require a significant amount of time, but these mechanisms can become very powerful implementation tools. They provide the ability to:

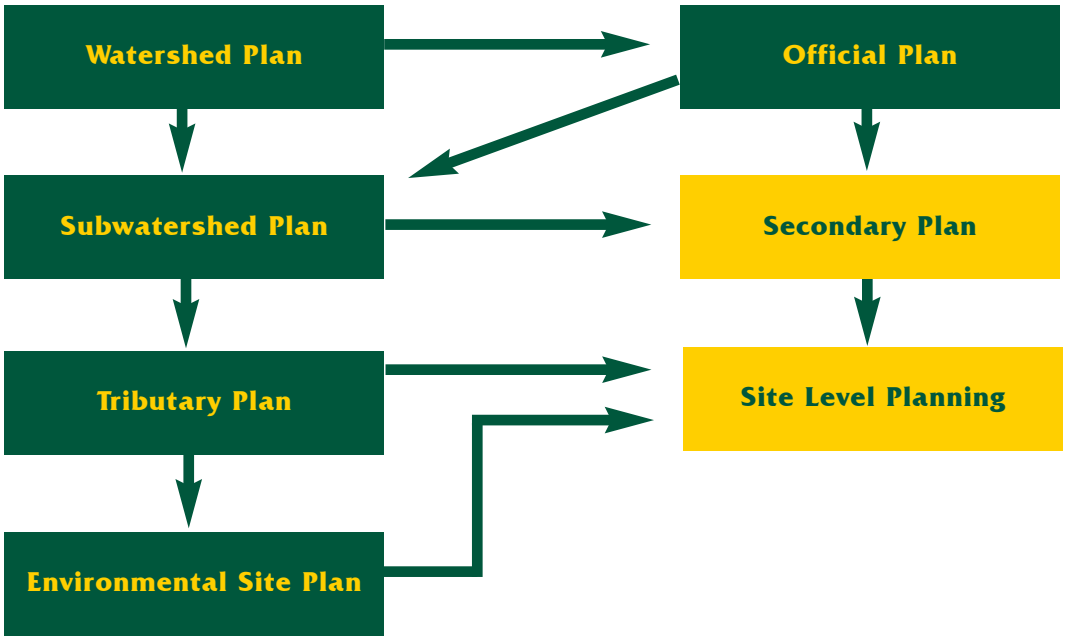
- protect terrestrial and aquatic features from changes in land use;
- protect natural resources for future conservation and/or managed use; and
- restrict land use changes and uses in sensitive areas.

There are a number of management controls that can be integrated into planning documents to address watershed issues. These include:

- specifying terrestrial constraint areas;
- establishing buffers for watercourses or other sensitive features;
- identifying factors related to land use (i.e., density and type of land use, etc.);
- providing policies for acceptable uses on certain types of lands;
- identifying recharge areas for infiltration and/or groundwater protection;
- setting policies for service corridors;
- identifying management needs for resource areas;
- locating areas and types of stormwater management facilities that are required; and
- identifying allowable uses in hazard and environmental lands.

Municipal land use planning mechanisms such as official plans, secondary plans and community plans should use watershed and subwatershed plans as guiding documents. Correspondingly, land use planning mechanisms are a primary tool for implementing the watershed management strategy components that relate to allowable land uses. Planning departments responsible for these land use planning mechanisms needs to have a full understanding of the watershed and subwatershed planning process. Appropriate land use designations and related policies will be developed by local municipalities and other agencies as appropriate (i.e., hazard lands, environmental protection areas, etc.). The implementation plan should therefore identify what land use planning mechanisms will be affected and what changes are needed to them for implementation of watershed or subwatershed plans.

Figure 5-2: Watershed Planning and the Land Use Planning Process



5.3.2 Legislation, Regulations and Policies

There is a broad range of legislative, regulatory and policy tools that can be used in the implementation of watershed and subwatershed plans. A listing of the relevant legislation and policy documents is included in Figure 5-3.

One of the barriers to watershed and subwatershed plan preparation identified in Section 4.2 is that the provincial legislative framework does not specifically recognize the process of watershed planning or watershed management. Despite this, many of the legislative, regulatory and policy tools that relate to water can still be applied since their original purpose is similar (e.g., environmental resource protection). Existing legislation, regulation and policies provide direction for:

- land use management;
- the management and the protection of natural resources;
- water quality control;
- pollution control and pollution prevention;
- the management and control of activities that could lead to water quality impacts;
- protection of fisheries;
- the identification and protection of hazard lands; and
- the operation of and maintenance policies for existing infrastructure.

Key considerations in using legislative, regulatory and policy tools for implementing watershed or subwatershed plans include:

- the designation of natural areas must be defendable and may conflict with landowner rights;

- protection standards or measures will typically be required for the management of resource features identified; and

- engineering standards (e.g., servicing standards) will likely be influenced by policy changes.

The designation of land (e.g., as an ESA) or prescriptions on allowable land uses on a parcel of land can be viewed as conflicting with landowner property rights. This can be a difficult issue as landowners may view it as constraining their ability to use the lands and therefore having a significant financial impact. Although these matters have been discussed for years, there is still no clear resolution to this issue. It is typically dealt with by encouraging the dedication of lands as an environmental feature and providing financial incentives in the form of reduced property taxes or purchase of the land.

Figure 5-3: Legislation, Regulations and Policies Related to Watersheds

ISSUE	LEGISLATION, REGULATION OR POLICY	ADMINISTERED BY
Flood Protection and Stormwater Conveyance Design	*Municipal Act* *Planning Act* *Building Code Act* *Conservation Authorities Act* Ontario Regulations (for each CA) *Lakes and Rivers Improvement Act* *Navigable Waters Protection Act* Provincial Policy Statement Floodplain Criteria (1982) *Beds of Navigable Waters Act* *Drainage Act* *Public Lands Act* MTO Drainage Manual	MMAH MMAH MMAH MNR CA MNR DFO MNR MNR MNR OMAFRA MNR MTO
Sediment Control During Construction	*Municipal Act* Ontario Regulations (for each CA) *Endangered Species Act* *Environmental Protection Act* *Lakes and Rivers Improvement Act* *Ontario Water Resources Act* *Environmental Contaminants Act* *Fisheries Act*	MMAH CA MNR MOE MNR MOE EC DFO
Fisheries Protection	*Endangered Species Act* *Fisheries Act*	MNR DFO
Bacteria Control	*Environmental Protection Act* *Ontario Water Resources Act* *Environmental Protection Act*	MOE MOE EC
Water Quality	*Pesticides Act* *Environmental Protection Act* *Ontario Water Resources Act* *Environmental Contaminants Act*	MOE MOE MOE EC

