Subwatershed Planning Guide

Draft

January 2022

Ministry of the Environment, Conservation and Parks

ACKNOWLEDGEMENT

This draft Guide was developed with significant contributions from the Conservation Authorities Working Group. The Conservation Authorities Working Group includes representatives from conservation authorities, municipalities, developers, and other partners and was established by the Ministry of the Environment, Conservation and Parks (MECP) to provide advice and input on the regulatory and policy proposals under the *Conservation Authorities Act*.

DISCLAIMER

This document should be read in its entirety. The Guide should be read in conjunction with direction in the Provincial Policy Statement, 2020 (PPS) and provincial plans (e.g., Greenbelt Plan, A Place to Grow: Growth Plan for the Greater Golden Horseshoe, Growth Plan for Northern Ontario). Information, technical criteria, and approaches outlined in this Guide are meant to support the policies of the PPS, provincial plans and applicable legislation. Users must meet all applicable legislation, regulation and policies. The information contained herein should not be relied upon as legal advice.

Cette publication hautement spécialisée Subwatershed Planning Guide n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n’est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère de l’Environnement, de la Protection de la nature et des Parcs au MECP.landpolicy@ontario.ca.

Subwatershed Planning Guide

DRAFT

Table of Contents

1.0 BACKGROUND AND CONTEXT

1.1 Purpose of Guide

The Guide provides advice for implementing land use planning policies related to watershed and subwatershed planning in coordination with planning for water, wastewater and storm water servicing, water resources, drinking water source protection and climate change resilience. The best practices and practical approaches contained in this document are intended to guide subwatershed planning in Ontario, primarily for land use and infrastructure planning under the *Planning Act*.

1.2 Benefits of Watershed and Subwatershed Planning

Among other things, this guide promotes consistent application of provincial policies and programs and offers a valuable administrative, planning, and technical framework for:

- Protecting, improving, or restoring the quality and quantity of water in a watershed.
- Mitigating potential risk to drinking water sources.
- Mitigating potential risk to public health or safety or of property damage from flooding and other natural hazards and the impacts of a changing climate.
- Facilitating an integrated and long term planning approach at a watersheds scale.
- Identifying water resource systems, which are necessary for the ecological and hydrological integrity of the watershed.
- Clarifying roles and responsibilities among municipalities, provincial ministries, and conservation authorities.
- Streamlining planning processes and reducing duplication and delays.
- Facilitating complete communities (e.g., open space and parks, diverse housing supply, complete streets, and approved employment lands).

1.3 Context

Watershed planning has been evolving in Ontario for decades. In the early 1900s, binational legislation such as the 1909 Boundary Waters Treaty recognized the need for water management on a watershed basis. This treaty established a cross-jurisdictional framework for managing water quantity issues.

Enactment of the *Conservation Authorities Act* in 1946 represented the emergence of a natural resource management framework on a watershed basis in Ontario, which resulted in the formation by municipalities and the province of Ontario's current 36 conservation authorities.

Watershed management efforts in Canada largely focused on flooding, drought, water quality, erosion, and hazards until the 1970s. The 1972 Great Lakes Water Quality Agreement (GLWQA) addressed several emerging concerns, such as chemical contamination and aquatic habitats.

In 1993, the Province published a trio of guidance documents to support the development and consistent application of water management policies in the municipal land use planning process. These documents were entitled:

- Water Management on a Watershed Basis: Implementing an Ecosystem Approach
- Subwatershed Planning
- Integrating Water Management Objectives into Municipal Planning Documents

The Province has since included direction for watershed and subwatershed planning in provincial policies and plans. The Provincial Policy Statement (PPS), Greenbelt Plan, A Place to Grow, Growth Plan for the Greater Golden Horseshoe (Growth Plan), Niagara Escarpment Plan, Lake Simcoe Protection Plan, and Oak Ridges Moraine Conservation Plan all recognize or require watershed or subwatershed planning (or equivalent) to inform land use planning by municipalities.

1.4 Watershed vs. Subwatershed Plans

Watersheds as defined in the PPS means "an area that is drained by a river and its tributaries." Subwatersheds are defined as an area that is drained by a tributary or some defined portion of a stream (see Figure 1).

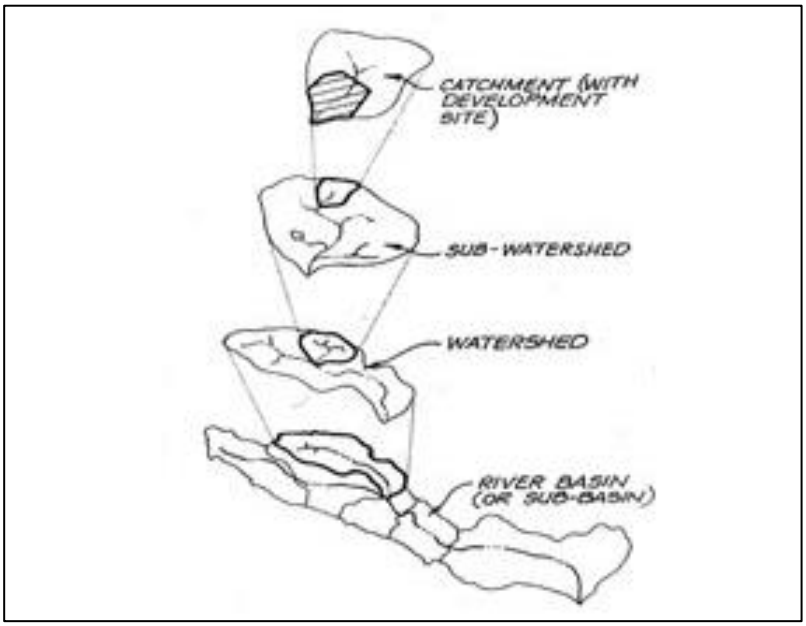


Figure 1 Watershed vs. subwatershed (copied from a website as an example of a simple illustration).

Watershed planning is typically carried out for two purposes:

- To identify overall watershed conditions.
- To identify and prioritize measures protect water resources, the management of human activities, land, water, aquatic life, and resources within a watershed.

Watershed plans may provide a comprehensive understanding of the ecological form and function in the watershed, the importance of different water resource and natural areas and features, factors that sustain them and indicators to monitor the long-term health of the watershed. Watershed planning may provide the "big picture" of how land use changes and the provisions of water, wastewater and stormwater infrastructure impact and interact with ecosystems and water resources within a watershed area.

Watershed planning typically includes:

- Watershed characterization.
- A water budget and conservation plan.
- Water quality assessments.
- Consideration of climate change projections, impacts and severe weather events.
- Land and water use management objectives and strategies.

- Scenario modelling to evaluate the impacts of forecasted growth, servicing options and mitigation measures.
- Environmental monitoring plan.
- Requirements for the use of environmental best management practices, programs, and performance measures.
- Criteria for evaluating the protection of quality and quantity of water
- The identification and protection of hydrologic features, areas, and functions and the inter-relationships between or among them.
- Targets for the protection and restoration of riparian areas.

Subwatershed planning is typically carried out for a sub-drainage area of a larger watershed. It can provide a higher level of detail than a watershed plan. A subwatershed plan reflects and refines the goals, objectives, targets, and assessments of watershed planning, as available at the time a subwatershed plan is completed, for smaller drainage areas, is tailored to subwatershed needs and addresses local issues. A subwatershed plan is triggered by a specific local issue requiring a higher level of details (i.e., development proposals, area-based water quantity and/or quality problems), or specific policy requirements as will be identified in the relevant sections of this Guide.

Watershed planning, where undertaken, may inform subwatershed planning. Watershed planning can enable the assessment and consideration of upstream, downstream, and cumulative effects of development throughout the entire watershed, provide additional context and information that supports, and expedite subwatershed planning. Watershed and subwatershed planning are intended to support land use and infrastructure planning, promote informed decision making, and lead to greater efficiency and effectiveness of the land use planning process.

1.5 Relationship of Watershed Planning to Land Use and Infrastructure Planning

Watershed planning informs broad scale municipal planning processes, including decisions on allocation of growth, planning for water, wastewater and stormwater infrastructure, and the identification of water resources within the watershed. Subwatershed planning informs site-specific development applications and official plan amendments, site plans, zoning, plans of subdivision, secondary plans, master environmental servicing plans and environmental approvals. Some planning authorities develop subwatershed plans to inform all planning decisions for a growing area. This may also be required to meet provincial policies provided that the subwatershed plan contains the appropriate information to inform planning

decisions.