ISSUE	LEGISLATION, REGULATION OR POLICY	ADMINISTERED BY
Watershed Planning	*Conservation Authorities Act*	MNR
	Ontario Regulations (for each CA)	CA
	Crown Timber Act	MNR
	Drainage Act	OMAFRA
	Endangered Species Act	MNR
	Environmental Assessment Act	MNR
	Environmental Protection Act	MOE
	Forestry Act	MNR
	Game and Fish Act	MNR
	Historical Parks Act	MCCR
	Lakes and Rivers Improvement Act	MNR
	Municipal Act	MMAH
	Ontario Planning and Development Act	MMAH
	Ontario Water Resources Act	MOE
	Aggregate Resources Act	MNR
	Planning Act	MMAH
	Trees Act	MNR
	Woodlands Improvement Act	MNR
	Canada Waters Act	EC
	Canada Wildlife Act	EC
	Navigable Waters Protection Act	DFO
	Wetland Policy Statement	MNR
	Provincial Policy Statement	MMAH

Agencies:

MMAH	Ontario Ministry of Municipal Affairs and Housing
MNR	Ontario Ministry of Natural Resources
CA	Conservation Authority
OMAFRA	Ontario Ministry of Agriculture and Food
EC	Environment Canada
DFO	Fisheries and Oceans Canada
MOE	Ontario Ministry of Environment
MTO	Ontario Ministry of Transportation

5.3.3 Environmental Enhancement, Stewardship and Education

Watershed and subwatershed plans are "community based" plans. As noted throughout this report, the community (including residents, businesses, municipalities and other public agencies) plays an important role in both developing the plan and implementing it. Community participation in the development of a watershed or subwatershed plan builds support for its implementation and contributes to successful implementation.

Stewardship programs can range widely. They can include "hands-on" restoration and conservation activities such as riparian plantings or reforestation projects. They can also include encouraging landowners and residents to participate in monitoring activities such as amphibian or bird monitoring programs. Some stewardship programs provide education and encouragement to landowners and residents to act as "watchdogs" of the natural environment and parks. Stewardship programs can also include municipalities and other public agencies in practicing good stewardship on their own lands and infrastructure. To be successful, stewardship programs have to be planned well, maintained over time, and have an effective coordinator with the time and resources to make it work.

There is a wide range of education material available from conservation authorities, other government agencies and NGOs for use in implementation programs. In some cases, generic material (for example, on preserving natural shorelines) is more effective if it is adapted to meet local needs and audiences. As with stewardship programs, educational programs need to be well designed, maintained and coordinated to be effective.

5.3.4 Land Acquisition

Land acquisition is a powerful tool for protecting sensitive ecological features, such as ESAs, valleylands or wetlands, especially when other tools, such as land use policies will not provide sufficient protection. Municipalities or conservation authorities often have policies that apply to land acquisition, along with land acquisition plans that set out priorities and policies for acquisition.

In recent years, "land acquisition" has expanded to encompass a variety of innovative ways in which sensitive ecological features and functions can be preserved without land necessarily being purchased by a municipality or conservation authority. Land acquisition can take many forms including:

- outright purchase at market value;
- dedication of the lands at a nominal cost;
- conservation easements;
- covenants on title;
- landowner agreements that limit uses and sale; and
- dedication to a land trust.

Land acquisition plans are typically developed to acquire land that is judged to be important to protect or manage for the overall health of the watershed and/or to meet the watershed objectives. There are a number of factors that should be considered when developing land acquisition plans:

- What are the priority lands for acquisition?
- What lands should be in public ownership and which can remain private?
- What purchase policy will be used?
- How are the properties to be maintained and managed?
- What uses will be allowed on the lands?

Land acquisition is carried out by the area municipality, a conservation authority or through an NGO. Funds can be made available through a number of sources, including dedicated lands, public sector funds, private organizations or foundations, and public fundraising efforts.

5.3.5 Monitoring

A monitoring plan is an integral part of implementation and allows managers, decision-makers and the public to determine whether the overall goals and objectives of the watershed plan are being met. This is discussed in section 6.1 of this report.

5.3.6 Future Studies

Typically, the recommendations of a watershed or subwatershed study include carrying out additional studies as part of implementation. This allows critical data gaps to be filled and the collection of necessary background information for other planning processes. Examples of future studies include:

- tributary studies as support for Draft Plans of Subdivision;
- conservation plans;
- master servicing plans;
- stormwater management plans;
- wellhead protection strategies;
- groundwater infiltration studies; and
- design reports.

5.3.7 Funding Mechanisms

Implementing watershed and subwatershed plans will very likely have an impact on both capital expenditures and on operation and maintenance budgets. Capital projects could include natural feature enhancement and restoration, the construction of SWM facilities, the removal of in-stream barriers such as dams, and land acquisition programs. Operation and maintenance programs can be affected by changes in levels of maintenance (such as increased frequency of catchbasin cleaning) or by the creation of additional facilities (such as stormwater management ponds) that must be maintained. When developing an implementation plan, it is important to consider and identify all funding requirements and determine the source of funds for the overall program.

Available sources of funding include:

- municipal taxes;
- provincial and federal revenue sources;
- development charges;
- grant programs;
- private funding; and
- special charges (ie. water/sewer rates, sewer use surcharges, stormwater utilities).

There are certain restrictions on the use of some of these funds. Development charges are to be used on development-related capital works only. Grants and private funds are often restricted to environmental enhancement or stewardship programs. Special charges are typically a "user pay" approach that relates to the corresponding utility.

5.4 STEP 3 - DEVELOP A WORK PLAN FOR IMPLEMENTATION

A workplan will define the specific actions to be followed in the implementation process. Typically, there is an implementation role for all of those involved in the Implementation Committee. An example of the responsibilities of the various parties for typical elements of a subwatershed plan is presented in Figure 5-4.

It is important, at this stage, to test the Implementation Plan against the Goals and Objectives set for the watershed or subwatershed to ensure that the plan will be effective in meeting the objectives set. Figure 5-5 illustrates the use of a matrix for such an evaluation. To be effective, an implementation work plan must be comprehensive and thorough. To test for completeness a number of questions need to be asked:

- Does the implementation plan meet the watershed objectives?
- Does the plan meet agency needs?
- Does it identify responsibilities?
- Is the process outlined?
- Does it provide scheduling?
- Does it outline the AEM requirements?

Figure 5-4: Typical Responsibilities for Implementation (Subwatershed Plan)

MANAGEMENT RECOMMENDATION	PURPOSE (Why)	RESPONSIBILITIES (Who)	TIMING (When)	OTHER CONSIDERATIONS (How)
NATURAL HERITAGE SYSTEM				
Protect significant stream corridors - main branch and tributaries Protect floodplain, fill line	Protect life and property Water quality bufferPreserve hydrologic functions Habitat protection Provide wetland and stream protection and facilitate engagement	Municipality, CA, Landowners and Community	Develop and adopt policies immediately Implement at draft plan stage	Designate greenspace Implement flood and fill line regulations SWM design EIS for adjacent developments SWM, trail and interface between wetland and development
Protect woodlots with significant wildlife habitat Protect and enhance supporting areas	Wildlife habitat Landscape ecology and aesthetics	Landowners, Municipality,MNR Municipality, landowners, community groups	Change OP as necessary EIS at draft plan stage Ongoing Management	Designate greenspace EIS for adjacent developments SWM, trail and interface between greenspace and development
Require EIS for development in adjacent lands and/or category two areas	Protect and enhance function of NHS, develop amenity benefit for human residents	CA, Region, City to review Developer EIS	Draft plan stage Policy in Official Plan	Refer to specific features and function in strategy.

Other management recommendations typically include:

STORMWATER MANAGEMENT

AQUATIC MANAGEMENT AND RESTORATION

MONITORING

Figure 5-5: Evaluation of Implementation Plan

WATERSHED GOALS AND OBJECTIVES	STRATEGY ELEMENTS		
	LAND USE PLANNING	POLICIES/CRITERIA/REGULATION	FUNDING MECHANISMS
● To protect, restore, enhance terrestrial and aquatic features and their hydrologic and ecological functions	● Natural features protected as constraint lands	● New SWM policies developed ● Buffers included in new policies (etc.)	etc.
● To protect and restore natural vegetative canopy along streams and aquatic system function	● Stream corridor and buffers identified for protection	● Buffers in new policies ● Protection provided in new SWM criteria ● Servicing standards provide stream protection(etc.)	etc.
● To protect, restore and enhance water quality in streams	● Natural heritage features protecting water quality identified for protection	● New SWM policies for water quality developed etc.	etc.
etc.	etc.	etc.	etc.

5.5 STEP 4 - ALLOCATE RESOURCES TO THE WORK PLAN

Adequate resources must be made available to enable the work plan to proceed. This will include staff resources for all of the public agencies involved and financial resources for any items that require capital or operational funds.

5.6 STEP 5 - DEVELOP A SCHEDULE

Typically, implementation work plans will cover a number of years. Implementation usually encompasses both short and long-term measures. Short-term "successes" are important in terms of building commitment to implementation and engaging stakeholders. Short-term measures include revisions to policies and guidelines and small-scale projects such as fish ladders. Long-term measures typically include land acquisition, large environmental restoration projects and stewardship activities. Monitoring starts early but continues throughout the implementation process.

In developing a schedule, managers should consider:

- What are the priorities to make the plan workable (i.e., what needs to be done first)?
- How will the schedule be affected by budgets or available funds?
- What are long and short-term action items?
- What items are needed, if any, to facilitate the actions of others?

5.7 STEP 6 - CARRY OUT THE PLAN

Moving through Step 1 to 5, carry out the Plan.

6.0 MEASURING SUCCESS AND REVIEWING THE PLAN

6.1 MONITORING AND REPORTING

Monitoring and reporting are integral parts of the watershed management process. Through monitoring, we gather information about the state of the watershed, and our progress towards meeting the targets we have set. Reporting transmits this information to a variety of audiences (managers, politicians, interest groups, stakeholders and the public). Watershed monitoring is our "reality check," the activity that in the short term answers the question "How are we doing?" Without adequate and effective monitoring and reporting, we manage in a vacuum.

These sections will focus on and reflect the experience of CVC, GRCA and TRCA in monitoring and reporting. In a parallel process, MNR's Pilot Project on Watershed Monitoring is also examining these issues.

What will Monitoring and Reporting Achieve?

Effective monitoring and reporting programs will achieve many things. They can:

- provide basic information to allow adaptive environmental management to take place;
- track changes in stresses, conditions and responses;
- measure progress with respect to goals, objectives and targets;
- graphically communicate results to agencies, stakeholders and the public;
- allow management efforts to be better focused (e.g., by identifying areas where additional efforts may be required or where certain strategies are being very successful);
- provide information that will allow for better resource allocation;
- detect emerging issues;
- identify and celebrate success and achievements;
- build agency, stakeholder and public support for continued implementation of watershed and subwatershed plans;
- increase visibility and "buy in" to watershed management efforts;
- contribute to greater accountability; and
- provide a base of information that can be used in other planning, conservation or restoration processes.

6.1.1 Watershed Monitoring

What is Watershed Monitoring?

Environmental monitoring has been carried out for decades. Typically it has been carried out by multiple agencies, each with their own area of interest and approach to gathering information. Watershed monitoring is very different. It is environmental monitoring that:

- is carried out on a watershed or subwatershed basis;
- is integrated and interdisciplinary;
- looks at the whole ecosystem, not just its constituent parts;
- addresses (among other things) the goals, objectives and targets that have been set in watershed or subwatershed plans;
- uses short and long-term targets;
- is based on solid science (i.e., is defensible and replicable);
- is dynamic and flexible in order to respond to changes and uncertainty in ecological processes;
- measures stresses (e.g., pollutant loadings), environmental conditions (e.g., water quality) and responses (government, business and public efforts to improve watershed health);
- includes consideration of the natural, social and economic environments;
- allows trends to be measured; and
- incorporates reporting to agencies, stakeholders and the public.

What are the Key Steps Involved in Developing a Monitoring Program?