Notwithstanding the relationships between these two levels of watershed planning and land use planning, it is important to acknowledge that they may also inform regulatory, policy and resource/land management decisions of conservation authorities, other agencies and other sectors. As such, these other agencies, Indigenous communities, and stakeholders should be involved in their development, implementation and endorsement. Figure 2 illustrates the relationships between watershed, subwatershed, and land use and infrastructure planning and specific conservation authority programs and services.

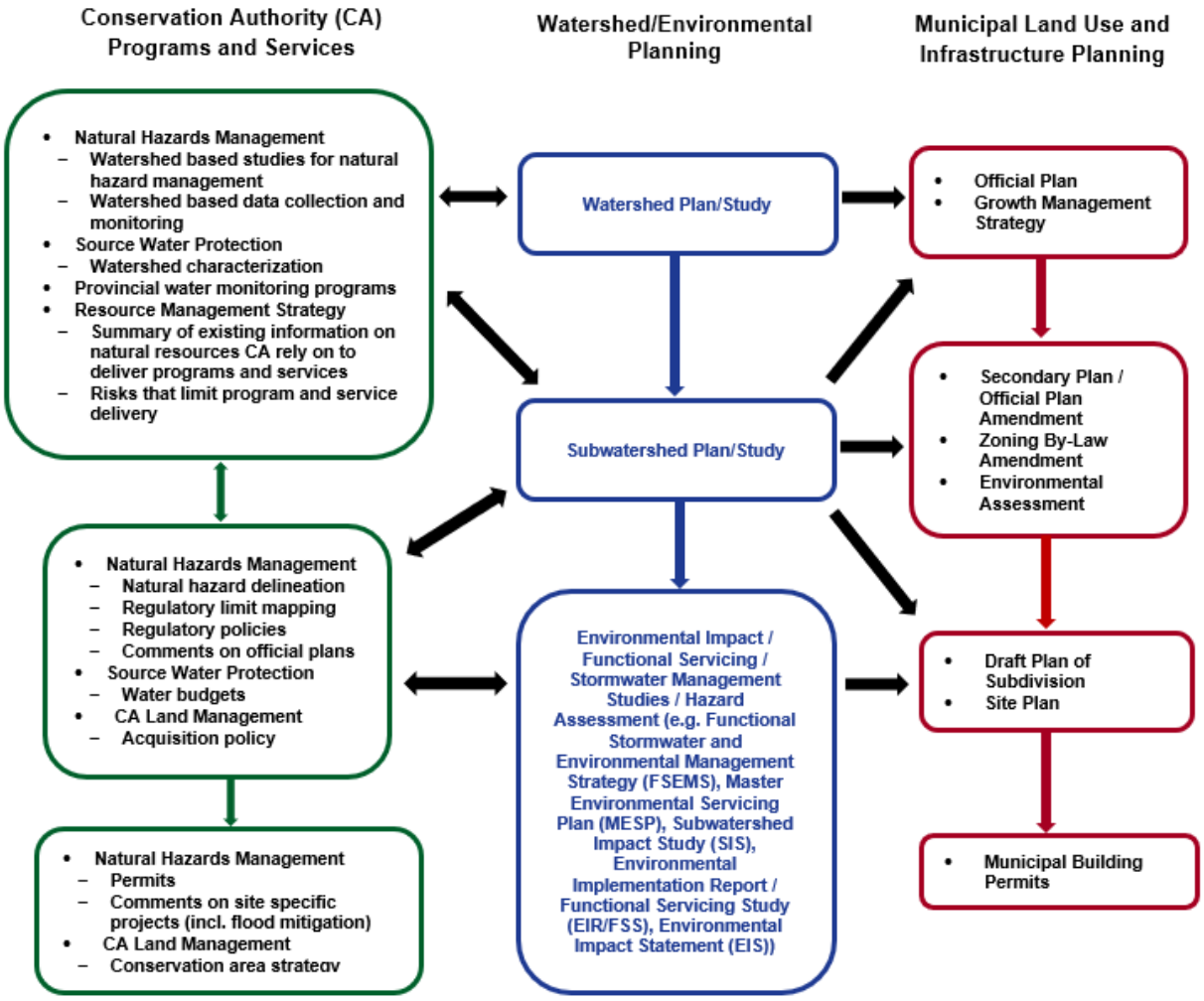


Figure 2 Relationship between watershed, subwatershed, land use, and infrastructure planning and specific conservation authority programs and services.

1.6 Policy Context

Under the *Planning Act*, municipalities and other planning authorities have the authority to make local planning decisions and must consider a number of provincial interests including environmental matters. These planning authorities must ensure that their local planning decisions are consistent with the provincial direction provided in the PPS. The PPS provides province-wide direction to protect, improve or restore the quality and quantity of water considering impacts on a watershed scale.

Further, planning authorities must conform to provincial plans such as the Growth Plan on issues such as growth management and incorporate these policies into their planning frameworks. The Growth Plan requires collaborative planning between upper, lower and single-tier municipalities, and conservation authorities as appropriate[1], to ensure that watershed planning is undertaken to support a comprehensive, integrated, and long-term approach to the protection, enhancement, or restoration of the quality and quantity of water within a watershed. In the region of the Greater Golden Horseshoe, the Province has mapped the Natural Heritage System using a common methodology that provides a consistent level of protection across municipal boundaries. The Growth Plan also requires planning for large-scale development, in designated greenfield areas, including secondary plans, to be informed by subwatershed plans or equivalent.

The following summary identifies key land use planning policy direction related to watershed/subwatershed planning:

- **Provincial Policy Statement** policies encourage a coordinated approach to planning, within and across municipalities, on water, ecosystem, shoreline, watershed and Great Lakes matters. The policies require planning authorities to protect, improve or restore the quality and quantity of water by, among other things, using the watershed as the ecologically meaningful scale for integrated and long-term planning to assess the cumulative impacts of development and prepare for the impacts of a changing climate to water resource systems. (*PPS 1.2.1 and 2.2.1*).
- **Growth Plan and Greenbelt Plan** policies specifically require watershed planning to be undertaken to inform the identification and protection of water resource systems, growth management, and other land use and infrastructure planning decisions. Subwatershed

[1] Conservation authority involvement is at the request of or on behalf of municipalities, to align with provisions under the *Conservation Authorities Act* and regulations.

planning is to be undertaken to inform large-scale and site-specific land use planning decisions. (*Growth Plan, 3.2.6, 3.2.7, 4.2.1, 4.2.3, 4.2.4, and Greenbelt Plan 3.2.3, 3.2.4, 3.2.6, 4.2.3 4.3.1 4.3.2).*

- **Oak Ridges Moraine Conservation Plan** policies require watershed planning by municipalities, as well as other development requirements. Development and site alteration within a subwatershed must meet specific policy requirements related to impervious cover and natural vegetation. Development of new or upgrading/extension of existing infrastructure is to be supported by watershed studies and subwatershed plans. Also, stormwater master plans are to be based on appropriate watershed scale studies and stormwater management plans prepared in accordance with watershed plans. (*ORMCP 24, 27, 41, 45 and 46*).
- **Niagara Escarpment Plan** has an objective of ensuring that hydrologic features and functions including the quality, quantity and character of groundwater and surface water, at the local and watershed level, are protected and where possible enhanced. It also states that growth and development within certain areas shall be compatible with and provide for compliance with approved watershed and/or subwatershed plans. (*NEP 2.6, 1.6.8.9, 1.7.5.9, 1.8.5.10*).
- **Lake Simcoe Protection Plan** applies land use planning policies to the Lake Simcoe watershed. The LSPP includes actions to be taken to protect and restore the ecological health of the Lake Simcoe watershed. The LSPP also includes the need for subwatershed evaluations that provide detailed guidance for area-specific hydrologic and natural heritage resource planning and management.

1.6.1 Equivalent Studies

The Growth Plan and Greenbelt Plan allow equivalent master plans, assessments and studies to be used by municipalities and planning authorities to inform land use and infrastructure planning and decision-making. Equivalent studies can be existing, enhanced, or new, and achieve or exceed the policy requirements within the Growth Plan and Greenbelt Plan.

Existing studies should be assessed to determine whether they are appropriate for achieving existing policy or approval requirements and updated accordingly. Existing studies may have information that can be used or expanded on. Additionally, existing studies should include the following to be considered equivalent for the purposes of watershed planning:

- The water resource system has been identified and policies developed to protect, improve, or restore the system.
- Existing watershed conditions have been characterized.
- Scenario modelling to evaluate the impacts of forecasted growth and servicing options.
- Goals, objectives, and targets to protect, improve or restore water quality and quantity have been set with management actions based on environmental best practices.
- Consideration of how those goals, objectives and targets will be implemented in land use and infrastructure planning decisions.
- Consideration of climate change including the results of any local/regional climate change impact assessments.
- Identify how the condition of the watershed will be monitored and implementation progress will be evaluated on an ongoing basis.