Institutional, scientific and fiscal issues must be considered in the early planning stages when developing a monitoring program. The following process is being used by CVC to develop its Integrated Watershed Monitoring Program and is illustrated in Figure 6-2.

1. Analyse the Issues

With stakeholders, develop a set of questions that the monitoring program is expected to answer. Following this, group questions under "like" issues. Review any background data and information as a first cut in verifying identified issues.

2. Develop Specific Objectives and Questions

Although broad objectives may be necessary to encompass the interests of all stakeholders, specific objectives are required for watershed monitoring.

The answers to these questions will be used by decision and policy makers. They include:

- Is the ecosystem changing?
- If so, is it improving or deteriorating?
- At what scale is the change occurring?
- At what rate is the change occurring?
- Can we establish a cause and effect relationship between the change and our management actions?
- Are we meeting the targets we have set for ourselves?

3. Simple Conceptual Models of Impact and Refine the Program

These models will be useful in determining which variables to monitor and will also provide rationales for monitoring. As an example, the conceptual impact model in Figure 6.1 was used to develop the monitoring program associated with gravel extraction some distance away from a creek supporting a coldwater fishery. Once the model is developed, indicators should be selected and sampling protocols and locations developed.

- *Selection of indicators* should consider such factors as the sensitivity to stressors, the ability to measure changes, cost-effectiveness, the ability to integrate, the ability to anticipate change and timeliness.

- *Sampling protocols* should be: appropriate, scientifically defensible, repeatable, and cost-effective.

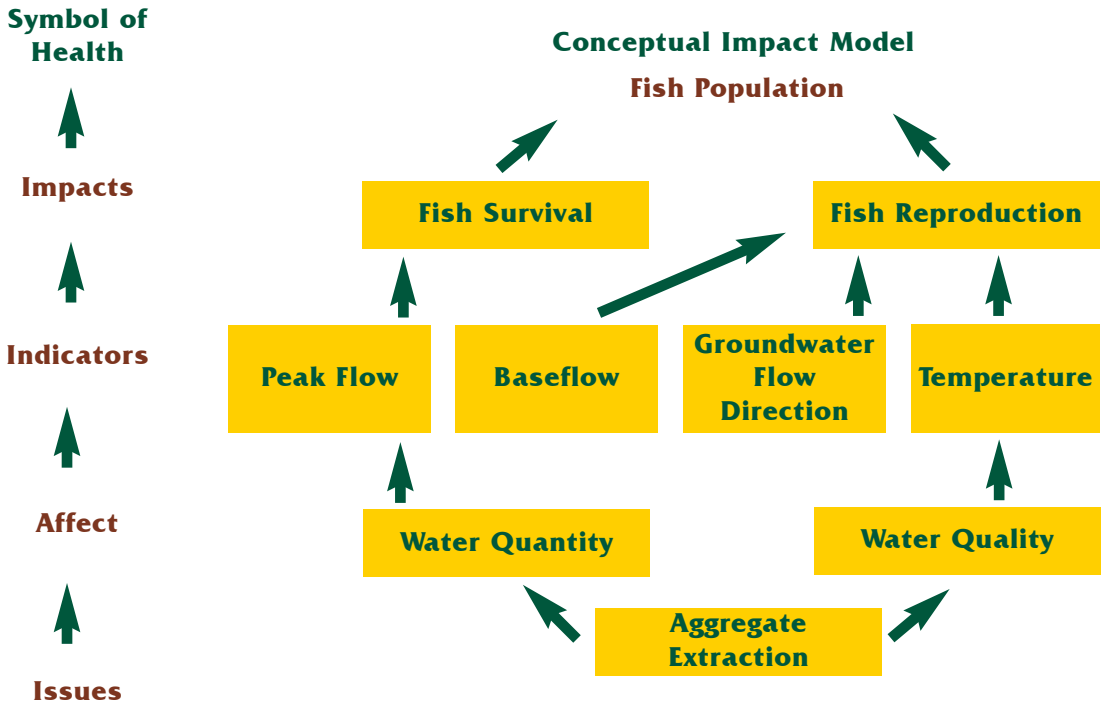
- *Sampling locations* should consider locations in which: current and future environmental pressures are expected, multiple environmental features and functions exist, known sensitive features are found, conditions are such that it can form a baseline or reference site, historical and current data collection is being collected, and the site is accessible.

4. Establish an Information Management System

An information management system for storing, retrieving, manipulating and disseminating data must be in place to receive the results of the monitoring program as they become available. The system should:

- be designed to deal with large amounts of data efficiently;
- be link pieces of data to reflect linkages in the field;
- be minimize information duplication; and
- be allow queries to be made of the data.

Figure 6-1: Conceptual Impact Model Used by CVC



5. Develop Rigorous Quality Assurance Programs

It is essential quality assurance be undertaken to ensure consistency, systematic and statistically valid approaches to sampling. The objective will be to:

- generate quality data;
- ensure complete documentation and defensibility of all data; and
- expedite data evaluation and acceptance.

6. Prepare a Cost Estimate

A cost estimate should be prepared for the entire program.

7. Analyze Data and Prepare Reports

8. Practice Adaptive Management

A monitoring program should be reviewed periodically to ensure that the data being collected and the information being provided to decision-makers is still relevant. If this is not the case, then the program should be revised as appropriate.

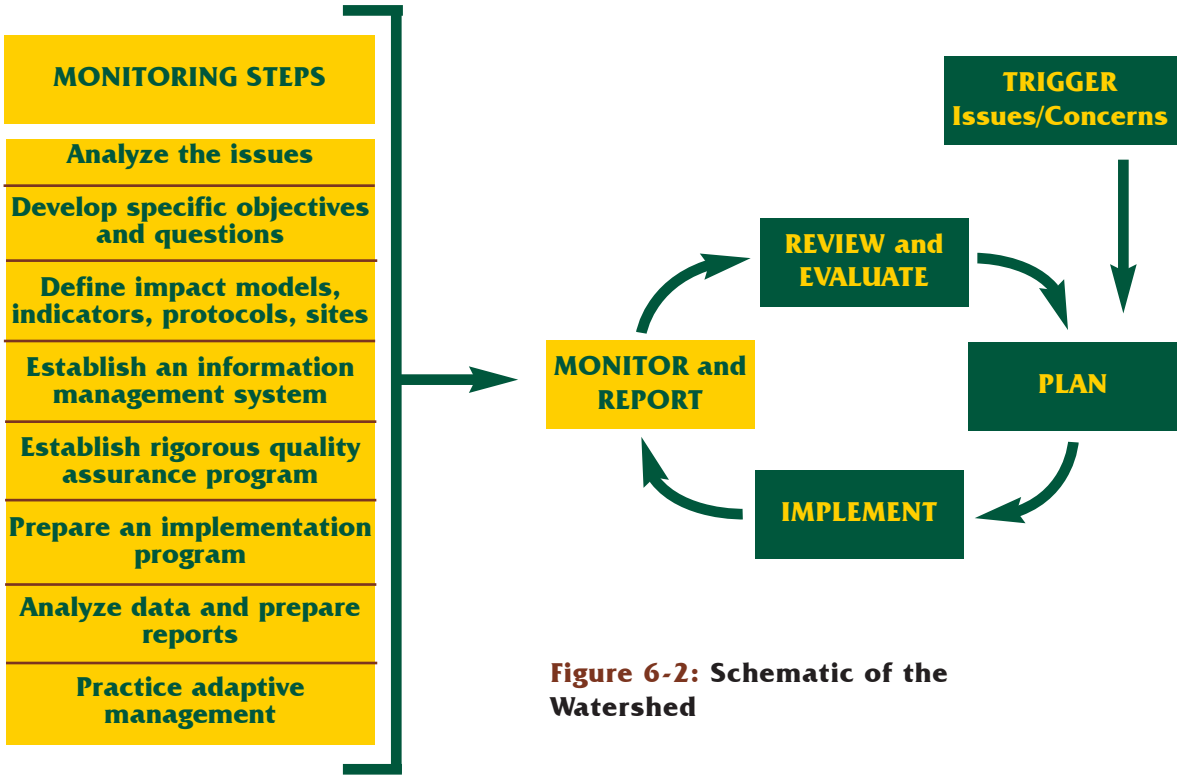


Figure 6-2: Schematic of the Watershed

How Should Watershed Monitoring be Carried Out?

In over ten years of developing and implementing watershed plans, CVC, GRCA and TRCA have learned many things about how to monitor a watershed. Key observations include:

- Watershed monitoring requirements (i.e., a monitoring and reporting plan) should be developed during the watershed/subwatershed planning process, not afterwards.
- Watershed monitoring should measure changes against baseline conditions (i.e., before land development takes place or before restoration work occurs).
- Watershed monitoring should be timely. It should be carried out at the right times of year and at a frequency that reflects the response time for the component being measured.
- Watershed monitoring should be cost-effective. It should return significant information for the money invested. We shouldn't be spending all our money on monitoring the system, to the exclusion of action.
- Watershed monitoring should yield useful information (i.e., it should provide answers to the questions that are being asked).
- Watershed monitoring should be carried out on a coordinated, partnership basis, using data and information from various sources (e.g., municipalities, provincial and federal agencies, organizations, institutions and the public).
- The public should be involved in the development of the monitoring and reporting plan.

- Involving the public in monitoring the watershed (e.g., in activities such as monitoring amphibians and participating in bird census) helps to build stewardship.

A monitoring case study (CVC's Integrated Watershed Monitoring Program 2001 Summary Report) is included as Appendix H.

An Introduction to Indicators

The health of watersheds is typically assessed using "indicators". Indicators are pieces of information that tell us something about conditions around us. A physician uses indicators (blood pressure and body temperature) as an initial screen of the health of a patient. A pilot uses barometric pressure as an indicator of future weather conditions.

Because watersheds are complex ecosystems, we usually need to develop a suite of indicators to assess their health. We might need to examine such aspects as river flows, the quality and quantity of groundwater, the quality of surface water, the state of fish communities, the size and linkage of terrestrial habitats and many other factors. Information is collected as part of a monitoring program that relates to goals, objectives and targets set for a watershed.

The list of indicators used in the Don Watershed Regeneration Plan are presented in Case Study #5. Reviewing these, it can be seen that they are organized in a framework that reflects the principles used in the development of the Plan (Caring for Water, Caring for Nature and Caring for Community). The indicators selected reflect the specific context and challenge of the watershed, as well as public preferences. Finally, it should be noted that the indicators used cover not only the natural environment, but also the social and economic environment.

There are many models for developing indicators, but perhaps the most commonly used in the environmental field is the "Stress-Condition-Response" model. This is based on the concept that human actions (such as pollution, channelizing a stream or cutting down a woodlot) create stresses on the environment. These cause changes in environmental **conditions** that can be measured. These could be, for example, changes in water quality, changes in a fish community or loss of habitat for a particular species. The changes in the environment in turn lead to responses from society to address the problem (e.g., pollution abatement programs, riparian plantings or naturalization programs). Typically, indicators are developed to measure all three of these: stresses, conditions and responses.
Some of the considerations when choosing indicators are listed in Figure 6-1. Many of these relate to science (such as validity and information richness). It is worthwhile noting the importance of *understandability* as a criterion. To be effective as a tool, an indicator must be able to be communicated to a wide range of audiences. It must be simple and meaningful to people.

Figure 6-3: Criteria for Picking Indicators

Validity:

- Is the indicator relevant to the watershed?
- Is it useful at an appropriate scale?
- Is it sensitive enough to detect changes in the system?

Understandability:

- Is the indicator understandable to decision makers and the public?
- Is it simple and direct?
- Can it be used to present information in a way that is useful?

Interpretability:

- Is there a benchmark or baseline against which measurements can be interpreted?
- Is it replicable? Will it allow an analysis of trends?
- Is there a commonly understood method of collecting and analyzing the data?

Information Richness:

- Does the indicator give information about more than one environmental component?

Data Availability:

- Are data currently available?
- Will data be available in the future?

Timeliness:

- Does the indicator detect environmental changes in a timely manner?
- Does it anticipate future changes?

Cost and Effort:

- Can the data be obtained and interpreted with reasonable cost and effort?

Necessary:

- Is the indicator necessary to give us the information we need?

Sufficient:

- Is the suite of indicators sufficient to assess the overall health of the watershed.

6.2.2 Watershed Reporting

How Should Reporting be Carried Out?