1.7 Roles and Responsibilities

Municipalities/Planning Authorities

Watershed/subwatershed planning for land use planning purposes is a responsibility of the planning authority, usually a municipality, under the PPS and provincial plans, as required. Some municipalities might have a footprint in multiple watersheds or a given watershed might contain all or parts of multiple municipalities. Provincial land use policies and plans direct planning authorities to coordinate planning matters and consider cross-jurisdictional and cross-watershed impacts.

Upper and single-tier municipalities will need to coordinate watershed planning across jurisdictional boundaries and with lower tier municipalities, and with other agencies involved in resource management. These municipalities may decide to enter into agreements with conservation authorities, as appropriate, to undertake a role in the watershed or subwatershed planning. Ultimately, municipalities and other planning authorities are responsible for ensuring studies are completed and for using watershed/subwatershed plans to inform the municipal land use planning and applicable infrastructure decisions.

Conservation Authorities

Conservation authorities are established through the *Conservation Authorities Act*. This Act provides that municipalities within a common watershed can petition the province to establish a conservation authority to deliver programs and services in natural resource management. Recent amendments to the *Conservation Authorities Act* group conservation

authority programs and services into three categories that an authority is authorized to deliver in the area over which it has jurisdiction:

1. Mandatory programs and services as set out in O. Reg. 686/21 (Category 1 programs and services).
2. Programs and services which conservation authorities deliver at the request of and on behalf of a municipality pursuant to a memorandum of understanding, service level agreement or similar agreement (Category 2 programs and services).
3. Programs and services that a conservation authority determines is advisable in its jurisdiction (Category 3 programs and services).

Pursuant to O. Reg. 686/21, conservation authorities are now required to develop a watershed-based resource management strategy with guiding principles and objectives that inform the design and delivery of the mandatory programs and services. The strategy is to include a summary of existing technical studies, monitoring programs and other information on the natural resources the conservation authority relies on within its area of jurisdiction or in specific watersheds that informs and supports the delivery of mandatory programs and services. The strategy also is to identify and analyze issues and risks that limit the effective delivery of the mandatory programs and services and actions to address those issues and mitigate the risks, including providing cost estimates for the implementation of those actions.

Conservation authority involvement in watershed/subwatershed planning to support land use planning is a not a mandatory program or service under the *Conservation Authorities Act* or regulations. A municipality may seek the involvement of a conservation authority in watershed or subwatershed planning by entering into a memorandum of understanding or service level agreement with the authority. While watershed/subwatershed planning is not specifically required for any of the mandatory programs and services set out in regulation under the *Conservation Authorities Act,* watershed based studies, watershed planning, data and monitoring may support the effective delivery of mandatory programs and services related to the risk of natural hazards.

Conservation authorities have provincially delegated responsibilities from the Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF) to represent provincial interests regarding natural hazard policy under the PPS (section 3.1), requiring the authorities to comment on municipal official plans for consistency with those PPS policies. This authority role is now recognized in O. Reg. 686/21 as part of the conservation authority mandatory programs and services. The Regulation also recognizes the authority's role as a public body under the *Planning Act*

for the purpose of ensuring that decisions under the *Planning Act* are consistent with the natural hazard policies in the PPS and in provincial plans. In addition to using watershed-based technical studies and monitoring in preparing and managing for natural hazards, the information a conservation authority collects and uses in the management of natural hazards may help inform a municipally led watershed/subwatershed planning exercise.

Where, under the *Planning Act*, the authority seeks to represent interests other than the natural hazards mandate it has been assigned in O. Reg. 686/21 (for example where the authority is commenting or intervening on a development proposal on matters related to natural heritage – PPS section 2.1), these would fall outside of the mandatory programs and services. Accordingly, where this role is financed in whole or in part by the municipal levy, it would have to be agreed to in a cost apportioning agreement between the authority and its participating municipalities. As well, conservation authorities exercise and perform the powers and duties of a source protection authority for a source protection area established under the *Clean Water Act, 2006* to support source protection committees in undertaking watershed-based source protection planning as a mandatory program and service.

Watershed and subwatershed planning for municipal land use planning purposes should integrate or leverage these other watershed-based initiatives.

Province

Where the province is the approval authority, the Ministry of Municipal Affairs and Housing (MMAH), with technical support from partner ministries such as the Ministry of the Environment, Conservation and Parks (MECP) and NDMNRF, will review applicable land use planning decisions (i.e., upper or single tier Official Plans and Official Plan amendments) to ensure that they are consistent with the PPS and conform/don't conflict with applicable provincial plans.

The MECP also has review and/or approval authority over projects under the *Environmental Assessment Act* and approvals for new or expanded infrastructure under the *Environmental Protection Act* and *Ontario Water Resources Act*. During this review and/or approval process, MECP may review infrastructure and other project studies and information, planning decisions and watershed planning, where appropriate. For example, watershed planning, where completed, can be referenced as a supporting document in the Consolidated Linear Infrastructure Environmental Compliance Approval for municipal stormwater management systems and can support and inform the development of a monitoring plan for a

municipal stormwater system.

Relevant provincial ministries may be able to support or participate on watershed planning steering committees requiring technical expertise on watershed matters.

2.0 PURPOSE AND PRINCIPLES OF SUBWATERSHED PLANNING

Planning for developing areas was traditionally based on parcels of land defined by jurisdictional boundaries or development proposals. Subwatershed planning is done to protect and enhance water resource and broader natural systems and protect public health and safety within the context of the overall watershed while informing development or land use change and identifying and addressing specific issues on a subwatershed basis. The following outlines a renewed approach to ensure the delivery of efficient and appropriately timed subwatershed studies.

2.1 Purpose of Subwatershed Plans

The fundamental reasons for undertaking subwatershed planning can include:

- Protecting and enhancing the environment, including important natural heritage systems and water resource systems.
- Protecting life and property from natural hazards within the development area, upstream and downstream and within the watershed pre-, during and post-construction.
- Developing a framework to inform land use planning and regulatory decisions and maximizes cost efficiencies to municipalities, agencies, development sector, taxpayers, and landowners.
- Supporting the appropriate location of infrastructure.
- Providing meaningful opportunities for public and Indigenous community input.
- Promoting a sustainable, balanced approach which contributes to the social, economic, and environmental health of the community.

As defined in the Growth Plan and the Greenbelt Plan, a subwatershed plan:

- Is based on pre-development monitoring and evaluation.
- Is integrated with natural heritage protection.
- Identifies specific criteria, objectives, actions, thresholds, targets, and best management practices for development, for water and wastewater servicing, for stormwater management, for managing and minimizing impacts related to severe weather events, and to support ecological needs.

The Growth Plan and Greenbelt Plan identifies that a subwatershed plan should:

- Consider existing development and evaluate impacts of any potential or proposed land uses and development.
- Identify hydrologic features, areas, linkages, and functions.
- Identify natural features, areas, and related hydrologic functions.
- Identify natural features, areas, and related hydrologic functions.
- Provide for protecting, improving, or restoring the quality and quantity of water within a subwatershed.
- Delineate ecologically significant groundwater recharge areas.

Specifically, subwatershed plans should:

- Establish the area based on subwatershed boundaries within the context of three considerations: 1) the location and extent of proposed natural resources, land use and development activities, 2) the existence and nature of upstream and downstream water-related natural features, uses, conditions or hazards, and 3) available watershed plans specifying subwatersheds for study.
- Identify the location, areal extent, present status, significance, and sensitivity of the existing natural environment within the subwatershed.
- Establish goals and objectives for management of the subwatershed to protect long-term environmental health.
- Identify environmentally sensitive or hazard lands, and recommend, with reasons, appropriate environmental management practices.
- Identify official plan land use designations.
- Provide directions for the screening and selection of best management practices for the subwatershed.
- Recommended practices should address a range ofactivities (e.g.,

woodlotmanagement).

- Address cumulative impacts of changes to subwatersheds on the natural environment and determine potential mitigation measures to address impacts on the natural environment.
- Integrate disciplines, policies, mandates and requirements of all agencies and interests in a subwatershed to resolve conflicting or changing approaches to watershed management.
- Provide opportunities for informing consistent draft conditions of approval for individual municipalities within the subwatershed.
- Promote participation in and support for subwatershed planning.
- Establish an implementation strategy that identifies roles, responsibilities of all involved parties and timing of works and programs to ensure that chosen environmental and development practices are implemented.
- Outline requirements for monitoring programs and information updates recommended by the plan.
- Provide technical information that will support delineation of the water resource system, natural heritage system and natural hazards.