Ten years ago, watershed reporting didn't exist, except as an idea. In the last ten years, much has been learned at CVC, GRCA and TRCA about how to report effectively. In particular, TRCA's Don and Humber Report Cards have broken new ground in watershed reporting see Appendix F). Key lessons that have been learned on reporting include:

- Reporting should be carried out on a regular and periodic basis (e.g., every 3 to 5 years).

- Different types and frequencies of reporting may be needed for different audiences. (e.g., scientists may want to know about loadings from wastewater treatment plants, managers may want to know the number of exceedances, and the public may want to know the number of bypasses).

- The public should be involved in designing and developing monitoring reports. This will ensure that the finished products appeal to the public and are appropriate for the layperson.

- Reporting should be tied to watershed goals, objectives and targets.

- Reporting should be based on solid science with data available for those who wish to view it at a detailed level.

- Reporting should present trend information that clearly indicates whether progress is being made.

- Reporting should note the limitations of data and knowledge.

- Reporting should consider stresses, conditions and responses.

- Reporting documents should be clear, easy-to-understand, and graphically appealing.

6.2 PERIODIC REVIEW AND EVALUATION OF WATERSHED PLANS

Like monitoring and reporting, periodic review and evaluation of watershed and subwatershed plans is an integral part of the watershed management process. Review and evaluation of watershed and subwatershed plans is consistent with the principles of Adaptive Environmental Management (AEM). As noted in section 3.1, AEM is a systematic and iterative approach for improving management policies and practices by learning from the outcomes of management actions. It aims for continuous learning and improvement and allows environmental managers to incorporate new scientific thinking, new technologies and new techniques in management practices. Currently the state of practice in Ontario is limited and initiatives on Review and Evaluation are just getting underway.

What Will a Periodic Review Accomplish?

- It is a formal review of the objectives, targets, management strategies, implementation plans and monitoring plans contained in watershed or subwatershed plans.

- It is a reality check: periodic review allows original assumptions (e.g., population growth) to be tested against reality.

- It will allow watershed or subwatershed plans to be amended and updated to reflect changes in environmental conditions, stresses, public preferences, science and technology.

- It allows for integration of subwatershed level information at the watershed level (and inter-watershed).

- It allows for consideration of cumulative effects.

- It provides a mechanism for re-engaging agencies, stakeholders and the public, reinvigorating watershed management efforts and re-committing to overall goals of watershed protection and health.

When and How Should a Review be Undertaken?

- A review should be done when the natural system has had enough time to respond to management actions taken as a result of a watershed or subwatershed plan. This is generally about ten years after completion of a watershed or subwatershed plan. The information needed to undertake the review can be collected continuously over time (such as is being done by GRCA) or at specific intervals (e.g., every ten years).

- It should involve partners, key stakeholders and the general public.

- It should answer the following questions:

  - Have we achieved what we wanted to achieve? (Have we met our targets?)

  - Were our assumptions about the future accurate?

  - How have stresses and environmental conditions changed?

  - Do we need to alter our objectives, targets or actions?

7.0 CONCLUSIONS

Watershed Management

Watershed management as practiced by CVC, GRCA and TRCA is consistent with Ontario's "fundamental shifts" that have been adopted for managing the environment. Watershed management:

- is built on the concept of shared responsibility for environmental protection and enhancement;
- shares implementation of plans across jurisdictional agencies;
- strives for continuous improvement in environmental performance through the use of Adaptive Environmental Management;
- is "place-based", using boundaries that are ecological; and
- uses a broad spectrum of tools including regulation, the land use planning process, best management practices, incentives, education and volunteer actions.

Watershed management is comprehensive in that it considers all facets of the natural environment, addresses social and economic issues, includes both protection and restoration of the environment, and includes a full range of strategies from source control to end-of-pipe. It must be noted however, that to date, social and economic issues have not been as thoroughly addressed in watershed management as have been issues relating to the natural environment.
Watershed management has four elements: planning, implementation, monitoring and reporting, and periodic review. The science of watershed planning is fairly mature. Implementation of watershed and subwatershed plans is carried out extensively, but not always in a rigorous manner. And although there are good examples of each in CVC, GRCA and TRCA, it is fair to say that monitoring and reporting and periodic review are less well developed as concepts and in practice.

In the Part Two Report of the Walkerton Inquiry, Justice O'Connor recommended that drinking water sources be protected by watershed-based source protection plans. The framework of watershed management will support and enable these source protection plans to be developed.
This report identifies a number of elements that are critical to the success of watershed planning and management (see Figure 4-1). Barriers and challenges are also identified (see Figure 4-2), along with trends that have been observed (see Figure 4-3).

To be truly effective, watershed management needs to be recognized as being a fundamental and core requirement of society, as fundamental as an official plan or a transportation plan. Adequate resources and stable, multi-year funding need to be provided for:

- developing watershed and subwatershed plans;
- retaining in-house technical expertise; and
- coordinating watershed planning, implementation, monitoring and reporting and reviewing of plans.

It was clear from the development of this report that the practice of watershed management continues to mature and that conservation authorities, agencies and stakeholders are still learning from each other. This suggests that it would be useful to repeat this project in another ten years.

Watershed Planning

Watershed planning is a proven, cost-effective and streamlined tool for protecting and managing resources on a watershed basis. Watershed and subwatershed planning is increasingly being viewed as an integral part of the land use planning process.

The most efficient and effective way to carry out watershed planning is to begin at the largest scale and proceed to the smallest. This means first developing a watershed plan, then developing subwatershed plans on a priority basis, developing tributary plans as needed and finally developing environmental site plans where they are required.

The framework used by CVC, GRCA and TRCA for watershed planning is outlined in section 3.2 of the report. This is considered to be "best practice".

In the last decade, there have been a number of changes in how watershed planning has been carried out. These are reflected in sections 3.1, 3.2, 3.3 and 4.3. Some of the key changes are:

- the development of better tools for characterization of watersheds;
- increased integration across disciplines; and
- the start of consideration of economic and social factors in watershed planning.

Watershed management is "place-based". Accordingly, while a common framework is used for watershed planning, the details of the approaches used may vary considerably because of environmental issues, social preferences, funding availability and a host of other factors. The variation in the case studies included as Appendices C to H underscore this point.