2.2 Principles for Subwatershed Planning

Principles that underpin a subwatershed planning process include:

1. A subwatershed plan considers the entire drainage area within which it is situated, including upstream, downstream, and cumulative influences and effects and is informed by watershed plans, where they exist.
2. A subwatershed plan strives to protect, enhance and restore the quality and quantity of water and maintain and restore/enhance critical natural system interactions, functions, and resiliency, while informing development and infrastructure planning.
3. The subwatershed management framework supports a precautionary approach, partnering, using sound science, taking well-planned actions, measuring and achieving results, and adjusting management approaches where expected results are underachieved.
4. The process requires an interdisciplinary and adaptive management approach.
5. The scope and level of technical study required is based on a clear statement of purpose, goals, and objectives and a flexible

approach.

6. A subwatershed plan builds on technical information available in existing watershed plans, technical reports, and monitoring data.
7. A subwatershed plan is supported by multi-year data collection to ensure that baseline conditions are properly characterized.
8. Planning authorities are encouraged to build stronger relationships, collaborate, and partner with, and meaningfully involve Indigenous communities.
9. The roles and responsibilities of partners, milestones, and timelines are clearly defined at the onset.

3.0 SUBWATERSHED PLANNING PROCESS

There are several potential prerequisites to initiating a subwatershed planning process. Either a watershed plan, if there is one, or an Official Plan may endorse or recommend the development of a subwatershed plan building upon the direction of the PPS and as required by other provincial plans. In the more rapidly urbanizing areas of Ontario, especially within the growth centres identified within the Growth Plan, the priority and timing for subwatershed plans should be determined well before development pressures are acute. This allows for a more orderly, progressive, cohesive, and timely planning approach.

Once a subwatershed planning program/process has been developed which identifies the requirements, priorities, and timing for individual subwatershed plans, the development of each subwatershed plan involves five steps:

1. Setting the Stage
2. Recognizing and Aligning Interests
3. Preparing and Approving the Plan
4. Implementing the Plan
5. Monitoring and Evaluating the Plan

This five-stage process is cyclical in nature and requires adaptive management to regularly evaluate progress and monitor watershed trends (Figure 3).

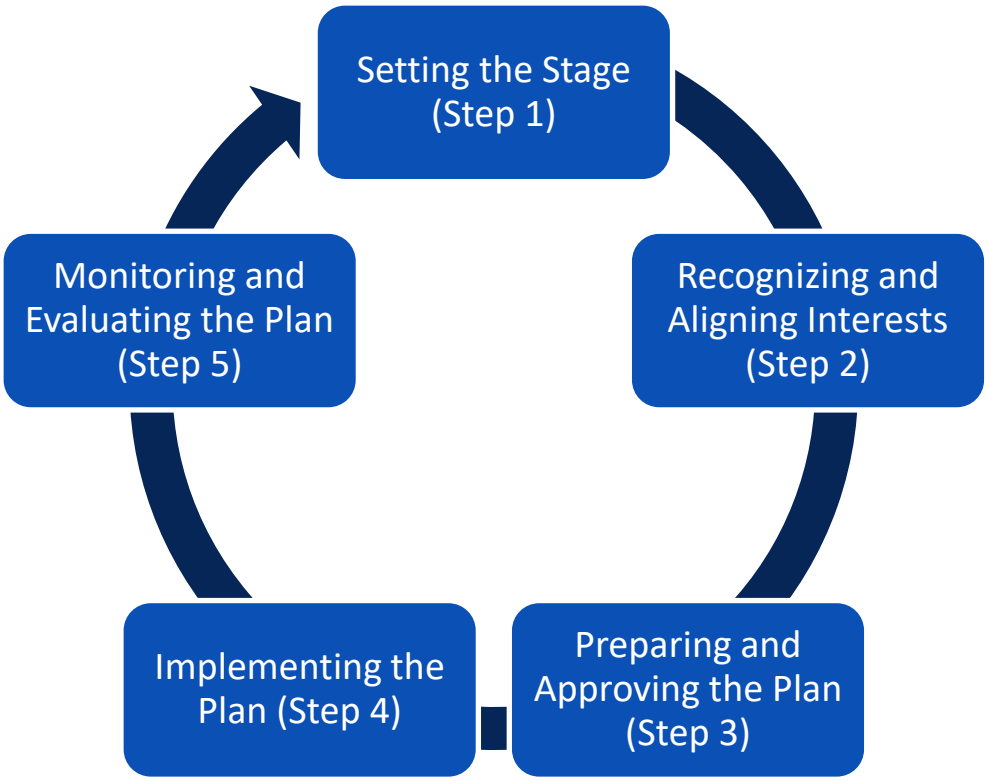


Figure 3 Steps of subwatershed planning.

3.1 Setting the Stage (Step 1)

Prior to undertaking a subwatershed plan, there are several activities which should be carried out to ensure that the planning process proceeds smoothly and expeditiously. Best practices include:

- Identifying partners with an interest in participating in the subwatershed planning process, such as Indigenous communities, relevant agencies and stakeholders.
- Identifying First Nations and Métis communities that are affected, or have an interest in, the subwatershed planning process, and partnering and engaging with these communities throughout the subwatershed planning process. The Provincial Policy Statement, 2020 requires that planning authorities engage with Indigenous communities and coordinate on land use planning matters (see Section 5.0 for more information on partnering and engaging with Indigenous communities).

- Securing agreement from partners on the purpose, timing, and desired outcomes of the plan. Subwatershed plans may be undertaken for several reasons including the orderly development of greenfield areas or areas planned for extensive urban redevelopment and intensification; significant land use change; natural resources development; or the restoration of natural system functions.
- Identifying high-level issues and concerns from existing watershed/subwatershed studies and/or through the early establishment of a baseline data and monitoring program using established and accepted protocols. Once an area has been slated for subwatershed planning, the establishment of a data collection and monitoring program can identify on-the-ground conditions and trends over time and inform and accelerate the forthcoming planning process.
- Establishing and securing agreement among partners for participating in and supporting the plan. This would include consensus on the scoping and phasing of the subwatershed planning process. Subwatershed plans can be scoped, depending on the size of the drainage area, amount of information already available through a watershed plan and assessment reports for drinking water source protection under the *Clean Water Act, 2006*, or other study/monitoring/data availability, and the purpose of the subwatershed plan. For example, in intensification areas, emphasis may be placed on further defining natural hazards such as flooding, including spill areas,[2] as well as identifying candidate areas for restoration of natural heritage features, functions, or areas.
- Establishing the appropriate coordinating agency.
- Ensuring that data and information can be shared easily among subwatershed planning partners by through accepted, common data collection protocols and sharing portals.
- Determining funding mechanisms and responsibilities. This may involve establishing the extent of funding, who should contribute and phasing.

[2] Spill areas occur when floodwaters leave a watercourse and its valley, flowing overland before rejoining the same watercourse at a distance downstream or moving into another watershed. Until recently, it was not possible to map spill areas. Though the use of new tools and technologies, spill areas can now be modelled, characterized, and mapped.

3.2 Recognizing and Aligning the Interests (Step 2)

A Charter or agreement is a high-level document which defines the framework for organizing and managing the development of a subwatershed plan. It is one means of securing consensus and commitment from parties on how the subwatershed planning process will proceed. The Charter would formalize the purpose, scope, goals, and objectives of the plan, subwatershed boundaries and plan area considerations (e.g., upstream/downstream considerations), commitments, roles and responsibilities, and agency endorsement/sign-off to proceed. It should also specify milestones and timelines, establish steering and advisory committees and their membership and functions, and outline expectations for conflict resolution, and consultation. In establishing a charter, consideration for advancing technical work in parallel with land use planning and regulatory requirements should be considered to accelerate timelines and streamline processes.

A Terms of Reference for the plan should be developed concurrently with the Charter in coordination with the municipalities, conservation authorities, agencies and landowners. The Terms of Reference should be in keeping with the directions and commitments set forth in the Charter and specify:

- Technical study requirements of the subwatershed plan as outlined in step 3 (including protocols, methodologies, modelling specifications, assessment tools, data-sharing, monitoring and data collection requirements, and reporting and submission formats).
- Reference and guidance materials to be followed.
- Milestones, timelines, and deliverables.
- How Indigenous communities may be involved in the subwatershed planning process.
- Engagement opportunities.
- Landowner coordination approaches.
- Public notification commitments, and
- Public participation opportunities.

A steering committee and working groups are effective ways to conduct subwatershed planning. Steering committees are typically established at the early stages of the planning process and provide general oversight to the planning process. The steering committee would be responsible for developing the terms of reference, engagement strategy, and directing any relevant working groups.

Members of the steering committee are responsible for representing the

mandate, perspectives and responsibilities of their organization or community and meeting deadlines, negotiating to resolve conflicts or differences of opinions among committee members, and ensuring that the process remains focused and on track.

Members of the steering committee should include:

- Municipality(ies)
- Planning authorities
- Conservation authorities
- Indigenous communities and organizations
- Watershed or subwatershed councils and/or source protection committee
- Government Ministries and/or Agencies
- Environmental organizations
- Other interest groups

As you progress through the subwatershed planning process, you may want to establish topical/subject matter working groups to address components of the subwatershed plan. These topical working groups could then report to the steering committee.

It is important to ensure appropriate and meaningful Indigenous involvement. Indigenous representation on a steering committee may help to inform an appropriate Indigenous engagement approach for communities and organizations.

3.3. Preparing and Approving the Subwatershed Plan (Step 3)

A subwatershed plan has three phases which should be specified in the Terms of Reference:

Phase 1 Identification of Existing Conditions and Initial Impact Assessment

Phase 2 Completion of Impact Assessment and Development of the Preferred Land Use Scenario

Phase 3 Implementation and Management Strategies

The phases of work identified should not be regarded as consecutive steps. Rather, they represent different components. Work can be undertaken on a subsequent phase before work on all prior phases is complete. When this is done, work on subsequent phases can be modified and updated as prior

phases are finalized. Such an approach avoids undue delays that can arise from overly rigid compartmentalization.

The following section outlines the key phases of a watershed planning process in more detail for potential greenfield development or urban boundary expansions (i.e., new development areas which will be added to existing settlement areas).

3.3.1 Phase 1 - Identification of Existing Conditions and Initial Assessment

In Phase 1, subwatershed objectives should be confirmed and boundaries delineated and refined based on water resources and natural heritage systems rather than political or land ownership units. In some cases, where a subwatershed is too large to be practically studied as a single project, it may be broken into smaller coherent areas for the purpose of the subwatershed plan. Alternatively, a greater level of scrutiny and study may be applied to areas of the watershed that focus on areas of future development, as compared with the analysis required for upstream portions of the subwatershed that will largely not be affected by future development or its impacts.

Table of contents for a subwatershed plan usually includes:

- background
- existing watershed conditions
- scenario analysis
- vision, goals, objectives, and targets
- engagement and communications
- implementation
- monitoring and evaluation
- references and resources

This phase will identify the existing natural features, areas, and related hydrologic functions and conditions, including their location, in the subwatershed. Wherever possible, the Phase 1 work should make use of, and where appropriate, rely upon previous work that is available from a range of scientific sources including existing technical studies such as watershed and source protection plans and baseline data collected prior to and in anticipation of the plan launch. However, the relevance and suitability of existing data (i.e., reflective of existing conditions) should be confirmed. Once an area has been slated for subwatershed planning, the establishment of a data collection and monitoring program can identify on-the-ground conditions and trends over time and inform and accelerate the planning process. Appendix A contains information on key technical tools and considerations for watershed characterization related to water resource systems, water quantity/quality

and natural hazards, as well climate change considerations in the planning process.

Data Requirements and Collection

Generally, a minimum of one year of monitoring data should be collected to satisfy the requirements for identifying existing conditions over four seasons. However, in the case of unusual conditions such as low precipitation years, two to three years of monitoring may be required to give a more complete set of data for assessing existing baseline conditions. Additional data may continue to be gathered throughout the Phase 1 and 2 components of the subwatershed plan, with consequential adjustments to the emerging plan being made as appropriate. Such an approach allows work to continue without unnecessary delays, while at the same time ensuring that the plan is based on data that is valid, reliable, and complete.

The areas and features, including those which are regionally and locally significant, and conditions to be identified in Phase 1 may include, but are not limited to such things as:

- Surface water quantity
- Surface water quality
- Groundwater quantity
- Groundwater quality
- Baseflow and flow
- Discharge and recharge areas
- Key hydrologic features and areas
- Groundwater and surface water features and hydrologic functions
- Wetlands
- Terrestrial habitat
- Aquatic habitat
- Fisheries communities
- Wildlife communities
- Vegetation communities
- Species at risk
- Soil conditions and geology
- Geomorphology
- Erosion sites

- Existing transportation corridors
- Existing servicing infrastructure
- Existing utility infrastructure
- Existing channel alterations
- Ecological and natural heritage system linkages
- Existing development and land use and their impacts
- Cultural heritage systems and features
- Flooding patterns and trends

During this phase, mapping of all relevant areas and features should be completed, along with known natural hazards, water resources systems and natural heritage systems. In mapping and producing the plan, particular focus is placed on the protection of features and areas as defined by provincial policy. Opportunities for enhancement and rehabilitation of significant and sensitive features and areas, including appropriate buffers, should be identified to increase the resiliency of the overall system and define developable areas indicated on the mapping.

An initial set of high-level objectives and targets for management of the subwatershed may be identified at this stage, however, specific objectives and targets should be identified and agreed to in subsequent phases based on further data collection and assessment.

Initial Assessment

Based on the hydrological and natural attributes, natural hazard and development and land uses identified through the characterization work, and upon land use planning policies in place that are consistent with provincial and local plans and the PPS, a preliminary land use scenario can be prepared.

The preliminary land use scenario provides the basis for an initial assessment of the impact of development on the subwatershed. The initial impact assessment includes an initial technical assessment of impacts to water resource and natural systems and their hydrological and ecological functions.

To ensure an efficient process, the initial impact assessment can be based upon available data respecting the natural heritage system, and the hydrology of the subwatershed. Often, it is necessary to gather additional data. This includes subsequent field studies for species identification and counts. It may also include additional hydrological monitoring (surface and ground water) to get a better picture of activity to address data concerns arising from unusually wet or dry years, for example. This additional data

can then be considered and incorporated in subsequent phases, however, not all additional data collection is required before commencing Phase 2. It should be clearly stated in the documentation that the collection and analysis of data is ongoing and will be incorporated into subsequent phases.

A key tool for accurately assessing impacts in areas like hydrology is the use of modelling. It is essential that the models used are accessible and available to all participants in the subwatershed planning process so that they may use the model to assist in development of an optimal subwatershed plan. An appropriate model can be selected in keeping with the technical requirements and standards for flood hazard mapping completed by municipalities for their Official Plans and by conservation authorities to comply with obligations to provide the mandatory programs and services related to the risk of natural hazards. This model should be used as the basis of future modelling in subsequent supporting studies such as Environmental Impact Statements or Master Environmental Servicing Plans.

The circulation of the draft Phase 1 for comment to Indigenous communities, landowners, participating agencies, public, and other interested stakeholders provides the opportunity for technical input at this stage of the planning process.

3.3.2 Phase 2 - Completion of Impact Assessment and Development of the Land Use Scenario

The technical assessment of how the subwatershed environment will be affected by the development, land uses changes, or future watershed conditions proposed within the area is completed in Phase 2. The impact assessment, evaluation of final data collection, setting of targets and constraints, and identification and evaluation of subwatershed management alternatives combine to form the foundation for developing the subwatershed plan.

Based on the preliminary land use scenario from Phase 1, certain technical and engineering analysis may be completed at this stage:

- Preliminary road layout.
- Preliminary location of municipal services including road crossings of valleys, and sanitary sewers alignment.
- Identification of services proposed in open space areas.
- Utility information such as proposed hydro, and natural gas easements and crossings.
- Preliminary topographic and grading analysis including soil type analysis and preliminary locations of stormwater management

facilities.

A major component of this phase is a water budget analysis. This water budget analysis begins with the hydrological information derived in Phase 1. It incorporates analysis of the full hydrologic cycle, including infiltration, evapotranspiration, and ground water recharge and the impact of the proposed land use scenario on that hydrologic cycle. Any hydrologic data gathering already in progress can be incorporated at this stage.

The water budget analysis considers recent trends in more severe rainfall events that may be a consequence of a changing climate. In addition to reflecting existing conditions, this analysis includes a forecast of future conditions that must be considered, especially with respect to extreme precipitation events. This analysis also includes an evaluation of anticipated changes resulting from development to the quantity of surface water and groundwater, and analysis of water quality changes.

The water budget analysis helps shape both the drainage plan for the subwatershed, and impact management measures.

The various inputs used to identify targets should include:

- Considerations for development in hazardous areas.
- Managing impacts on natural hazards and on necessary infrastructure where avoidance is impossible.
- Protecting sensitive habitats from infrastructure location.
- Protecting wetlands from water table changes and hydrologic impacts.
- Protecting defined sensitive natural features and functions and linkages and avoiding human impacts (such as trails), where necessary.