There is limited information available on the extent of watershed and subwatershed planning in the province (see section 2.1). A revised survey form has been developed and included as Appendix A to improve the understanding of how many plans have been developed, the reasons for development, the studies carried out, and other factors. It is hoped that this will improve both the response rate by conservation authorities and the quality of information received.

Detailed information is provided on the status of watershed and subwatershed planning in CVC, GRCA and TRCA (see section 2.2).

Implementation

A wide variety of implementation tools are available for use in implementing watershed and subwatershed plans. These tools, and a process for implementation are described in section 5 of this report.

Effective implementation requires clear actions with timelines and responsibilities, clear lines of accountability, "buy-in" of partners and stakeholders, support of municipal politicians and staff, and the use of short-term (do-able) milestones as well as long-term actions.

Monitoring and Reporting

Effective monitoring of stresses on the environment, environmental conditions and responses is a vital element of watershed management and the Adaptive Environmental Management process.

Over the last ten years, CVC, GRCA and TRCA have made significant progress in the development of watershed monitoring programs. Elements of monitoring programs and information on how monitoring and reporting should be carried out are presented in section 6.1.

CVC, GRCA and TRCA are moving away from monitoring programs that are subwatershed-focused to those that are watershed-wide in scale (or conservation authority-wide in the case of TRCA which has nine watersheds in its jurisdiction).

Monitoring and reporting on environmental stresses and conditions is fairly mature as a practice. However, monitoring and reporting on responses (i.e., implementation actions) is still under development.

Some of TRCA's watershed reports have set new standards for reporting. There is increased understanding of how to communicate effectively to the public, and how this builds understanding, accountability, and impetus for action.

Review of Plans

It is now ten years since the province's first watershed and subwatershed plans began to be developed. Conservation authorities and the stakeholders involved in watershed management need to shift focus now to reviewing these plans, to determine if the objectives, targets, management strategies, implementation plans and monitoring plans need to be amended. Periodic review of plans is addressed to a limited degree in section 6.2 of the report.

Stakeholder and Public Involvement

Watershed planning and management is by nature a partnership activity that involves stakeholders in all aspects (i.e., in planning, implementation, monitoring and reporting and review of plans). Stakeholders typically include conservation authorities, municipalities, agencies and non-governmental organizations, as appropriate.

Public involvement is central to the success of watershed planning and management. Public concerns over issues often trigger the development of a watershed or subwatershed plan. In the watershed planning process, effective public involvement starts early in the process and continues as the plan is developed. Public involvement in implementation helps to ensure that goals are met. Key factors that contribute to effective public involvement are listed in section 4.3.2.

REFERENCES

1 Beak International, 2001. A Review of Watershed Management Experience. Research Paper # 11, prepared for the Executive Resource Group.

2 Conservation Ontario, 2001. The Importance of Watershed Management in Protecting Ontario's Drinking Water Supplies.

3 O'Connor, 2002. Part Two Report of the Walkerton Inquiry: A strategy for safe drinking water. Published by the Ontario Ministry of the Attorney General.

4 MOEE and MNR, 1993. Water Management on a Watershed Basis: Implementing an ecosystem approach. MOEE and MNR, 1993. Subwatershed Planning. MOEE and MNR, 1993. Integrating Water Management Objectives into Municipal Planning Documents.

5 Watershed Planning Implementation Project Management Committee, 1997. An Evaluation of Watershed Management in Ontario, Final Report.

6 Footnote: This is not to say that implementation, monitoring and reporting and review have not taken place. They have, but in general with less rigor than watershed planning. There are, for example, no provincial guidelines or generally accepted best practices for how watershed plans should be implemented, monitored, reported on or reviewed

7 MOEE and MNR, 1993. Water Management on a Watershed Basis: Implementing and ecosystem approach., p.30.

8 Footnote: It should be emphasized here that integrating subwatershed plans into an overall watershed plan is not merely an additive process. Developing a watershed plan from its constituent subwatershed plan pieces requires a watershed-scale analysis of habitat linkages, water budgets, groundwater resources and other matters.

GLOSSARY

Abiotic - Not relating to living things.

Aquatic - growing or living in, or frequenting water.

Aquiclude - A saturated geologic unit that is incapable of transmitting significant quantities of water under ordinary conditions.

Aquifer - A saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients.

Attenuation (Flow) - Flow that is lessened or weakened, or the severity reduced.

Bank Stability - The ability of a stream bank to resist change.

Base Flow -The water that flows into a stream through the subsurface.

Bedrock - The solid rock underlying unconsolidated surface material

Bedrock Geology - The study of the solid rock underlying unconsolidated surface material. Also refers to the description of bedrock types.

Benthic Invertebrates - Organisms without an internal skeletal structure that live on or in a body of water, e.g., water insects.

Biological Diversity - the variability among organisms and the ecological complexes of which they are a part .

Biomass - The amount of living matter, usually measured per unit area or volume of habitat.

Biotic - Relating to or caused by living beings.

Climate - The average weather conditions of a place or region throughout the seasons.

Conductivity - The quality or power of conducting or transmitting.

Contiguous - Having contact with, or touching along a boundary or point.

Discharge Area - An area where water leaves the saturated zone across the water table surface.

Drainage Density - Length of watercourse per unit drainage area.

Ecological - Relating to the totality or pattern relations between organisms and their environment.

Ecosystem - Systems of plants, animals and micro-organisms together with the non living components of their environment, related ecological process and humans.

Elevation - The height of a portion of the earth's surface in relation to its surroundings.

Entrain - To draw in and transport through water.

Episodic - Made up of separate loosely connected episodes.

Erosion - The wearing away of the land by the action of water, wind or glacial ice.

Flood Pulse - The peak flow during a flooding event.

Floodplain - A plain bordering a river, which has been formed from deposits of sediment carried down the river. When a river rises and overflows its banks, the water spreads over the floodplain.

Flow Regime - The pattern of how water levels change in a stream.

Flow Stability - Determined by measuring the ratio of surface discharge to groundwater discharge on an annual basis.

Fluvial - Relating to a stream or river.

Geology - The science of the composition, structure and history of the earth. It thus includes the study of the materials of which the earth is made, the forces which act upon these materials and the resulting structures.

Geomorphology - The scientific study of the origin of land, riverine and ocean features on the earth's surface.

Glaciation - The covering of an area or the action on that area, by an ice sheet or by glaciers.

Gradient - The rate of regular or graded ascent or descent.

Granular - Having a texture composed of small particles.

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

Groundwater Table - The meeting point between the groundwater and the unsaturated layer above it.

Habitat - The environment of an organism; the place where it is usually found.

Hydrogeology - The scientific study of groundwater.

Hydrology - The scientific study of surface water.

Imperfect Drainage - Occurs when water cannot easy flow over the land surface through a well formed drainage network

Infiltration - Water entering the pores of the earth's surface.

Intermittent Stream - A watercourse that does not flow permanently year round.

Invertebrates - Animals lacking a spinal column

Local Discharge - Discharge to a watercourse that originates nearby. The water moves through the upper layers of the groundwater system.

Lowflow - The flows that exist a stream channel in dry conditions.

Macroinvertebrates - Animals lacking a spinal column that are visible with the unaided eye.

Meandering - A curve in the course of a river which continually swings from side to side.

Meltwater Channel - The path of drainage, and leftover sedimentary deposits from ice or snow melt.

Moraine - The debris or rock fragments brought down with the movement of a glacier.

Morphology - see geomorphology

Non Renewable Resources - A resource that is not capable of being replaced by natural ecological cycles or sound management practices within the timeframe of a human life.

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.

Organic Matter - Of, relating to , or derived from living organisms.

Permeability - The quality of having pores or openings that allow liquids to pass through.

Physiography - Study or description of landforms (see geomorphology)

Precipitation - The deposits of water in either liquid or solid form which reach the earth from the atmosphere. It includes rain, sleet, snow and hail.

Productivity - Rate of production, especially of food or solar energy by producer organisms.

Recharge Area - An area where water enters saturated zone at the water table surface.

Regional Discharge - Water that has traveled deep beneath the ground through the saturated zone and resurfaces at the water table.

Renewable Resources - A resources that is capable of being replaced through ecological processes or sound management practices.

Return Period - The frequency in which a flow event in a stream is likely to repeat itself.

Riffle:Pool System - A riverine system that alternates cycles of shallow broken water (riffle) and deeper still water (pool).

Riparian - Relating to or located on the bank of a watercourse.

Riparian Zone - Areas adjacent to a stream that are saturated by groundwater or intermittently inundated by surface water at a frequency and duration sufficient to support the prevalence of vegetation typically adapted for life in saturated soil.

Saturated Soil - Soil that is full of moisture.

Scale - A graduated series or scheme of rank or order.

Sediment - Material deposited by water, wind or glaciers.

Sedimentary Bedrock - Rock formed of mechanical, chemical or organic sediment such as rock formed from sediment transported from elsewhere, by chemical precipitation from solution or from inorganic remains of living organisms.

Slope - Ground that forms a natural or artificial incline.

Spawn - To produce or deposit eggs in the reproductive process (used of aquatic animals).

Stratigraphy - Geology that deals with the origin, composition, distribution and succession of layers of the earth.

Stream - A body of running water flowing on the surface of the earth.

Substrate - The base on which an organism lives.

Subwatershed - A region or area bounded peripherally by a water parting and draining ultimately to a tributary of a larger watercourse or body of water.

Subwatershed Planning - A method used to deal with environmental concerns over broad areas of land. The subwatershed plan integrates the functions of resource management and the land use planning process. A subwatershed plan does not set out ideal land uses, but it does make valuable contributions to the land use decision making process by developing a detailed understanding of the subwatershed ecosystem and making recommendations regarding the management of the ecosystem, in light of alternative land use patterns.

Surficial Geology - Deals with the study and description of the forms on the outer layer of the earth.

Terrestrial - Living on or growing on land.

Thermal Regime - The characteristic behaviour and pattern of temperature.

Till - A tough unstratified clay loaded with stones originating from finely ground rock particles that were deposited by glacial activity.

Topography - A detailed description or representation of the features, both natural and artificial, of an area. Also the physical and natural features of an area, and their structural relationships.

Valley - A long, narrow depression on the earth's surface, usually with a fairly regular downward slope. A river or stream usually flows through it.

Water Budget - The movement of water within the hydrologic cycle can be described through a water budget or water balance. It is a tool that when used properly, allows the user to determine the source, and quantity of water flowing through a system. From a groundwater perspective the key components of a water budget are: infiltration, contribution to baseflow, deeper groundwater flow outside the study area, and groundwater taking.

Water Cycle - The continuous movement of water from the oceans to the atmosphere (by evaporation), from the atmosphere to the land by condensation and precipitation, and from the land back to the sea (via stream flow).

Water Quality Indicator - An entity that provides information on the condition and quality of water through their life cycle patterns. Water quality can also be determined through non living sources, like chemical sampling.

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

Weathering -The disintegration of the earth's crust by exposure to the atmosphere, most importantly, rain.

Wetland - An area where the water table is seasonally above the substrate surface, and the saturation period long enough to promote hydric or organic soils. A wetland can provide an important role in the hydrologic cycle and host unique species of flora and fauna.

ACRONYMS

AEM	Adaptive Environment Management
BMP	Best Management Practice
CA	Conservation Authority
CCRS	Caledon Community Resources Study
CRWMS	Credit RiverWater Management Strategy
Cu	Copper
CVC	Caledon Community resources Study
DFO	Fisheries and Oceans Canada
EC	Environmnet Canada
EIR	Environmental Implementation Report
EMP	Environmental Management Plan
ESA	Environmental Site Agreement
FC	Fecal Coliform
FMP	Fisheries Management Plan
GIS	Geographic Information System
GRCA	Grand River Conservation Authority
GRIC	Grand River Implementation Committee
MESP	Master Environmental Servicing Plan
MMAH	Ontario Ministry of Municipal Affaires and Housing
NMNR	Ontraio Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MTO	Ontario Ministryo of Transportation
NEC	Niagara Escarpment Commission
NGO	Non-Government Organization
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs (now
OMAF	Ontario Ministry of Agriculture and Food)
PLUARG	Great Lakes Pollution From Land Use Activities Working Group
PWQFO	Provincial Water Quality
RAP	Remedial Action Plan
SS	Suspended Solids
STP	Sewage Treatment Plant
SWM	Strmwater Management
TAWMS	Toronto Area Watershed Management Study
TP	Total Phosphorus
TRCA	Toronto and Region Conservation Authority
WPCP	Water Pollution Control Plant