The Phase 2 study also considers various alternatives for managing the subwatershed. These alternatives consider such matters as:

- Land uses.
- Drainage patterns, floodplains, and flood spill areas.
- Development planning and regulatory controls.
- Mitigation measures.
- Best management practices.
- Opportunities and options for rehabilitation, restoration or enhancement.

The various alternatives are evaluated, and based upon that evaluation, a preferred subwatershed plan is developed. The evaluation considers the following questions:

- How well do the alternatives achieve the subwatershed plan objectives?
- Are the alternatives contributing to the achievement of specific provincial policy requirements for maintaining or improving hydrologic functions in a given area?
- Can the alternatives be effectively implemented?
- Can the alternatives be maintained over the long term?
- Do the alternatives achieve human safety and protection against natural hazards and avoidance natural hazard aggravation?
- Do the alternatives meet other community planning objectives?
- Do the alternatives provide resilience against climate change impacts?

Based on an analysis of the information gathered and evaluation of various management alternatives, the subwatershed plan is circulated for input and comment from Indigenous communities, stakeholders and the public.

3.3.3 Phase 3 - Implementation and Management Strategies

Phase 3 outlines ways in which the subwatershed plan should be given effect. Specific roles and responsibilities for that implementation among various parties are identified.

Several processes are key to successful implementation. At this phase, the subwatershed plan provides land use and policy recommendations to inform the land use planning process and preparation of a Secondary Plan, Block Plan, and/or Tertiary Plan, and Official Plan Amendment, pursuant to the *Planning Act.*

Any environmental assessment and/or master planning processes that are required for water, wastewater or stormwater infrastructure within the subwatershed area should be aligned with the findings and recommendations of the subwatershed plan. Large-scale and site-specific land use planning decisions should be informed by the subwatershed plan or equivalent.

Phase 3 also outlines any specific rehabilitation or retrofit work that is required, including an identification of which parties are responsible for implementation.

If unique circumstances required additional data collection to extend into Phase 3 (for example, additional hydrology monitoring is required to reflect unusual climate conditions), the watershed plan is modified at this stage, if needed, to reflect any unusual results from the supplementary data collection.

The management strategies for the subwatershed are identified in specific terms in Phase 3. Various management practices are outlined to guide how the following (in many cases related) matters will be addressed, as applicable, in specific detail:

- Hydrogeology
- Groundwater quantity
- Groundwater quality
- Hydrology and hydraulics
- Flood control
- Erosion control
- Water budget
- Surface water quality
- Pollution by specific parameters
- Pollution control and prevention practices
- Sewage attenuation
- Stormwater management system maintenance
- Construction management practices
- Thermal impact, and its mitigation
- Low impact development best practices
- Vegetation strategies for restoration/enhancement and vegetation protection zones
- Stream morphology
- Fisheries protection and enhancement measures
- Aquatic habitat protection and enhancement measures
- Terrestrial habitat protection and enhancement measures
- Headwater protection
- Recharge protection and recharge zones
- Specific species protection measures

- Natural heritage feature protection and enhancement
- Trail location and management
- Wildlife corridors including road crossings
- Wetland management and enhancement or replacement
- Natural heritage feature buffers and linkages

Phase 3 may also identify more detailed technical study and additional work that are required at a local level, in subsequent stages of the development process, and which parties will be responsible for that work. Environmental Impact Reports, or Environmental Impact Studies (or similar work using different nomenclature) and functional stormwater reports provide the detailed work at a block plan or the draft plan of subdivision plan level. The undertaking of these detailed studies, in accordance with and informed by the subwatershed plan, is the responsibility of development proponents, with public agencies providing technical and planning input and review.

It is important that the appropriate level of study be assigned to the subwatershed planning process to avoid deferring components to the more technical local level and vice versa.

Phase 3 should identify a staging and sequencing plan for the development of the subwatershed based on the characteristics and assessment of the subwatershed to ensure an orderly and efficient timing of the delivery of infrastructure to support the development of the area. In this phase, an appropriate timeframe for an update of the subwatershed plan should also be specified. Generally, a timeframe of 10 years is adequate. However, the timing for updates should relate to the timing of development or land use change proposed within the watershed. Should monitoring identify significant unanticipated outcomes of concern, an earlier update of the subwatershed plan is appropriate.

3.3.4 Subwatershed Plan Timelines

Depending on the amount of information available, the size of the subwatershed, the scope of the work that needs to be done, and extent of and public and Indigenous engagement, timelines from initiation to completion will vary. Baseline monitoring of watershed conditions may be necessary if data gaps exist. Three to five years of monitoring is typically appropriate to determine a baseline condition of the watershed components being assessed. It is important that baseline condition monitoring commence as early as possible to facilitate the process and ensure sufficient fieldwork can be completed to inform Phase 1. The phases of work should not be regarded as consecutive steps and work can be undertaken on a subsequent phase before work on all prior phases is

complete. The following timeline is suggested as a reasonable minimum timeframe to achieve.

Phase 1 - Identification of Existing Conditions – 4-season field work and multiple years (to account for variability, e.g. 3 years) of monitoring baseline conditions are necessary prior to initiating the planning process Initial Impact Assessment - Months 6 to 12 after baseline conditions are established

Phase 2 - Completion of Impact Assessment and Development of the Land Use Plan - Months 12 to 24

Phase 3 - Implementation and Management Strategies - Months 24 to 36

3.4 Approval and Implementation of Plan (Step 4)

After Phase 3 is completed, municipalities may proceed with finalizing the land use plan and developing the Secondary Plan and Official Plan Amendment based on the subwatershed plan.

It is important that the foundation for subwatershed plans is based on strong science to inform land use plans, policies, and regulatory limits. To ensure that best science forms the basis of these land use plans and that they are defensible should there be appeals to the Ontario Land Tribunal.

Once a subwatershed plan has been completed, acceptance and endorsement of the plan is required for participating agencies who have a regulatory or planning role in implementing the plan.

3.5 Monitoring and Evaluation (Step 5)

3.5.1 Monitoring

Monitoring the effects of implementing subwatershed plans provides essential information to assess whether anticipated results match results on the ground. Assessment of monitoring data should reveal whether the intended purpose, goals and objectives of the plan have been realized. Unexpected monitoring results of concern may warrant a review and update of the subwatershed plan.

Implementation monitoring is about monitoring progress on implementation actions identified through the watershed planning process. This includes tracking implementation progress, collecting data and information to report on progress and evaluating where implementation actions could be improved, if necessary.

Subwatershed monitoring while related to implementation monitoring, is about long-term watershed monitoring through an environmental

monitoring program where indicators of watershed health are monitored on an ongoing basis to determine trends of watershed conditions. It is vital that monitoring programs continue throughout the watershed planning process. Ongoing monitoring will help determine trends within the watershed and be used to assess progress on watershed implementation.

Determining and selecting indicators to measure conditions and trends in the subwatershed are essential to understand the effects of development or land use change and ensure environmental health of not only the subwatershed, but the watershed within which it is situated.

The duration, purpose and responsibility for monitoring and data collection; the accepted protocol, methods, and formats for collecting and submitting the information; and the responsibility for the interpreting and reviewing the data and undertaking any required actions should be clearly articulated in the approved Terms of Reference. General matters to be monitored are drawn from the existing conditions and assessment of impacts (Step 3, Phase 1). Monitoring time frames for municipal infrastructure should adhere to the required maintenance and assumption periods associated with the design, construction, inspection and approval of these services by all approval agencies, including the Province.

The monitoring program, as laid out by the Terms of Reference for the plan, should answer the following questions:

- What specific outcomes are we trying to measure?
- What indicators are to be used to measure these outcomes?
- Who will do the monitoring and over what time period?
- How will monitoring data be formatted, shared, and analyzed?
- Is the program cost efficient and practical to ensure the best monitoring value for the budget?
- Does the monitoring program match the anticipated pace of development?
- Is the subwatershed plan being implemented as designed? (Operational monitoring)
- Are best management practices being followed?
- Is the subwatershed plan achieving the anticipated on-the-ground results?
- If monitoring indicates that intended outcomes are not being achieved and issues are identified, what adaptive measures/management options, strategies and remedial plans are in place and who is responsible for implementation?

3.5.2 Evaluation

Implementation monitoring and subwatershed monitoring information should be shared with Indigenous communities, other partners, stakeholders, and the public on a regular basis. The ongoing sharing of information about implementation will:

- Help build credibility and support for the subwatershed plan.
- Quantify progress on implementation actions.
- Encourage partners and stakeholders to remain actively engaged.
- Emphasize transparency around the subwatershed planning process.
- Encourage broader participation and collaboration.

Reporting can be done several different ways in terms of format and frequency. Annual or frequent reporting is recommended. It is important that reporting cover both implementation of the plan and ongoing monitoring of subwatershed conditions. Adaptive management on a watershed and subwatershed basis includes ongoing learning from scientific research and monitoring, and implementation experience. Research into issues and innovations, such as addressing climate change or incorporating new development and design best practices, can be incorporated into watershed planning in an iterative way, as watershed plans are reviewed and updated. Municipalities should keep abreast of opportunities for research pilot projects, and partnerships with other municipalities, non-government organizations, and academic institutions as well as entering into agreements with conservation authorities to support municipalities with watershed and subwatershed planning and evaluation.

The subwatershed plan should be reviewed and updated at regular intervals identified in the plan.

4.0 PUBLIC ENGAGEMENT

The purpose of public engagement and participation in any planning or decision-making process is to encourage the exchange of ideas, mobilize local knowledge, and gain public perspectives and input. Public input is a key determinate of the success of the plan. Through public engagement, there are opportunities to obtain local and traditional knowledge about environmental conditions and trends from community environmental and Indigenous groups, engage citizen scientists in collecting data, increase public awareness and education about the process and identify controversial issues at the beginning of the process so that concerns can be addressed

effectively in the preparation and implementation of the preferred plan.

The nature and extent of the public engagement process will depend on such factors as the size of the plan area, number of affected landowners, timing of the plan, and requirements for public consultation under the *Planning Act* associated with a municipal Secondary Plan/Official Plan Amendment and the *Environmental Assessment Act* for any associated servicing/infrastructure/transportation studies. The time required for a public engagement process should be included in overall timelines for completing the subwatershed plan.

5.0 INDIGENOUS PARTNERSHIPS AND ENGAGEMENT

Ontario recognizes the value that Indigenous people place on the environment and have expressed that they have protective customary stewardship practices and are deeply connected, spiritually and culturally, to the land, water, air and animals. Planning authorities should work with Indigenous communities through all aspects of the subwatershed planning process.

5.1 What is it?

A partnership approach with Indigenous peoples can lead to a more comprehensive subwatershed plan. Indigenous peoples in Ontario consist of numerous First Nations and Métis communities and peoples. Ontario is covered by many treaties and other agreements. Understanding treaty areas and the locations of First Nation communities is important for subwatershed planning.

First Nations and Treaties maps are available through the Government of Ontario.

More information on First Nations in Ontario can be obtained by contacting Chiefs of Ontario, or from other Provincial and Territorial Organizations that a local First Nation may be part of.

More information on Métis in Ontario can be obtained by contacting the Métis Nation of Ontario, or through liaising with Independent Métis communities.

5.2 Why is it important?

Relationship building and meaningful engagement with Indigenous peoples

is important for subwatershed planning. Municipalities should recognize and respect Indigenous communities' relationship to, and customary stewardship of, land, water and resources, and the specific knowledge and history they can bring to subwatershed planning. Working with Indigenous partners helps to promote respectful and mutually beneficial relationships in the management and protection of watersheds and subwatersheds.

5.3 How to do it?

Municipalities are encouraged to work with Indigenous communities who may be interested in and affected by subwatershed planning. Municipalities should reach out to local Indigenous communities within the watershed or subwatershed, as well as Indigenous communities that have traditional or treaty rights in the watershed or subwatershed – some of these communities may be located relatively far from the subject subwatershed (refer to the referenced First Nations and Treaty maps, or contact Chiefs of Ontario and Métis Nation of Ontario). In-person visits, phone calls, emails and letter circulation can help with determining if there is an interest in working together and how this will be accomplished. Early engagement is vital. Interested, or potentially affected, Indigenous communities should be partners in subwatershed planning.

It is important to remember that many Indigenous communities and their staff often face resource and capacity pressures. Municipalities should consider how to equitably partner with Indigenous communities. Meaningful Indigenous engagement can lead to a more comprehensive and robust subwatershed plan.

Indigenous Engagement Best Practices:

- Early engagement is vital and contact with Indigenous communities should be made prior to commencement of subwatershed planning.
- Meaningful representation on steering committees/subwatershed planning governance structures.
- Consideration of traditional ecological knowledge, if offered.
- Support for capacity building through subwatershed planning development and implementation.
- Discuss with each Indigenous community how best to work together.
- Learn from each other and foster relationship building.

Partnership/Collaboration:

- Explore development of stewardship programs that support Indigenous community studies, restoration and involvement, with a focus on Elders, women and youth participation.

- Further develop conservation partnerships with Indigenous communities to encourage conservation, implement best management practices and identify restoration opportunities within watersheds or subwatersheds.
- Work with Indigenous communities to develop targeted initiatives and materials and include Indigenous perspectives in subwatershed awareness initiatives.
- Involve Indigenous communities in environmental monitoring to provide input into current and future subwatershed planning efforts.
- With respect to water quality and quantity, share information and promote opportunities to work collaboratively with Indigenous communities to address the maintenance of water quality and quantity within subwatersheds.
- Provide opportunities for Indigenous youth to network with non-Indigenous youth in municipalities regarding subwatershed planning.
- Promote mentorship opportunities for Indigenous youth to meet and work with experienced individuals with expertise in watershed or subwatershed planning.

5.4 Traditional Ecological Knowledge

Effective engagement with Indigenous communities may include the sharing of different types of knowledge, information and perspectives by communities, including traditional ecological knowledge. This type of input will be important for all aspects of subwatershed planning

Effective engagement with Indigenous communities may include the consideration of traditional ecological knowledge as part of watershed delineation and characterization. This knowledge can, for example, help determine historical water levels, historical and cultural land uses, significant cultural sites, ecologically sensitive areas and important times of year for a variety of species. Traditional ecological knowledge may help to define research questions and data collection for any monitoring programs.

Municipalities should discuss with the appropriate Indigenous knowledge holders how traditional ecological knowledge may be shared and how it may be used.

5.5 Indigenous Subwatershed Planning Resources

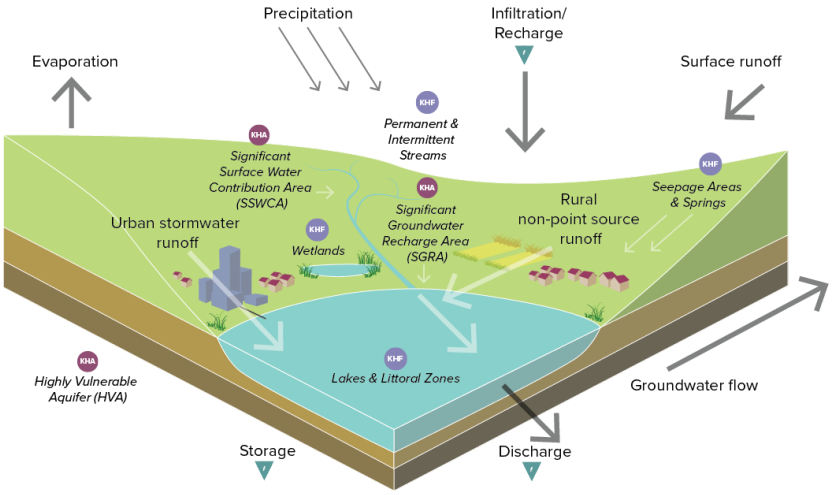
The Centre for Indigenous Environmental Resources (CIER) has created a series of First Nations Integrated Watershed Planning Guidebooks. These can be useful resources on the topic of Indigenous involvement in watershed planning.

APPENDIX A – KEY TECHNICAL TOOLS AND CONSIDERATIONS

WATER RESOURCE SYSTEMS

Water resource systems consist of surface water and groundwater features and areas (consisting of key hydrologic areas and key hydrologic features) and their hydrologic functions. It is recommended that the water resource system be viewed as an integrated system. For many features and areas there will be overlap, including with natural heritage features and systems, and source protection areas.

- ***Key hydrologic areas*** are areas which contribute to the hydrologic functions of the water resource system. These areas maintain ground and surface water quality and quantity by collecting, storing and filtering rainwater and overland flow, recharge aquifers and feed downstream tributaries, lakes, wetlands and discharge areas. These areas are also sensitive to contamination and feed key hydrologic features and drinking water sources.
    - ***Key hydrologic areas*** include: significant groundwater recharge areas, significant surface water contribution areas and highly vulnerable aquifers.
    - ***Key hydrologic features*** include: permanent and intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
- ***Hydrologic functions*** represent water's movement through the environment. They are the functions of the hydrological cycle that include the occurrence, circulation, distribution and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water's interaction with the environment including its relation to living things. Generally, the hydrologic functions of recharge, storage, and discharge of water need to be maintained to support ecosystems and communities.
- ***Vegetation protection zones,*** which are a vegetated buffer area surrounding a key natural heritage feature or key hydrologic feature are also important for the protection of the water resource system.



Legend:

Hydrologic Function | KHA Key Hydrologic Area | KHF Key Hydrologic Feature

WATER QUANTITY

Water Budgets

A water budget can be conceptualized as water inputs, outputs and changes in storage by quantifying elements of the hydrologic cycle within a watershed or subwatershed plan area in an attempt to assess the volume of water available. A water budget model can be used to assess the current conditions of water resources or the potential effects of future activities or land development scenarios on water resources. The process can be simple or complex, and appropriate spatial and temporal scales should be selected.

Water budget analysis is conducted through numerical or conceptual modeling. A range of different models exist. A summary of models used in Ontario for water budgets is provided in the *Water Budget Reference Manual*[3] *(*Table 4-3). Also, environmental flow modelling is required to ensure consideration of the water supply or reserve flows available to maintain ecological features and functions and to develop instream flow targets for water-quantity stressed watersheds.

To account for climate change/severe weather considerations in water budgets, the *Water Budget Reference Manual* should be consulted. The *Guide for Assessment of Hydrologic Effects of Climate Change in Ontario*[4]

[3] http://www.waterbudget.ca/waterbudgetreferencemanual

[4] https://www.researchgate.net/publication/309565142_Guide_for_assessme

can also assist with incorporating climate change considerations into watershed planning. Lastly, a significant amount of work has been completed through source protection planning (i.e. watershed characterization, water budgets and water quality assessments). Conservation authorities acting as local source protection authorities under the *Clean Water Act, 2006* could provide valuable information in understanding water quantity and water budgets.

Water Conservation Plans

Water conservation plans are important for municipalities to undertake to maintain water resources for both human and ecosystem use and needs. Recognizing water as a valuable and non-renewable resource which must be utilized efficiently and cost-effectively is necessary when looking to sustain related social, environmental, and economic characteristics within the watershed plan area. Water conservation systems can help in avoiding, downsizing, or postponing water and wastewater projects. The development of a water conservation plan can inform work undertaken in Phases 2 and 3 of the watershed/subwatershed planning process.

ORMCP Technical Paper 11 – Water Conservation Plans[5] provides a useful framework to follow when developing water conservation plans. The process outlined in this technical paper separates the development of a water conservation plan into four phases: defining conservation needs, choosing appropriate measures and incentives, drafting the plan, and revisiting the plan.

WATER QUALITY

Water quality describes the physical, chemical, and biological characteristics and conditions of water and aquatic ecosystems which influence the ability of water to support the uses designated for it. Water quality is measured with a wide range of physical, chemical and biological variables, parameters, indicators and measurements. The main objectives of water quality assessment in the context of watershed/subwatershed planning are to use existing information where possible to characterize status and trends of water quality to ensure water quality meet and continue to meet water quality objectives; and to determine the impact of water management on water quality, and how future land uses or infrastructure may impact water quality, including assimilative capacity of the receiving waterbody.

By assessing the sources and means by which nutrients and pollutants are

---

nt_of_hydrologic_effects_of_climate_change_in_Ontario

[5]https://www.oakridgesmoraine.org/wp-content/uploads/2017/09/ORMCP-TP-11-Water-Conservation-Plans.pdf

getting into water, better planning and mitigation practices can be incorporated into watershed/subwatershed planning.

Water Quality Assessment

The basic steps of a water quality assessment are as follows:

1. Carry out exploratory analysis of water quality data by collecting and graphically representing data related to indicators that measure the quality of water. Indicators: phosphorus, chloride, nitrogen, oxygen levels, suspended solids, temperature, bacteria, nutrients, and hazardous contaminants such as pesticides, metals, petroleum hydrocarbons, pharmaceuticals etc. Data representation: scatterplots (including time series plots), boxplots, maps.
2. Complete statistical tests to identify trends over time, including:
    - Have there been noticeable changes in water quality over time?
    - If there are changes, what are the potential contributing factors (i.e. human activities, climate change, and / or invasive species)?
    - Are there gaps in the data to prevent adequate assessment of trends?
3. Identify water quality impairments and assimilative capacity in the watershed. This can be done using a variety of methods and models, but it involves documenting the proposed pollutant loads from point and non-point sources resulting from future land uses/infrastructure, in a variety of scenarios (existing conditions and future conditions); and, determining where limits have been reached both at the point of interest and looking further downstream, using a cumulative impact approach. For groundwater, water quality data from monitoring wells can be compared to drinking water criteria for all indicators analyzed to help identify problem water quality parameters in the aquifer. Monitoring wells from the same aquifer units should be assessed to determine the typical maximum, minimum and average water quality ranges for the aquifer. Parameters that exceed the standard can be highlighted. For surface water, determine whether water quality targets such as the Provincial Water Quality Objectives (PWQOs) can be met or exceeded. This might include determining the mixing potential of the proposed discharge flow, the extent of the mixing zone associated with each indicator/parameter, and verifying whether PWQOs can be met at the edge of the mixing zone.
4. Avoid and/or plan for minimal impact to water quality based on the assimilative capacity of the receiving waters. This involves:
    - Choosing scenarios for growth that will ensure that water quality objectives and targets can be met, or conditions improved;

- Consider optimal locations for infrastructure such as wastewater treatment and stormwater ponds to prevent water quality impacts;
- Ensure through environmental assessments, master planning and source protection planning that potential impacts to water quality can be avoided or mitigated;
- Address provincial effluent discharge requirements (see B-1-5 Deriving Receiving Water Based Point Source Effluent Requirements for Ontario Waters[6]); and
- Encourage/support/enable the adoption of practices that address point and non-point source contributions to water quality conditions such as Low Impact Development features, and other best practices for water and wastewater infrastructure.

CLIMATE CHANGE

It is important to recognize the link between watershed planning, climate change and municipal land use and infrastructure planning. The *Planning Act* requires that official plans contain policies that identify goals, objectives, and actions to mitigate greenhouse gas emissions and provide for adaptation to a changing climate. Additionally, the PPS and provincial plans all contain direction to prepare for/consider the impacts of a changing climate in land use planning, infrastructure planning and watershed planning. Watershed planning can provide an ecological framework for managing impacts of climate change and developing more resilient communities, since it is an ecosystem-based, integrative approach to the protection of water for both communities and the environment.

Examples of how climate change can be considered in watershed planning are:

- Include use of climate change resources in the Charter/Terms of Reference.
- Have climate change expertise on the steering committee.
- Have scenarios and targets be informed by climate models on land use, water resources and natural resource management.
- Consider the effects of implementing adaptation measures when evaluating alternatives.
- Include adaptation strategies related to infrastructure management (e.g. reducing demand through water conservation and efficiency, restoring

[6]https://www.ontario.ca/page/b-1-5-deriving-receiving-water-based-point-source-effluent-requirements-ontario-waters

riparian and instream habitat to lessen strain on the municipal system).

- Identify how new climate science information will be integrated into monitoring and how through adaptive management, goals, objectives and targets will be refined based on unexpected events. Any climate adaptation/mitigation measures chosen for implementation should be evaluated for their effectiveness.

NATURAL HAZARDS

Understanding natural hazards is an important and necessary consideration for undertaking watershed planning.

Flooding and erosion are naturally occurring processes influenced by changing land uses in the watershed and exacerbated by climate change. By understanding the function and susceptibility of various river, stream, valley and lake systems to disturbance, the potential impacts of proposed developments, or potential remedial measures can be identified depending on the risk, and methods of reducing these impacts through design changes or mitigative measures may be implemented.

The location and extent of natural hazards can be outlined in floodplain / flood hazard limit mapping depending on the provincial standard. Mapping erosion hazard limits may be done through soil and slope stability analyses. These considerations are important for informing where development may and may not occur, as well as for managing its associated impacts on watercourses, including where/how to focus mitigation. This information can be highlighted through watershed technical studies or planning. Existing natural hazards should be sufficiently characterized and the effects of development on natural hazards be evaluated.

When information does not exist on the location of hazardous lands or hazardous sites, or when information is out of date, studies should be undertaken to identify potential risks from natural hazards. A range of provincial guidance documents are available to support the PPS natural hazard policies. The *Technical Guide – River and Stream Systems: Flooding Hazard Limit*[7] and *Technical Guide – River and Stream Systems: Erosion Hazard Limit*[8] describe standards and procedures which should be followed for addressing water related natural hazards.

[7] https://www.renaud.ca/public/Environmental-Regulations/MNR%20Technical%20Guide%20Flooding%20Hazard%20Limit.pdf

[8] https://www.scrca.on.ca/wp-content/uploads/2018/09/MNR-Technical-Guide-River-and-Stream-Erosion-Hazard.pdf